

# Draft Background Paper

## Expert group meeting for the Global Sustainable Development Report: Emerging issues for the attention of policy makers, 5-6 April

### I. Introduction

With the establishment of the UN High-level Political Forum (HLPF) on Sustainable Development in 2012, Member States created an entry point for scientists across the world to be heard at the highest levels of the United Nations. The HLPF has a central role in overseeing the follow up and review of the 2030 Sustainable Development Agenda at the global level and will act as the main platform for providing political leadership and guidance on the Agenda's implementation.<sup>1</sup> An additional crucial aspect of the HLPF is that it was given the task to *"strengthen the science-policy interface through review of documentation bringing together dispersed information and assessments, including in the form of a global sustainable development report, building on existing assessments"* (The Future We Want, 2012).

The Global Sustainable Development Report (GSDR) is a United Nations publication aiming to strengthen the science-policy interface at the High Level Political Forum (HLPF), which serves as the United Nations platform for follow-up and review to the 2030 Agenda and for providing political leadership and guidance on sustainable development issues at the international level.

The identification of new and emerging issues is one function of the science-policy interface (United Nations, 2015). While many approaches exist, common features include the involvement of experts and formalized processes drawing on scientific evidence, assessments, and projections. Science-policy interfaces are the many ways in which scientists, policy-makers and other stakeholders link up to communicate, exchange ideas, and jointly develop knowledge to enrich policy and decision making processes and research (Young et al., 2013). The 2015 GSDR underlined the importance of finding adequate ways to identify emerging issues across the whole spectrum of sustainable development, including its social and economic dimensions.

The science-policy interface involves the exchange of information and knowledge leading to learning, and ultimately influencing decisions and changing behavior, it plays an important role in decision-making and can usually fulfill many different functions at the different stages of the policy making process. For instance, scientific advice can steer public attention to issues that form threats to human well-being and that imply policy intervention. Many environmental and health problems (e.g. climate change, malaria, HIV/AIDS) were brought to the forefront of political attention through a process of awareness creation through scientific expertise. Alternatively, in the absence of public concern and before an issue enters the policy cycle, scientific expertise can be used to bring an issue to the attention of policy-makers, provide problem definition and assess chosen policy decisions or the potential impact of different policy options as well as monitor and support the implementation of these policies. In general, it could be said that it is crucial to inform policy and decision makers about new and future opportunities as well as threats and have them prepare for slow changes and sudden shocks.

### Aims and objectives

This background paper aims to inform the discussion at the expert group meeting. The ultimate objective of the meeting is to support policy deliberations on the GSDR at the HLPF in July 2016, with a view to strengthening the science-policy interface for sustainable development.

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<sup>1</sup> A/RES/70/1, GA resolution 70/1 of 25 September 2015.

As noted above, the identification of emerging issues forms part of the science-policy interface. In this context, scope exists to inform policy-makers of new opportunities as well as risks, including slow changes and sudden shocks. To this end, one chapter of the GSDR has been dedicated to emerging issues in science in the context of sustainable development.

Policymakers are exposed to a broad range of analyses, rankings, and advice concerning emerging issues, prepared from a multitude of perspectives. However, the available material varies widely in terms of scales – geographical and temporal – and in the thematic coverage of issues. As such, it is not readily accessible for policy-makers in the HLFP. There is thus a need to systematize the existing material, informed by a sustainable development perspective. The Secretary-General's 2016 report on follow-up and review at the global level highlights that a critical mandate for the HLPF is to address new and emerging issues.<sup>2</sup>

The expert group meeting will discuss approaches and methodologies for systematically identifying the range of issues for possible consideration by policymakers, in particular at the HLPF. In addition, the experts will carry out an indicative prioritization exercise, based on an indicative list of issues drawn from an electronic survey. The background paper aims to support the discussions by:

- Outlining criteria for identifying emerging issues.
- Providing a possible framework for categorizing emerging issues.
- Presenting a sample of emerging issues from a variety of sources.

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<sup>2</sup> Report of the Secretary-General, Critical milestones towards coherent, efficient and inclusive follow-up and review at the global level, 2016, A/70/684.

## II. Identifying emerging issues

The term emerging issue is somewhat vague, partially dependent on the context. In broad terms, an emerging issue can be understood as one that is not yet generally recognized, but could have major impact on sustainable development if not addressed. Often perceived as risks, emerging issues could also be positive, potentially resulting in foregone opportunities, or negative and could result in critical undesired effects in the future if not addressed.<sup>3</sup> Often an emerging issue is distinguished by its relative novelty, in the sense it has only recently been identified and considered important by scientists, but has not yet received proper recognition by policy makers. However, it should be noted that the novelty of a topic (or of a set/cluster of signals) does not necessarily imply the character of an emerging issue. The inherently subjective process of identifying emerging issues can, however, be guided by criteria, chosen with a view to field of interest.

**Table 1: Criteria for identifying emerging issues**

Criteria	Explanation
<i>Risk assessment</i>	
Probability of occurrence	Likelihood of occurrence
Impact/extent of potential damage	Impact on society, economy, environment
<i>General/cross-cutting</i>	
Persistence	Short to long-term effect, long decay in environment
Irreversibility	Damage/harm cannot be undone
Latency/delayed response	Gap between causal event and damage/harm
Ubiquity	Geographic (local to global), across multiple dimensions of sustainable development
Novelty	New to policymakers, departs from prevailing scientific understanding
Potential for mobilization	Limited to high political relevance
Plausibility	Clear cause-effect links, authoritative sources, evidence-based
Resolvability	Perceived as conducive to human intervention, within existing paradigms of action
Priority	Importance in terms of social and cultural norms, impact on already vulnerable/marginalized

Sources: Adapted from WBGU (1998); Amanitidou et al (2012)

<sup>3</sup> Definition adapted from UNEP, 2012.

Recognition as ‘emerging’ is based on ‘newness’, but not necessarily issues that are unheard of or that comes as a surprise. Newness could be as a result of:

- new scientific knowledge, which could be in form of new data, evidence, theory or model
- new technological development,
- new scales or accelerated rates of impact,
- a heightened level of awareness, and, or;
- new ways of responding to a known issue.

