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DRR Research Agenda – ZOD V4

A Research Agenda for Global Science in Support of Risk-Informed Sustainable Development and Planetary Health

February 2021

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‘At no point in human history have we faced such an array of both familiar and unfamiliar risks, interacting in a hyperconnected, rapidly changing world. New risks and correlations are emerging. Decades-old projections about climate change have come true much sooner than expected. With that come changes in the intensity and frequency of hazards. Risk really is systemic, and requires concerted and urgent effort to reduce it in integrated and innovative ways.’ (SRSG, GAR2019)

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Executive summary

The emerging Global risk landscape of a pandemic, climate change, social and financial crises, inequalities and vulnerabilities, pose new challenges for disaster risk reduction and its associated areas of climate change adaptation and risk reduction through the Sustainable Development Goals. The trend is for more severe complex impacts with increasing concern about and acknowledgement of complex, cascading and systemic risks. Rapid political, social and technological developments in addition to climate change are contributing to the shifting landscape. The risks can appear to be existential posing a threat to humanity's existence.

To meet these challenges DRR needs to be reimagined with much broader reach working collaboratively across sectors, disciplines and types of knowledge. One overriding need is to go well beyond siloed thinking and "business as usual" if we are to address these closely linked global imperatives successfully. For risk science, the need now is to maximise the impact risk science can have on changing this future towards better outcomes. To achieve this, risk scientists and knowledge holders have to integrate and reach beyond the traditional networks of our existing disciplinary fields.

This Agenda sets out some important areas where additional actionable knowledge is likely to result in reduced risk and vulnerabilities and improved human well being. It is intended for those working in DRR and related areas of global risk, climate change adaptation and development. We believe it is relevant to those interested in improving current DRR practice as well as those who see the need for more fundamental changes.

The Agenda was commissioned by the ISC (International Science Council) and UNDRR (UN Disaster Risk Reduction office) and the development has been led by the IRDR (Integrated Research on Risk program). From the outset the emphasis has been on a collaborative co-design approach with wide iterative consultation. The Agenda has engaged with and reflects the priorities and interests of groups well beyond traditional DRR research and practice, to build the evidence base needed for risk-informed decision-making in all geographies, sectors and scales. To help support additional engagement a number of specialist groups were organised covering among other areas, indigenous knowledge, technology, and the private sector.

The research priorities:

The priorities highlight that although much scientific research and progress has been achieved in DRR over the past decade, much of this knowledge is unused. Silos and significant disconnections remain within and between disciplines, and also between knowledge producers and potential knowledge users. This lack of integration and trans-disciplinary focus has reduced the capacity and impact of disaster risk science in addressing macro societal challenges, like alleviating poverty and reducing vulnerability and exposure to all forms of disaster risk.

The priorities are:

1-Key issues within the Global Risk landscape: Transitioning to a peaceful, safer, equitable, sustainable world within the context of DRR.

These priorities seek to inspire research that works to better understand the complex interconnections of systemic, compound cascading risks and impacts and their connection with vulnerability and exposure.

2-Addressing inequalities, injustices and marginalisation

How can risk science and knowledge best ensure justice and equity across humanity, and support the most disadvantaged and marginalised people and communities?

3-Enabling transformative governance and action

This theme inspires emphasis to how risk science can best support the most disadvantaged and marginalised people and communities to ensure that “no one is left behind”. Risk reduction and the achievement of Sustainable Development Goals are intrinsically linked, and highlight questions on how transdisciplinary science can expedite tackling inequalities and marginalisation.

4-Measurement to help drive progress

Ways of measurement are needed that incentivise improved risk knowledge and risk reduction.

5-Understanding the implications of new thinking on hazards.

The ISC/UNDRR 2020 report on Hazards Definition and Classification redefines hazards in the context of DRR. There are implications in terms of new hazards and new forms of hazard, as well as potential risk reduction opportunities.

6-harnessing technologies, data and knowledge for risk reduction.

Rapid technological advances are driving major changes in our lives and have the potential to contribute to all aspects of risk reduction and disaster management. This theme seeks to inspire research that takes the opportunities to maximise positive impact.

7-Foster interdisciplinary and multi-stakeholder collaboration

Why is so much knowledge apparently unused? There are many areas where it is well applied which could provide starting point for learning and change.

8-Supporting regional and national science and knowledge for policy and action.

Regions have distinctive mixes of hazards, exposures and vulnerabilities, which are influenced by complex interdependencies, capacities and governance structures. This theme seeks to sets out the distinctive priorities of different regions as appropriate.

The Agenda concludes with a section on implementation.

1. Introduction

Solutions to the combined risks and crises facing humanity and the planet can be found through the collaborative efforts of all types of knowledge and policy resources to drive change. Currently, many of the major global crises are well known: the Covid-19 pandemic, climate change, and financially and socially induced risks. Less well known are the day-to-day crises and risks impacting much of the globe through inequalities and vulnerabilities, often exacerbated by globalisation and digitalisation. Disaster risk has therefore come to occupy a central place in global development with science required to work more effectively, innovatively and collaboratively. Coherence between the Sendai agreement and parallel major UN frameworks concerned with addressing risks, e.g. the SDGs (Sustainable Development Goals), Paris Agreement on Climate Change, New Urban Agenda, Addis-Ababa Action Agenda and Agenda for Humanity will assist with addressing inequalities and instilling risk reduction as a critical function of development.

The global risk landscape is undergoing rapid and profound changes across DRR (Disaster Risk Reduction), climate change and sustainable development. The trend is for more severe complex impacts with increasing concern about and acknowledgement of complex, cascading and systemic risks, with impacts that cascade through social, economic and environmental systems. This reflects the growing interconnectivity and interdependence across socio-economic systems, as well as physical, biological, environmental, social, and cyber systems; and highlights the issue of physical and socio-economic tipping points within and across these systems. The Covid-19 pandemic is not only a cascading and systemic risk but lacks boundaries in space or time. The virus and the response it has engendered highlight the complexity of global risk, including the weakness of large-scale risk governance, and the fragility of our systems. Existing approaches to thinking about and managing risk are being overwhelmed by the pandemic's systemic nature.

Rapid political, social and technological developments in addition to climate change are contributing to the shifting landscape. One overriding need is to go well beyond siloed thinking and “business as usual” if we are to address these closely linked global imperatives successfully. Returning to, and supporting, business as usual is what many disaster support systems are set up to achieve; this entrenches existing vulnerabilities and other risk drivers and often does little to reduce risk or inhibit its increase. Disaster recovery offers opportunities which are sometimes, but often not, taken to address risk and undertake transformative change.

