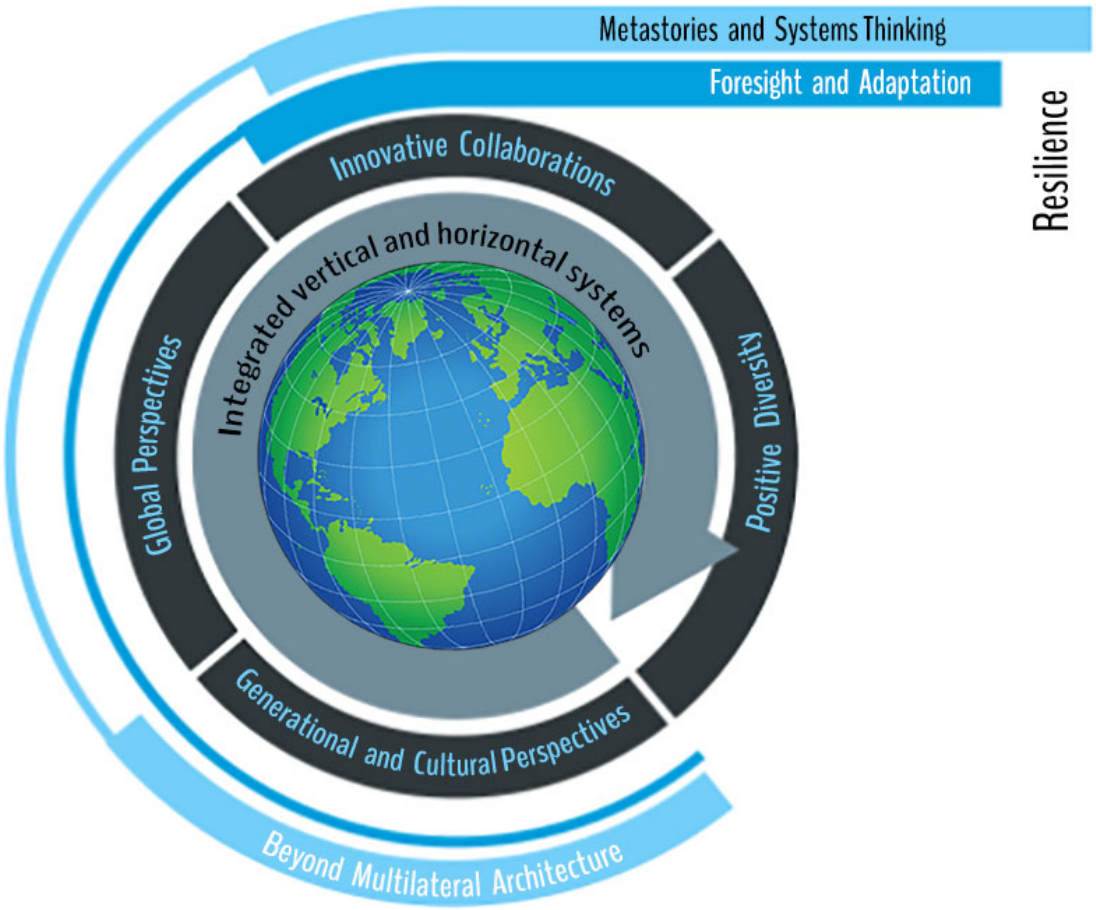
TOWARDS AN INTERNATIONAL ARCHITECTURE FOR MANAGING GLOBAL HAZARDS

SUMMARY REPORT FOR WORKSHOP PARTICIPANTS



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Core questions

The following report reflects the first steps in a project intended to identify plausible types of global hazards and systems to identify, monitor and mitigate them. The report's purpose is to generate workshop discussions to come to conclusions on three core questions:

1. What are the types and nature of global hazards that should be considered in the foreseeable future?

2. To what extent do existing global systems offer lessons-learned about ways to deal with such hazards?

3. What types of global systems should one consider for dealing with global hazards in the future?

SUMMARY REPORT FOR WORKSHOP PARTICIPANTS

The objective of the ***Towards an International Architecture for Managing Global Hazards*** project is to propose types of systems that would have practical relevance for dealing with global hazards in the foreseeable future. (See: Annex I: Project Definitions)

With this objective in mind, the initial phase of the project has been to seek the views of experts in disciplines involving hazards and disaster crisis drivers, innovation, organisational and inter-organisational behaviour, international relations, horizon scanning and public and private sector dynamics.

This report reflects a compilation of interviews undertaken between September and November 2020 as well as desk top research. (See: Annex II: Quantitative Analysis of Interviews.) It is intended for the second stage of the project in which experts will be asked to assess the substance of the report's findings and conclusions and to ensure the project is of relevance to decision-makers and policy planners.

This report focuses on four issues:

1. **Nature of Global Hazards:** Categorising the impact and scale of future global hazards
2. **Probability and Plausibility:** How to frame the likelihood of such threats occurring
3. **Lessons Learnt from Existing Systems:** Strengths and weaknesses of existing global structures in dealing with global hazards
4. **New Potential Structures:** Exploring new systems for anticipating, monitoring, and mitigating global hazards in the future

1. **Nature of Global Hazards:** Categorising the impact and scale of future global hazards

54% of interviewees noted that one of the most serious global hazards which the world faces now and most likely will in the future are the very institutions that have responsibility for dealing with such threats. Governments, it was felt, failed to think beyond the immediate in consistent and coherent ways. Sometimes specific types of threats and responses are so embedded in their own processes that they do not welcome alternatives that might change those processes. This assumption is reenforced by the ways that organisations all too often fail to search for 'the black swan', only focus on one small portion of that 'elephant in the room' and act like that proverbial 'ostrich'. 'Deep uncertainties' further reflect the ways that planners and decision-makers define hazards. All too often only shocks generate change, and those changes all too often create unanticipated vulnerabilities.

