Scientific Advisory Board
of the Secretary-General of the United Nations

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The Crucial Role of Science for Sustainable Development and the Post-2015 Development Agenda

Preliminary Reflection and Comments by
the Scientific Advisory Board of the UN Secretary-General

to the ongoing discussions in New York
(ECOSOC, Open Working Group on Sustainable Development Goals, other post-2015 related processes)

4 July 2014

Executive Summary

I. The UN Secretary-General's Scientific Advisory Board (UNSG SAB) wishes to underline the crucial role of science[1] for sustainable development:

- Science is critical to help meet the challenges for sustainable development, as it lays the foundations for new approaches and technologies to identify, clarify and tackle global challenges for the future. Science can thus significantly contribute to sustainable development, but requires to that end a broad understanding of science as such.
- Basic science and applied science complement each other, they are the two sides of the same coin.
- Science is universal. It does not only bring about progress on the way towards a more sustainable world; it is also in itself a way of crossing national, cultural and mental borders and thus helps lay the foundation for a sustainable world.
- Science possesses a strong educational component. Science literacy provides the basis for solutions to everyday problems, generally, in uncontroversial ways. Science education and capacity-building in science need to be strengthened to make the most of the transformational power of science.
- Science is a public good and has to be considered as such. Science can also further democratic practises.

II. The UNSG SAB recommends to the UN Secretary-General and the international community to integrate science into the post-2015 development agenda, including the Sustainable Development Goals (SDGs), through the following actions:

1. Acknowledging the significant role of science for poverty eradication and for sustainable development and taking into account its comprehensive role for the SDGs beyond being a 'means of implementation', a statement on the crucial role of science should be anchored prominently in a preamble to the SDGs. Ideally, a stand-alone science SDG should be formulated or, at least, specific science-related targets should be made under each agreed SDG.
2. The international community should aim at establishing national minimum target investments for STI, including special allotments for the promotion of basic science and science education and literacy.
3. Recognizing the future set of SDGs as a complex system, the development of the SDGs should be based on an integrated scientific approach. The interrelatedness of the various areas should be mirrored in cross-cutting targets which taken together address the social, economic and environmental dimensions of sustainable development in an equitable manner.
4. Governments should acknowledge the potential of science to federate different knowledge systems, disciplines and findings and to contribute to an integrated understanding and knowledge basis in the pursuit of the SDGs.
5. Governments are called upon to build a new global research architecture to strengthen and organize interdisciplinary collaboration, to coordinate effectively enormous datasets, to fill data gaps, and to improve knowledge management. The compilation, anaylsis, and use of big data needs to be structured and coordinated internationally.
6. The new global research architecture should ensure linking scientific information and data as well as findings, scientific assessments and scientific advice with both policy and society. It should lead to an enhanced science-policy-society interface.

[1] Science should be understood in this paper in the broader sense of 'science, technology and innovation' (STI), ranging from natural science to technologies, social sciences and the humanities.

1. The crucial role of science for sustainable development

Science is critical to help meet the challenges for sustainable development as it lays the foundation for new approaches, solutions and technologies to identify, clarify and tackle global challenges for the future. Science provides answers that are testable and reproducible, and thus provide the basis for conclusive decision-making processes and effective impact assessments. Both in its scope of study as well as applications, science spans from the understanding of natural processes and human impacts thereon to the organization of social systems, the contribution of science to health and well-being, and on ways to improve subsistence and livelihood strategies so as to meet the overriding goal of poverty reduction.

