

IDENTIFICATION OF EMERGING ISSUES FOR SUSTAINABLE DEVELOPMENT

5.1 Introduction

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). Science-policy interfaces refer to 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.¹ The 2015 GSDR underlined the importance of utilizing these linkages to identify emerging issues across the whole spectrum of sustainable development, including its social and economic dimensions.² While many approaches exist for identification of emerging issues, common features include the involvement of experts and formalized processes drawing on scientific evidence, assessments, and projections.

The science-policy interface involves the exchange of information and knowledge leading to learning and, ultimately, changes to decision-making and behaviour. It can provide a variety of functions at different stages of the policy and decision-making process. For instance, scientific advice can steer public attention to issues that threaten human well-being and that require 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 relying on scientific expertise. Alternatively, in the absence of public concern and before issues enter the policy cycle, scientific expertise can be used to bring them to the attention of policy-makers, provide problem definition and assess the potential impact of different policy options. 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.

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 HLPF. 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.³

Following the initial consideration of emerging issues in the 2014 and 2015 Reports, it was felt that one problem was the relative absence of frameworks for: first, systematically identifying a range of issues for possible consideration by policymakers; and second, categorizing and presenting them. The aim of Chapter 5 is to give an overview of existing approaches to identification of emerging issues for sustainable development, as well as to provide and demonstrate a possible approach to identify emerging issues for future Global Sustainable Development Reports. The first part of the chapter aims to contribute to the policy discussion by: identifying what an emerging issue is, outlining criteria and introducing “scanning” as major approach for finding emerging issues; and providing a possible framework for categorizing emerging issues. It also presents a sample of emerging issues from a variety of sources. These sources were used to provide a broad overview of the emerging issues that can be considered by policy makers. The second part of the chapter focuses on the expert assessment of emerging issues which was conducted as an exercise in order to explore and apply a new approach to the identification of emerging issues for sustainable development.

Table 5-1. 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	Degree of 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

Source: Adapted from WBGU (1998)⁵; Amanitidou et al (2012)⁶

Box 5-1: Emerging issue and newness

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

1. new scientific knowledge, which could be in form of new data, evidence, theory or model;
2. new technological development;
3. new scales or accelerated rates of impact;
4. a heightened level of awareness; and
5. new ways of responding to a known issue.⁴

5.2 Identifying emerging issues

There are numerous ways in which the idea of 'emerging issues' pertinent to policy makers and the sustainable development agenda could be conceptualized (See Box 5-1). The broad scope of sustainable development suggests that virtually any social, economic or environmental process or challenge amenable to scientific understanding may potentially be relevant. Emergence, meanwhile, could signify the novelty or intensification of some of those issues, fresh understanding of their causes or consequences, the development of new management options, or the identification of issues that have gone previously unrecognized. The inherently subjective process of identifying emerging issues can, however, be guided by criteria, selected with a view to the particular field of interest, e.g. the global environment.

For instance, as illustrated in table 5-1, 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 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 a 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 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 signals”.⁷ Weak signals are the first sign of emerging issues and the indicators of possible change.⁸

More broadly, scanning 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.⁹ Figure 5-1 situates the “scanning” in a broader context of future-oriented tools for policymaking.

Exploratory scanning focuses on compiling 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. So as to avoid a one-dimensional view on emerging issues, it is advisable to consult as wide as possible a variety of information sources, taking into account the scope and purpose of the exercise. The role of

human perception, especially expert opinion, plays a key role in many approaches to identifying emerging issues. More broadly, the framing of issues – guided by shared assumptions and worldviews – influences which issues are labelled as emerging.¹¹

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 WGBU¹² for environmental issues, the following questions could be useful in filtering emerging issues for consideration by policymakers at the international level in the HLPF:

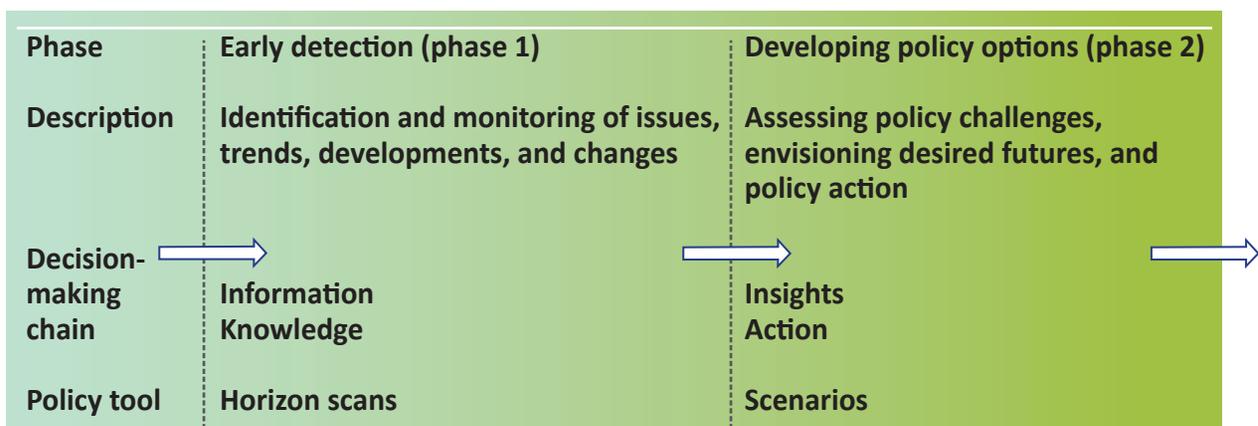
1. Does the issue in question relate closely to the Sustainable Development Goals?
2. Is the issue a potential threat or opportunity of global, or at least international relevance?
3. Does management of the risk or harnessing of the opportunity depend on international action and cooperation?
4. Is the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

Figure 5-2 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.

5.2.1 Frameworks for emerging issues

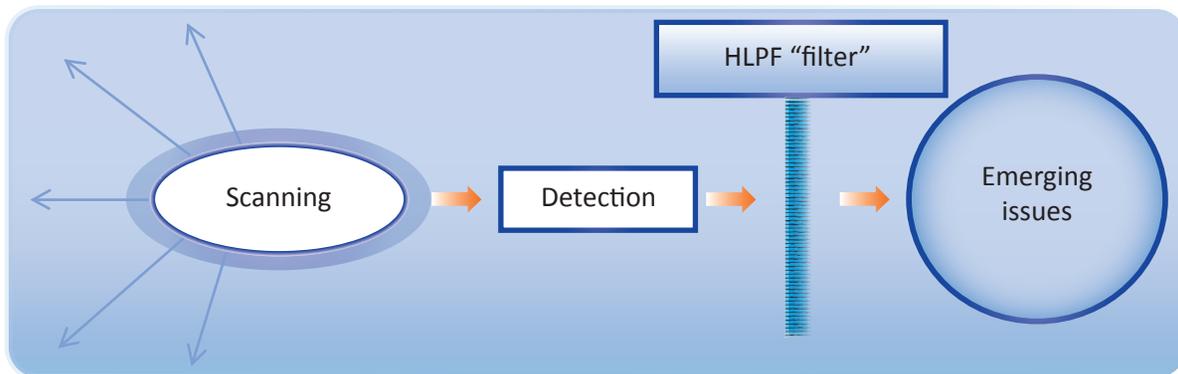
Following the exploratory scanning of issues, the next step usually involves clustering or categorizing the issues in manner that facilitates analysis and insight^{13, 14}. Various frameworks can be used – what works will depend on the context and overall goal of the research. Ideally, the framework should be reasonably flexible. In order to