Our trajectory urgently needs to change. Achieving this requires nothing less than reimagining DRR, to extend it from a singular focus on major events, to a proactive inclusive approach with climate adaptation, vulnerabilities and development to address the causes as well as consequences of disaster.

To identify knowledge gaps and priorities, and to build the evidence base needed for risk-informed decision-making in all geographies, sectors and scales, the Agenda has engaged with and reflects the priorities and interests of groups beyond traditional DRR research and practice. This consultative process is set out below and in Appendix X. It includes disaster risk scientists, researchers, academics, and technical institutions in both the public and private sectors, traditional and Indigenous knowledge holders, as well as funders of research and practice.

The new research agenda helps to both identify the needs of stakeholders working at country, regional and international levels and to itself be guided by those needs. It will also guide the development of research to address those needs, as well as to solve broader issues. The Agenda's audience are all

those engaged in DRR work as practitioners, policy makers and researchers, as well as in related areas connected with risk identification, reduction and management. This extends to those working on all aspects of vulnerability, and to those funding risk and development research and practice.

The agenda calls for an integrated, inclusive approach to risk reduction with prominence given to the issues of justice and equity.

This Agenda document contains the detailed rationale and process for developing for the Agenda (including a set of key questions guiding the work), a review of the trends and status of disaster risk knowledge, the research priorities comprising the Agenda, and an implementation guide. Additional detail and supporting material is found in appendices and hyper-links.

[INSERT BOX ON TERMINOLOGY – Box 2: we have had feedback on a variety of terms including gendered terminology and “natural disasters”. We try to eliminate these, but sometimes we quote from others. We should also cover the idea of “science” vs “knowledge”.]

2. Developing the Research Agenda

2.1 Organisation

The Agenda was commissioned by the ISC (International Science Council) and UNDRR (UN Disaster Risk Reduction office) and the development has been led by the IRDR (Integrated Research on Disaster Risk program). From the outset the emphasis has been on a collaborative co-design approach with wide consultation.

Two groups were established to support the development of the Agenda (see Appendix for details of the groups and the consultation process): a Core Group, and an Expert Review Group (ERG). The Core Group is responsible for guiding the development of the Agenda and providing input, while the ERG provides input and commentary from diverse perspectives. Membership of the Core Group consists of representatives of the ISC, UNDRR, the IRDR Scientific Committee and IRDR Executive Director and other IRDR and external members. The Expert Review Group consists of Core Group members, plus IRDR ICoE's (International Centre's of Excellence) and National Committees, representatives of the Science and Technology Advisory Groups (STAGs), as well as a wide range of people from diverse backgrounds (science, advocacy, funders, private sector) outside the IRDR community. In practice a small sub-group from the CG oversaw the detail of the development.

To ensure that sectors and sources of knowledge that are often excluded were included, a number of specialist sub-groups were established from ERG. These included: indigenous knowledge; the private sector; information and communication technology; early career science communities.

2.2 Process

The Agenda was developed iteratively through multiple consultations with, and input from, the stakeholder groups mentioned above. The formal iterations are set out in an Appendix. In addition, the iterative consultation process included the following steps:

- An informal survey of the IRDR Community (IRDR SC, IPO, ICoEs, NCs) to help establish the initial draft research priorities.
- A review and analysis of the published largely scientific literature (see Appendix), to help establish the state of research, gaps and needs across DRR, resilience and other themes. ‘Disasters science’ spans the natural and social sciences, meaning it is not an established single branch of science, nor does it fit neatly into a single, well-established scientific discipline. Rather it is found in environmental, earth, economics, geography (human and physical), engineering, sustainability, ecology, sociology, political science, law, education, health, anthropology, and more, including specific branches of these sciences, such as: climatology, hydrology, oceanography, remote sensing, and many others. Publications for this review came from Scopus and Google Scholar databases, and a survey disseminated across IRDR networks (Science Committee members, International Centers of Excellence (ICoEs), National Committees (NCs) and members of the Research Agenda Core Group.
- A penultimate draft of the Agenda will be presented at the 2021 IRDR Conference. The conference will be asked to endorse the agenda.

2.3 Principles and key questions guiding agenda development

The development of the Research Agenda is informed by a number of principles. These were developed by the Core Group to act as a set of normative guidelines and highlight what the Agenda should aim to achieve. However, they are not intended to be prescriptive or binding. In summary, the principles are about: encompassing global risk and including systemic and emerging risks; advancing coherence across the substantive areas encompassed by major Global agreements on DRR, climate, SDGs, and other critical issues; emphasising collaboration and being inclusive of disciplines, regions and forms of knowledge; and being relevant to policy and practice.

The Agenda:

1. Is responsive to the new Global risk, development and planetary health contexts and actively supports coherence across major UN agreements on DRR, climate change, planetary health, Sustainable Development Goals etc.
2. Takes a systemic and multi-risk perspective, capturing emerging, dynamic, complex and cascading risks, and gives attention to the appropriate response space;
3. Is focused on policy relevance and outcomes; Aims to inform processes to implement and achieve collaboratively the Sendai Framework for DRR, the Paris Agreement on climate change, and the SDGs targets, as part of the 2030 resilience agenda;
4. Is based on consultation, and proactively promotes collaboration across disciplines, domains and stakeholder groups – in line with the Sendai principle of transdisciplinary collaboration;
5. Recognises DRR as essential to the development process and improved human well-being;
6. Engages with traditional and other forms of knowledge, and where practicable promotes co-production of knowledge;
7. Includes consideration of how research is funded, and how the results could be implemented;
8. Aims to go from theory to practice by focusing on policy impact;
9. Is flexible and adaptable to changing circumstances.

2.4 Key questions guiding the work

The Agenda’s work of identifying knowledge gaps and priorities is guided by some key questions. The overarching questions are how transformation to a lower risk, more sustainable world can be achieved;

and what pathways to transition, from where we are to where we need to be, are or could be available?

Other issues include:

- We need to gain an understanding of the rapidly changing global risk, including social and ecological tipping points;
- This includes understanding of hazards in today's science and political context; and the role of technology;
- What model of governance will address these complex transboundary risks?
- A fundamental issue for science itself is that science needs to change: it needs to be much more collaborative, trans disciplinary, fully accepting of and working with other sources of knowledge, and those who fund and implement the evidence generated by science and friends.