There was a suggestion that 'longer-term' was the wrong way to describe global hazards. For planners and decision-makers, 'longer-term' or long-range threats often implies that the threat is far away, and that its plausibility and 'practical relevance' are therefore significantly reduced. A better term, it was felt, would be 'hidden threats'.

The belief that institutions responsible for addressing threats were all too often threats themselves was reflected in the ways that hazards were analysed. Crisis threats should be regarded as complex systems of changing problems that interact with each other. The tendency to see crisis impacts as essentially linear was regarded as a major failing that ignored the true nature of crisis threats. 'Some of the greatest mistakes are made when dealing with a complex mess, by not seeing its dimensions in their entirety, carving off a part, and dealing with this part as if it were a complicated problem, and

then solving it as if it were a simple puzzle, all the while ignoring the linkages and other connections to other dimensions of the mess.'[1]

From this overarching perspective, interviewees' perspectives on hazards and their plausible global impacts can be summarised in five categories:

1. Present crisis drivers that will increase exponentially over the next two decades. Examples that fit within this category were *displacement as a violent continuum*, *dynamics and dimensions of climate change* and *Earth's ecological bandwidth*.

   In a world of approximately 9.7 billion people in 2050, an estimated 1.2 billion people will be displaced. Forecasts suggest that they will be trapped in "no-man's lands", where resources will be limited and where states or coalitions of states will clash in efforts to restrict ever increasing movements of the displaced. When it comes to *climate change*, the reasons for concern are well known, but the dimensions, dynamics and consequences over time less so. Yet, the increasing and accumulative impacts of climate change made this existential threat one that will most likely increase exponentially over time. In a related vein, it was suggested that *the Earth's ecological bandwidth*, even without climate change, meant that increasing human population and maintaining that population may be incompatible with the planet's capacities to do so.

2. Convergence of existing crisis drivers. Convergence often results in unexpected connections and ramifications. For example, effective response to wildfires in the state of California normally depends upon *ad hoc* fire fighting forces, 15% of whom consist of prison labour. However, in 2020, at a time when the fires were raging at unprecedented rates, Covid-19, was also raging through the local prisons. These intertwined incidents resulted in fires that spilled over into poor communities which led to unprecedented 'community impoverishment'.

   In general, a consistent theme was that convergence reflects interacting crises, making each harder to deal with and in turn creating 'mega-crises'. Rarely is there a linear causal thread – crisis drivers do not spring from common causal roots, rather there can be myriad interactions between different types of micro-crises.

3. Synchronous failures and global collapse. Synchronous failures, like convergent crisis drivers, reflect a multiplicity of stresses that are interactive and non-linear. However, synchronous failures

[1] Ben Ramalingam and H. Jones with T. Reba and J. Young, 'Exploring the Science of Complexity: Ideas and Implications for Development and Humanitarian Efforts', Working Paper 285, ODI, London, 2008, pp.

differ from convergent hazards in two fundamental ways. In the first place, the hazards themselves are global in impact, and secondly, they result in virtually simultaneous systems and societal collapse across the globe. Some have suggested that the combined consequences of systems stresses such as global indebtedness, a pandemic, cyber collapse and 'exhausted multilateralism' could result in overloads which societies across the world could not handle. This perspective was reflected in a series of comments that can be summarised in the words of one interviewee, 'We can say that we are increasingly sliding towards a planetary situation in which a convergence of stresses makes synchronous failure across the global a possibility as never before.'

Such failures would result not only in the collapse of conventional institutions of governance and economies, but also breakdowns in functional systems dramatically affecting food availability, communications, energy sources, political structures and security. 'All of these,' noted one interviewee, 'will underscore a more general sense that few institutions can be trusted or have legitimacy.'

4. Negative results of technological innovations. Few would deny the positive transformations that have resulted from technological innovation and in various ways will most likely continue to do so. Nevertheless, while the consequences of present and foreseeable technologies could clearly have been a subset of other categories, the emphasis that at least 38% of interviewees placed on the downside of technological innovation seemed to justify technological innovations as a separate hazard category.

   The range of potential threats emanating from technological transformations that were noted was extensive. From bio-engineered pandemic drivers and hypersonic weapons systems to cyber threats and the 'tyranny of data', the consequences of technological innovation were seen as threats to societal stability and survival in the foreseeable future. Unregulated Artificial Intelligence, the Internet of Things and cyber dependence could result in fundamental changes in the ways that human beings lived their lives, pursued their livelihoods and contended with unprecedented vulnerabilities.

5. Fundamental changes in the nature of human agency and human space. Intertwined with previously mentioned hazard categories were fundamental changes in the nature of human agency and human space. Driven for the most part by transformative technologies, the very nature of being human might become dependent upon innovations rarely considered. These in turn might lead to new forms of vulnerabilities that would stem from *what controls whom* and *vice versa*.

Though this prospect was only touched on by one interviewee, it represents a perspective that has been the subject of analyses in the scientific and social science literature. For a project intended to anticipate systems for dealing with future global hazards, this category seemed to be very relevant.

Q Do these capture the nature and scale of global hazards in the foreseeable future? What should be added, expanded or eliminated?

2 Probability and Plausibility: How to frame the likelihood of such threats occurring

79% of those interviewed for the project took issue with the concept of high and low probabilities. 47% were reluctant to delve into the issue, 19% of whom regarded the issue as 'counterproductive'. Of these, there was concern that probability calculations were all too often a 'bureaucratic convenience' that justified planners and decision-makers opportunities to avoid having to explore anything but the immediate. To some extent, the rationale for that position was accepted as the inevitable consequence of having to address the short-term concerns of leaders' constituencies.