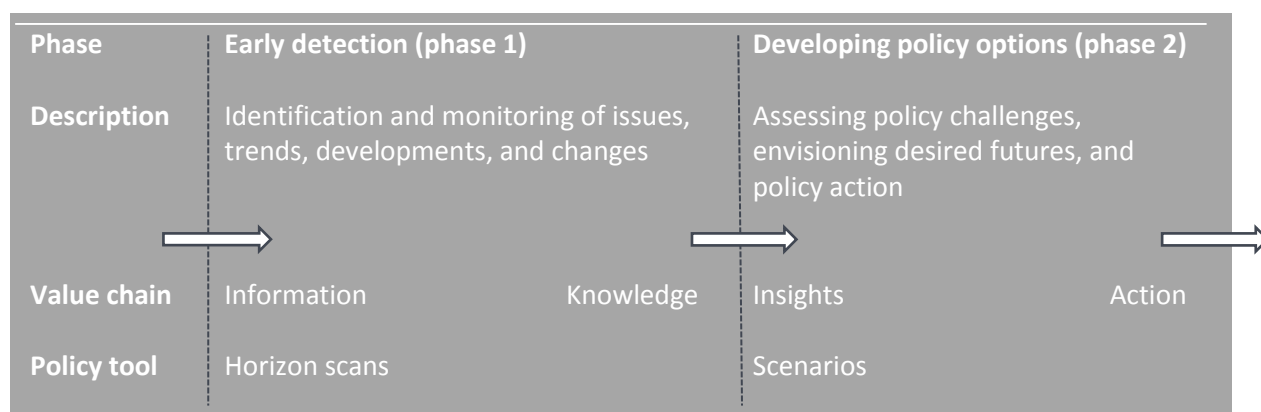
Source: UNEP, SP7 Emerging Issues Project (2015)

For instance, as illustrated in table 1, a common starting point is an assessment of probability and impact, with additional criteria catering for more fine-grained analysis. Thus an assessment of potential persistence of an effect will could be of importance in considering an emerging issue in the environmental domain. It must also be recognized that how – and by whom – an issue is perceived as emerging

will make difference, not least to effective policy action. Scientific findings and support are necessary, but whether an issue comes to the fore will also depend on political processes and social norms.

The process of identifying emerging issues can proceed in a number of ways, but a common starting point is “scanning” for issues across a range of sources, informed by the purpose of the exercise. horizon scanning, which is defined as “the systematic examination of potential (future) problems, threats, opportunities and likely future developments including those at the margins of current thinking and planning. Horizon scanning may explore novel and unexpected issues, as well as persistent problems, trends and weak signal” (Van Rij, 2010). More broadly, it serves a policy development function by informing scenario and other future-directed exercises, and by emphasizing the creation of networks and knowledge flows between organizations (Habegger, 2009). Figure 1 situates the “scanning” in a broader context of future-oriented tools for policymaking. Thus an effort aimed at detecting low-cost technologies for implementation of the SDGs could search journals and research papers related to areas such as water, energy and agriculture, as well as related content from the UN system, conferences, and even social media.

Figure 1: Simplified phases of a foresight process



Source: adapted from Habegger (2009)

Even a guided scanning process is likely to generate a large number of issues. To identify issues that are appropriate for policymakers at the global level, some form of filter can help to screen out issues of primarily local or national significance. Adapting the “global filter” proposed by the WGBU (1998) for environmental issues, the following questions could be useful in filtering emerging issues for consideration by policymakers at the international level in the HLPF. They are as follows:

1. Does the issue in question relate closely to the Sustainable Development Goals?
2. Is the potential threat or opportunity of global or at least international relevance?
3. Does management of the risk or harnessing of the opportunity depend on international action and cooperation?
4. Is the issue expected to persist (non-transient) and/or does it have a clear increasing trend?

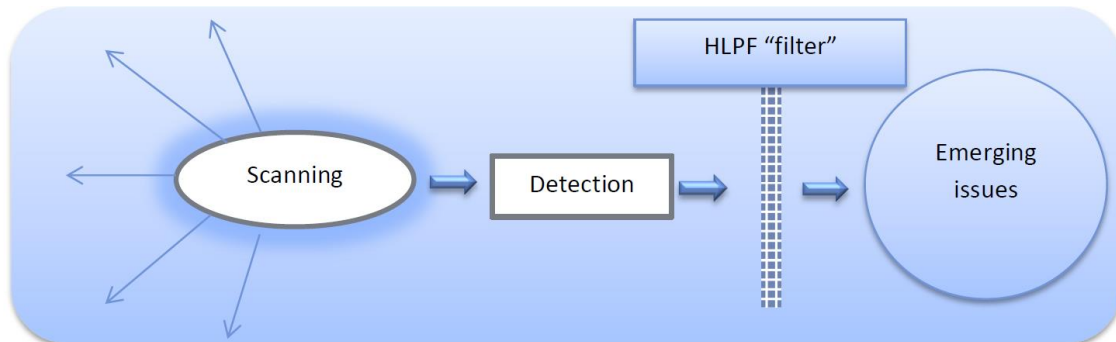


Figure 2: Schematic representation for identifying emerging issues

Figure 2 sets out in schematic terms the process of scanning for issues, with the application of a “filter” to sift for issues of potential interest to policymakers, in this case the HLPF.

### III. Framework for emerging issues

Following the exploratory scanning of issues, the next step is usually to cluster or categorize the issues in manner that facilitates analysis and insight (Amanatidou et al., 2012, Sutherland et al., 2011). There are various methods to cluster collected issues and it depends on the context and overall goal of the research. Ideally, the framework should be reasonably flexible. In this case, the issues from the sources above were categorized using three frameworks:

- STEEP framework: Social, Technological, Economic, Environmental and Political;
- GSDR framework: areas and issues typically covered in definitions of “sustainable development” in the literature (Kates et al, 2005)
- DPSIR framework: Driving Forces-Pressures-State-Impacts-Responses.