3. Why a new agenda is needed - Context and rationale

Why is a new global risk science research agenda needed, rather than amending the present settings of risk science networks, platforms and research programmes? Some of the reasons for this are mentioned in the introduction and in this section. The rationale for a new risk science research agenda is found in: changes in thinking about disasters and risk; the emerging global risk landscape; the need for coherence across the areas encompassed by major global agreements relevant to reduction of risks and vulnerabilities.

3.1 The emerging global risk landscape

NOTE TABLE AND NOTE ON THE OVERARCHING RISK DISCOURSE TO BE ADDED.

The global risk landscape is undergoing rapid and profound changes across DRR, climate change and sustainable development. The trend is for more severe complex impacts and there is increasing concern about and acknowledgement of complex, cascading and systemic risks: unprecedented climate and weather shocks and stresses being associated with economic and humanitarian crises potentially driving large scale movements of people, as well as crises precipitated by accelerated warming in polar regions and major changes to ocean ecosystems, are some of the more obvious signs of these changes. The Covid-19 pandemic is not only a cascading and systemic risk lacking boundaries, but is itself framed in many different ways (e.g. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7526906/>). The virus and the response highlights the complexity of global risk as it plays out over multiple scales in space and time, the weakness of large scale risk governance, and the fragility of our systems. In keeping with many high profile risks, Covid-19 is portrayed in mainstream media alternatively as war, as a fairness issue, as a geo-political issue, as a public health issue, and as about competence of politicians, the public sector and leadership – among other framings. At different times and from different perspectives, these may all be reasonable.

This rapidly evolving landscape is characterised by multiple definitions and frames varying by sector, discipline, circumstances and worldviews – however even within and across disciplines there can be distinctive risk ways of defining and framing risk. Approaches vary from the mathematical precision of engineering, insurance and financial modelling and analysis; the approaches used by the society and technology research community, and cultural and social theorists, with Ulrich Beck for example arguing that risk is an alternative to class as a way of framing society in the contemporary world; the increasing use of the SDGs to frame risk for corporations [<https://www.unpri.org/sustainable-development-goals/the-sdgs-as-a-risk-framework/308.article>]; and the strong social justice frames brought to bear by environmental and climate justice, human rights and labour advocates. Risk can be shifted between organisations, agencies and people in a way that transfers and exacerbates vulnerabilities (Eriksen et al, 2020). This is not the risk shifting of insurers, but for example the legal shifting of risk from power companies onto the people of Texas evident during the 2021 winter storm (XX). There are also sectors where risk can appear to be ignored: for example risk can appear to be treated as an externality in current development models; and groups that focus on the perceived benefits for example through economic analysis to argue that the risks are small compared with the benefits. Many countries, sectors and companies have their own standards and protocols for formally assessing risk, often drawing on the ISO-1300, the international risk standard, which frames risk in terms of failure to meet objectives.

This indicative list of ways of seeing risk has now been joined by a range of concepts highlighting risk as an immense challenge for both humanity and the planet: systemic, complex and cascading risks, and risk as existential (for example GAR 2019; Renn; CSER; the 2020 UN Development Report; Global Risk Report 2021 of the World Economic Forum). These concerns have led to new fields with a focus on global catastrophic and existential risks which are events that can bring humanity to collapse (eg CCER; Rethinking Human Development. <https://council.science/actionplan/human-development/>). The idea of Anthropocene Risk (Keys 2019 <https://www.nature.com/articles/s41893-019-0327-x>) is an attempt to explain emerging global risks and how they arise, with humanity seen as the main driver of change on the planet. Understanding Anthropocene risk requires holistic approaches. These more complex risks, or ways of thinking about risk, are emerging as a sub-discipline with their own substantial research efforts. They reflect a merging of global environmental change, escalating inequalities, and other contamination, economic and social issues and crises, which are creating new, larger risks and uncertainties.

The focus on global risk stems from growing concern about the prospects for humanity and the life supporting capabilities of the planet. The threats are seen as complex and intensifying, but are subject to a range of interpretations. Regardless of the exact severity of the threat, the implications are high levels of disruption to the lives and livelihoods of much of humanity, disruption or partial cessation of the global flows of goods and services, including the ecosystem services underpinning humanity, and undermining future and reversing past achievements of the SDGs, climate adaptation and disaster risk reduction.

This global focus should not obscure the reality for many people that it is the everyday risks, vulnerabilities and crises they face that are of major concern. Global risk is important hereto the extent that it is connected to these local issues.

Consistent with ways risk is framed and viewed, and with the imperative of collaboration across disciplines, sectors and forms of knowledge, this agenda uses multiple framing in developing its priorities. Risk is highly pluralistic in nature, with multiple interconnections, dimensions, multiple

scales and complex multiple impacts. We need to work with these multiple framing and with uncertainty and surprise across planetary and social systems.

4. The disaster risk field – recent evolution and emerging issues.

Part of the global risk landscape consists of a number of major global agreements ultimately concerned with improving the condition of humanity and the planet through risk reduction, including disaster risk. The agreements and their associated institutions provide one important avenue for policy development and implementation. In addition to the Sendai Framework for DRR, they include the SDGs, Paris Agreement on Climate Change, Post-2020 Global Biodiversity Framework, New Urban Agenda, Addis-Ababa Action Agenda and Agenda for Humanity.

These agreements and others highlight that DRR is recognised as a mainstream development issue, but needs to go much further. The field struggled to gain traction in the development process although the issue has long been discussed with Cuny's 1983 publication on "Disasters and Development" being an early argument for the integration of the fields. This is despite the rhetoric of risk, vulnerability and resilience, and the 1990s UN decade on disaster reduction, with its attempts to drive a "culture of prevention". DRR has been viewed historically as focused on preparation and response for specific events, rather than on identifying and tackling the underlying causes and drivers of risk through identifying and addressing the factors underlying and exacerbating disaster risk.

Today, DRR increasingly needs to deal with the intersectionality of risks and impacts; and is now framed more as a proactive, inclusive approach working to integrate with climate adaptation, inequalities, vulnerabilities and development to address the underlying causes of disaster. The global agreements mentioned above provide policy avenues for improving the condition of people and the planet through risk reduction – and to some, extend the scope of the risk reduction task to re-tooling our social and economic systems. Synergies and coherence across the areas covered by these agreements could drive dramatic improvements in DRR.