Conceptually, many interviewees felt that the way that probability calculations were used tended to focus on a single event, or, hazard, and failed to take into account issues of convergence or vulnerable systems – as noted in the categorisation of hazards, above. There, too, was a concern that attention to probability all too often led to arbitrary and overly rigid categorisation and prioritisation of threats. Equally as concerning was the likelihood that probability calculations were inevitably focused on 'predictions' which tended to narrow the sorts of mindsets needed for dealing with increasingly complex crisis drivers.

On the other hand, there were at least 19% who considered probability calculations as a sensible means to eliminate the improbable and focus on the probable. Certain threats could be calculated with considerable precision, for example, science can accurately predict if and when a meteorite might hit the earth. There is a range of such threats the impact of which can be accurately calculated, and, hence, plausibility and to some extent impacts can be prioritised in 'the risk register'.

While the issue of plausibility generated conceptual and operational differences among those interviewed, there were various 'hunches' which interviewees mentioned that did

suggest a willingness to speculate. 81% of respondents, for example, regarded the consequences of climate change a hazard, highly plausible with truly existential impacts. However, it was also conceded that the sheer range of possible hazards which climate change could generate remained an unknown, making precise probability calculations difficult. Other probabilities which interviewees suggested were the likelihood that 'military adventurism' in outer space would occur in the 'foreseeable future' (14%) and that the onset of nuclear war probably would not (9%).

Q Is high and low probability calculation an issue that this project should pursue? If so, is it a potentially useful tool, and how might one improve it?

3. **Lessons Learnt from Existing Systems:** Strengths and weaknesses of existing global structures

For the purposes of the project, the parameters of 'systems' and 'systems architecture' began to emerge along the following lines:

The majority of interviewees – 71% – felt that previous and present systems suggested approaches and structures that had considerable relevance when it came to achieving global objectives, including assessing, monitoring and even mitigating global hazards. On the other hand, 29% were sceptical about the ability of systems, as presently defined, to offer capacities to prevent or mitigate such crisis drivers. The latter argued that the sheer interconnectedness of threats made it impossible for systems to adapt adequately. In some instances, they might be effective in raising awareness and recognition at global levels, but there were few instances when they had effective impact on means for prevention and mitigation.

Those who felt that there were lessons to be learned from previous and present systems pointed to various examples that could be categorised either as (i) single issue or multi-issue based, (ii) principally political or functional in terms of objectives; (iii) advocacy or operationally focused; (iv) structurally, temporary or permanent, (v) state-based or multi-sectorally based; and (vi) centralised or decentralised.

From this analysis, one could draw the following conclusions about the utility of past and present systems for dealing with the types of hazards that might be of global concern.

Downsides

There were eleven broad issues concerning systems weaknesses which emerged from the interviews:

1. Declining confidence in multilateral systems. 53% of interviewees looked at present systems for

dealing with global hazards as essentially those linked to the United Nations. To some, however, it has become increasingly clear that the state-based multilateral system was constitutionally unfit to deal with 'transnationality' and that states, *per se*, are increasingly unable to deal with some of the most serious global hazards that will need to be confronted, e.g., cyber threats and misuse of the global commons, including outer space. Broadly speaking, 30% of these concerns were based on the assumption that 'restructuring' of the state-based system was essential but not sufficiently recognised by those who could promote change. 'Top down hierarchical systems and structures inherited from the 1950s are robust but slow to adapt. This has led to the emergence of parallel systems of action, where issues are being dealt with through networks that are much more flexible but generally less robust.'

2. Lack of clarity about systems' missions and goals. Whether the United Nations or other systems such as the *Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)*, all too often there is a lack of clarity about overall objectives. Observers have noted that the term, 'collaboration' was used – intentionally or unintentionally – as a way to disguise the fact that there was little sense of common purpose. In the case of the IPBES, it was felt one reason was that the platform was coming up against contending political interests in which assessments, conclusions and recommendations were not adequately taken into account. Another example was the OECD (Organisation for Economic Cooperation and Development). It was increasingly evident, so it was suggested, that the difficulties of reconciling contending interests among a number of member-states meant that the OECD all too often moved away from systems *objectives* and increasingly focused on systems *processes* – resulting in the perception that its mission and goals were in a perpetual state of flux.

3. Failure of systems' components, i.e., organisations, to share information and expertise effectively and consistently. Even systems with seemingly clear objectives fail to integrate the types of expertise required to achieve those agreed objectives. While 'stove piping' is a standard issue when it comes to organisational and inter-organisational analysis, it was also deemed to be a significant issue in understanding the dynamics of global systems. Furthermore, in various state-based systems, states have to confront the dilemma between sharing information and what they perceive as specific national interests, e.g., security. This 'purity of focus' suggests that information and expertise required

by systems to maintain their value are by no means predictable.

4. Lack of systems' receptivity. 'The client accuses me of trying to sell what he believes he doesn't need. He knows what he needs, and he's just not that interested in thinking in any other way.' This comment arose in a discussion on the insurance sector, or, more specifically, the work of the International Association of Insurance Supervisors (IAIS). The point was that, even when a highly respected 'provider' sought to make 'the client' think differently, in this instance more in a futures context, the reaction was negative. This unwillingness to consider alternatives, to be more speculative, was an organisational failing that all too often spilled over into larger systems. In this sense, the issue of receptivity permeated several discussions on the impact of the sciences on international systems. As one interviewee noted, 'Science is the one true global culture which can transcend all boundaries of nationalities and faith, and that's why scientists have been more internationally minded.' Nevertheless, internationally minded science has in many instances to contend with situations encountered, for example in the IPCC, where scientific recommendations are often watered down by unreceptive governments.