> *Faced with the challenges of climate change, science has already contributed to providing solutions for a secure and sustainable energy supply. Yet there is need and room for further innovation, for instance with regard to the deployment of storage or energy efficiency. Moreover, the transformations needed cannot be tackled solely by relying on engineering or technological sciences. The social sciences and the humanities play a vital role in the successful realization of sustainable lifestyles: They identify and analyze underlying reasons behind decisions at the personal, sectoral, and societal level; they help devise ways to deal with them while taking social, political and cultural issues into account. They also offer a platform for critical discourse about societal concerns and aspirations, and discuss priorities and values that determine political processes.*
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> *The improvements in weather prediction accuracy are an example of scientific success, with current 5-day forecasts being about as good as the 1-day forecasts were four decades ago. Nevertheless there is still a need for longer predictions and for more regional applications and dissemination of the forecasts of* extreme *weather events such as heavy rain, flash flood, and storm surge, which particularly affect the most underdeveloped countries in Africa and Asia.*
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> *Although infectious diseases have been contained significantly during the last decades by vaccination and antibiotics, the world has to face an inevitable rise in pathogens resistant to antimicrobial drugs.[2] In addition, new forms of pathogens have been recognized or already known pathogens have appeared with new properties. The same applies to other widespread diseases. New approaches and new methods of treatment based on fundamental research on both the origin of antibiotic resistance and on the development of new antibiotics and alternatives are of critical importance to furthering human health and well-being.*

As these examples show, **science contributes significantly and directly to sustainable development**. They also demonstrate that science for sustainable development requires a broad understanding of science, which covers the whole range of disciplines from natural sciences to engineering to social sciences and the humanities.

Basic science and applied science are two sides of the same coin, they are interconnected and interdependent[3]. They complement each other so as to provide innovative solutions to the challenges mankind has to face on the way to sustainable development. Or as Max Planck said: "knowledge must precede application, and the more detailed our knowledge […], the richer and more lasting will be the results we can draw from that knowledge"[4]. Basic research is driven by curiosity about the unknown and is not oriented towards direct practical application. Basic science means thinking out of the box. It leads to new knowledge and offers new approaches, which in turn may lead to new ways of the practical use. This requires patience and time and it is a long-term investment. But it is the prerequisite for breakthroughs and big leaps forward for mankind. It is the fuel for progress and for a sustainable world.

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[2] WHO (2014): Antimicrobial resistance: global report on surveillance. See also German National Academy of Sciences Leopoldina and Academy of Sciences, Hamburg (2013): Antibiotics Research: Problems and Perspectives.

[3] See also International Council for Science (2004): ICSU Position Statement: The value of basic scientific research.

[4] Max Planck (1925): The Nature of Light.

Examples for such transformational ideas are numerous. In medical history, the discovery of the bacterial origin of diseases allowed for the development of immunization methods thus saving thousands of lives. Electricity-based light is not just the evolution of the candle; it required new concepts and major breakthroughs. The accelerator-based particle physics is another example of the transformational impact of science for a better world: initially developed for basic research only, many major medical centers are nowadays using accelerators producing X-rays, protons, neutrons or heavy ions for the diagnosis and treatment of diseases such as cancer, thus treating millions of patients.

Science, like music, **is universal**. It is a language that we can share and that helps us communicate better, leaving cultural and national borders behind.

For example at CERN, the European Laboratory for Particle Physics in Geneva, more than 10,000 physicists of 60 different countries work together, inspired by the same passion and shared goals. In universities aorund the world, new graduate and undergraduate programs are created seeking to educate global problem solvers able to work across diciplines, scales and geographies.

Science plays a key educational role. The critical thinking that comes with science education is vital in training the mind, understanding the world, making choices and solving problems. Science literacy supplies the basis for solutions to everyday problems in uncontroversial ways, reducing the likelihood of misunderstandings and furthering common understanding. Science literacy and capacity-building should be particularly promoted in low- and middle-income countries, where both the appreciation of the benefits of science as well as the resources for science are lacking. This situation creates dependence on countries that are scientifically more literate and resourceful.

Science is a public good that not only brings about transformative change on the road towards sustainable development. It is in itself also a way of crossing national, cultural and mental borders and thus helps lay the foundation for a sustainable world. Science may further democratic practises when results are freely disseminated and shared as well as made accessible to all.

The World Wide Web was originally invented to facilitate the exchange of information among scientists working in the CERN laboratories. Since then,the web has radically changed the way mankind accesses information. Since Tim Berners-Lee developed it in a publicly funded research center, he had no interest in patents and made his revolutionary knowledge freely available to everybody.

