International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

International Science Council
The global voice for science

Address: Schlossplatz 1, A-2361 Laxenburg, Austria
Telephone: +43 (0) 2236 807 000
Email: repository@iiasa.ac.at

1st Consultation Report

Bouncing Forward Sustainably: Pathways to a post-COVID World

Strengthening Science Systems

Elena Rovenskaya, David Kaplan, and Sergey Sizov

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Introduction

This report is in three parts. The first part of the report outlines the process of the 1st Consultation. The second part of the report provides a summary of the discussion which is grouped around the main themes that were identified in the Background Paper produced for the 1st Consultation. The third part of the report provides a preliminary list some potential recommendations emerging from the 1st Consultation. Correspondence and off-line discussion with the participants, as well as work to analyze collected material are on-going. The list of recommendations outlined in this report should therefore be treated as a work-in-progress.

About the authors

David Kaplan is Senior Research Specialist at the International Science Council (ISC) (Contact: david.kaplan@uct.ac.za).

Elena Rovenskaya is Program Director of Advanced Systems Analysis Program and Acting Program Director of Evolution and Ecology Program at the International Institute for Applied Systems Analysis (IIASA). She is also Research Scholar at the Faculty of Computational Mathematics and Cybernetics, Lomonosov Moscow State University, Russia (Contact: rovenska@iiasa.ac.at).

Sergey Sizov is Science Diplomacy Officer at the International Institute for Applied Systems Analysis (IIASA) (Contact: sizov@iiasa.ac.at).

Acknowledgments

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The Process

The 1st Consultation was a 3-hour webinar that took place on 19 June 2020. Chaired by Lidia Brito, Director of UNESCO Regional Bureau for Sciences in Latin America and the Caribbean, fourteen renowned representatives of the international science community as well as members of the IIASA-ISC Team (Annex 1) deliberated on the overarching question: *Which barriers should be reduced and which enablers should be reinforced in order to strengthen the capability of the science system to provide adequate input in crises triggered by extreme events like COVID-19?*

To inform and support the 1st Consultation, the IIASA-ISC Strengthening Science Systems Team produced a Background Paper that analyzed critical issues within the science system that have been highlighted by the COVID-19 crisis (Rovenskaya et al., 2020). The paper proposed three axes of improvement that are required so as to ensure that science can react more efficiently and effectively to future global exogenous threats: *increased agility*, *enhanced reliability*, and *a more effective science-policy-society interface* and a number of specific issues therein. A "Systems map" depicting major interlinkages among key issues relevant for the three axes of improvement complemented the Background Paper (Strelkovskii et al., 2020). Prior to the meeting, the participants received the Background Paper and the Systems map and, in addition, an Orientation and Extended Agenda which outlined the issues for discussion and the expected outcomes (Annex 2).

The Orientation and Extended Agenda set out the objective of the meeting: *"The intended outcome of the 1st Consultation is to produce a number of statements – about 10-15 in total – containing a diagnosis of the key challenges confronting the science system as well as actionable recommendations to address these challenges. Taken together, the suggested recommendations are expected to have a high potential to improve all three axes."*

The consultation was very structured. Defined times were allocated to each axis of improvement. The participants shared a number of relevant experiences from the COVID-19 situation. Discussion was focused on the design of a future science system which would be better prepared to deal with exogenous shocks of various kinds.

Towards the end of the consultation, participants were asked to complete an online survey, which asked respondents to address the question: *Which elements should be the most important focus for policy makers to strengthen the capability of the science system and its capacity?* The results of the survey are presented in Annex 3.

The engagement with the participants in the 1st Consultation continued after the meeting. Participants were asked to provide additional written comments. The IIASA-ISC Strengthening Science Systems Team will synthesize a full list of potential recommendations with more substantiation, which will serve as input to the 2nd Consultation. The 2nd Consultation will include representatives of the science funders, the private sector, particularly those engaged in research with the public sector to address key challenges arising from the COVID-19 situation and those dealing with relevant data and analytics, science journalists, publishers, and other relevant categories. Participants in the 2nd Consultation will be asked to reflect on the feasibility and implementation of the proposed recommendations.

The Discussion

To reiterate, with reference to the COVID-19 crisis, the discussion was structured around the three axes of improvement that the Background Paper identified as required in order to ensure that science can react more efficiently and effectively to global exogenous threats: *increased agility*, *enhanced reliability* and *a more effective science-policy-society interface* and a number of specific issues therein. Within each of these three axes a number of issues were identified.

Discussion ranged widely over these issues and the inter-relationships between them. This section of the report is concerned principally with the barriers and enablers that were identified by the participants as currently confronting the science system. This is by no means a comprehensive record of the discussion but rather a summary of some of the main issues discussed.

Increased agility

Publications. Peer-reviewed publications remain the main channel for the dissemination of research results. However, pre-prints and other grey literature have gained a much higher importance and visibility with COVID-19. Despite significant efforts on the part of journals to improve the situation, the length of time that it takes to publish papers in peer-reviewed journals is a major obstacle to enabling research results to be made public timeously. AI-based tools are showing promising in terms of facilitating the review and the publishing processes.