5. Planning and prioritisation processes. There was considerable praise for the UN's Sustainable Development Goals initiative. However, from a systems perspective, it was, like many others, seen as failing to promote plans that reflected the complexity and interdependencies that need to underpin its objectives. According to some interviewees, it was guided by 'old linear tools', directed by single discipline experts and 'looking historically, narrowly and backwards.' The reason for this approach reflected not only outmoded methodologies, but also a prioritisation process that all too often was guided by governments' sensitivities and a related reluctance to be diverted by the uncertainties of 'the future'. In the words of one interviewee, 'Systems tend to get disassembled if they are dealing with unlikely risk and the crises that gave rise to them… They will focus on recurrent risk and not on exceptional exogenous risk.' Priorities and the prioritisation process get lost in the disassembly process.

6. Lack of diversity. The 2008 global financial crisis could be explained in various ways, but from interviews one consistent theme was that there had been a lack of diversity. On the one hand, the financial banking system had 'extreme external correlation', i.e., banks

were interconnected, and that was acceptable. At the same time there was 'extreme internal correlation', i.e., banks all behaving in the same way, and that meant that there was a considerable lack of diversity. This lack of internal diversity meant that 'they all behaved in the same way, pulling each other down since they also were interconnected.'

7. Coherent systems action all too often mobilised at the brink of crises. There were some sceptics (29%) amongst those interviewed who questioned whether there really have been any successful systems, even when there were common threats that were existential. From this perspective, responses to existential threats were developed 'on the hoof', and 'no systems have worked, and success depended on expert individuals mobilising.' Other interviewees (% not recorded) did accept that essential systems change only occurred at the brink because only then did the systems' components 'run out of options based on their standard repertoire'. They had no choice but to seek alternatives – often too late as the 2008 banking crisis made very evident.

8. Confusion over 'public good'. In various ways interviewees suggested that there was a lack of clarity about systems' ultimate purposes, and one clear example stemmed from the seemingly ambiguous term, 'the public good.' Various intergovernmental and non-governmental systems failed to have a clear sense of what would meet the needs of society. This failure, it was suggested, was often due to the fact that they intentionally or unintentionally were insensitive to the views and perspectives of local bodies and relevant communities. Hence, the nature of public good was restricted to 'top down' perspectives, prevalent in many global systems. There were exceptions, including CGIAR (Consultative Group on International Agricultural Research), but even in this regionally based multisectoral system of scientists, private sector, governments, IGOs and INGOs, the parameters of public goods remained narrow. The reason: there was confusion about the scope of public goods because of persistent tensions between CGIAR's geographically based regional components over priorities and uncertain funding.

9. 'The resilient North and the vulnerable South'. Increasingly what is referred to as 'the humanitarian sector,' in this instance that loose-knit network of non-governmental organisations, has recognised that its interactions are too often based upon the presumption that the so-called 'developed world' is inherently resilient while those middle and lower-income states are inherently

vulnerable to a wide-range of crisis threats. Some exceptions were noted such as the International Federation of Red Cross and Red Crescent Societies. Yet, those interviewed with development and humanitarian backgrounds suggested that the 'resilient North and the vulnerable South' perspective results in distrust by many institutions in the South about the purposes of aid systems. It was an example of a proclivity to impose solutions and standards rather than achieve them through system collaboration and co-development.

10. Funding dependencies too often determine organisational action within systems. "[They] are so busy getting private sector money, because governments do not have enough, that [they] are ceding to the private sector partner, and the ownership of that intellectual property." This comment made about CERN (European Organization for Nuclear Research) reflected many of the other systems that were mentioned during the course of the interviews. The International Maritime Organisation, though highly respected, was but another. Severe criticisms of the IMO included the accusation that member states are able to appoint employees of corporations, including shipping companies, to their delegations, and these have dominated some delegations. These delegates can actually determine 'their government's position on IMO policy' and 'are not subject to conflict of interest rules nor to a code of conduct'. Similarly, the Gavi (Vaccine Alliance) system has been criticised for allowing wealthy partners, i.e., the private sector, to determine health goals and vaccine costs. Indirectly related, it also has been seen as an electoral tool used by recipient governments in the wake of elections.

11. Inability to deliver 'narrow focus plans'. A failure of the British government to deliver 'narrow focus planning' (e.g., specific plans for handling AI crises, epidemics) was used by one interviewee as an analogue to describe a major failing of international systems more generally. In international systems as with the British government, there was a capacity to build dense, extensive, bureaucratic, hierarchical decision-making systems. However, when it came to designing and implementing plans to deal with specific threats, systems within most governments and in international systems were regarded as weak.

Upsides

Despite the criticisms noted above, interviewees also felt that there were important and positive lessons that have emerged out of present systems.

1. Global perspectives. CERN, as noted earlier, may have its downsides, but at the same time it

offers an interesting example of systems thinking that goes beyond physics as 'a global public good.' The implications of its scientific work is understood, but that its resources are increasingly used across the globe to promote projects such as assistance to vulnerable children far less so. Recognised interdependencies are seen more and more as an effective way to promote global commons. In a related vein, through the UK's Public Health England, important work on hazards terminology and classification is produced for UNDRR/International Science Council in order to expand the international network of contributors to global hazards identification. The British Geological Survey was bent on fulfilling a similar objective of promoting a more global systems approach to geological vulnerabilities.

2. New forms of collaboration. As noted earlier, a growing criticism of many systems that deal with global hazards is that they do not have a more inclusive approach for identifying and mitigating hazards. The Non-Communicable Disease Alliance is but one of a growing number of systems that suggest new forms of collaboration. In the case of the NCDA, the major actors are at the community level. The Alliance's mission is to 'unite and strengthen civil society to stimulate collaborative advocacy, action and accountability for NCD prevention and control.' Its network consists of approximately 2000 organisations in more than 170 countries. The UNDRR's Sendai Framework was seen as another example of a new form of collaboration, in this instance through restructuring the ways it handled its mandate. By bringing together four different aspects of global risk reduction - disaster risk reduction, climate change adaptation, environmental management and poverty reduction – into one integrated framework, Sendai not only integrated objectives, but also created more integrated planning processes and capacities as well. Another relatively new form of collaboration that offered useful models was the city to city perspectives across all continents under the rubric of the Global Resilient Cities Network (GRCN). The objectives of the GRCN include ways that cities can share information, collaborate on developing innovative practices and seek project funding – all in a network that is urban and not dependent on state based structures.