STEPP framework is probably the most basic taxonomy for obtaining a broad categorization of potential emerging issues that is readily applicable to a number of disciplines and modes of analysis.

DPSIR is a causal framework for describing the interactions between society and the environment, and as a result this framework is best suited to environmentally-related emerging issues. The GSDR framework has a broader approach, which includes six categories: Nature, Life support, Community, People, Economy, and Society (figure 3). Nevertheless, it focuses on the elements that should be sustained and developed where socially related emerging issues can fall in many categories of the framework. Consistent assignment of issues to clusters was found to be difficult.

During the initial clustering effort, the STEEP framework proved to be more suitable than the DPSIR and GSDR frameworks. This is by no means to claim that it is inherently superior to any other frameworks, but simply to say that it proved more capable of being applied with reasonable ease to the rather broad set issues in question. As a result after clustering all issues using all three approaches, the STEEP framework proved to be preferable to use for further analysis, as it is most

suitable for the collected list of issues, as well as being familiar to many most known by different interest groups.

**Figure 3: Illustrative issues using GSDR framework for SD analysis**

SUSTAINABILITY - What is to be sustained?	DEVELOPMENT - What is to be developed?
<p><b>Nature</b>            Earth (Climate change, extreme weather events)            Biodiversity (Species loss, redistribution, expansion)            Ecosystems (resilience of oceans)</p>	<p><b>People</b>            Income and employment opportunities (unemployment and poverty)            Health (genetic mutations, emerging diseases)            Demography (population growth)</p>
<p><b>Life support</b>            Ecosystem services (abuse of ecosystems, impacts of climate change)            Resources (agricultural land issues, water crisis, overfishing)            Environment (catastrophes, pollution, domestic waste, diseases)</p>	<p><b>Economy</b>            Economic resilience (energy and financial crises)            Economic growth (sustainable growth, green economy)            Technological and innovative capacities (technologies to monitor environmental and social process, open data access)            Consumption (sustainable production and consumption)</p>
<p><b>Community</b>            Peace (regional conflicts, local violence, migration, cyber-attacks)            Culture (sustainable consumption)            Places (sustainable urban development)</p>	<p><b>Society</b>            Effective institutions (persistent poverty, failure of governance)            Legitimate states (wars, transboundary issues, geopolitical challenges)</p>

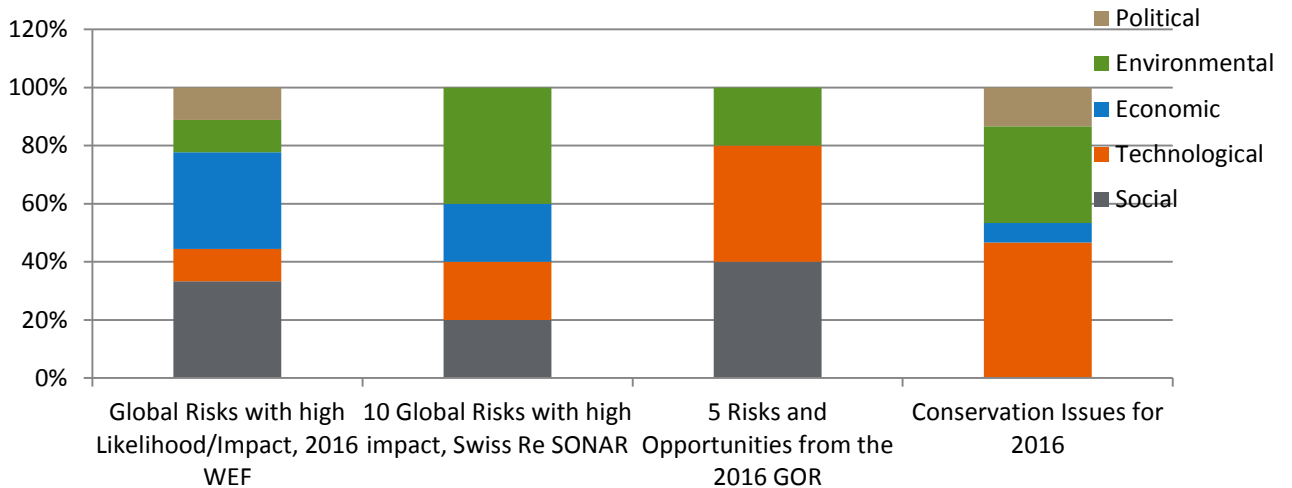
Source: UN (2014); Kates et al (2015)

By way of illustration the emerging issues identified in a four reports and assessments, prepared from different perspective and for different audiences were placed in the STEEP framework. All issues were divided between these five categories. As can be seen from table 2, the social and political issues had the lowest share of issues; however, the distribution is sensitive to the type and number of reports. For example, the large number of issues technology-related issues from one report – Conservation Issues for 2016 – influenced the picture (figure 4). Moreover, as some of the emerging issues can fall into several categories, it was obvious that many issues that were sorted to social, technological, economic or political categories could also fall into environmental one.