The peer review system as a quality assurance mechanism is a further concern. Among the deficiencies of the system of peer review are rigidity and the dominance of the Global North's traditions and perspectives. Peer review of interdisciplinary research is recognized as presenting particular difficulties.

In order to enhance the agility of the science system, it is essential to enable researchers and other stakeholders to have far easier access to and navigation of already existing research results and insights on issues that are relevant to the crisis. Again, AI-based tools have great potential to improve capacities in this regard.

Modeling and data. Modeling is a powerful research method to study complex systems where experimenting with real systems is not possible. As modeling proceeds from understanding to generating policy advice, the requirements for models should become more stringent. Issues of model transparency, complexity, standards, and comparison need to be addressed to make models a reliable tool to inform policy responses to exogenous crises. The science community needs to accelerate the movement towards greater model openness and scrutiny. This includes open access to data, research results, and computer code. The climate modeling community is ahead of many others in many of these aspects and provides best-practice examples. To increase the relevance of modeling, communication between modelers, experts in the field and decision makers should be enhanced. To improve agility to future crises, research models and data should be made easily reusable.

Data is fundamental for adequate research. In the absence of data availability and transparency, modelling skills and infrastructure are of little use when it comes to reacting to societal challenges. Common data standards will be helpful to improve the efficiency and speed of research, which is particularly critical in times of rapidly developing crises. International organizations could play an important role in promoting data sharing and the unification of data standards.

One problem that has become more apparent in the context of COVID-19 is the "nationalism curse" in regard to statistics. Not only do different countries collect and publish data in different ways which precludes inter-country comparison, but very little attention is given to data heterogeneity of regions and groups even within countries. This is despite the fact that different regions and groupings reveal very different vulnerabilities and responses to the threats posed by COVID-19.

Finally, considerable amounts of useful data are held by both the public but particularly the private sector which are not made accessible to researchers. Widening data sharing and accessibility is critical to advance in many scientific fields.

Flexibility. The COVID-19 experience has shown how difficult it is for poorly endowed and supported research institutions to respond with agility to sudden threats. Strong research institutions are an essential pre-requisite for a rapid and quality response. Ironically, in a number of countries, the funding of institutions focused on epidemiology, public health risks and response to disasters was significantly reduced immediately prior to the COVID-19 crisis. To enable rapid response of science systems, it is vital that adequate and stable public funding is provided to institutions which study exogenous risks. This can ensure that research insights are produced *ex* *ante* and that these institutions can be rapidly mobilized when needed to produce the research recommendations for policy makers.

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.

Special attention needs to be paid to young researchers. Career track and performance requirements make it difficult and disadvantageous for young researchers to quickly re-orient their research. Putting aside ongoing research creates risks for researchers, especially if it relies on third-party funding and especially for early- and mid-career scientists. Funding is a pre-requisite for researchers to shift their attention to the crisis. A further pre-requisite is job and career security. 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. Such recognition would be especially valuable in the times of the COVID-19 crisis, since the crisis puts extra pressure on university-based researchers who are now required to shift to online teaching.

While a number of scientists representing “minorities” (for example, women) were very visible during COVID-19 and can be role models for others, there are indications that the crisis has led to widening inequalities in scientific research. Discrimination against “minorities” especially in funding allocation will retard agility and further enhance inequalities within science.

Enhanced reliability

Cooperation. The lockdown, travel and inter-personal contact restrictions caused by the COVID-19 situation pose major challenges to the practices of science where cooperation and collaboration among scientists play an important role. Doing research in small teams has become vary widespread; groups are typically volatile, they are created and discontinued flexibly in response to emerging ideas, individual passions, and available resources to execute these ideas. If the restrictions continue, this may have a negative impact on such practices, which in turn can negatively impact on the quality of research.

Conferences, research visits, and the international labor market of researchers have been key factors fostering scientific exchange and mobility. Scientific collaboration, in turn, has been critical to enhancing the quality of research. New visa regimes and restrictions on travel, etc. will inhibit future research collaboration. Current restrictions, especially if continued, will have a negative impact, particularly on networks incorporating scientists at early stages of their careers. This, in turn, will undermine the quality of future research.

Of particular concern is that existent mechanisms for building networks of collaboration will be severely disrupted by the COVID-19 crisis. Currently, most research networks center on major research universities in the industrialised countries. Students from all over the world undertake postgraduate studies and research at these institutions and here establish their global networks. There is likely to be a significant decline in the supply of foreign students entering these universities. The decline in students will in turn negatively impact on revenue streams for many of these research institutions, so further limiting research and the flow of foreign students. New networks and new mechanisms to support these new networks are required. An expanded role for universities in the South requires further investigation.

Another important dimension of collaboration is that between scientists in the public and the private sectors. In areas such as drug development, we are witnessing enhanced levels of cooperation. But, there is scope for further enhancing cooperation in many other areas. With a majority of science and scientists engaged in the private sector, incentives need to be developed that would encourage private sector science to engage far more actively with the societal challenges posed by COVID-19 and future crises.