Figure 5-1: Simplified phases of a foresight process



Source: adapted from Habegger (2009).¹⁰

Figure 5-2: Schematic representation of a process for identifying emerging issues in the HLPF



Source: Authors' elaboration.

understand which framework is most suitable for the sustainable development context, emerging issues from a selection of assessments and reports – see table 2 below – were categorized in accordance with three frameworks:

1. STEEP framework: Social, Technological, Economic, Environmental and Political;
2. “Kates” framework: areas and issues typically covered in definitions of “sustainable development” in the literature;¹⁵
3. DPSIR framework: Driving Forces-Pressures-State-Impacts-Responses.¹⁶

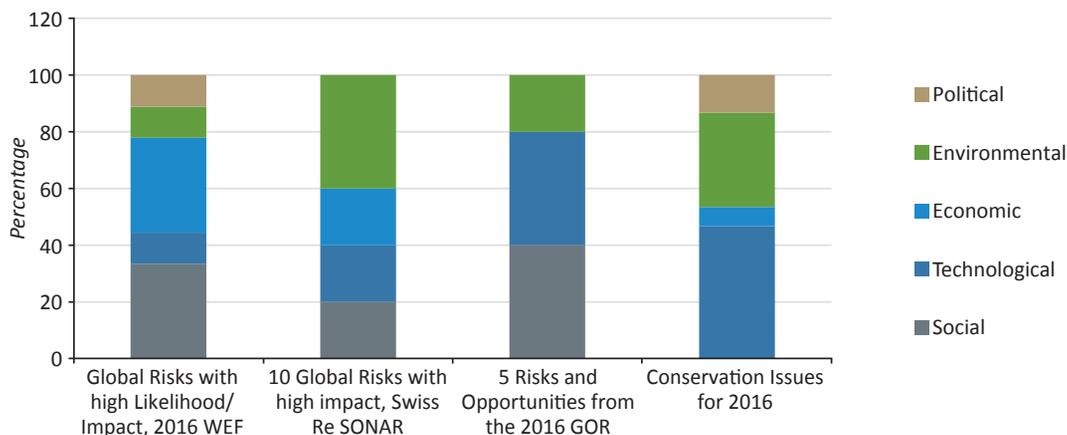
STEEP framework is the most straightforward taxonomy for obtaining a broad categorization of potential emerging issues that is readily applicable to a number of disciplines and modes of analysis. DPSIR is a causal framework for describing the interactions between society and the environment and, as a result, is best suited to environmentally-related emerging issues. The Kates et al framework has a broader approach, which includes six categories: Nature, Life support, Community, People, Economy, and Society. For purposes of an initial clustering effort, the STEEP framework proved to be more suitable than the other two frameworks. This is by no means to

claim that it is inherently superior; rather, that it proved more capable of being applied with reasonable ease and consistency to the rather broad set of issues in question. Additionally, categories used in the STEEP framework were familiar to different interest groups.

Table 5-2 illustrates the categorization of emerging issues identified in a four reports and assessments, prepared from different perspective and for different audiences. In this sample, social and political categories had the lowest share of issues; however, the distribution of issues is sensitive to the type and number of reports from which they are drawn. For example, the large number of technology-related issues listed in Table 5-2 reflected one report – Conservation Issues for 2016 – used during the scanning phase (Figure 5-3). Moreover, some of the emerging issues could fall into several categories – issues that were sorted into social, technological, economic or political categories could also fall into the environmental category.

In the presentation of possible emerging issues, it may be useful to further group them in accordance with a rough timeframe. Table 5-3 illustrates this with issues taken from the WEF and SAB reports. The introduction of a temporal dimension for emerging issues can assist in clarifying

Figure 5-3: Percentage of Emerging Issues by category and data sources



Source: Authors' elaboration.

Table 5.2: Emerging issues identified in selected prominent reports and assessments

Emerging Issues Source	Social	Technological	Economic	Environmental	Political
"Global Risks" with highest average impact and likelihood (World Economic Forum, 2016)	<ul style="list-style-type: none"> • Large-scale involuntary migration • Profound social instability • Water crises 	<ul style="list-style-type: none"> • Cyberattacks 	<ul style="list-style-type: none"> • Fiscal crises in key economies • Unemployment and underemployment • Asset bubble 	<ul style="list-style-type: none"> • Failure of climate-change mitigation and adaptation 	<ul style="list-style-type: none"> • Interstate conflict
10 Global Risks in Terms of Impact in the next 3 years (Swiss RE, 2015)	<ul style="list-style-type: none"> • Lifestyle drugs • Rising pandemic risk 	<ul style="list-style-type: none"> • Predictive maintenance • The dangers of LED light 	<ul style="list-style-type: none"> • De-globalisation • The great monetary experiment 	<ul style="list-style-type: none"> • "Super natural" catastrophes • Brazilian drought • Wildfires • Fossil fuel management 	
Risks and Opportunities (Global Opportunity Report, 2016)	<ul style="list-style-type: none"> • A generation wasted: <ul style="list-style-type: none"> -The digital labour -Market -Closing skills gap • Global food crisis: <ul style="list-style-type: none"> -New diets -Smart farming 	<ul style="list-style-type: none"> • Resistance to life-saving medicine: <ul style="list-style-type: none"> -Antibiotic-free Food -Precision treatment • Accelerating transport emissions: <ul style="list-style-type: none"> -Flexibility mobility -Crowd transport 		<ul style="list-style-type: none"> • Loss of ocean biodiversity: <ul style="list-style-type: none"> -Regenerative ocean -Economy -Closing the loop 	
Horizon Scan of Global Conservation Issues for 2016 (Sutherland et al. 2016)		<ul style="list-style-type: none"> • Artificial Intelligence • Electric Pulse Trawling • Osmotic Power • Satellite Access to Shipborne Automatic Identification Systems • Passive Acoustic Monitoring to Prevent Illegal Activity • Synthetic Body Parts of Endangered Animals • Artificial Glaciers to Regulate Irrigation 	<ul style="list-style-type: none"> • Changing Costs of Energy Storage and Consumption Models 	<ul style="list-style-type: none"> • Managed Bees as Vectors • Increasing Extent of Construction of Artificial Oceanic Islands • Increasing Aquatic Concentrations of Testosterone • Effects of Engineered Nanoparticles on Terrestrial Ecosystems • Invasive species as Reservoirs of Genetic Diversity 	<ul style="list-style-type: none"> • Ecological Civilization Policies in China • Unregulated Fisheries in the central Arctic Ocean Threaten Expanding Fish Stocks
Top Challenges for the Future of Humanity and the Planet identified by the UN Secretary-General's Scientific Advisory Board (UN-SAB, 2016)	<ul style="list-style-type: none"> • Ensuring investment, as a fraction of GDP, in basic research and science education • Providing drinking water for all 	<ul style="list-style-type: none"> • Emissions free technology: changing the fossil fuel paradigm 	<ul style="list-style-type: none"> • One ocean, many countries: building a "Blue economy" sustainably 	<ul style="list-style-type: none"> • Addressing threats to biodiversity and establishing a new paradigm for the global tropics • Putting in place a comprehensive strategy against infectious agents, including a global system for immediate response 	<ul style="list-style-type: none"> • Averting enormous human disasters through prediction • Finding solutions for a world overwhelmed by unequal resource use and continued population growth

 Sources: World Economic Forum¹⁷; Swiss Re SONAR¹⁸; UN Global Compact¹⁹; Sutherland et al.; UNESCO contribution to GSDR 2016.²⁰

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 the STEEP framework can be used again to organize emerging issues by context and time periods.

