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Third Background Paper. Input to the 3rd Consultation

Bouncing Forward Sustainably: Pathways to a post-COVID World

Strengthening Science Systems

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Introduction

The COVID-19 crisis has highlighted the critical role of science in acquiring knowledge of the pandemic and its effects, as well as communicating that knowledge to policy makers. The IIASA-ISC Consultative Science Platform on Strengthening Science Systems assesses how science has responded to the COVID-19 crisis and, utilizing this understanding, is advancing a number of proposals to strengthening the capacity for science to serve society in the future. Lessons learnt from the COVID-19 crisis show that *increased agility*, *enhanced reliability*, and *a more effective science-policy-society interface* are required to ensure that science can react more efficiently to such exogenous shocks in the future. The IIASA-ISC Consultative Science Platform on Strengthening Science Systems uses these three axes as a framework and engages with eminent experts to investigate the barriers that confront science, the factors that may allow for these barriers to be overcome, and to advance concrete policy proposals that will allow for science to be better equipped to confront future challenges.

The process consists of three consultations, literature analysis and synthesis. The 1st Consultation took place on 19 June 2020 (see the Background Paper (link)) and brought together fourteen renowned scientists who developed a number of proposals whereby the capacity of science to serve society in the context of future global crises could be enhanced. The deliberations resulted in initial draft recommendations (see 1st Consultation Report (link)) selected for further discussion in the 2nd Consultation.

The 2nd Consultation took place on 20 July 2020 and involved nineteen representatives of science funders, the private sector, science journalists, publishers and those concerned with public understanding of science (see the Second Background Paper (link)). The participants reflected on and advanced the initial draft recommendations that emerged from the 1st Consultation. Based on the deliberations of the 2nd Consultation (see 2nd Consultation Report (link)), the IIASA-ISC team further refined the draft recommendations. These draft recommendations – summarized below – are the basis for our discussion in the 3rd Consultation that will bring together policy makers, policy advisors and policy experts, as well as representatives of the private sector engaged with R&D.

Strengthening mechanisms through which science can provide advice for policy at national and international/multilateral levels, as well as enhancing cooperation between science in the public and private spheres are both critical to ensure that policy decisions are based on sound scientific evidence. While participants will have the opportunity to comment on any of the draft recommendations, the discussion in the 3rd Consultation will therefore focus on recommendations for strengthening science input for policy and on enhancing cooperation between public science and the private sector.

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SUMMARY OF RECOMMENDATIONS

Recommendations with turquoise color highlight are those which should be in the focus of the discussions of Break-away group 'Science for policy' and with green color highlight are those for Break-away group 'Enhancing the contribution of the private sector' at the 3rd Consultation.

Access to and diffusion of scientific knowledge

R1: The efficiency and effectiveness of the **quality assurance system of research outputs** should be enhanced. The rigidity and slowness of paper processing by commercial scientific journals have been long recognised as major obstacles for swift dissemination of a variety of scientific outputs. Peer review of interdisciplinary research is recognized as presenting particular difficulties (link). COVID-19 underlined the imperative to make the peer review system agile, international, rigorous and inclusive if science is to meet the challenges of future crises. International organizations of science, including ISC and UNESCO, could take a lead and devise such a system through a dialogue with international disciplinary bodies, national academies, publishers and national research councils.

- The incentives for scientists to conduct peer review should be increased. These include material rewards as well as acknowledgement and recognition by journals and in the career assessment of scientists.
- Scientists should be trained to be effective reviewers. Special training is required for inter-disciplinary review.
- Comprehensive and transparent databases of potential reviewers where scientists could freely opt in should be developed. Smart AI-based tools capable of effective navigation through these databases should be deployed. This can significantly improve identification of appropriate and willing reviewers and thus significantly speed up the review process.
- A system of rapid and light review for preprints could be established that would allow readers to have an overall assessment of the preprint quality.

R2: The move to **open science** – open access publishing, open methods, models, and data – is a priority for science. Open access to the record of science should be accelerated, which will serve not only scientists, but also science translators and the general public. The incentive system for sharing information by scientists should be fundamentally changed. The key is to develop a system that allows for the widest and most rapid diffusion of knowledge while simultaneously rewarding new scientific discovery.

- Data, models, and computer codes that provide evidence for scientific claims must be concurrently accessible for scrutiny and reproducibility. The FAIR approach to these issues (Findable-Accessible-Interoperable-Reusable) provides a necessary framework.
- Data and codes should be deposited in open well-managed repositories. It should be the responsibility of funders as a condition of funding, and of journals as a condition of publication, that relevant data and codes are concurrently and openly available.