3. Systems' triggers. Despite the initial hopes for the UNFCCC (UN Framework Convention on Climate Change), its accomplishments reflected all too low and fluctuating baselines and indeed membership. However, since its founding over a quarter of a

century ago, various agreements have resulted, e.g., Kyoto Protocol, Paris Agreement, with varying success. More importantly in this context are the plethora of 'sub-systems' that the UNFCCC initiative has generated. Those mentioned included Indigenous Peoples Organisation for Climate Change, the youth network (YOUNGO) and the Women-Gender Constituency. In other words, the positive side of a global systems initiative should also be measured in terms of the systems and related networks that it triggers.

4. Consequences of new technologies. In various ways, new technologies not only have opened the way for the creation and maintenance of international systems, but also the need for such systems to control technology's perceived downside. For both reasons, many interviewees regarded new technologies as a stimulus for the development of more global systems of various sorts in the future. Bio-engineered 'products' posed both opportunities and threats, as did Artificial Intelligence. Similarly, the benefits of satellite observation offered positive benefits for the world in general, while at the same time posing potential threats. This duality has been recognised with the emergence of a number of interactive systems. Examples include a series of initiatives dealing with outer space such as updating the International Telecommunication Union and a 2019 initiative to bring together an amalgam of states, UN agencies (UNOOSA) and the private sector to develop a global code of conduct to establish norms and regulate behaviour in outer space.

5. Lessons being learned. The increasing criticisms of the United Nations were regarded in part as lessons that were being learned about the need for more inclusive systems for addressing global issues. There was a sense among some interviewees that, 'while governments might be the sole actors when dealing with nuclear war,' they lacked the technical knowledge to deal alone with issues such as the consequences of Artificial Intelligence. Here, the lesson-learned was that conventional state-based systems were more effective in dealing with increasing complexity by expanding its constituencies, bringing the sciences, the business sector and communities to the table. A growing number of systems, it was suggested, has deflected some of the disillusion with multilateral systems by expanding the types and proportion of non-state actors being part of their systems.

Q To what extent were there valuable lessons to be learned from existing systems and networks, and how might these be reflected in systems intended to deal with global hazards in the future?

4. **New Potential Structures:** Exploring new systems for anticipating, monitoring and mitigating global hazards

Included in this review are interviewees' reflections on the extent to which their proposed systems would build upon present systems or be substantially different for dealing with plausible global hazards and their impacts.

1. Beyond the multilateral architecture Interviewees were generally in agreement that systems designed to meet the challenges of the future would have to be multisectoral, multidimensional and not merely reflections of conventional state structures. Replacing predominantly state based structures should be systems where decisions reflected more fluid, self-organising entities. Priorities would not be determined solely by states; and, when it came to the process of anticipating, monitoring and mitigating global hazards, multisectoral and multidimensional systems would have to be the way forward. The sciences, the private sector and an array of non-state organisations would all be 'sitting at the table' alongside conventional multilateral institutions. With that in mind, it was suggested that when it came to systems for dealing with global hazards, instead of the UN being used as a vehicle for global cooperation, it 'should be used as a vehicle for establishing platforms that enabled new forms of global cooperation in a distributed way.'

2. Positive diversity. Effective systems need to focus on diversity. All too often systems, particularly those underpinned by state-based structures, tend to see that collaboration depends upon promoting systems that reflect what earlier was described as 'extreme internal correlation', or, in other words, they all behaved in the same way, 'pulling each other down since they also were interconnected.' Increasingly decision-makers and policy planners will have to realise that effective systems are those which foster and enable options for action that go well outside the norm. Towards that end the US DoD's DARPA model was regarded as a system that successfully

fostered diversity.[2] A commitment to diversity also fosters what one interviewee has called 'collaborative advantage'. Increasingly, positive diversity will result in far more sensitive 'co-designed, co-produced and co-delivered products' for dealing with hazards. As will be suggested, below, that positive diversity also needs to be linked to *foresight*, perceived as essential for expanding the scope of positive diversity.

3. Integrated vertical and horizontal systems. Even in instances where the components of standard systems remain, e.g., the United Nations, there had to be fundamental changes in the ways that traditional structures are used and the ways that such structures use others. Systems of the future, some interviewees believed, will have to be 'hybrid multilateral structures', in which governments would acknowledge that a wide range of non-state actors had 'equal standing in capacity and prerogative.' Not only would this require an understanding that decisions would be made at 'the right level', but that they would not depend upon hierarchical structures. In several instances, interviewees strongly felt that systems of the future had to reflect a 'bottom-up' approach across all their components. In any event, any system for the future had to reflect an amalgam of horizontal and vertical interaction.

4. Resilience as a key objective. Linked to integrated systems was the suggestion that there should be greater focus on 'resilience architecture'. The emphasis on this sort of architecture had three important dimensions. In the first place, focusing on resilience means that the disruptive nature of hazards will not depend upon imposing order, but rather upon promoting approaches where action can be taken in situations of relative chaos. Secondly, the nature of resilience also includes thematic and longer-term analyses of potential instruments for prevention and coordination. Thirdly, effective resilience has to include regional, national and local

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[2] *Defense Advanced Research Projects Agency (DARPA)*. The US government's Defense Advanced Research Projects Agency (DARPA) is renowned for the innovations that it fosters and supports. To that extent it is an organisation, but Its links with other research organisations and networks also makes it an influential component of a burgeoning research system. Its unusually unbureaucratic way of promoting research, allowing researchers to go down whatever paths they regard as important, as long as it can somehow be justified in terms of US defence interests, has had considerable impact on the ethos of research more generally. Though sectorally specific, DARPA's flexible approach towards research continues to result in innovations that have global transformative impacts, including one way back in the 1960s that enabled digital resources to be shared among geographically separated computers -- the first steps towards the Internet.

levels to be effective, consistent with #3, above.