5.2.2 Identifying emerging issues from a variety of sources

In addition to the reports above, the preparation of the 2016 GSDR includes material from a range of sources: (a) selected issues from emerging issue identification 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 (e) 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 some cases, such processes have long standing, while others are more recent. In light of the 2030 Agenda, it is anticipated that more UN agencies will focus on identifying emerging issues for sustainable development. The following are some examples of emerging issues processes and exercises from United Nations entities. A selection of these processes is summarized in Annex 1. For instance, UNEP provided information on emerging issues identified by regional processes, drawing on the criteria outlined in Box 5-2. Additionally, UNESCO provided a contribution for the GSDR 2016 with the results of the research on top challenges for the future of humanity and the planet identified by the UN Secretary-General's Scientific Advisory

Box 5-2: UNEP SP7 Emerging Issues Project

The project was focused on definition of emerging environmental issues and processes for identifying and selecting emerging issues at the regional scale. From the perspective of the regions, emerging issues must be critical to the sustainable development of the region of focus and recognized as very important in the region, but has not yet received adequate attention from the policy community. It should require immediate priority action by decision makers as well as other stakeholders and actors in the region and must be evidence-based, including scientific and traditional sources of knowledge, recognized as 'emerging' based on 'newness'.

Source: UNEP.

Board conducted using Delphi method (See Box 5-3 - the outcome of the research is presented in Table 5-2). Intergovernmental Oceanographic Commission (IOC) of UNESCO provided a list of emerging issues in the particular field as well.

National Academies of Science

National academies of science play a significant role in the academic world by coordinating and sometimes defining research priorities in all scientific fields of interest and importance to a particular country. National academies are also often charged with providing independent, objective advice to their governments on matters related to science and technology. Membership in a national academy of

Table 5-3: Emerging issues and indicative timeframes

	STEEP		Anticipated Impacts
	0-2 Years	2-5 Years	5+ Years
Social	<ul style="list-style-type: none"> • Violence 	<ul style="list-style-type: none"> • Profound social instability • Putting in place a comprehensive strategy against infectious agents, including a global system for immediate response 	<ul style="list-style-type: none"> • Ensuring investment, as a fraction of GDP, in basic research and basic science education • Providing drinking water for all
Technological	<ul style="list-style-type: none"> • Cyberattacks 	<ul style="list-style-type: none"> • Averting enormous human disasters through prediction 	<ul style="list-style-type: none"> • Emissions free technology: changing the fossil fuel paradigm
Economic	<ul style="list-style-type: none"> • Fiscal crises in key economies 	<ul style="list-style-type: none"> • Unemployment and under-employment • Asset bubble 	<ul style="list-style-type: none"> • One ocean, many countries: building a "Blue economy" sustainably
Environmental	<ul style="list-style-type: none"> • Emerging diseases 	<ul style="list-style-type: none"> • Water crises 	<ul style="list-style-type: none"> • Failure of climate change mitigation and adaptation • Addressing threats to biodiversity and establishing a new paradigm for the global tropics
Political	<ul style="list-style-type: none"> • Large-scale involuntary migration 	<ul style="list-style-type: none"> • Inter-state conflict 	<ul style="list-style-type: none"> • Finding solutions for a world overwhelmed by unequal resource use and continued population growth

Source: Authors' elaboration.

Table 5-4: Selected issues considered by national academies of sciences

Emerging Issues	The Royal Society UK	Hungarian Academy of Sciences	Academy of Sciences of Tajikistan	Brazilian Academy of Sciences	Slovenian Academy of Sciences and Arts	Cameroon Academy of Sciences
Social	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
Technological	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
Economic	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			
Environmental	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	
Political	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

Source: Authors' elaboration, based on inputs from academies of sciences.

Box 5-3: Delphi Method by UN-SAB25

The Delphi method is used to distil knowledge and build reliable consensus among experts who may not be in the same geographical location. It involves structured, sequential questioning of a panel of experts, in this case members of the UN Secretary-General's Science Advisory Board (SAB), with controlled feedback. In round one of the Delphi study, twenty three big ideas that would have a global impact in addressing the implementation of the Sustainable Development Goals were submitted. In round two, Board members systematically assessed these ideas. The result was a list of top eight challenges.

Source: UNESCO

Box 5-4: 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. 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.²¹

science is among the highest honours a scientist can receive. Therefore, it was considered that national academies could be a useful source for information on emerging issues in science, potentially bringing in diverse national areas of emphasis.

The list of emerging issues contained in Table 5-4 is a snapshot of issues compiled from publically available reports and statements issued by national academies, as well, in some cases, from information provided directly by national academies following email request. It represents

a list of selected issues considered by some national academies of sciences sorted using the STEEP framework. From the selection of issues, it is apparent, at least from this sample of national academies, that they are addressing the kinds of issues falling within the domain of sustainable development – water, infectious diseases, resilience to extreme weather – as well as more “advanced” scientific enquiry, for instance in relation to artificial intelligence.

Issues from Leading Journals

In its simplest form, scanning for emerging issues can be based on a fixed set of authoritative, peer-reviewed academic journals.²² For the purpose of the GSDR, criteria for selecting articles of interest could include: 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. Boxes 5 and 6 present two examples of topics highlighted in leading scientific publication that are potentially relevant for sustainable development in the future, beyond their intrinsic relevance within their field or discipline.

Box 5-5: Mastering the game of Go with deep neural networks and tree search, Silver et al. 2016

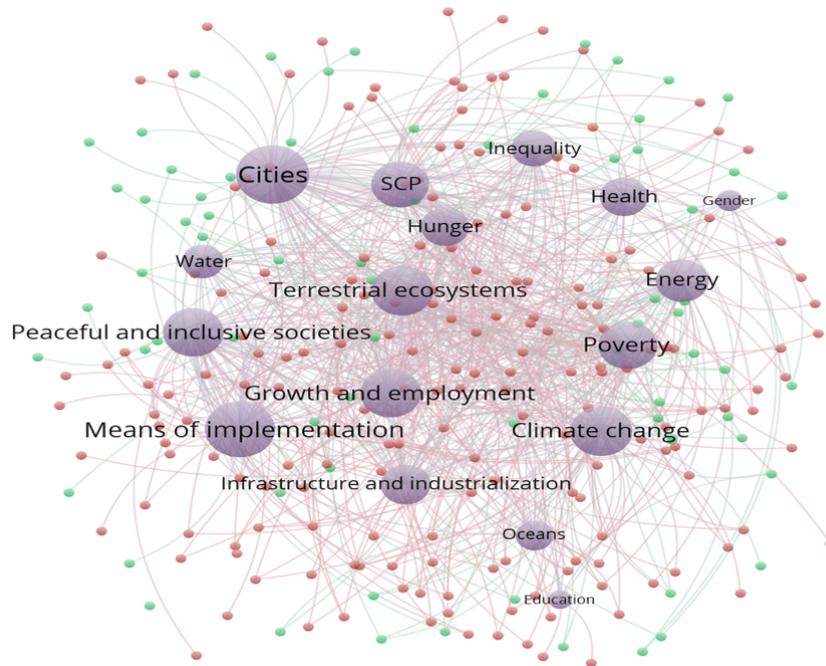
The game of Go has long been considered as the most challenging of classic games for artificial intelligence, due to the very large number of possible moves and the difficulty of evaluating board positions. It required a different approach to the one used in the IBM computer that famously beat the world's 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 games to 1.²³