**Table 2: Emerging issues identified in prominent reports and assessments<sup>4</sup>**

Emerging Issues Source	Social	Technological	Economic	Environmental	Political
<b>"Global Risks" with highest average impact and likelihood, World Economic Forum, 2016</b>	<ul style="list-style-type: none"> <li>• Large-scale involuntary migration</li> <li>• Profound social instability</li> <li>• Water crises</li> </ul>	<ul style="list-style-type: none"> <li>• Cyberattacks</li> </ul>	<ul style="list-style-type: none"> <li>• Fiscal crises in key economies</li> <li>• Unemployment and underemployment</li> <li>• Asset bubble</li> </ul>	<ul style="list-style-type: none"> <li>• Failure of climate-change mitigation and adaptation</li> </ul>	<ul style="list-style-type: none"> <li>• Interstate conflict</li> </ul>
<b>10 Global Risks in Terms of Impact in the next 3 years, Swiss RE</b>	<ul style="list-style-type: none"> <li>• Lifestyle drugs</li> <li>• Rising pandemic risk</li> </ul>	<ul style="list-style-type: none"> <li>• Predictive maintenance</li> <li>• The dangers of LED light</li> </ul>	<ul style="list-style-type: none"> <li>• De-globalisation</li> <li>• The great monetary experiment</li> </ul>	<ul style="list-style-type: none"> <li>• Super natural catastrophes</li> <li>• Brazilian drought</li> <li>• Wildfires</li> <li>• Fossil fuel management</li> </ul>	
<b>5 Risks and Opportunities, 2016 Global Opportunity Report</b>	<ul style="list-style-type: none"> <li>• A generation wasted: <ul style="list-style-type: none"> <li>○ The digital labour</li> <li>○ Market</li> <li>○ Closing skills gap</li> </ul> </li> <li>• Global food crisis: <ul style="list-style-type: none"> <li>○ New diets</li> <li>○ Smart farming</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Resistance to life-saving medicine: <ul style="list-style-type: none"> <li>○ Antibiotic-free Food</li> <li>○ Precision treatment</li> </ul> </li> <li>• Accelerating transport emissions: <ul style="list-style-type: none"> <li>○ Flexibility mobility</li> <li>○ Crowd transport</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>• Loss of ocean biodiversity: <ul style="list-style-type: none"> <li>○ Regenerative ocean</li> <li>○ Economy</li> <li>○ Closing the loop</li> </ul> </li> </ul>	
<b>Sutherland et al, A Horizon Scan of Global Conservation Issues for 2016</b>		<ul style="list-style-type: none"> <li>• Artificial Intelligence</li> <li>• Electric Pulse Trawling</li> <li>• Osmotic Power</li> <li>• Satellite Access to Shipborne Automatic Identification Systems</li> <li>• Passive Acoustic Monitoring to Prevent Illegal Activity</li> <li>• Synthetic Body Parts of Endangered Animals</li> <li>• Artificial Glaciers to Regulate Irrigation</li> </ul>	<ul style="list-style-type: none"> <li>• Changing Costs of Energy Storage and Consumption Models</li> </ul>	<ul style="list-style-type: none"> <li>• Managed Bees as Vectors</li> <li>• Increasing Extent of Construction of Artificial Oceanic Islands</li> <li>• Increasing Aquatic Concentrations of Testosterone</li> <li>• Effects of Engineered Nanoparticles on Terrestrial Ecosystems</li> <li>• Invasive species as Reservoirs of Genetic Diversity</li> </ul>	<ul style="list-style-type: none"> <li>• Ecological Civilization Policies in China</li> <li>• Unregulated Fisheries in the central Arctic Ocean Threaten Expanding Fish Stocks</li> </ul>

<sup>4</sup> Sources: World Economic Forum, The Global Risks Report 2016, risks from figure 1 with higher than average impact and likelihood; Swiss Re SONAR: New Emerging Risk Insights, 2015, p. 7; DNV-GL, UN Global Compact, Mondaymorning-Global Institute, Global Opportunity Report 2016; Sutherland et al, A Horizon Scan of Global Conservation Issues for 2016, 31(1) Trends in Ecology & Evolution (2016).



**Figure 4: Percentage of Emerging Issues by category and data sources**

In the presentation of possible emerging issues, it may be useful to further group them in accordance with a rough timeframe (table 3). The introduction of a time dimension for the emerging issues can assist in clarifying institutions and policy-making levels that could have a potential interest in an issue. Results can be presented in the format of a table, where STEEP framework can be again used to organize emerging issues by context and time periods within the emerging issues are considered most important.

**Table 3: Indicative sorting of indicative issues**

STEEP	Anticipated Impacts		
	0-2 Years	2-5 Years	5+ Years
Social	<ul style="list-style-type: none"> <li>• Violence</li> <li>• Natural disasters</li> </ul>	<ul style="list-style-type: none"> <li>• Unemployment</li> <li>• Migration</li> <li>• Terrorism</li> </ul>	<ul style="list-style-type: none"> <li>• Demography</li> <li>• Urbanization</li> <li>• Health</li> <li>• Indigenous people</li> </ul>
Technological	<ul style="list-style-type: none"> <li>• Cyber-security</li> </ul>		<ul style="list-style-type: none"> <li>• Massive open information</li> <li>•</li> </ul>
Economic	<ul style="list-style-type: none"> <li>• Global economic slow-down/crisis</li> </ul>	<ul style="list-style-type: none"> <li>• Unemployment</li> </ul>	<ul style="list-style-type: none"> <li>• Green economy</li> <li>• Energy</li> <li>• Sustainable Growth</li> </ul>
Environmental	<ul style="list-style-type: none"> <li>• Emerging diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Catastrophes</li> <li>• Food security</li> <li>• Waste</li> <li>• Urbanization</li> </ul>	<ul style="list-style-type: none"> <li>• Climate Change</li> <li>• Biodiversity</li> <li>• Oceans</li> <li>• Water quality/scarcity</li> <li>• Air Quality</li> </ul>
Political	<ul style="list-style-type: none"> <li>• Land use</li> </ul>	<ul style="list-style-type: none"> <li>• Regional conflicts</li> <li>• Wars</li> </ul>	<ul style="list-style-type: none"> <li>• National governance</li> <li>• Environmental governance</li> <li>• Uncertainty</li> </ul>



#### **IV. Emerging issues from a variety of sources**

Exploratory scanning focuses on accumulating potential emerging issues from a wide variety of data from different sources, while an issue-centered approach concentrates on identifying core documents that describe substantial parts of potential issues (Amanatidou et al., 2012). So as to avoid a one-dimensional view on emerging issues, it is advisable to consult as wide a variety of possible information sources, taking into account the scope and purpose of the exercise.

For these reasons, the preparation of the 2016 GSDR includes material from a range of sources: (a) selected issues from emerging issue identification arrangements and mechanisms within the UN system; (b) a snapshot of emerging issues and research priorities identified by national academies of sciences; (c) selected issues from leading academic journals; and (d) a summary of relevant points from crowdsourced science briefs.