5. Foresight and adaptation. Systems for dealing with global hazards should in the future be designed to focus far more consistently and systematically on plausible global hazards in a longer term context. This, however, was not to suggest that the focus should be on 'prediction'. Rather there was a general consensus that systems at the global level needed to be more anticipatory and not remain in institutional 'comfort zones.' Global systems of the future needed to move away from their 'obsession' with the present and the seemingly predictable and be more willing to deal with the unknown and unpredictable. Nevertheless, a related dilemma was that in those instances where there was an acknowledgement of foreseeable risks, all too often – as in the case of the Finnish and German governments' Offices for Foresight and the insurance sector – there are systems for informing policymakers, but little to adapt to identified risks. One interviewee suggested that the organisational tendency 'to shelf-guard', to shelve more speculative thinking rather than apply it, also spilled over into international systems.

6. Metastories and systems thinking. 'How do you design a system that operates organically rather than mechanically?' was the rhetorical question from one interviewee. The thought perhaps was answered by another interviewee's belief that systems architecture to go beyond the mechanical needs to be based upon 'metanarratives' and 'a holistic platform approach.' 'In complex environments, the stories that are important are not the stories that look inside a particular organisation or even a collection of organisations, but they are narratives that reach across society. Do we have the stories that enable us to cooperate effectively in radically changing environments?' To what extent, can threats be integrated into a more meaningful bigger picture rather than being isolated as something for the attention of experts? In a related vein, the interviewee also suggested that it was essential to understand the dynamics of metastories in understanding systems' relevance, 'for the things that we accept to be true in one moment we may find it not acceptable in a subsequent moment.'

7. Generational and cultural sensitivity. A major challenge for those considering ways to identify and mitigate global hazards was that the systems presently being explored need to be sensitive to the attitudes of different generations. That challenge to some extent was reflected in the project, itself. To what extent, for example, did the preliminary results of the project to date take

into account a spectrum of attitudes and perceptions of different generations and cultures? Those interested in developing systems for dealing with global hazards will have to take such factors into account, as will the ***Towards an International Architecture for Managing Global Threats*** project.

Q To what extent would the types of systems or various elements of them be effective in creating means to anticipate, monitor and mitigate global hazards?

ANNEX I: PROJECT DEFINITIONS

For the purposes of the ***Towards an International Architecture for Managing Global Hazards*** project, the following subject definitions were used:

A hazard is a broad category of potential threats that could lead directly or indirectly to extensive loss of life, injuries, disruption of livelihoods as well as destruction of infrastructures and damage to the environment. For the purposes of this project, a hazard or combination of hazards would have direct or indirect impact across many parts of the globe.

Systems, for this project, consist of individual entities, e.g., a single organisation, not necessarily similar, that formally come together with counterparts for reasons of common interest. Though a system's components are inherently independent, systems reflect at a minimum mutual self-interest, and often degrees of perceived interdependence. Some systems might be defined in terms of a single time bound objective; others may be based upon perception of interests that are not time bound. And, again, for this project, they are global in scope.

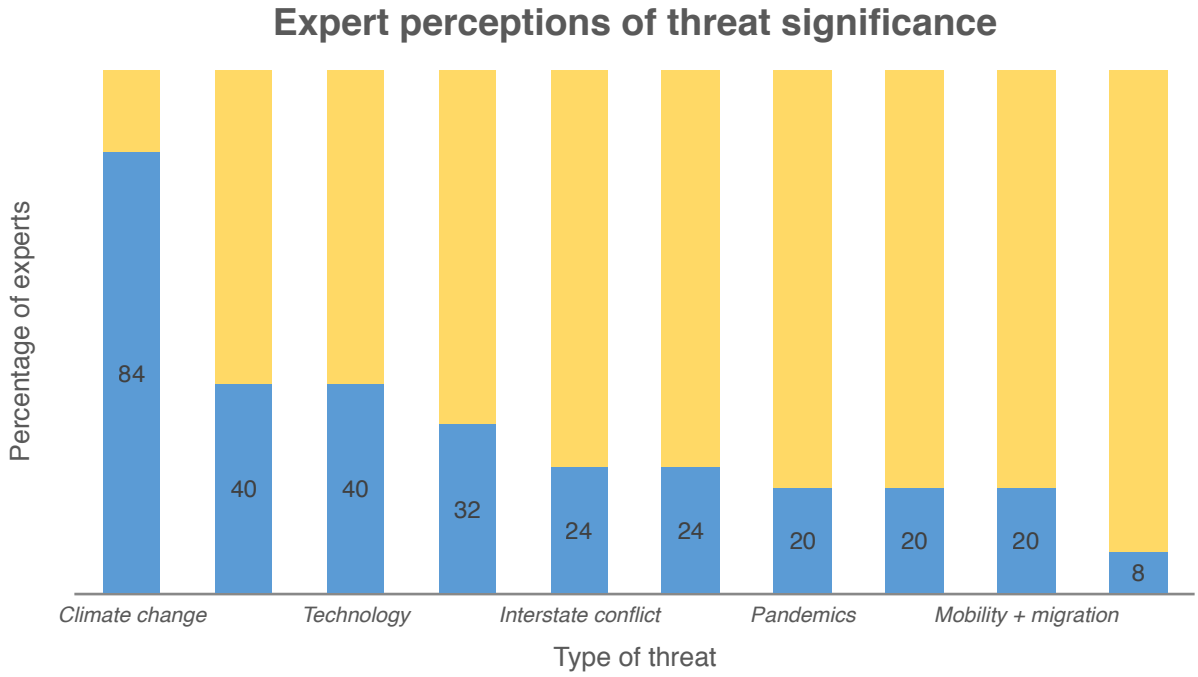
A Network will be defined as a loose knit amalgam of independent entities who interact in ways less formal and structured than systems. Networks can include a 'network of systems'.