This is a major change because these agreements did not exist before 2015, making integration across the domains they cover at best ad hoc and often unofficial. Change is also seen in the rise of trans-disciplinarity which needs to extend to include forms of knowledge beyond science and scientists. Traditional science alone is not sufficient to deal with the complex risk environment we currently face, with its emerging risks and growing uncertainties. There are many institutions working on these risks, including research organisations, think tanks and others with major influence such as the WEF, World Bank and European Commission. The affiliations of those in the agenda's CG and ERG highlight the diversity.

The 2020 review of hazards terminology https://council.science/wp-content/uploads/2020/06/UNDRR_Hazard-Report_DIGITAL.pdf with its reappraisal and reframing of what hazards should be included within the scope of the Sendai agreement highlights this shift in thinking. Drawing on Sendai, the review shifts the definition of hazard from phenomena to also include human activities and processes:

“a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation”.

[Note that in practice some substances were also included.]

The Report sets out a strong case for an “all- hazards approach to achieve risk reduction as a basis for sustainable development”. This is intertwined with the systemic complex nature of the contemporary hazards landscape, epitomising the evolution of the whole DRR field:

“interconnected, cascading and complex nature of natural and human-induced hazards, including their potential impact on health, social, economic, financial, political and other systems, are all interlinked in the discussions on sustainable development and climate change adaptation.”

The current situation is given added urgency in our “complex, hyperconnected, overheated, fast-paced world”, where under pressure social and ecological systems can reach their tipping points as argued in GAR-2019.

4.1 Where have we been and where are going? Status and gaps in DRR research

The review of relevant literature and the gaps that it highlights demonstrates both the need for a new Research Agenda, and also where future scientific and policy efforts could best be directed.

[SUGGEST THAT A PARA IS ADDED AS A SUMMARY?]

Box 2. Summary of key findings and emerging gaps from the literature review.

Concepts and framings

- The disciplinary boundaries of ‘disaster risk science’ are hard to perceive and constantly changed by scientific advances and new knowledge.
- Disaster risk science is informed by conceptualizations of risk, hazard, exposure, vulnerability, resilience, capacity, and more.
- Definitions and framings of such concepts are constantly evolving and often contested – reflecting new knowledge generation from diverse and inter-related disciplines.
- Risk and hazard, at the core of this review, are such examples, with multiple and overlapping framings including: disaster, climate, environmental, natural, technological, biological, transboundary, cascading, compounding, Natech, Anthropocene, financial and systemic.
- In the context of increased global connectedness, the evolution of risk understanding from ‘natural’ to ‘systemic’ is apparent, but there may also be an element of ‘new framings for existing approaches and knowledge’ – this points to the importance of risk science communication for non-academic audiences.
- Generally speaking, risk science literature may be categorized by:
 - I. The phases of disaster management (i.e. response, recovery, preparedness and prevention/mitigation), which is typically hazard or disaster event-oriented.
 - II. Concepts of vulnerability, resilience, adaptation, transformation and others, which often take a systems approach.
- The conceptual links between disaster risk, climate change and sustainable development and multiple and complex, with explorations of synergies and trade-offs between domains particularly popular since the advent of the 2030 Agenda.

Gaps, emerging priorities, and potential implications for the research agenda to consider

- The relationship between developments in disaster risk science and advances in policy/practice is unclear, but a general trend is the growing disconnect between knowledge and action, for example:
 - The desired shift to ex-ante (before the event) from ex-post (after the event) approaches to risk management.
- One reason for this disconnect may be the lag between conceptual/theoretical advances and new grounded knowledge and empirical data generation, particularly around the assessment of risk.
- There are a plethora of both quantitative and qualitative approaches to understanding how risks manifest, responses to risk and perception of risk, stemming from the disciplinary diversity informing risk science, but the integration of approaches for a holistic understanding of risk is lacking.
- There are significant differences and disparities in disaster risk science production between global regions and nations, and across scales.
- Further, the systemic, cascading and transboundary nature of risk in a globalized and interconnected world needs to be reconciled with current systems of risk governance. There is a lack of a global coordinated action to tackle global risk, although for some risks, such as financial, strong global institutions exist.

5. Research priorities within the Global Risk landscape:

Transitioning to a peaceful, safer, equitable, sustainable world in the context of DRR.

This section sets out draft research priorities. The priorities have been developed through the consultations undertaken as part of Agenda development (see Section 4), through gaps and needs identified by the analysis of published material (Section XX and Appended), and by examination of key documents including GAR and the 2020 Hazard Terminology and Classification report. The field is very dynamic with new issues and priorities certain to emerge. These priorities should be read with other major research priority setting exercises in mind such as the 2021 Horizon Europe (Section 5); The 2020 UN Research Roadmap for Covid-19 Recovery; the Earth Commission, and the 2019 IPBES Global Assessment Report on Biodiversity and Ecosystem Services.

These consultations identified that much scientific research and progress has been achieved in DRR, but that much knowledge remains unused. Silos and significant disconnections remain within and between disciplines, and also between knowledge producers and potential knowledge users. This lack of integration and trans-disciplinary focus has reduced the capacity and impact of disaster risk science in addressing macro societal challenges, including alleviating poverty, reducing vulnerability and exposure to all forms of disaster risk, and improving risk governance.

Implementation of many aspects of these higher-level themes will require major change, and in some cases transformation (whether social and behavioural, political, policy based and other aspects of transformation within the current risk science and research paradigm). Consequently, a key overarching question is how transformation can be achieved? It is acknowledged that transformation will rely on identifying diverse pathways to transition, and collectively defining a vision of where risk science should be in a decade from now, how this will be achieved, and how success will be measured.

In seeking to encourage change towards an integrated approach to risk reduction and human well-being across sectors, funders, sources of knowledge - including trans-disciplinary risk science - the research priorities are set out in a way that includes macro level issues, as well as more specific technical concerns, and priorities at regional levels (including the complexities of regional differences, development and implementation challenges). The priorities are set out under broad themes, with additional detail in an appendix. The themes are:

- Understanding risk creation and perpetuation: systemic, cascading and complex risks;
- Addressing inequalities, injustices and marginalisation;
- Enable transformative governance and action to reduce risk;
- Measurement to help drive progress;
- Understanding the implications of new thinking on hazards;
- Harness technologies, innovations, data and knowledge for risk reduction;
- Foster multi-stakeholder collaboration for solutions to risk challenges;
- Support regional and national science and knowledge for policy and action..