- Common data standards will be helpful to improve the efficiency and speed of research. International organizations could play an important role in promoting data sharing and the unification of data standards.
- The use of open source software should be promoted.
- Apart from data and code, other products of the research process that pre-date the publication of an article such as the formation of researchable hypotheses and research protocols, as well as negative results should be made freely available and be eligible for funding.

R3: Make **access to and navigation of existing research** easier. Mechanisms to facilitate utilization of already existing and emerging research results and insights relevant to a crisis should be enhanced.

- The use of accessible repositories for existing research and data by scientists should be promoted.
- Beyond open access, platforms aggregating research on a particular topic should be developed. Conditions should be created that such platforms could emerge rapidly with the onset of a crisis.
- Machine reading can substantially improve how we do knowledge synthesis. Governance schemes for these emerging machines enabling science production processes should be developed.

Collaboration and partnerships

R4: **Scientific cooperation** at the regional and global scale should be developed. A number of factors including travel restrictions due to COVID-19 lead to the situation that traditional mechanisms for building and maintaining global research networks, such as conferences and research visits, are breaking down. A number of political and economic factors are leading to a significant reduction in early-career scientists from developing countries enrolling in universities in the developed countries and then establishing research networks. Attention should be paid to the development of new mechanisms to encourage scientific cooperation at the regional and global scale, and particularly, to developing networks centered in the South. COVID-19 has clearly demonstrated the value of international cooperation in producing scientific knowledge rapidly and ensuring that scientific knowledge is an effective input into policy. The clear demonstration of the value of international cooperation in the context of a global crisis provided by COVID-19 should be used by scientists and others to further enhance the trend towards a higher degree of international cooperation and the understanding of science as a global good.

- The nationalization of science systems that is currently observed in many countries should be counter-acted.
- There should be a richer set of international joint research calls supporting and facilitating international scientific cooperation whereby each national funding body funds own researchers proportionally to their contribution to the project. Such funding mechanisms can establish the

foundation for long-lasting collaboration between scientists well beyond the time of the call which can be useful when the next crisis occurs.

R5: Mechanisms to enhance **cooperation between public science and the private sector** should be identified. Many solutions rely on public-private research partnerships and on private sector technology platforms. Incentives for the public and private sector to share data and knowledge must be developed.

- Collaborative efficiency across the public-private interface can be enhanced through "relational professionals" that are able to communicate sensitively to both communities.
- Funding programmes should be created to facilitate collaborative engagement between scientists and industry, policymakers, and citizens.
- The proclamation of a global crisis – perhaps by the United Nations – should be a signal for more extensive cooperation between science in the private and public spheres. Cooperative projects will require clear agreements as to how risks and any possible future returns are distributed as between the different parties.

Research focus and funding

R6: **Critical risks and the resilience** of socioeconomic-environmental systems should be a key focus of **future research**. A strong input from the social sciences is required as decision-making contexts, policy implementation, and societal and behavioral responses are key to the derivation of feasible policy recommendations.

- Countries – especially in the developing world – should develop their science and technology capacities across a broad range of risk areas. Research should take a multi-dimensional and integrated view on possible future risks. Complex systems can be a suitable framework for such research.
- A compelling research agenda on risk research should be designed by the science community and be advanced to governments and funders.
- A stronger involvement of social science in risk research aimed at better understanding of the soft systems – social systems and institutions – is needed to inform quantitative models and local decisions. Future research should pay more attention to specific societal weaknesses and the political, social, economic contexts and the decision-making realities of countries. Insights and practices drawn from one context may have very different and unanticipated outcomes when applied to another context.
- As humanity has had to deal with exogenous crises periodically throughout its existence, useful lessons can be derived from the past. Hence, the history of crises and attendant societal responses should be integrated into research on risk.
- More research is required to understand the tradeoff between the science system efficiency and flexibility and to identify solutions that would allow an increase in both.

- Another important tradeoff that requires attention is that between present losses and anticipated future losses. Win-win solutions that enhance future resilience without compromising the present should be identified.
- A systems approach supported by interdisciplinary research is key to the identification of effective policy actions in crisis situations which are necessarily multi-dimensional.
- To improve agility to future crises, research models and data should be made easily reusable. The use of general-purposes models should be expanded.

R7: The **re-direction of research efforts** in times of crisis should be made easier. Mechanisms must be put in place to allow researchers to move rapidly into new areas of public policy concern. This entails funding, performance evaluations for career development and leadership. Under all circumstances, attention should be paid to maintaining high standards of scientific conduct.