##### ***Global UN initiatives***

A number of UN entities and agencies engage in emerging issues identification processes and related exercises, in variety of forms. In some cases such as processes have a long standing, in other instances they are more recent. In light of the 2030 Agenda, it is anticipated that more and more UN agencies will focus on identifying emerging issues to ensure solutions are found on potential obstacles, and opportunities are explored to push the Agenda's implementation forward. The following are some examples of emerging issues processes and exercises from UN agencies or entities. A selection of these processes is summarized in annex 1.

##### ***National Academies of Science***

National academies of science play a significant role in the domestic academic world by coordinating, and sometimes defining, research priorities in all scientific fields of interest and importance to the particular country. National academies are also often charged with providing independent, objective advice to their governments on matters related to science and technology. Members are mainly elected in recognition of their distinguished and continuing achievements in their specific scientific field. As a result, membership to a national academy of science is widely recognized as the highest honor that a scientist can receive. Additionally, National Academies have often long-standing collaborations with organizations, such as the United Nations, which benefit from the extensive expertise in various scientific and technological areas. Therefore, it was considered that National Academies could be a great source for information on emerging issues in science.

The following list is a snapshot of issues collected by browsing available online information as well as in some cases was directly provided by National Academies by email request.

**Table 4: Selected issues considered by national academies of sciences**

<b>Emerging Issues</b>	<b>The Royal Society UK</b>	<b>Hungarian Academy of Sciences</b>	<b>Academy of Sciences of Tajikistan</b>	<b>Brazilian Academy of Sciences</b>	<b>Slovenian Academy of Sciences and Arts</b>	<b>Cameroon Academy of Sciences</b>
<b>Social</b>	Food and environmental security	Effects of labour market status and education on subjective well-being of youth in Europe	Improvement of quality of education	Neglected Diseases	State and vision of higher education in Slovenia  New dictionary of Slovenian language	Agriculture for Improved Nutrition of Women and Children in Nigeria
<b>Technological</b>	Solar Geoengineering	Application and development of nuclear analytical techniques	Methods of prevention, diagnosis, and treatment of infectious diseases		Bio-robotics  Risks of computing, artificial intelligence and internet	Anti-malarial Drug Resistance in Cameroon
<b>Economic</b>	Long-term Growth from Science and Innovation	International comparisons of product supply chains in the agro-food sectors: determinants of competitiveness & performance in EU and international markets	The economic mechanisms & development of market relations in Tajikistan			
<b>Environmental</b>	Resilience to extreme weather	Improved monitoring and forecasting of ecological status of EU inland waters by combining future Earth observation data & models	Monitoring of water resources and their integrated use	The Forest Code and science in Amazonia	Forest and wood	
<b>Political</b>	Joint action on disasters, development and climate change	Potentials and challenges of evolving border concepts in a post-Cold War world	S&T policies and politics	A State Policy for Science, Technology & Innovation	Establishment of court of honour in science ethics Ethics of public expression and hate speech System of evaluation of research work in Slovenia	Elements for a National Biotechnology Policy Framework for Cameroon

### ***Issues from Leading Journals***

In its simplest form, scanning for emerging issues can be based on a fixed set of highly-authoritative peer-reviewed academic journals such as Science, Nature, Science Advances, and the Sustainability Science Section of the Proceedings of the National Academy of Sciences of the United States of America. For the purpose of the GSDR, criteria such as the following might be used for selection: major breakthrough in knowledge or technology, potentially high impact on sustainable development, global and long-term significance, greatly increased scientific interest in the issue, calling for or implying the need for policy action or for new sustainable business opportunities.

#### **Ancient grasslands at risk, William J. Bond**

The problem of deforestation has led to efforts to identify areas suitable for reforestation, and large areas of open grassy vegetation have been identified as potential sites for reforestation. However, recent research demonstrates that rather than being the degraded secondary products of deforestation, grasslands are often ancient and highly biodiverse. But it remains difficult to reliably distinguish primary and secondary grasslands on a large scale. Science Vol. 351, Issue 6269, pp. 120-122 (2016).

#### **Mastering the game of Go with deep neural networks and tree search, Silver et al.**

The game of Go has long been considered as the most challenging of classic games for artificial intelligence, due to the very large number of possible moves and the difficulty of evaluating board positions. It required a different approach to the one used in the IBM computer that famously beat the world's leading chess player in 1997. For the computer Go player, deep neural networks are trained by a novel combination of supervised learning from human expert games, and reinforcement learning from games of self-play. Since the publication of the study, the computer Go player beat the best human Go player in the world by 4 to 1 Nature 529, 484–489 (28 January 2016).

### ***Crowdsourced Science Briefs***

Crowdsourced briefs are inputs received from the scientific community around the world, highlighting a specific issue, finding, or research with a bearing on sustainable development or the inter-linkages between them. The call for policy briefs for

the 2016 GSDR requested prospective authors to review up-to-date findings relating to a particular issue, address a single issue of importance, or present recommendations and solutions to a problem or challenge. The call specifically stated that contributions from both the natural and social science communities from all disciplines were highly valued and welcomed. Further guidance to potential authors called for concise briefs (less than 1,500 words) that are factual and based on peer-reviewed literature. It was also recommended to highlight key messages from the current scientific debate for the attention of policy-makers.

The open call for science briefs resulted in over 45 submissions accepted from 23 countries from all regions. All briefs were written in English bar one that was in Russian. Most of the contributing scientists were affiliated with universities or research centres from developing and developed countries.

Out of the 45 policy briefs, 16 focused on social policy issues, 11 on technological, 2 on economical, 10 on environmental, and 5 on political. It should be noted that although this is a random collection

of issues identified by various knowledge-holders, their consideration still bears merit, as it is a small sample of emerging issues that would not have necessarily been identified otherwise.

The following table illustrates some of the issues highlighted by the public contributions by theme.