By way of overview, Figure 2 illustrates how the themes or research priorities discussed in the following subsections fit together as a whole. Importantly, the themes should not be viewed as mutually exclusive. Each area of research fits with the overall objective of augmenting the global risk science ecosystem to better address the challenges faced due to intensifying global, regional and local risk context.

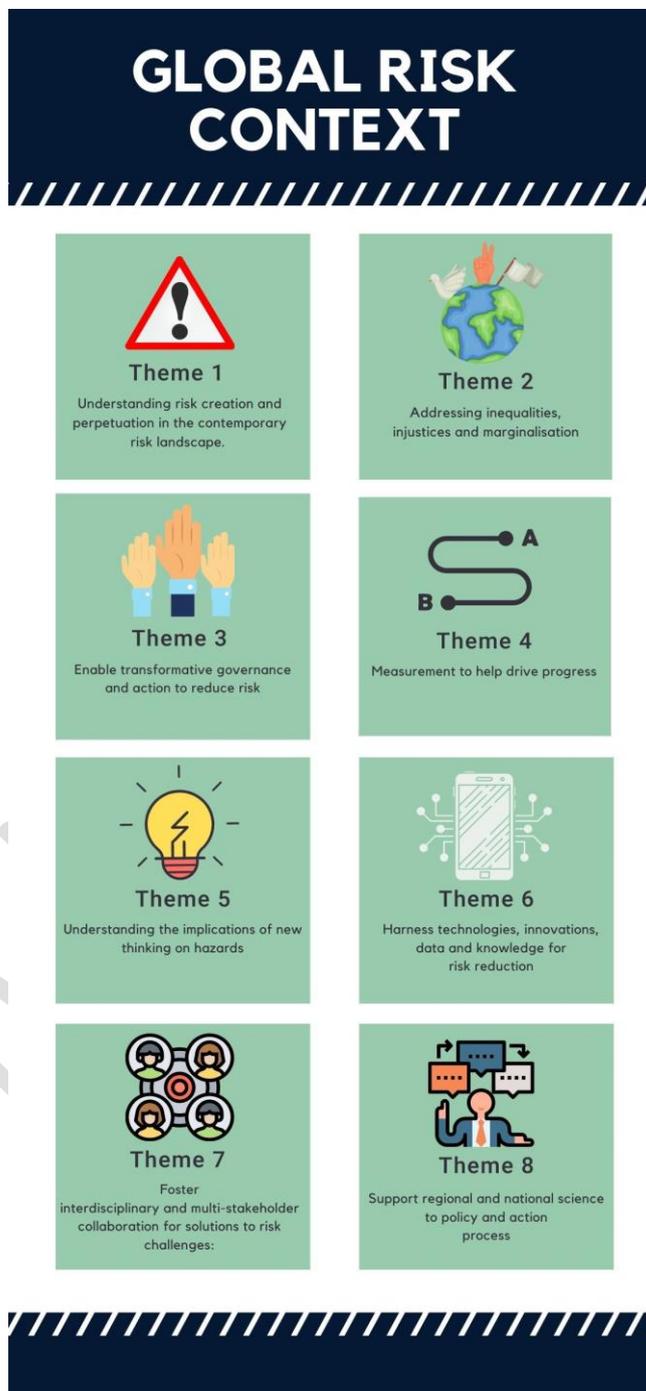


Figure 2: An overview of the eight research priority areas.

5.1 Theme 1: Understanding risk creation and perpetuation in the contemporary risk landscape: systemic, cascading and complex risks (also see under “Hazards” below).

The rapidly evolving global risk landscape demands better understanding of the complex and systemic risks and bio-physical and social tipping points, and interdependencies that increasingly confront humanity. Knowledge of these underpins risk reduction action and avoidance of “tipping points” which could lead to sudden increases in vulnerability, through loss of livelihoods, food and water security, among other issues, for large sections of humanity. This highlights that many aspects of these global risk issues are grounded within the Sustainable Development Goals, which need to take account of disaster risk as well as the transition risks accompanying change to a more sustainable world (ILO 2015; xx). This is because climate change, disasters and unaddressed inequalities and issues of justice can rapidly undermine development gains and lead to the perpetuation and deepening of poverty and other drivers of risk.

The 2020 Hazards Terminology report sets out six recommendations. Recommendation 6 supports this priority:

Rec 6 – “Address cascading and complex hazards and risks: “There is an urgent need to investigate further the direct and indirect linkages and effects of natural, biological, technological and other human-induced hazards to identify better and understand cascading and complex hazards and risks in a systematic way. The shift towards a broader view and a more context-dependent definition of hazards requires a systematic approach to risk that considers hazard, vulnerability, exposure and capacity together and better understands their complex interactions...”

5.2 Theme 2: Addressing inequalities, injustices and marginalisation

Key to understanding and reducing risk is further understanding of the dynamic nature of exposure, vulnerability, resilience and capacities. In particular, how can risk science and knowledge best ensure justice and equity across humanity, and support the most disadvantaged and marginalised people and communities. Included in this conceptualisation of marginalisation is marginalisation of indigenous knowledge. Consultations emphasised the need to better understand how the concepts of resilience and vulnerability guide practice. Models of resilience should not overlook power asymmetries, and there are multiple states of ‘desired’ or ‘aspired for’ resilience across different global contexts. Practice needs to ensure inclusion of the most marginalised as part of ensuring that no one is left behind as set out in the SDGs and Sendai Framework. <https://www.odi.org/sites/odi.org.uk/files/resource-documents/12304.pdf> The potential of rights based approaches in this context should be examined.

How can science support tools that allow practitioners to robustly justify considering risk when defining development strategies (whether for poverty reduction and social development, or infrastructure)?

At a more strategic level, consideration should be given to alternative approaches to addressing inequalities as proposed by Thomas Piketty (2014). Confronting inequities, injustices and rising vulnerabilities through new social and economic systems at different scales from local to global should

be examined.

5.3 Theme 3: Enable transformative governance and action to reduce risk

What formal and informal governance arrangements across the public, private and non-profit sectors can promote synergies between the major global agreements to reduce risk and vulnerabilities?

The use of the SDGs for framing risk is under examination in the commercial world, and it offers an opportunity to achieve both conventional risk reduction as well as the normative goals of the SDGs. However, much more may be needed – in many cases regeneration is required beyond sustainability per se. Understanding the role of different actors including mediating actors is key to providing better support for systemic risk governance. A systemic approach to governance will require a move away from institutional and scientific divides that create arbitrary separations for instance between DRM and development.