Architecture for the purposes of this project suggests the overarching context in which systems operate. That context, or, architecture, may reflect, for example, a more globalised world order rather than a multilateral systems architecture. The former might reflect a form of atomisation where social, political and economic dynamics are determined principally by fluid, self-organising entities. They exist in parallel and normally independently of conventional structures such as states or the assumptions and procedures that normally guide economic, political and social institutions. Alternatively, an intensifying multilateral world may be driven as a reaction against an atomized world, and that reaction will coalesce around a state-based agenda. Both are examples of the architecture that will frame the types, dimensions and dynamics of systems

ANNEX II: QUANTITATIVE ANALYSIS OF INTERVIEWS

QUESTION 1. *Potential longer-term crisis threats and their global impacts*

There was generalised consensus on two matters. First, 66% of experts highlighted the risk of the confluence of crises, *i.e.* crises interacting, making each harder to deal with – and the risk of a 'mega-crisis' triggering unexpected connections and ramifications. **Secondly, 88% of experts** agreed on the overarching political and institutional inability of current societies and systems to deal with current threats.



48% of experts highlighted that this approach was too hazard-centric

QUESTION II: *Probabilities of future threats (as seen in ANNEX I) occurring*

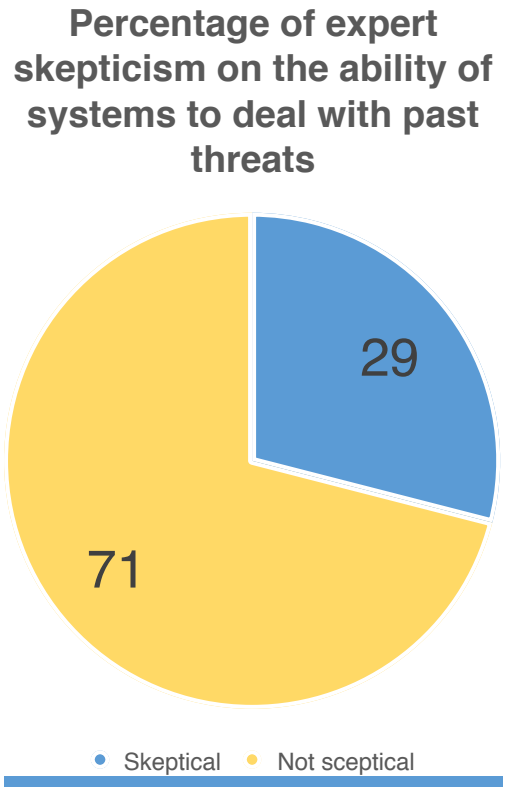
Most experts (69%) took issue with assigning probabilities to track the likelihood of threat occurring. Nearly half (41%) declined to offer probabilities of threat occurrence; one-fifth (17%) argued that giving probabilities was counter-productive getting politicians into a mindset of prediction, which is technical, mathematical but does not grant any resilience tools; and one-fifth (24%) argued that probabilities were not necessary as most of the threats were already occurring.

Of those who offered thoughts on the probabilities of certain risks, 18% cited medium to high probability of **technological threats,** 14% cited medium to high probability of **social** and **political** threats and 9% cited low to medium probability of **space conflict**.

However, consensus around the certainty of climate change was generalised, with 81% of experts indicating it was certain to occur.

QUESTION III: *System effectiveness in dealing with past threats*

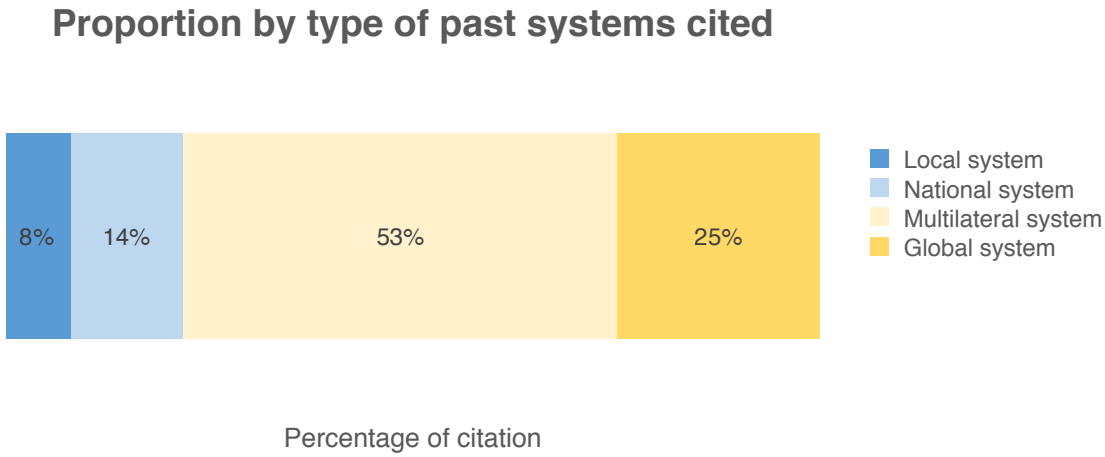
Experts offered their thoughts on the ability of systems to cope with past threats. Some argued that the interconnectedness of threats made it impossible to tackle through structured systems; some blamed systems for a lack of adaptability or argued that although systems bring about recognition or awareness at global level, there is no congruence around prevention or mitigation.