While the achievement of many sustainable development goals (SDGs) will depend on science, **science in its own right needs to be part and parcel of the post-2015 development agenda**. To make the most of the transformative power of science, it needs to be anchored prominently in a preamble to the SDGs or ideally as a stand-alone science SDG. Given the current state of negotiations, however, clear reference to sciene should at least be made under each agreed SDG. The international community should aim at establishing national minimum target investments for STI, including special allotments for the promotion of basic science and science education and literacy. These targets should also be applied by low- and middle-income countries to help break the cycle of dependency on scientific solutions from high-income countries.

Recommendation 1: The UNSG SAB calls on the UN Secretary-General and the international community as a whole to integrate science into the post-2015 development agenda by acknowledging its significant role for poverty eradication and for sustainable development, reflecting its comprehensive role for the SDGs beyond being a 'means of implementation', a statement on the crucial role of science should be anchored prominently in a preamble to the SDGs. Ideally, a stand-alone science SDG should be formulated, or, at least, science related targets should be defined under each agreed SDG.

Recommendation 2: The international community should aim at establishing national minimum target investments for STI, including special allotments for the promotion of basic science and science education and literacy.

2. The interrelatedness of focus areas and the necessity for an integrated scientific approach towards sustainable development

For the post-2015 development agenda to be a truly transformative sustainable development agenda, the interrelatedness of the development issues addressed in the SDGs and their equitable contribution to the three dimensions of sustainable development must be explicitly addressed.

In the past meetings of the Open Working Group (OWG), focus areas were treated separately from each other, while at the same time the OWG acknowledged the high level of interrelatedness of the proposed focus areas in its document of March 2014.[5] The artificial division of goals based on disciplinary approaches may be necessary for comprehension, resource mobilization, communication and public awareness-raising. Nevertheless, the UNSG SAB sees the need to strongly re-emphasize just how complex systems work and how inter-dependent they are.

> *An example is the strong interrelation among nutrition, health, gender equality, education, and agriculture. It is impossible to be healthy without adequate nutrition. Adequate nutrition is closely linked to agriculture for producing nutritious food. Agriculture, however, effects the environment and thus biodoversity: it is estimated to be the main driver for deforestation when not implemented conscientiously. Women are at the nexus of health, nutrition and agriculture. In rural areas, they are responsible for the daily food production and the childcare. Due to a lack of access to education and a resultant lack of knowledge, they are not familiar with the interlinkages portrayed above. Moreover, their cultural background often discriminates against their well-being as second-class human beings. Promoting gender equality and empowering rural women is of decisive importance to pursue further improvements in all these areas, including reducing unsustainable population growth. Science is best placed to elucidate such interlinkages.*
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> *Another example for the close interlinkages of agricultural practices, health and environment is the concept of "one health" that encompasses among others the idea that the health of humans and animals is closely linked, which, for example, is shown by the fact that viruses which originally start in animals spread to humans, as seen in the case of Ebola or influenza.*

Achieving sustainable development requires that its social, economic and environmental dimensions are addressed in a balanced manner. Therefore the targets under each SDG should ideally address all three dimensions of sustainable development. Further, all targets of the SDGs taken together should ideally address all dimensions of sustainable development in an equitable manner.

Recommendation 3: SDGs should be based on an integrated scientific approach.[6] The SAB recommends to the Secretary-General and the international community to emphasize the strong interrelations between the various areas and to acknowledge their cross-cutting nature. The SDGs also need to address the social, economic and environmental dimensions of sustainable development in an equitable manner.

In view of the interdisciplinary nature of science for sustainable development the UNSG SAB sees the importance of more intensified cooperation of different fields of science and for further research, in order to appropriately address the challenges of sustainable development. Moreover, science can also assist in explaining the interrelationships between the findings of research in, and the practice of, different disciplines and areas of knowledge. With regard to the aforementioned example on forecasting extreme weather, through interdisciplinary research, particularly among mathematics, physics and earth sciences, it is possible to improve accuracy of the forecast and its geographical range, and to provide more time before impact.