The rationale to enhancing governance coherence across the substantive areas covered by major global agreements offers opportunities to: avoid duplication across complementary research areas, and missed opportunities for trans-disciplinary social reach and capacity development; enable stronger science and knowledge based contribution to the SDGs, Paris Climate Change agreement, New Urban Agenda and other international agreements; and enhanced use of existing coherent networks (i.e. ASEAN; <http://www.iai.int>) within risk science.

Full, or even partial achievement of any one of Sendai, Paris or the SDGs requires achievement of the others. The overarching question is how can science best contribute to this essential integration for risk reduction? Therefore, coherence across the global research network and the rapid identification of what is already known will allow focus on producing the required knowledge. Another approach would see emphasis on informal networking and governance structures, possibly aided by technology.

5.4 Theme 4: Measurement to help drive progress

Develop operational indicators for exposure, vulnerability and capacity, that encourage improvement. Recommendation 5 of the Hazards Terminology Report is to ...”operationalise parameters for exposure, vulnerability and capacity, building on the UNGA definitions. ... Much work has been done in defining and standardising parameters for exposure in the context of natural or geophysical hazards, and in defining indicators of vulnerability for disaster risk reduction, but no consensus exists in the definition or application of exposure or vulnerability for use in risk assessment across the list of hazards within the broad scope of this report. ...”

There are many indicators for the constituents of risk, but they are subject to many shortcomings. A challenge is to develop indicators or measurement tools that incentivize positive change. There is work in this area: for example the development of indicators to drive risk literacy and awareness, and associated behavioural transformations, at a societal scale <https://www.cser.ac.uk/research/science-global-risk/>

5.5 Theme 5: Understanding the implications of new thinking on hazards.

The ISC/UNDRR 2020 report on Hazards Definition and Classification redefines hazards in the context of DRR, drawing on the Sendai Framework. The redefinition of hazards goes far beyond the traditional hazards of floods, drought, storm fires etc, and extends to most biological, technological, societal

hazards including violence, and by extension the hazards that climate adaptation and the SDGs are explicitly intended to avoid or redress. https://council.science/wp-content/uploads/2020/06/UNDRR_Hazard-Report_DIGITAL.pdf The report:

“was guided by the definition of ‘hazard’ adopted by the United Nations General Assembly (UNGA) in February 2017; namely, “a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation”. [Note that in practice some substances were also included.]

“Hazard information when combined with exposure, vulnerability and capacity is fundamental to all aspects of disaster risk management, from multihazard risk assessments for prevention and mitigation to warnings and alerts, to disaster response and recovery, long-term planning and public awareness.”

Indigenous knowledge and experience would be valuable in many contexts within this priority.

Understanding new forms, or newly common, extreme hazard behaviour: this is related to the need to understand emerging complex hazards and risks. These are emerging on the traditional DRR suite of hazards, for example, extreme flame behaviour in wildfires, extreme heat and atmospheric changes interacting with other potential hazards; as well as occupational hazards; chemical hazards such as persistent organic pollutants and endocrine disruptors; and economic and livelihood hazards arising from Globalisation.

Understanding interactions with other hazards, vulnerabilities etc. These have typically been seen as fairly linear and obvious, such as extreme heat and wildfires, but can be very complex and potentially systemic as with Covid-19 which highlights the coupled interactions between human/social environment and nature – and this is with respect only to the hazard.

Targeted impact-based forecasts and warnings. Improved early warnings, in terms of reliability and lead-time, are desirable for all hazards, and essential for many where warnings are poorly developed. Accurate forecasts of hazard behaviour are the key input for warning messages. Assessment of exposure to the hazard provides information on the areas needing the forecast and warning. [<https://reliefweb.int/report/world/climate-adaptation-summit-invest-early-warnings-and-early-action>]

“We need more impact-based forecasting to help bridge the gap between early warning and early action, by warning for not just what the weather will be, but what the weather will do,” ... “But to provide good early warning services you need good observations” ... “As extreme weather events increase, we must prioritize support to people most exposed and most vulnerable to climate hazards and stresses, even if they are the hardest to reach,”... See also <https://www.crews-initiative.org/en>

5.6 Theme 6: Harness technologies, innovations, data and knowledge for risk reduction

Rapid technological advances in Artificial Intelligence, digitalisation and analytical capacity, among other areas, and the very widespread adoption of mobile devices and social media, are driving major

changes in our lives and have the potential to contribute to all aspects of risk reduction and disaster management. They can also create new risks and vulnerabilities. Specific discussion points emphasised on-going technical developments of relevance to DRR as set out below. In addition to our consultations, this section draws on the expertise of the Fraunhofer Institute and ETH Zurich. [<https://css.ethz.ch/en/center/CSS-news/2021/01/trend-analysis-civil-protection-2030.html>]

Modelling and technical capacity are currently very limited with respect to global and lower level systemic, cascading and compound risks. Some models such as global climate models and models of the global economy are well resourced and widely used despite many uncertainties. Improved understanding of the emerging global risk landscape is at least partly dependent on better modelling of the underlying processes. Global information and communication technologies can help with risk reduction and the achievement of the SDGs, but they are also leading to other forms of inequality.

- Digitalisation is the defining technological trend of our era. The increased connectivity where everything is being connected to everything else, our dependency, or over-reliance, on such systems including for logistics and retail, and their huge energy requirements, increases social and economic vulnerabilities and creates new systemic risks. These new types of risk affect all stages of DRR and are not well understood.
- Artificial Intelligence (AI), Machine Learning and Natural Language Processing. AI capabilities are expected to develop rapidly and promise greatly enhanced analytical capability. This is especially the case in complex and novel risks.
- Big data and social media, offers the ability to widen the social reach of risk information and to guide engagement at national and international levels to influence social change, as well as humanitarianism. It can greatly expand the scope of inclusion through crowd sourced data and analysis <https://link.springer.com/article/10.1007/s10479-017-2584-2> Through its capacity to visualize, analyze and predict disasters, big data is changing humanitarian operations and crisis management.
- A fundamental issue concerns the interaction between people and the new technologies: we need to understand what factors impede and what support the technologies in achieving their promise of risk reduction – rather than risk creation; and how the technologies can be better used to support the SDGs and risk reduction eg through enhanced public engagement (such as <file:///C:/Users/johnh/Downloads/UNDP-Oxford-Peoples-Climate-Vote-Results.pdf>), and organisation.