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

Social	Technological	Economic	Environmental	Political
20 briefs	14 briefs	4 briefs	14 briefs	10 briefs
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 and opportunities		Urban storm water: challenges and opportunities	Urban Sustainability Transformations in real life politics

Source: Author's compilation.

Figure 5-4: Overview of science briefs and their coverage of the SDGs



Note: Submitted briefs are labelled brown (2015) and green (2016) circles, which are connected to labelled circles. Size of nodes is proportional to the number of links.

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 science 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 – available in all six official languages of the United Nations – specifically stated that contributions from both the natural and social science communities and from all disciplines were highly valued and welcomed. 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 70 submissions accepted from all regions of the world. The majority of briefs were written in English, although briefs were also submitted in Chinese, Portuguese, Russian, and Spanish. Most of the contributing scientists were affiliated with universities or research centres from developing and developed countries.

Table 5-5 illustrates some of the issues highlighted by the briefs by theme, using the STEEP framework introduced earlier. The largest share of the briefs related

to the social category, followed by technological, economic, environmental, and political issues. Even though this is a random collection of issues identified by various knowledge-holders, their consideration still bears merit as they may highlight emerging issues that would not necessarily have been identified through other processes.

Figure 5-4 illustrate diversity of the briefs submitted in response to the calls for the GSDR 2015 and 2016, by showing their coverage of the 17 SDGs and of the linkages among them.

The following section draws out some of the highlights from a selection of the briefs received for the GSDR 2016, including new and interesting findings. The content of other briefs is described in other chapters (Chapter 1, Chapter 2 and Chapter 3). In particular, a significant number of briefs were relevant to technology issues and are referenced in chapter 3.

A number of briefs examined emerging new paradigms necessary to enable transformative shifts to sustainable development that incorporate a wider understanding of social welfare (public health, happiness, quality of environment, literacy), differentiate between sustainable development and economic growth as measured by GDP per capita, and promote social reforms that reduce inequalities.²⁴

The broader institutional role that professions exercise in accomplishing change is important, since

delivering sustainability may involve challenging deeply institutionalized assumptions and practices in order to create and institutionalize new organizational models and working arrangements.²⁵ Thus the point was made that science, technology and innovation policies will need to evolve through international coordination at levels of conceptualization, implementation and practice.²⁶ Recommendations on how to promote greater dialogue among scientists, engineers, practitioners, stakeholders, and policymakers were outlined in a number of briefs.²⁷ Recognition of the need for integrated assessment of crosscutting issues that relate to the achievement of several SDGs simultaneously was apparent throughout many briefs, defining a myriad of nexus approaches.²⁸

Sustainable urbanization, infrastructure, employment

Enhancing the science-policy interface is critical in addressing emerging issues in urban development and building resilient cities. Current methodologies to measure the state of urbanization across the globe and the degree of urbanization patterns may need to be updated so that policymakers and civil society can better address current and emerging urban challenges.^{29, 30}

Shifting to a green economy entails opportunities in many countries to develop renewable energy industries, where there is great potential for green jobs to create employment, if priority is given to education, training, and skills development for both technical and non-technical jobs.³¹ The space *underneath* cities also deserves more attention—research of sub-relief is important not only because of utility infrastructure, but also because of geological, geomorphological and ecological processes that can affect a city's resilience.³² Regional collaborative environmental governance is underway in some areas to balance economic development with ecological and social concerns, and ensure participation of civil society organizations, trade associations the media and communities.³³ Financial, political and societal efforts and innovations within the city structure will necessarily become increasingly synergistic and inclusive.³⁴

The unique challenges and structures of refugee camps can be effectively reimagined as spatial phenomena through which applications of urban social policy have the potential to provide relative autonomy for inhabitants, allow development of levels of self-organization that can generate eventual collaboration between refugees and government, and result in more sustainable outcomes for the displaced and vulnerable.³⁵

Public health, clean water and air

While stormwater reuse has great potential as a key adaptation measure to counteract the impacts of climate change on water resources available for urban use,

the increasing presence of dangerous water pollutants in stormwater runoff—including industrial chemicals, pharmaceuticals, and endocrine disruptors—is an emerging threat to public health and ecosystem services, especially in urban areas and places where water is scarce. New research on Emerging Water Treatment (EWT) processes has developed potentially sustainable alternatives for water treatment, including low-cost solar alternatives, but requires coordinated action by multiple actors to enable field level application and diffusion.³⁶ Wider availability of scientifically rigorous guidelines for stormwater reuse is also needed in most countries to protect public health and to guide good practice.³⁷

Urgent global action is needed to accelerate the prevention, control, elimination and eradication of neglected tropical diseases (NTDs) through sustainable drug development.³⁸ The outbreak of Ebola Virus Disease illustrates the interlocking nature of the socioeconomic determinants of health, especially within the context of sustainable development in poor and under-served communities in Africa. One brief highlights the need to better organize and finance global health emergency response systems, including an integrated global health emergency workforce, while also making health systems and infrastructure in the Africa region stronger and resilient.³⁹

New strategies and new ways of thinking are needed to maximize the ethical and sustainable impacts of big data for emerging issues in health policy, to ensure that no one is left behind.⁴⁰ Unified standards in disaster medicine can build capacity of future health workers to be more effective responders to humanitarian and disaster crises, contributing to increased resilience and sustainable development at the community level.⁴¹ Global health policy think tanks and academic institutions have a critical role in ensuring effective knowledge sharing, technical assistance to tackle implementation challenges, and the creation of innovative strategies to achieve better health in all regions of the world.⁴²

Countries in special situations

While this year's chapter focuses on issues of global relevance that can be addressed by the HLPF, different emerging issues may be most relevant at different geographical levels, from regional to national to sub-national. Some emerging issues at the national level may be common to groups of countries sharing certain characteristics. Such categories distinguished by intergovernmental processes and legislation at the UN include Least Developed Countries (LDCs), landlocked developing countries (LLDCs), and Small Island Developing States (SIDS). It is essential to pay attention to LDCs, as they have 12 per cent of the world's population, but 24 per cent of global poverty.⁴³ Many LLDCs are among the poorest of the developing countries.⁴⁴ SIDS have limited

Box 5-6: Selected emerging issues in LDCs, LLDCs and SIDS

Least developed countries (LDCs)