Of the 71% of experts who were **not sceptical** and **saw systems as having been successful in dealing with past threats**, 31% gave examples of single-issue based systems (i.e. the Paris Agreement, Montreal protocols, Hyogo);

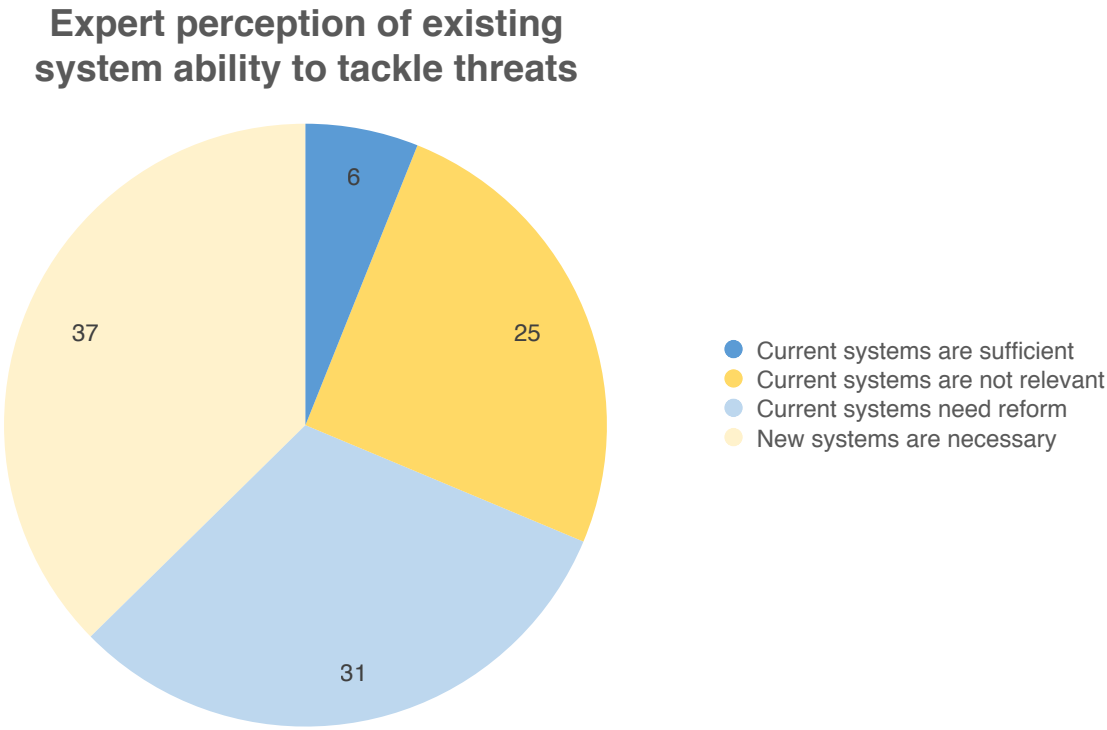
and 40% gave examples of decentralised systems (i.e. the Eastern Roman Empire).

Below is a breakdown of the **four main types of systems experts cited** as having emerged to deal with past threats.



QUESTION IV: *Ability of current system architecture to deal with future threats identified in ANNEX I*

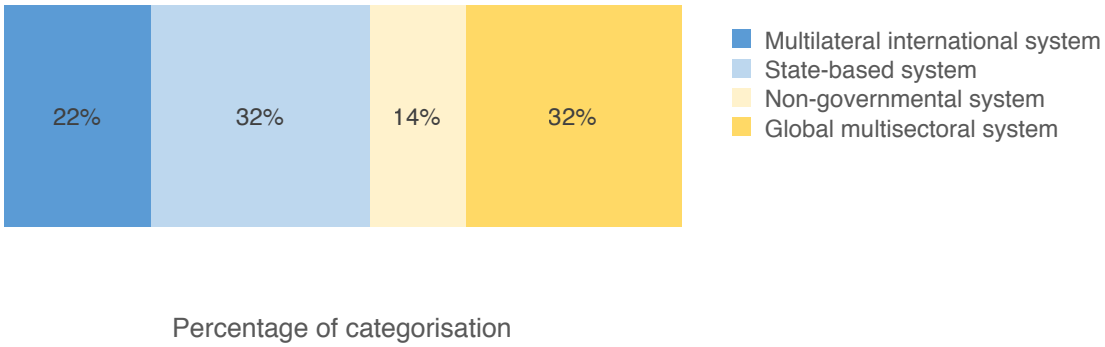
Experts offered their thoughts on the ability of current systems to cope with present and future threats and cited ideal resilient systems architectures.



QUESTION V: *Types of system architectures seen as relevant for dealing with future threats as identified in ANNEX I*

The above proposed types of system architecture fall into four main 'buckets': **multilateral international systems**; primarily **state-based systems** acting at both national and local levels; **non-governmental systems** acting at local and global levels through networks of NGOs, private actors or civil society; and a **global multisectoral system** with states as subcomponents amidst private actors, NGOs, civil society, experts, etc.

Categorisation of proposed systems



QUESTION VI: *Ways in which the proposed systems should operate when dealing with future threats as identified in ANNEX I*

Approximately one-third of experts believed proposed systems should be

Adaptable through self-learning – 40%
Engaged in public-private partnerships – 35%
Decentralised in dynamic: self-organising, network based, segmented – 30%
Accountable: mutual, supranational, and future oriented – 30%
Evidence-producing – 30%
'Action research' and 'action taking' – 30%

Approximately one-quarter of experts believed proposed systems should be

Operational through subsidiarity – 25%
Solution-finding: scenario specific, single-issue based problem-solving – 20%

A small percentage of experts believed proposed systems should be

Engaged in intergenerational processes – 10%
Diversified for resilience – 10%
Based on 'Enlightened self-interest' – 5%