5.7 Theme 7: Foster interdisciplinary and multi-stakeholder collaboration for solutions to risk challenges: Bringing actionable knowledge to policy and practice

Researchers and knowledge holders across DRR and risk science frequently observe that there is much in the way of research results and other knowledge which appears useful, actionable, and pertinent to the policy or practice issue in question, yet lies unused [Albris et al 2020; ISC 2020] – well articulated in the European Environment Agency’s reports on “Late Lessons from Early Warnings”. This issue was raised directly or indirectly in most of our consultations, and affects policy and practice across public, private and non-profit sectors.

However, there are many exceptions where research does inform policy and practice. These include, for example, the ICT sector, reinsurers, aviation safety and in the public domain much of the health sector, surveillance and military equipment. There is also extensive knowledge held by practitioners in the form of experience and practice. Unlike modern science, this knowledge is often poorly documented and therefore less recognised.

Why are research, discussions and policy debates seemingly not influencing change? For a start, knowledge needs to be in actionable form to be useful for the risk reduction task. And the challenge is to develop effective ways of ensuring it informs policy and practice. The transdisciplinary nature of risk science and knowledge, bridging sectors and stakeholders, may be central to finding solutions.

5.8 Theme 8: Supporting regional and national science and knowledge for policy and action

[Points listed below come from CG and ERG members. The section is to be completed by CG and ERG members.]

Each region of the world (based on UNDRR or IPCC regions?) is likely to have its own unique concerns and priorities for both disaster risk reduction and global risks. While the Global risk priorities set out above apply in most places, the details, priorities and day-to-day lives of the people will vary. Regions have distinctive mixes of hazards, exposures and vulnerabilities, with their associated interdependencies, capacities and governance structures and trends. They also have their own approaches to, and priorities within, the SDGs and other global agreements, as well as trends in demographics, economies, livelihoods, governments and human security. Capacities here refer to the availability of resources, as well as expertise, trained people and governance. It is also likely that regional priorities are important at the global level, and should be part of a re-appraisal of the existing priorities.

Members of the IRDR community were asked to identify regional concerns where different from the Global priorities already identified. This was seen as a starting point in identifying current key regional issues and priorities. Some examples follow. Further regional engagement is required.

South and Central America - focused on vulnerabilities

Asia - Issues of coherence and governance

Pacific and other SIDS - Climate change and justice issues are seen as key: mitigation, retreat, climate evacuation/diaspora. The context is one of small countries with rapid urbanisation, low levels of development and services of all kinds including those related to the SDGs, and low capacities.

Africa – governance, especially for transboundary risks. Large population movements. Those excluded from

Europe – all hazards of significance with climate and industrial hazards dominating. A challenge is the development of models of integrated risk management incorporating justice and equity concerns. The context is one of many very different countries with the EU providing a coherent overarching body assisting with risk reduction and management.

6. Implementing the Agenda

6.1 Implementation across global, regional and national levels

Disaster management is increasingly complex across global, regional and local levels (Albris, Lauta and Raju, 2020). While the global stage debates the trajectories laid out in the Sendai Framework, at the national and local levels, disaster risk practitioners, policymakers, and experts are faced with the challenge of implementation, in which the role of science and all types of knowledge is becoming ever more crucial for supporting sound decision making. Policymakers are faced with prioritising decisions to enhance resilience and better protect people from the impacts of disasters, the dynamics of which are increasingly amorphous, as we have seen with the rapid and far reaching impacts of the COVID-19 Pandemic. Adding complexity at the national scale, no singular discipline, government department or stakeholder that can be said to have an authoritative voice. Disaster management involves a complex myriad of actors and interests (social, political, economic etc), which means that implementation is a complex area.

As outlined in Appendix 4, in developed contexts epistemological, institutional and strategic 'knowledge gaps' exist at the interface between science and policy communities, undermining the ability to maximise potential for constructive integration between risk science and knowledge and risk-based policy and decision making (Albris, Lauta and Raju, 2020). In addition, limited capacity and resourcing, political complexities and rapidly intensifying social inequalities lead to further vulnerabilities and exposure to risk. In all, these gaps highlight a global risk science landscape that needs to transition more rapidly to better support policy and decision making in order to address emerging issues.

Risk science is inherently an integrating domain that draws from, and contributes to, diverse areas of research and professions. Consequently, it is envisaged that risk science can become the connective tissue in various policy agendas [and xxx] drawing in scientific and non-scientific inquiry that exists beyond the DRR realm and integrating the disparate but rich intelligence into decision-making. Reflecting this rationale, the following section outlines:

- A framework that guides the implementation of risk science priorities across a range of disciplines, audiences and user groups.
- A review framework that will monitor [indicators of success defined through consultation].

The hope is that this section can help policy-makers, professionals and XXX, as well as scholars, “to rethink how to address the present need for more knowledge in disaster risk reduction constructively—as one thing seems certain: we will not need less knowledge going forward” (Albris, Lauta and Raju, 2020: pp. 10).

6.2 The precautionary principle

The precautionary principle (or precautionary approach) is a broad epistemological approach to innovations with potential for causing harm when extensive scientific knowledge is lacking. The principle emphasises caution, pausing and review before implementing innovations that may prove disastrous. As such, the precautionary principle is of practical relevance as much to risk assessment as

to risk management.

Precaution calls for deliberate and comprehensive attention to contending policy or technology pathways (Stirling, 2007). Far from being in tension with science, precaution offers a way to be more measured and rational about uncertainty and ambiguity, acknowledging that attempts to assert a single aggregated picture of risk are neither rational nor ‘science-based’.

6.3 The need for actionable knowledge

Refocusing and augmenting the existing risk science ecosystem so that new and pre-existing knowledge is available in forms that are actionable, is a key priority in implementing this agenda. This means supporting progress towards enhanced integration between science and policy communities improve the accessibility and inclusion of risk science at the forefront of wider discussions beyond the DRR realm, including societal risk, sustainability and development.

This means working with those expected to implement the agenda, at whatever level from international organisations through to communities and households. Extending the ethos that grounds this Agenda, this means a much greater emphasis co-production of knowledge with stakeholders, and a deepening of relationships between the science community and wider knowledge and implementation communities. This approach will ensure stakeholders have ownership and see the risk based knowledge developed by diverse processes of co-production as their own, and as useable/informative, and hence it will be better implemented.

Overall, the success of this agenda will rely on the relationships built during the process of design and implementation and the buy-in achieved and invested in across disciplines and sectors.