The fragile economies of LDCs in conjunction with trade and development challenges are further exacerbated by a high level of vulnerability towards internal and external shocks. There is robust evidence that climate change and climate variability worsen existing poverty, exacerbate inequalities, trigger new vulnerabilities and act as a threat multiplier for poor countries.⁴⁵ Another emerging issue for LDCs is the challenge of creating jobs and livelihoods for the young people currently entering the labour force - a number estimated to increase by 10.2 million people per year.⁴⁶ LDCs' share of global trade remains low at around 1 percent.⁴⁷

Landlocked developing countries (LLDCs)

Of the 31 land-locked developing countries, half are classified as LDCs. In addition to higher trade costs, landlocked countries on average export less than half of the per-capita amount of their maritime neighbours.⁴⁸ LLDCs are especially dependent on peace and stability in their neighbouring countries to maintain international trade. When transit countries are affected by civil war or other forms of social unrest, transit routes can be damaged or closed, which can result in the rerouting of major trade corridors and even an interruption in transit.⁴⁹ Overall, LLDCs showed little progress in human development with ten of the world's 20 lowest-ranking countries being landlocked, and the divergence between LLDCs and coastal developing countries is widening.⁵⁰

Small Island Developing States (SIDS)

Population displacements due to climate change are an emerging issue for SIDS as already widespread migration flows are exacerbated by adverse climate events. However, international laws to protect migrating populations across international borders due to environmental degradation or change are limited.^{51,52}

Another emerging issue is the impact of continued ocean acidification and associated coral bleaching. Acidified oceans could cause harvest failure of marine resources and thus could have a significant impact on fisheries in SIDS.⁵³ As coral reefs play a significant role in fish production and fisheries, marine biodiversity, coastal protection, and tourism, loss of coral reefs will have a major impact on SIDS economically, socially and environmentally.

Source: Authors' elaboration.

resources, remoteness, susceptibility to natural disasters, vulnerability to external shocks, excessive dependence on international trade, and fragile environments (Box 5-6).

5.3 Expert assessment of emerging issues

A common way to conduct exploratory scanning is through experts and expert networks.^{54, 55, 56} After a process of gathering issues, the initial list of issues or question is whittled down in the course of a combination of voting and discussions among experts. Such exercises have been conducted in various fields of study. For instance, in 2014 the international Antarctic community came together to 'scan the horizon' to identify the highest priority scientific questions for the next two decades and beyond.⁵⁷ Another recent consultative and priority-setting exercise sought to identify the 100 key research questions for the post-2015 development agenda, bringing together the research interests and priorities of academics and practitioners working on international development.⁵⁸

As an input to GSDR, an expert group meeting (EGM) was convened, bringing together the twenty specialists from different fields. During this face-to-face meeting, experts considered potential criteria for identifying emerging issues. They also considered a list of emerging issues for potential consideration by policymakers. To this end, the experts engaged in an indicative prioritization exercise, based on the indicative list of issues drawn from an electronic survey.

Prior to the meeting, an initial list of emerging issues had been collected using an open-ended online survey that was distributed to members of the sustainable development and scientific communities. As a next step, an electronic survey containing 85 issues was circulated to the participants in the expert group meeting, as well as larger group of experts, who were invited to score the issues on the basis of importance. Mean scores were calculated and a ranking list was generated (see Box 5-7).

The scanning exercise involved in support of the preparation of this chapter identified numerous candidate issues across a diversity of scales, disciplinary domains and substantive foci. During the discussion it was suggested the experts use the following criteria: regional relevance; policy relevance; urgency; evidence-based; probability and impact of event; persistence; irreversibility; latency/delayed response; ubiquity; novelty; potential for mobilization; and distribution of the issue across the world (See Table 5-6). The need to select and evaluate issues against transparent criteria was clear. So too was the need to explore connections among the issues, to synthesize issues where possible, and to identify common themes.

The experts discussed the 20 topics ranked highest from the online survey. The strength of the STEEP framework was recognized in enabling an initial categorization into different domains. However, expert input highlighted the usefulness of taking an additional step to differentiate between issues that relate to values, threats, opportunities, causal mechanisms and responses. Therefore, it was decided to look at a limited number of illustrative emerging issues through this prism. For each issue, the emerging threats concurrent with the issue's progression were considered. Thereafter, the experts discussed the opportunities and the corresponding causal mechanisms that would arise from addressing these emerging issues on a global political level.

Subsequently, potential actions and responses to mitigate emerging threats were examined. Finally, the key emerging features and characteristics of each issue were reviewed to summarize the primary considerations and alterations in political action. This approach is illustrated in Table 5-6 and in the text below, using four illustrative issues taken from the scanning exercise.

Establishing institutional mechanisms and partnership from global to regional, national, and local levels. It can be argued that institutions and institutional mechanisms for development provide the missing link that can explain the differences in growth rates and development trends across developing countries.⁵⁹ Partnership and trust between individuals and groups on all levels is a social asset with important economic benefits since it enables people to make agreements and undertake transactions that would otherwise not be possible.⁶⁰ The establishment of both institutional mechanisms and partnerships is of the utmost importance in securing global sustainable development and in order to “leave no one behind”.

Coping with the increasing impacts of climate change. Climate change is a defining human development challenge of this century. Changes in rainfall, temperature and water availability will have the most severe impacts on vulnerable countries. While climate change is hardly new a new issue, the experts agreed that climate change

Box 5-7: Priority emerging issues selected by experts in a indicative prioritization exercise

- Establishing governance mechanisms for the SDGs, from global (UN) to regional, national, and local levels.
- Coping with the increasing impacts of climate change.
- Political instability and social unrest from increased income and wealth inequalities.
- Ensuring access to affordable, sustainable, and reliable modern energy services for all.
- Accelerating the implementation of environmentally-friendly renewable energy.
- The need to develop alternative economic models that decouple economic growth resource use and minimize environmental degradation.
- The need to protect and restore ecosystems.
- Persistence of poverty globally, including the poor in rich countries.
- Strengthen and enhance the means of implementation and global partnership for sustainable development.
- Highly unequal distribution of household wealth across and within nations.
- Enhancing social protection and environmental protection in developing countries as a means to decrease inequalities and combat environmental degradation and climate change.
- Integrated assessment of sustainable development pathways.
- Increasing the sustainability, inclusiveness, safety, and resilience of cities and human settlements.
- Depletion of ocean fish stocks and exploitation of marine resources.
- Time lags of several decades between scientific findings and policy action.
- Migration and all forms of movement of people across borders due to changes in demographics, weather patterns, and other causes.
- Promotion of sustainable industrialization.
- Reduction of future agricultural yields due to climate change, especially in Africa.
- Inadequate funding for health systems, especially in developing countries.
- Putting in place the blend of governance forms and approaches required for the 2030 Agenda.