- Funding as well as job and career security are pre-requisites for researchers to shift their attention to the crisis. Performance evaluation system of different career stages should recognize the contribution of scientists in undertaking research which addresses crises even if this research does not result in a publication in a peer-reviewed journal or another traditionally recognized output. Special attention needs to be paid to young researchers as career track and performance requirements make it difficult and disadvantageous for them to quickly re-orient their research.
- One institutional mechanism to mobilize research efforts in a certain area could be to create "emergency teams" possessing relevant and complementary expertise needed to deal with particular kinds of crises. These "emergency teams" could exist in a stand-by mode being ready to be activated on demand. Funding for the active work of such "emergency teams" could then be arranged without incurring the delays necessarily entailed in securing funding through a competitive process.
- To create incentives for researchers to shift to the topic of the emerging crisis, rapid and easy-to-access grants could be useful. Mini-grants of this kind could in particular support efforts to mobilize, interpret, and communicate already existing research, which would be especially useful when the crisis is developing very rapidly and there is no time to conduct new research.
- More and faster communication channels between funding agencies, scientists, and policy makers should be established and activated in times of a crisis so as to allow for better coordination of efforts. This would include decision making processes that could rapidly call for a systematic re-direction of research.
- Good scientific practice in response to a rapidly developing crisis should be explicitly formulated and enforced. Existing codes of scientific conduct should be amended with explicit statements detailing what constitutes cases of scientific misconduct that are likely to occur in times of an exogenous crisis. Institutions that enforce the scientific code of conduct (internal – to the universities and research organizations, and external – at the national or supra-national level) should be significantly strengthened.

Public understanding and trust in science

R8: **Public understanding of science** should be enhanced. Citizen engagement in science is a democratic imperative in a world increasingly conditioned by science. The awareness of the general public should be significantly enhanced as to how science operates; in particular the role of the scientific debate and disagreement should be made more widely known. This will result in an environment in which there will be greater public acceptance of science and the validity of scientific results.

- Scientific literacy of citizens should be enhanced, which includes not only scientific facts, concepts, and methods, but also the processes of how science operates. The public should be made more aware that science advances through debate and contestation. The centrality of debate and contestation should be taught very early, as an integral component of science instruction in school.
- Civil servants should have basic training in understanding science and have direct access to scientists located in academia so as to obtain additional views as needed.
- Science communication must be improved. Scientists should be trained and incentivized in the communication of science.
- As implementation of scientifically-informed policies requires public acquiescence, a more active engagement of citizens in science is needed, in particular, in the co-construction of actionable knowledge that responds to societal needs. In addition to scientific merit, journals should regard engagement with society as a positive in determining the merits of a submission for publication.
- Incentives for the scientific community to engage in processes of deliberative societal dialogue about the use of new knowledge and not merely in the creation of new knowledge should be put in place.

R9: **Trust in science** should be enhanced. Measures of combating opposition to and distrust of science, as well as mechanisms for maintaining and increasing trust in science are required. Besides the efforts of scientists, science journalists and other communicators of scientific knowledge are critical for building the public trust in science.

- Scientists have a responsibility not only to produce new scientific knowledge but also translate complex problems and solutions as they perceive them in ways in which they can be more easily assimilated outside of the science community.
- There is a need for appropriate public funding to enhance the capacity of science journalism and science media. This is especially critical in countries where science journalism and science media are not well developed.
- The integrity of science journalism should be enhanced. Science journalists have a duty to ensure that the public receives only high-quality scientific information.

- Cooperation between scientists and publishers should be promoted to achieve more effective public outreach. Such cooperation could be facilitated by an intermediary agency.
- COVID-19 has clearly demonstrated the provisional nature of scientific knowledge Scientists have a duty not to overstate the importance of their contributions and to make evident some of the limitations or the provisional nature of their findings.

Science as an input into policy

R10: **Institutions for science advice** should be strengthened. Strong institutions for science advice to policy ensuring interdisciplinarity, transparency and a capacity to draw on global science should be built.

- The involvement of the science community in an advisory role should be broadened in terms of the number of scientists involved and the range of disciplines.
- The transparency of science advisory mechanisms should be significantly increased. Expert judgement and potentially even evidential basis of given recommendations should be made transparent.
- Government structures should refrain from influencing scientific advice. Ethical standards for the independence of scientific research should be respected.
- Scientific advice to policy makers should be formulated and communicated in the way best suited for this audience category. Science translators can facilitate this mutual understanding.
- Multiple perspectives and opinions coming from the science community can be confusing to politicians who need to take clear decisions and to do so swiftly. Science translators could help overcome the problem of science that does not speak with one united voice.
- Beyond the level of national governments, science advisory mechanisms should be further developed at the multilateral level.
- When making decisions, policy makers are confronted with a plethora of science-based and non-science-based considerations. Scientists engaged in providing science advice to governments should recognise and acknowledge that while their advice is important, it covers only the area of their discipline and expertise; it is the responsibility of policy makers, not scientists, to interface and integrate different pieces of advice and make policy decisions.