[input required – are there other approaches to achieving actionable knowledge?]

6.3.1. Funders/donors are a critical part of this process

Science funding streams have a direct impact on the types of science undertaken and how this technical knowledge is developed and integrated with user needs (from policy and decision makers through to diverse public audiences).

[Input from Chloe Demrovsky, Joyce Coffee, Anne-Sophie Stevance and others required here]

6.4 How this agenda will be pursued over the next decade to 2030

Priority areas for implementation are listed as follows:

- Epistemological/Knowledge
- Institutional
- Strategic
- Capacity and Resourcing
- Technical and data

TBC

6.5 How this agenda will work with other science processes (e.g. IRDR, GAR, Future Earth, IPCC, IPBES, and including private sector and non-profit risk related processes)

6.5.1 Potential implementation mechanisms

This Agenda runs in parallel with other Global science processes and activities; is focused on 2030 in line with the UN Agenda for 2030, and beyond; and needs to develop a range of collaborative implementation approaches with stakeholders in industry, finance, health and other sectors to ensure relevance and uptake of research progress and possible solutions by society and in mechanisms of risk governance, policy and decision making.

It is noted that targeting existing networks, such as GAR, IPCC, Future Earth, private sector and non profit governance mechanism offers potential for more rapid success, due to pre-existing systems, networks and connections to funders and implementers

6.5.2 The operational time-frame for the Agenda

This Agenda aims to serve the needs of DRR within the broad context of the Global risk landscape in the leadup to 2030, but needs to be aware that decisions taken in the decade to 2030 will have influence for many years after that date.

6.6 How this agenda will work with other policy/governance mechanisms

This Agenda needs to take account of all potential Implementation routes, including relevant private sector interests (funders, livelihoods, commerce, insurers) and non-profit governance mechanisms; where to achieve impact implementation must occur much more widely than in the traditional risk science strongholds in government agencies.

The Agenda also needs to take account of existing policy and governance mechanisms, such as those listed below.

- a. The existing IRDR international programme - as the main mechanism of scientific coordination and planning (membership, governance, programme planning and reporting, deliverables, outreach and resource).
- b. Mechanisms for effective interaction of SFDRR with the Paris Agreement, the SDGs, and other UN 2030 agreements.
- c. Achieving this Agenda will also require close collaboration with the GAR (Global Assessment Report) and WEF (World Economic Forum) and other major international risk related organisations.
- d. The Agenda will also support existing mechanisms within specific regional contexts, acknowledging the need to enhance context-specific needs and capacities.

Ideally, the various related international and Global programs would seek to avoid overlaps. In practice however, some overlapping is inevitable and probably desirable. After all, each program brings a slightly different approach, emphasis and priorities, and importantly different approaches to

implementation.

Working together cooperatively, whilst accepting some overlap and duplication, is most likely to bring success. However, it is pertinent to note the importance, but also the current absence, of platforms that facilitate informal collaborative opportunities, especially in terms trans-disciplinary knowledge sharing and dialogue between ‘science producers’ and ‘science users’ (see Section 6.5 below).

6.7 How this agenda will work with all stakeholders (i.e. academics, decision-makers, practitioners, donors, businesses, communities, etc.)

As outlined previously, this Agenda needs to be supported by a broad range of stakeholders across society including commerce, government decision makers, funders, indigenous groups and civil society. Wide consultation has been undertaken with these groups in order to help develop shared visions, identify priorities and foster buy-in and wider awareness of the Agenda and its principles (as per Section xx above).

Such stakeholders include:

- a. Alliances and institutional partnerships for the implementation of the new research agenda. This would need to include implementing organisations from government at all levels from international to ideally regional and local, as well as NGOs and commerce – in addition to scientific organisations. There may be ways to engage civil society and these should be included.
- b. Groups dedicated to DRR and CCA processes including GAR, GRAF, Future earth (in particular the Risk KAN), etc. These groups would need to evolve to include practitioners and people involved in implementation of the ideas being generated.
- c. Agenda operates outside of and is not formally connected to any of these processes. However, there are strong informal linkages and the expectation is that they would reinforce each other.

Emphasise the development of new networks, where it is acknowledged that:

- o Currently there are few outlets for scientists and related policy and decision makers to debate and discuss issues of relevance and strategic long-term outlooks, especially in informal settings. This highlights that we cannot ignore the vast range of informal networks, from which much innovation and knowledge sharing spreads out from. In an academic sense, as well as professionally and within civil society, informal networks are transformative.
- o The gap between academics and practitioners working on similar problems in disaster risk reduction, as well as in climate change adaptation, is perpetuated due to a lack of platforms, arenas, and opportunities to initiate dialogue and knowledge sharing.

6.8 Monitoring and evaluation of progress

NOT SURE ABOUT THIS SUB-SECTION, REQUIRES WORK/THINKING

Monitoring and evaluation of defined success indicators draws broadly on the research priority for enhanced measurement and indicators (refer Theme 4, Figure 2).

[Require input on monitoring and evaluation.

- Suggest a staged implementation approach with targeted outcomes through to 2030, and biannual review.
-
- Suggest on going involvement of expert subgroups, for example, establish the indigenous expert group as a continuing forum to support success in this augmented priority area. Similarly with the private sector and other groups.

Evolving priorities need to be seen as desirable in a highly uncertain environment and necessary to ensure an agile Agenda that reflects current applicability to emerging risk priorities. Changing circumstances is in no way a criticism of the original Agenda, rather it is an acknowledgement that it is designed to evolve. To do this we need to better identify knowledge needs and gaps, and build in the flexibility to address new priorities as they emerge.

7. Adaptability: maintaining relevance

The Global risk landscape is very dynamic in terms of both anticipated risk such as climate change, and surprises like Covid-19. The new Research Agenda needs to remain relevant as needs and priorities shift: it needs to be adaptable and flexible. This will require a process for regular monitoring of the global risk landscape, and review and updating as needed of the Agenda. Evolving priorities need to be seen as desirable in a highly uncertain environment and necessary to ensure the currency of the Agenda. Change in these circumstances is in no way a criticism of the original Agenda, rather it is an acknowledgement that it is designed to evolve. To do this we need to better identify knowledge needs and gaps, and build in the flexibility to address new priorities as they emerge. This also indicates a need for a mechanism for renewal and updating of priorities to ensure that priorities written in 2021 are not static and redundant by 2030

References and sources