Table 5-6: Examples of emerging issues placed within a broader frame of structural issues

Emerging Issues	Values to be Sustained	Threats	Opportunities	Causal mechanisms	Responses/Actions	Key Emerging Features
	Societal value (Freedom, Equality, Solidarity, Tolerance, Respect for nature, etc.)	Threats to the value	Frequently technological opportunities to address threats or enhance the value	Causal mechanisms pertaining to threat or consequence, in particular poorly understood mechanisms, given these their 'emerging issue' status	Policy and institutional opportunities	Emergent characteristic
Coping with the increasing impacts of climate change	Solidarity, Respect for nature	Political inactivity, with political mechanisms failing to keep up with velocity of impacts due to climate change	Employment and growth opportunities associated with deployment of clean technologies. Inclusion of women in policy, and programming and implementation in the clean energy sector	Unrecorded/undiscovered CO ₂ emissions (sources) yet to be added to calculations Failure to restrict emissions according to levels determined by science	Interlinkages between action and impacts of different countries need to be made compelling	Accelerating impacts outpacing expectations and societal response rate
Addressing global poverty in rich and poor countries and the highly unequal distribution of household's wealth across and within nations	Equality, Dignity	Deepening structural inequalities; conflict	Broader dissemination of productivity-enhancing (smartphones) and life-saving technologies. Innovation in cognitive-behavioural interventions to enhance voice and agency		Enhanced access to basic services, social protection, Universal Health Care	Growth no longer guarantees reduced unemployment and poverty
Establishing institutional mechanisms and partnership from global to regional, national, and local levels	Freedom; Accountability	Break down of trust; institutional inertia and inaction		Existing institutional arrangements, characterized by vertical properties, do not function well for complex sustainable development problems	Institutional experimentation; decentralized responses with broader stakeholder involvement	Implementation & governance challenge posed by integrated nature of 2030 Agenda
Alternative economic models that decouple economic growth from resource use and minimize environmental degradation	Respect for nature, Equality	Vested interests; political economy	New technologies and business models; disruption and innovation	Development perceived as synonymous with GDP growth; path dependence and lock-in	Focus on consumption and production; pricing of environmental externalities	Possibility of sustainability transition

remains an emerging issue. First, this is due to both to time lags between scientific understanding and political action. Second, evidence points to an escalation of global impacts.⁶¹ Experts of the EGM considered that impacts were outpacing expectations, providing a challenge for political decision-making processes and societal responses.

Addressing global poverty in rich and poor countries and the highly unequal distribution of households' wealth across and within nations. While poverty rates have declined in most regions, progress has been unevenly distributed. While positive trends in East Asia led to 80 per cent reduction of extreme poverty in the past 20 years, poverty in sub-Saharan Africa still stands at over 40 per cent.⁶² Africa had the potential to benefit from the growth of its working age population, but this will require an expansion in productive employment. It was observed that economic growth does not necessarily have a direct effect on a country's poverty line or unemployment rate. The wage gap between the poor and rich is not only present in the developing world; developed countries are experiencing an erosion of their middle class, with a widening of the gap between poor and rich. The potential gains from the extension of social protection systems, including floors, were also highlighted as an area of interest.

Alternative economic approaches that decouple economic growth from resource use and minimize environmental degradation. Economic models today consider only economic growth without taking into account the positive and negative effects of resource consumption on human well-being. Negative effects include climate change, pollution, land-use change, and biodiversity loss. Economic development has so far been associated with a rapid rise in the use of natural resources such as energy, materials, water and land, but many of them are becoming less abundant relative to demand, and some run the risk of critical scarcity in the near future.⁶³ Resource decoupling is particularly important when a resource is scarce and further depletion could frustrate societal progress and when it poses high environmental risks that cannot be substantially alleviated through greater efficiency.^{64, 65} The greening of economies, enterprises and jobs can potentially contribute to poverty eradication, social inclusion and the fight against climate change.⁶⁶ Economic models need to be updated to address these issues.

The consideration of the issues revealed numerous connections among them, suggesting that higher order synthesis was appropriate. Issues expressed as threats, technological opportunities or management and policy responses often relate to single, broader underlying problems. For example, the broad trend of climate change can be associated with emerging threats, opportunities, and policy responses. Table 5.6, produced by the scientists consulted for this chapter of the report for illustration

purposes, shows how different threats, opportunities, causal mechanisms and responses identified during scanning relate to broader underlying issues. Annex 6, also produced by contributing scientists, provides a more detailed version of Table 5.6.

5.4 Conclusions

Following the initial consideration of emerging issues in the 2014 and 2015 Reports, this chapter aimed to provide a framework for: first, systematically identifying a range of issues for possible consideration by policymakers at the HLPF; and then, second, categorizing and presenting them. The chapter gives an overview of existing approaches to identification of emerging issues for sustainable development. It also demonstrates a possible approach to identify emerging issues, which could be used for future Global Sustainable Development Reports as well as for the HLPF.

Given the very broad scope of the SDGs, identifying emerging issues for sustainable development will require reviewing a broad range of sources. The chapter introduced "scanning" as a major approach for finding emerging issues. The chapter presents a sample of emerging issues from a long consultation process that involved a variety of sources, such as global UN initiatives and national and international academies of sciences. Several sources were used to provide a broad overview of the range of emerging issues that can be considered by policy makers. The process of scanning can be usefully guided by criteria, which help to make explicit assumptions about what counts towards designing issues as emerging. Impact and probability of occurrence are commonly used. Additionally, such criteria as persistence, irreversibility, ubiquity, novelty, and potential for mobilization have been considered. Priority, a criterion that is meant to capture an issue's importance in terms of social and cultural norms or impact on already vulnerable and marginalized groups, can accommodate principles such as "ensuring that no one is left behind".

The chapter also provides a simple framework for categorizing emerging issues, as well as criteria that the HLPF could consider using to filter emerging issues in order to identify a limited number of those that are most relevant. Indeed, intergovernmental processes can only consider a limited numbers of issues at a point in time, and not all emerging issues can be addressed by a specific process. For example, in the context of the HLPF, this entails identifying emerging issues that are appropriate for addressing at the global level, by filtering out issues of primarily local or national significance. Naturally there are no neat, clear divides; what is local today can escalate across borders tomorrow. In this chapter it is suggested that the following could serve as starting points: (a) the extent to which the

issue in question related closely to the SDGs; (b) whether the issue is a potential threat or opportunity of global or at least international relevance; (c) whether management of the risk or harnessing of the opportunity depends on international action and cooperation; and (d) whether the issue is expected to persist (non-transient) and whether or not a clear increasing trend can be established.

The chapter also reflects efforts made to test the approach proposed for the identification and filtering of emerging issues, which involved an expert assessment of emerging issues. Experts pointed to the interdependence among emerging issues. The expert assessment made clear that such interdependence is best perceived by replacing emerging issues in a broader framework, which clarifies the values that are to be sustained, potential threats and opportunities, causal mechanisms at play, possible responses and actions, and key emerging features.

At a broad level, the expert meeting categorized issues identified during the scanning exercise as the following. A first category was the operationalization of the 2030 Agenda for Sustainable Development and establishment of institutional and governance arrangements that explicitly recognize a role for science in policy and decision-making. A second category was key values to be protected or enhanced through sustainable development, including values which, while always implicit in the concept of sustainability, have gained greater recognition in recent years. A third category was critical processes of social, economic and environmental change that threaten sustainable development; in particular, processes that are novel, accelerating, approaching what appear to be

dangerous thresholds and/or which have poorly understood causes and consequences. A fourth category was emerging opportunities to promote sustainable development, including new technological options and policy responses to deal with both novel and unresolved sustainability issues.