**Table 5: Distribution of and sample issues from crowdsourced policy briefs (2016)**

Social	Technological	Economic	Environmental	Political
16	11	2	10	5
Urban health	Artificial intelligence	Green economy	Heat waves	Thematic reviews in the 2030 Agenda
Gender mainstreaming	Green infrastructure	Green jobs	Climate change & society	Regional collaborative environmental governance in China
Education for sustainable development	Big data: challenges & opportunities		Urban storm water: challenges & opportunities	Urban Sustainability Transformations in real life politics

## V. Exploratory exercise with expert input

A common way to conduct exploratory scanning is through experts and expert networks (Sutherland et al, 2016). An initial list of issues is whittled down in the course of a combination of voting and discussions among experts. The process may include several steps:

- *Collection of potential emerging issues.* At this stage the objective is to gather inputs a large number of potential issues, from a broad cross-section of experts. This may be followed by some degree of ranking by experts.
- *Clustering of Emerging Issues.* This helps to systematize collected large data for the further selection procedure. There are different approaches to clustering of issues, depending on the scope of the exercise. In this case, it was decided to use the STEEP framework.
- *Expert discussion/Consensus-seeking.* This involves the expertise of specialists from different fields during a face-to-face meeting where experts can express their ideas and opinions during the finalization of the list of emerging issues for potential consideration by policymakers.

Participants at the EGM will engage in an indicative prioritization exercise, based on the indicative list of issues drawn from the electronic survey. Expert advice will also be sought on how to identify a sub-set of issues that may be appropriate for consideration by policy-makers, as well as potential criteria for such an identification process.

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## Annex 1

Entity and description	Issues
<p><b>Food security and nutrition</b></p> <p>The High Level Panel of Experts on Food Security and Nutrition (HLPE) was established in 2010 as the science-policy interface of the United Nations Committee on World Food Security (CFS).</p>	<p>A 2013 Note on emerging issues in the context of FSN highlighted four challenges: (a) many disciplines involved in the identification and framing of issues, and many different ways to relate them to the four dimensions of food security; b) issues can emerge specifically due to increased interdependencies between, e.g. agriculture and other sectorial issues such as transportation; c) issues can emerge in the future, therefore, requiring foresight tools; and d) contexts change and issues vary, which calls for regularly revisiting them.</p> <p>Participants surveyed were asked to provide in-depth disaggregated information on the effect the emerging issue they put forward had in terms of the number affected, their geographical location, gender and vulnerable group. This aspect of the methodology was already in line with the main premise of the 2030 Agenda of “leaving none behind.”</p> <p><i>Recent completed reports:</i> Water for food security and nutrition (2015), Food losses and waste in the context of sustainable food systems (2014), Sustainable fisheries and aquaculture for food security and nutrition (2014). <i>Underway:</i> Sustainable agriculture development for FSN, including the role of livestock (2016), Sustainable forestry for food security and nutrition (2016).</p>
<p><b>Environment – UNEP</b></p> <p>UNEP’s Emerging Issues Project has identified ten major issues of focus in the year 2015/16 based on the regional and policy relevance, urgency, evidence and newness.</p>	<p>The issues are: 1. Marine plastics and biodegradability; 2. Micro-beads and Cosmetics; 3. Emerging Zoonotic Diseases; 4. Drought and Plant Toxicity; 5. Soil Carbon and Valuation; 6. Loss and Damage; Water Risk Financial Share Pricing; 8. Dust and Sandstorms and Desertification; Illegal Wildlife Trade; 10. New Materials and 3D Printing</p>
<p><b>Marine environmental pollution – GESAMP</b></p> <p>Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) is an advisory body established in 1969 and consisting of specialized experts nominated by nine Sponsoring United Nations Agencies, namely IMO, FAO, UNESCO-IOC, UNIDO, WMO, IAEA, UNEP, and UNDP. GESAMP’s principal task is to provide scientific advice concerning the prevention, reduction and control of the degradation of the marine environment to the Sponsoring Agencies.</p>	<p>GESAMP’s New and Emerging Issues Programme - At its 2015 session, the impact of residues of chronic oil spills in the marine environment was raised as an issue of particular concern. GESAMP was called to carry out a study on disinfection by-products and biofouling to add further knowledge on the subject matter (Report of the 42<sup>nd</sup> Session of GESAMP, 2015).</p>
<p><b>Science - UNESCO</b></p> <p>Science Report mapping science, technology and</p>	<p>2015 Report contains chapter on Perspective on Emerging Issues with five articles (a) the increasingly global role universities play, including related opportunities such as educational partnerships, explosive</p>

<p>innovation (STI) produced annually for the past twenty years. The 2015 UNESCO Science Report: towards 2030, analyses trends and developments in science, technology and innovation policy and governance between 2009 and mid-2015, with a view to providing essential baseline information on the concerns and priorities of countries that should orient the implementation and drive the assessment of the 2030 Agenda.</p>	<p>growth in brain circulation, and the digital disruption, while the need to close the innovation gap is identified as among the challenges; (b) increased interconnectedness of the second generation World Wide Web and open science that has helped develop a modern approach to science through information-sharing and data-reuse; (c) the critical role science will have in implementing the 2030 Agenda and the need for an integrated approach to achieve this; (d) the need for a new framework for global science policy, and (e) the contribution of local and indigenous knowledge to the science-policy interface.</p>
<p><b>Disaster risk – UNU-HIS</b> United Nations University – Institute for Environment and Human Security (UNU-EHS) and the Alliance Development Works/Bündnis Entwicklung Hilft (BEH) publish the annual World Risk Report, which systematically considers a country’s vulnerability, and its exposure to natural hazards to determine a ranking of countries around the world based on their disaster risk.</p>	<p>The 2015 report examined the connection between food security and disaster risk, drawing on the report’s World Risk Index. One of the recommendations of in the report is that investment in food security should be designed in such a way that the vulnerability of societies towards disasters is lowered. Previous reports have considered Cities as an area of risk (2014) and Health and Healthcare (2013).</p>
<p><b>Digital dividends – World Bank</b> The World Development Report 2016, entitled Digital Dividends, analyzes the contribution of digital technologies to development. Noting their rapid spread throughout the world, it also recognizes that the broader development benefits from using these technologies have lagged behind.</p>	<p>The WDR 2016 also examines six nascent or emerging technologies that promise to be far-reaching in their impact on development. They are: fifth generation (5G) mobile phones, with vastly faster data connections than existing phones; artificial intelligence, computer systems that carry out tasks normally done by humans, such as speech recognition and decision making; robotics, understood as machines or mechanical systems that automatically handle tasks; autonomous vehicles, or self-driving cars; the internet of things, which refers to the interconnection of objects to internet infrastructure; and 3D printing, a process that enables to make three-dimensional objects from a digital file.</p>