International and regional cooperation in science is also highly important in addressing sustainable development challenges.

[5] Open Working Group on Sustainable Development Goals. "Annex 1: Interlinkages", 2014.

[6] See, for ex. Government of Columbia (2013). The integrating approach: A Concept Paper from the Government of Columbia to Assist in Defining the Architecture of the SDG Framework.

Recommendation 4: Governments should acknowledge the potential of science to federate different knowledge systems, disciplines and findings and to contribute to an integrated understanding and a knowledge basis in the pursuit of the SDGs.

3. The measurability of goals and targets as a basis for evidence-based policy-making and for monitoring the implementation progress

As proposed in the Rio+20 outcome document "The Future We Want", the SDGs must be "action-oriented, concise and easy to communicate, limited in number, aspirational, global in nature and universally applicable to all countries while taking into account different national realities, capacities and levels of development and respecting national policies and priorities"[7]. The document also calls for targets and indicators to assess and to accompany SDGs, while taking into account different national circumstances and levels of development.[8]

The UNSG SAB agrees with the above-mentioned requirements for the SDGs setting and achievement. However, in view of implementing such goals and targets, several questions arise:

- How can they serve as a solid basis for evidence-based policy-making?
- How can the progress in implementation made in each field be effectively monitored by indicators?
- How can data collection and adequate processing be ensured?

In the light of the experience with the Millennium Development Goals (MDGs), it is important that both goals and targets be specific, precisely formulated, well-defined, time-bound and measurable. Furthermore, the interrelatedness of SDGs must be taken into consideration when formulating concise goals and defining policy-relevant targets. Hence, there is a need for cross-cutting targets which give precise advice to policy-makers at all levels as they consider the interrelatedness and impact of political decisions in one area to that in other areas. Specific targets may well appear under different SDGs.

To assess the implementation progress at national and regional levels and to evaluate the progress made towards achieving the targets, the **UNSG SAB also calls for a set of well designed, measurable, policy-relevant, easy to interpret, baseline-oriented and disaggregated indicators**. The United Nations Handbook on Indicators for monitoring the MDGs[9] as well as the UN System Task Team Report on Statistics and indicators for the post-2015 development agenda[10] may serve as a starting point for choosing and developing appropriate indicators. This will most likely require the development of indicators beyond the MDG framework. Innovative approaches will be needed to ensure that the development of these indicators meet the highest scientific standards.

The information and communication technologies of today make participatory monitoring and the delivery of real-time data, e.g. via a simple text message, possible. If the new monitoring and evaluation framework were to draw on these new possibilities, these data need to be interpreted and integrated in the overall evaluation based on sound scientific methods.

A successful monitoring and evaluation process must be based on specific and reliable data. There has been criticism about the lack of measurements for some MDGs, especially due to a scarcity of data and the incompleteness of data collection. Therefore, in the UNSG SAB's view, it is indispensable to improve collection, sharing and analysis of data and their comparability at international level.

[7] United Nations (2012): The Future We Want – General Assembly Resolution A/RES/66/288, para. 247.
[8] Ibidem, para. 250.
[9] http://mdgs.un.org/unsd/mi/wiki/MainPage.ashx.
[10] UN System Task Team on the Post-2015 UN Development Agenda (2013): Statistics and indicators for the post-2015 development agenda.

The UNSG SAB would further like to emphasize the increasing importance of big data. For instance in the case of “big data for health”, enormous amounts of data sets are created every day by various sources for medical purposes in order to improve disease surveillance, diagnostics or treatment methods. However, data access or data standardization still causes significant obstacles, particularly with regard to interdisciplinary research cooperation.

Recommendation 5: Governments are called upon to build a new global research architecture to strengthen interdisciplinary collaboration, to effectively coordinate enormous datasets, to fill data gaps, and to improve knowledge management. The compilation, analysis, and use of big data needs to be structured and coordinated internationally.

Recommendation 6: The new global research architecture should ensure linking scientific information and data as well as findings, scientific assessments and scientific advice with both policy and society. It should lead to an enhanced science-policy-society interface.