The chapter demonstrates that a wide range of sources – document analysis, crowdsourcing, and expert meetings – can usefully be drawn on when identifying emerging issues in the context of sustainable development. The involvement of experts from multiple disciplines brings critical added value to this process, including for prioritizing emerging issues and provide multi-dimensional analyses of the issues and their inter-connectedness.

The exercise of emerging issues identification confirmed once again the complexity and inter-disciplinarity of sustainable development issues. Scientific expertise can shed new light on the complexity and interconnectivity of emerging issues, in the process strengthening the science-policy interface and possibly leading to more timely responses to emerging threats or the exploitation of new opportunities. The regular scanning and multidisciplinary analyses of emerging issues from different levels and perspectives is important and should be maintained as a necessary and useful early warning system for the science-policy interface.

There is scope for enhanced dialogue between scientists and policy-makers in considering both the processes by which emerging issues are brought to the attention of the HLPF, as well as the substantive character of issues that – out of the plethora of emerging issues – could usefully be considered by the forum.

Endnotes

- 1 Young, J.C., A.D. Watt, S. van den Hove, and the SPIRAL project team (2013): Effective interfaces between science, policy and society: the SPIRAL project handbook. See other references in United Nations, 2015, *Global Sustainable Development Report 2015*, New York, July.
- 2 United Nations (2015), *Global Sustainable Development Report*, New York, United Nations Department of Economic and Social Affairs.
- 3 United Nations (2016), *Critical milestones towards coherent, efficient and inclusive follow-up and review at the global level*, Report of the Secretary-General, A/70/684, New York.
- 4 UNEP (2015), SP7 Emerging Issues Project.
- 5 German Advisory Council on Global Change (WBGU). (1998). *World in Transition: Strategies for Managing Global Environmental Risks*. Springer., available at http://www.wbgu.de/fileadmin/templates/dateien/veroeffentlichungen/hauptgutachten/jg1998/wbgu_jg1998_engl.pdf
- 6 Amanatidou, E., M. Butter, V. Carabias, T. Könnölä, M. Leis, O. Saritas, V. van Rij, (2012), On concepts and methods in horizon scanning: Lessons from initiating policy dialogues on emerging issues, *Science and Public Policy*, 39(2), 208-221.
- 7 Van Rij, V. (2010), Joint horizon scanning: identifying common strategic choices and questions for knowledge, *Science and Public Policy*, 37, 7–18.
- 8 Hiltunen, E. (2010), *Weak signals in organizational futures learning*, PhD thesis, Helsinki School of Economics, A-365, available online at: <http://epub.lib.aalto.fi/pdf/diss/a365.pdf>
- 9 Habegger, B. (2009), *Horizon scanning in government: Concepts, Country experiences, and Models for Switzerland*, Center for Security Studies, ETH Zurich.
- 10 Habegger, B. (2009), *Horizon scanning in government: Concepts, Country experiences, and Models for Switzerland*, Center for Security Studies, ETH Zurich.
- 11 Inayatullah, Sohail (1998), Causal layered analysis: Poststructuralism as method, *Futures*, 30 (8) 815–829.
- 12 German Advisory Council on Global Change (WBGU), (1998), *World in Transition: Strategies for Managing Global Environmental Risks*, Springer, available at http://www.wbgu.de/fileadmin/templates/dateien/veroeffentlichungen/hauptgutachten/jg1998/wbgu_jg1998_engl.pdf
- 13 Amanatidou, E., M. Butter, V. Carabias, T. Könnölä, M. Leis, O. Saritas, V. van Rij, (2012), On concepts and methods in horizon scanning: Lessons from initiating policy dialogues on emerging issues, *Science and Public Policy*, 39(2), 208-221.
- 14 Sutherland, W. J., E. Fleishman, M. B. Mascia, J. Pretty, M. A. Rudd, (2011), Methods for collaboratively identifying research priorities and emerging issues in science and policy, *Methods in Ecology and Evolution*, 2(3), 238-247.
- 15 Kates, R.W., T.M. Parris and A.A. Leiserowitz (2005), What is sustainable development? Goals, indicators, values, and practice, *Environment*, 47, 3, 9–21.
- 16 UNEP (2006), *Africa Environment Outlook - 2: Our Environment, Our Wealth*, United Nations Environment Programme, Nairobi.
- 17 World Economic Forum (2016), *The Global Risks Report 2016*. Available online at: <http://www3.weforum.org/docs/Media/TheGlobalRisksReport2016.pdf>
- 18 Swiss Re SONAR (2015), *New Emerging Risk Insights*. Available online at http://media.swissre.com/documents/SONAR_2015_WEB.pdf
- 19 DNV-GL, UN Global Compact, Monday Morning-Global Institute (2016), *Global Opportunity Report 2016*.
- 20 UNESCO, 2016, *Top Challenges for the Future of Humanity and the Planet identified by the UN Secretary-General's Scientific Advisory Board*, contribution to GSDR 2016.
- 21 Bond, W. J. (2016), Ancient grasslands at risk, *Science*, 351 (6269), 120-122.
- 22 Examples are *Science, Nature, Science Advances, Sustainability, Current Opinion in Environmental Sustainability*, and the Sustainability Science Section of the *Proceedings of the National Academy of Sciences of the United States of America*.
- 23 Silver, David et al. (2016). Mastering the game of Go with deep neural networks and tree search, *Nature*, 529, 484–489.
- 24 Haapanen et al., 2016, *The role of economic growth in sustainable development from the perspective of 21st century growth critique*, Brief for the GSDR 2016; Dai et al., 2016, *Regional Collaborative Environmental Governance in Yangtze River Delta, China*, Brief for the GSDR 2016; López, J. I. V., 2016, *Social Security to strengthen pension systems in Latin America*. Brief for the GSDR 2016.
- 25 Sabini, L., 2016, *Project Management and Sustainability*, Brief for the GSDR 2016.
- 26 Attri, V.N., 2016, *Sustainable Development and World Trade: The Contribution of International Environmental Regulations to Trade*, Brief for the GSDR 2016.
- 27 Guttieres et al., 2016, *Role of Science, Technology and Innovation in Urban Frameworks: Enhancing the Science-Policy-Practice Interface for Resilient Cities*, Brief for the GSDR 2016; Ranjha, S., 2016, *Green infrastructure: planning for sustainable and resilient urban environment*, Brief for the GSDR 2016; Ebikeme et al., 2016, *Open Data in a Big Data World: challenges and opportunities for sustainable development*, Brief for the GSDR 2016.
- 28 Alva et al., *Thematic Reviews in the 2030 Agenda: the case for a review of natural resources*, Brief for the GSDR 2016; Kusch et al., 2016, *Sustainability in a changing world: integrating human health and wellbeing, urbanisation, and ecosystem services*, Brief for the GSDR 2016.
- 29 Vo, H., 2016, *Revisiting the Urban Age Declaration*, Brief for the GSDR 2016.
- 30 The 2016 report of the Inter-agency Task Force on Financing for Development reports on some of the initiatives to improve methodologies for monitoring and increase data available on urbanization. Ref: p. 49, Section II.A.7.3, http://www.un.org/esa/ffd/wp-content/uploads/2016/03/Report_IATF-2016-full.pdf.
- 31 Patar et al., 2016, *Environment and Green Jobs: Paradigm shift from a non-sector to an employable industry (an analysis from Indian perspective)*, Brief for the GSDR 2016.
- 32 Bolysov et al., 2016, *Urban sub-relief as underground infrastructure, territorial resource and source of hazards*, Brief for the GSDR 2016.
- 33 Dai et al., 2016, *Regional Collaborative Environmental Governance in Yangtze River Delta, China*, Brief for the GSDR 2016.