## ANNEX 2<sup>5</sup>

### Emerging Issues within Social category

Demography	Unemployment	Urbanization	Environmental awareness	Health	Indigenous people	Migration	Society	Violence
<ul style="list-style-type: none"> <li>• Changing demography – youth, entrepreneurship, gender</li> <li>• Population growth, migration between the states (income and shelter) and towards urban areas (comfort and services, consumption), education/awareness/motivation of population to care about the environment and the Planet</li> </ul>	<ul style="list-style-type: none"> <li>• The future of work &amp; talent gaps</li> </ul>	<ul style="list-style-type: none"> <li>• Vulnerability associated to urban densification</li> <li>• Urbanization (lifestyle, inter-connection, green transportation and construction)</li> <li>• Urbanization of global population</li> </ul>	<ul style="list-style-type: none"> <li>• Increased public interest and awareness on sustainability, including awareness on environmental rights and responsibilities</li> <li>• Consumer preferences – shifting values and social norms, organic farming, green pathways to sustainable development and poverty reduction</li> </ul>	<ul style="list-style-type: none"> <li>• Emerging health issues (humans, animal, vegetation); Antibiotic resistance (agriculture, livestock, fisheries); harmful algal blooms</li> <li>• Longevity and chronic diseases</li> <li>• Lifestyle drugs</li> <li>• Rising pandemic risk</li> </ul>	<ul style="list-style-type: none"> <li>• Arctic and indigenous peoples</li> </ul>	<ul style="list-style-type: none"> <li>• Large-scale involuntary migration</li> </ul>	<ul style="list-style-type: none"> <li>• Profound social instability</li> <li>• Connected &amp; collaborative society</li> </ul>	<ul style="list-style-type: none"> <li>• Large-scale terrorist attacks</li> </ul>

<sup>5</sup> UNEP GEO-6 Regional Environment Network (REIN) conferences; WEF 2016 risks from **table 2**; Swiss Re risks from **table 2**



## Emerging Issues within Technological category

Massive open information	Modern Inventions	Misuse and risks
<ul style="list-style-type: none"> <li>• Innovation in media and engagement tools – (e.g., Apps and the environment: emerging potential for public engagement and to promote behavioral change) - Opportunity for citizens to produce knowledge (e.g. citizen science)</li> <li>• Widespread availability and use of mobile technologies and social networks</li> <li>• Environmental monitoring based on citizen science</li> <li>• Data revolution and the knowledge economy – Internet of Things, open access to data, electromagnetic fields/radiofrequency, capacity building in technology and climate change mitigation/adaptation</li> <li>• E-distribution as the dominant distribution channel</li> <li>• Opportunities to use new technologies for monitoring and data sharing, citizen science, GIS, satellite, open data; use of social media - for environmental monitoring and increased sharing of information between the Arab region countries (lack of ability to monitor ocean acidification)</li> <li>• Big data &amp; smart analytics</li> <li>• Internet of things</li> <li>• E-distribution as the dominant distribution channel</li> </ul>	<ul style="list-style-type: none"> <li>• Geoengineering, (e.g. dumping iron filings, west coast of Canada (currently no regulations)</li> <li>• Advances in battery technology – potential to boost renewables</li> <li>• Accelerating technological developments: nano, e-devices, biotech, 3-D printing and manufacturing, new mining/extraction methods and geographic areas (shale gas, oceans, polar and glacier zones)</li> <li>• Radical medical innovation</li> <li>• Cognitive computing</li> <li>• Autonomous vehicles (including cars and drones)</li> <li>• Predictive maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Massive incident of data fraud/theft</li> <li>• Breakdown of critical information infrastructure and networks</li> <li>• Large-scale cyber attacks</li> <li>• Massive and widespread misuse of technologies (e.g. 3D printing, artificial intelligence, geo-engineering, synthetic biology, etc.)</li> <li>• Massive expansion of cyber risks</li> <li>• Dangers of LED light</li> </ul>

## Emerging Issues within Economic category

Green economy	Finances	Energy	Insurance	Growth	Poverty
<ul style="list-style-type: none"> <li>• Industrialization – resource efficiency, recycling of waste, clean production</li> <li>• Sustainable cities (green technology, knowledge), transportation issues, traditional architecture “green buildings”, as well as air quality linked to transport</li> <li>• Green economy, eco-tourism, green accounting, natural capital valuation</li> <li>• Sustainable consumption and production (consumption patterns of emerging middle class, local knowledge)</li> <li>• Green economy</li> </ul>	<ul style="list-style-type: none"> <li>• Asset bubble in a major economy</li> <li>• Deflation in a major economy</li> <li>• Fiscal crises in key economies</li> <li>• Unmanageable inflation</li> <li>• Great monetary experiment</li> </ul>	<ul style="list-style-type: none"> <li>• Market entrance of non-insurance companies in primary market — “Primary Attackers”</li> <li>• Changing/transforming regional energy markets and priorities: EU energy imports reduction and diversification (closely linked with EU climate policies), coal to stay or even increase to provide energy security in some countries; demand in China and South Asia</li> <li>• The need for distributed energy systems and the move towards re-municipalisation</li> </ul>	<ul style="list-style-type: none"> <li>• Redistribution of risk along the re/insurance value chain</li> <li>• Insourcing of reinsurance risks by primary insurers</li> <li>• Increasing supply of alternative capital for reinsurance solutions</li> <li>• Market entrance of non-insurance companies in primary market — “Primary Attackers”</li> </ul>	<ul style="list-style-type: none"> <li>• Growing middle class in High Growth Markets</li> <li>• Emergence of new economic powers — “Shift to the East”</li> <li>• Regional champions going global</li> <li>• De-globalization</li> </ul>	<ul style="list-style-type: none"> <li>• Unemployment and under-employment</li> </ul>