- 34 Koch et al., 2016, *How to achieve Urban Sustainability Transformations (UST) in real life politics?*, Brief for the GSDR 2016.
- 35 Al-Nassir, S., 2016, *Refugee Camps as a Spatial Phenomenon of Self-Organization*, Brief for the GSDR 2016.
- 36 Bandala et al., 2016, *Emerging Contaminants in urban stormwater: challenges and perspectives for sustainable water use*, Brief for the GSDR 2016.
- 37 Goonetilleke et al., 2016, *Urban Stormwater Reuse: an Agenda for Sustainable Development*, Brief for the GSDR 2016.
- 38 Kefalidou, A., 2016, *Sustainable drug development for Neglected Tropical Diseases*, Brief for the GSDR 2016.
- 39 Evoh et al., 2016, *Integrated Health Governance and Sustainability: Rebuilding Livelihoods and Resilience in Post-Ebola Communities in West Africa*, Brief for the GSDR 2016.
- 40 Fagan et al., 2016, *Balancing Big Data and the Right to Health: Strategies for Maximising Ethical and Sustainable Impact*, Brief for the GSDR 2016; Rasella et al., 2016, *Mobilizing Big Data and Microsimulation for SDGs: Forecasting the Impact of a Conditional Cash Transfer Programme on Tuberculosis in Brazil*, Brief for the GSDR 2016.
- 41 Herrgard et al., 2016, *Building Resilience by Professionalisation of Healthcare Workers Through Technological Innovations*, Brief for the GSDR 2016.
- 42 Jha et al., 2016, *Accelerating achievement of the sustainable development goals: A game-changer in global health*, Brief for the GSDR 2016.
- 43 UNFPA (2011), *Population Dynamics in the LDCs* Available online at: http://www.unfpa.org/sites/default/files/pub-pdf/LDC_Fact_Sheet.pdf.
- 44 UN-OHRLLS (2016), *About the landlocked developing countries (LLDCs)*. Available online at: <http://unohrlls.org/about-lldc/>
- 45 IPCC (2014), Working Group II Contribution to the Intergovernmental Panel on Climate Change, Fifth Assessment Report, 2013. See: <http://ipcc.ch>.
- 46 UNCTAD (2013), *The least developed countries report 2013: Growth with employment for inclusive and sustainable development*. Available online at: http://unctad.org/en/PublicationsLibrary/Ldc2013overview_en.pdf.
- 47 United Nations (2014), *World economic situation and prospects: Chapter 2 – International Trade*. Available online at: http://www.un.org/en/development/desa/policy/wesp/wesp_archive/2014wesp_chap2.pdf.
- 48 World Bank (2015), *Poverty overview*. Retrieved: <http://www.worldbank.org/en/topic/poverty/overview> (04/29/2016).
- 49 Faye, M. L., J. W. McArthur, J. D. Sachs, T. Snow, (2004), *The challenges facing landlocked developing countries*. *Journal of Human Development*, 5, 1, 31-68.
- 50 UNDP (2007), *Trade, trade facilitation and transit transport issues for landlocked developing countries*. Available online at: <http://unohrlls.org/UserFiles/File/Elle%20Wang%20Uploads/LLDCs%20Publication.pdf>.
- 51 UN-Habitat (2015), *Urbanization and Climate Change in Small Island Developing States*. Available online at: <http://unhabitat.org/books/urbanization-and-climate-change-in-small-island-developing-states/>
- 52 Smith Roy & Karen E. McNamara (2015), *Future migrations from Tuvalu and Kiribati: exploring government, civil society and donor perceptions*, *Climate and Development*, 7, 1, 47-59.
- 53 United Nations (2015), *The First Global Integrated Marine Assessment: World Ocean Assessment I*. Available online at: http://www.un.org/depts/los/global_reporting/global_reporting.htm
- 54 Sutherland, W. J., Aveling, R., Bennun, L., Chapman, E., Clout, M., Côté, I. M., Fleishman, E. (2012), *A horizon scan of global conservation issues for 2012*, *Trends in ecology & evolution*, 27(1), 12-18.
- 55 Sutherland, et al. (2016), *A Horizon Scan of Global Conservation Issues for 2016*, *Trends in Ecology & Evolution*, 31(1).
- 56 Oldekop, J.A., et al. (2016), *100 key research questions for the post-2015 development agenda*, *Development Policy Review*, 34: 55–82.
- 57 Kennicutt II, M.C. et al. (2015) *A roadmap for Antarctic and Southern Ocean science for the next two decades and beyond*, *Antarctic Science*, 27(1), 3–18.
- 58 Oldekop, J.A. (2016), *100 Key Research Questions For The Post-2015 Development Agenda*, *Development Policy Review*, 2016, 34 (1), 55–82.
- 59 Elobeid, E. (2012), *The role of institutions in sustainable development: The experience of Sudan economy*, *International Journal of Sustainable Development*, 4(5): 53-68.
- 60 World Bank (2003), *Sustainable development in a dynamic world*, World Development Report, Washington, DC, USA.
- 61 Rockstroem, J. et al. (2009), *A safe operating space for humanity*, *Nature*, 461: 472-475.
- 62 World Bank (2015), *Poverty overview*. Retrieved: <http://www.worldbank.org/en/topic/poverty/overview> (04/29/2016).
- 63 UNEP (2011), *Decoupling natural resource use and environmental impacts from economic growth*, A Report of the Working Group on Decoupling to the International Resource Panel, Fischer-Kowalski, M., Swilling, M., von Weizsäcker, E.U., Ren, Y., Moriguchi, Y., Crane, W., Krausmann, F., Eisenmenger, N., Giljum, S., Hennicke, P., Romero Lankao, P., Siriban Manalang, A., Sewerin, S.
- 64 UNEP (2010a). *Metal Stocks In Society - Scientific Synthesis*, A Report of the Working Group on Global Metal Flows to the International Panel for Sustainable Resource Management, Graedel, T.E., Dubreuil, A., Gerst, M., Hashimoto, S., Moriguchi, Y., Müller, D., Pena, C., Rauch, J., Sinkala, T., Sonnemann, G.
- 65 UNEP (2010b), *Assessing the Environmental Impacts of Consumption and Production: Priority Products and Materials*, A Report of the Working Group on the Environmental Impacts of Products and Materials to the International Panel for Sustainable Resource Management, Hertwich, E., van der Voet, E., Suh, S., Tukker, A., Huijbregts M., Kazmierczyk, P., Lenzen, M., McNeely, J., Moriguchi, Y.
- 66 ILO (2015), *Guidelines for a just transition towards environmentally sustainable economies and societies for all*, Available online at: http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_432859.pdf.