## Emerging Issues within Environmental category

Catastrophes	Climate Change	Food	Biodiversity	Diseases	Waste	Air Quality	Fossil Fuel	Oceans	Urbanization	Water
<ul style="list-style-type: none"> <li>Major natural catastrophes (e.g. earthquake, tsunami, volcanic eruption, geomagnetic storms)</li> <li>Man-made environmental catastrophes (e.g. oil spill, radioactive contamination, etc.)</li> <li>Environmental hazards that could have global effects</li> <li>Shifting regime of extreme climate and disasters</li> <li>Brazilian drought</li> <li>Wildfire</li> </ul>	<ul style="list-style-type: none"> <li>Extreme weather events</li> <li>Climate change – diseases and wildlife migration, broader stakeholder participation in adaptation/mitigation</li> <li>Climate change</li> <li>Climate change</li> </ul>	<ul style="list-style-type: none"> <li>Food safety threatened due to increased use of pesticides and unregulated chemicals</li> </ul>	<ul style="list-style-type: none"> <li>Major biodiversity loss and ecosystem collapse (land or ocean)</li> <li>Species redistribution in response to climate change linked to habitat loss and populations shifts (New species invading ecosystems/ linked to climate change)</li> <li>Expansion of populations (donkeys, wild pigs, monkeys, mina birds, carp) and widespread invasive species – Gwaif trees, “Prosopis juliflora” (Oman, UAE, Saudi Arabia) (Indian experience is a good example on how to treat this kind of tree and Harmful Algae Blooms)</li> <li>Reduction in species, loss of genetic resources, decline in natural soil fertility; Risk of epidemics, diseases, dangerous mutations - reduction and limitations in vaccination, bio-technologies, mass migration and climate conditions</li> </ul>	<ul style="list-style-type: none"> <li>Rapid and massive spread of infectious diseases</li> </ul>	<ul style="list-style-type: none"> <li>Rapid increase in unsegregated household waste including a large share of organic waste</li> <li>Non-traditional wastes (e-waste, construction and demolition debris, illegal dumping)</li> <li>Management of low-concentration compounds including pharmaceuticals, nanoparticles, new household products (“down the drain chemicals”) – currently not being measured; no dose response, concentration response, toxicology. Contaminants of emerging concern: nanoparticles, micro-plastics, endocrine disruptors, pharmaceuticals</li> </ul>	<ul style="list-style-type: none"> <li>NH3 emissions are increasing (agriculture, fertilizer)</li> <li>Air quality</li> </ul>	<ul style="list-style-type: none"> <li>Impacts of unconventional oil and gas extraction (e.g., fracking and tar sands)</li> <li>Shale gas extraction (fracking) and associated water use and pollution, as well as seismic effects linked to earthquakes</li> <li>Fossil fuel management</li> </ul>	<ul style="list-style-type: none"> <li>Putting resilience of oceans at risk</li> <li>Over exploitation of fish stocks, threatening collapse of fish stocks and negative impacts on livelihoods</li> </ul>	<ul style="list-style-type: none"> <li>Coastal erosion, coastal urbanization (esp. Gulf Cooperation Council countries)</li> </ul>	<ul style="list-style-type: none"> <li>Water crises</li> </ul>

## Emerging Issues within Political category

Environmental governance	Regional conflicts	National governance	Land use	Uncertainty	Private sector	Wars
<ul style="list-style-type: none"> <li>• Failure of climate-change adaptation and mitigation</li> <li>• Alternative metrics for GDP that include environmental health</li> <li>• Emerging opportunity to help address fragmentation: Natural capital accounting, ecosystem services</li> <li>• Environmental governance – land acquisition, payment for ecosystem services and resources, financing of terrorism</li> <li>• Poor capacity to respond to chemical and radiological (nuclear, medical, industry) accidents</li> <li>• Synergistic actions of impacts and environmental changes</li> <li>• Negative impacts from infrastructure used as an adaptive measure to climate change</li> <li>• Environmental governance: collaborative, natural capital, mobile devices and big data</li> <li>• Downgrading of conservation policies</li> </ul>	<ul style="list-style-type: none"> <li>• Interstate conflict with regional consequences</li> <li>• Migration and conflicts – impacts on tourism, impacts on natural resources</li> <li>• Transboundary issues: competition, transport, common market, eco footprint, air pollution</li> <li>• Continuous or growing competition for resources, primarily water and oil-gas and minerals</li> <li>• Fluctuating regional (in)stability, (in)security, geopolitical challenges, various impacts on the environment and well-being; rapidly changing policy priorities – self-reliance, limited cooperation, slow tech. transfer, environment is not a priority, new energy, trade, transport routes</li> <li>• Geopolitical instability &amp; divergence</li> </ul>	<ul style="list-style-type: none"> <li>• Failure of national governance (e.g. corruption, illicit trade, organized crime, impunity, political deadlock, etc.)</li> <li>• State collapse or crisis (e.g. civil conflict, military coup, failed states, etc.)</li> <li>• Increasing government influence and regulations – “Nationalisation”</li> </ul>	<ul style="list-style-type: none"> <li>• Failure of urban planning</li> <li>• Land grabbing</li> <li>• Changing/transforming land use and land ownership: land conflicts (mining vs. protected areas, mountain-valley or cross-border pastures), fragmentation and monocultures, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Failure/shortfall of critical infrastructure</li> <li>• Growing uncertainty on future scenarios</li> </ul>	<ul style="list-style-type: none"> <li>• Participation of the private sector in the implementation of sustainable development strategies through the framework of corporate social responsibility</li> <li>• Public sector moving risk to private sector</li> </ul>	<ul style="list-style-type: none"> <li>• Wars and conflict residuals and debris (mines, unexploded ordinance), impact of/and refugees (infrastructure will be required), rise of non-state actors</li> <li>• Weapons of mass destruction</li> </ul>