In the context of COVID-19, we observe a continued tendency to the "re-nationalisation of science and policy making." One way to overcome this could be regional cooperation and regional grouping, which can then become a basis for new forms of global cooperation.

Dissemination. Machine reading can substantially improve how we do knowledge synthesis as well as where quantitative models can automatically be recalibrated and reformulated by machine-based information harvesting and information interpretation in order to support scientific assessments. Likewise, machines can help to disseminate new findings including micro-targeting human behavior. We will soon need to think about how to develop governance schemes for these emerging machines enabled science production processes and science-society interactions.

A more effective science-policy-society interface

Future research priorities. The COVID-19 crisis emphasized the need to enhance our preparedness to address exogenous shocks and to increase our understanding of the vulnerabilities of critical systems. Foresight – analyzing likely future risks and how such risks might be mitigated and responded to – should be an important part of the research portfolio. Such foresight should be undertaken at national, regional and global levels. Research to enhance preparedness to shocks should include stress testing of our systems, including governance systems, to a broad range of shocks. In such stress-testing, sustaining both health and livelihood are important criteria for assessment. On the other hand, despite the urgency of dealing with the COVID-19 crisis, this research should not displace the centrality of research on sustainability, including climate change.

Appreciating the social and political context is very important. In order to facilitate effective policy implementation of science advice, more research of the decision-making contexts and realities is needed. Scientists proffering advice will need to be more attuned to the interests and concerns of policy makers; of the importance that policy makers assign to factors other than science advice and of the possibilities and limitations of state capacity to implement any advice that is given. *Ex-post* analysis of how science advice was used by politicians and how political decisions were successful or unsuccessful in dealing with exogenous crises are key inputs in informing future policies.

Systems approach. A systems approach supported by interdisciplinary research is key to the identification of effective policy actions in situations in which resources are very limited. Systems thinking is hard to execute; it requires not only efforts of individuals, but also institutional arrangements and education, especially in the developing world. Furthermore, systems thinking should be complemented by recognizing and appreciating the role of all relevant actors, and scientists should actively contribute to this recognition.

Science advice to policy. To facilitate evidence-based decision making, science advice needs to be institutionalized at the national and international level. At the international level, the International Network for Government Science Advice (INGSA) plays an important coordinating and informing role.

For science advice to be rendered relevant and to be accepted by policy makers, social science and behavioral science should be an integral part of any policy-oriented research. As one participant put it, "To deliver the vaccine is as important as to develop a vaccine." The research should focus not only on how an exogenous crisis unfolds, but also on the societal response to it and on policy implementation. Local and context specific knowledge should be collected and analyzed.

It should be recognized that policy makers and scientists have two different value and systems of cognition. Mutual understanding is a basis of mutually beneficial relationships. Science translators can facilitate this mutual understanding. The system of science translators could also help overcome another important barrier in the science-policy interface, namely that science does not speak with one united voice. 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. Competition between science communities multiplies this challenge and can hinder the quality of advice. More cooperation between scientists in addition to science translators could help address this problem.

Transparency of science advice to the general public is another very important issue. Scientists could make the advice they give to politicians publicly known, which would put additional pressure on the politicians to explain and justify the policy decisions that they make. If the public are in step with science, this would significantly enhance the power of science to influence policy.

Furthermore, the science community is not only expected to do research into issues of relevance to current policy challenges, an additional important societal function of science is to look beyond the immediate horizon and set the future agenda for politicians. Here science advice may have to compete with other powerful interest groups.

Another concern is that while science provides inputs into policy making to deal with exogenous crises, scientists typically are not involved in decisions on measures which are taken by other authorities. These authorities may not realize how their decisions impact the capability of science to provide input to policy and thus a dialogue with all relevant stakeholders needs to develop here.

Trust in science. Trust in science and in the trustworthiness of insights and recommendations from science are key to the effective functioning of the science-policy interface. While in many countries, the public trusts science more than other actors, including religious leaders, crises like COVID-19 can lead to the erosion of trust in science. One reason for this is the proliferation of pseudoscience and misinformation. Another reason is the lack of public understanding of how the science functions. For example, the public is often confused when being exposed to scientific debates and disagreements between scientists. The public needs to understand that uncertainty in relation to scientific findings is very likely and that healthy scientific debate is integral to the advance of science and essential to ensure quality control in science. Public understanding of science varies considerably as between countries. Greater efforts to enhance public understanding of science should be made where this understanding is weakest. A mechanism of error correction should be a part of the presentation of scientific findings. Beyond the problem of a lack of understanding, is the issue of outright opposition to science that is strategically supported by certain groups. Measures to counteract opposition to science and the advance of pseudoscience are needed.

To conclude, we would stress that while there is a general tendency to think of agility as trading off with reliability, our intention in this project is to identify a set of recommendations which could move the science system to a more efficient state such that **both** agility and reliability, as well as the science-policy-society interface are enhanced. Clearly, some countries are more advanced along the three axes than others. In the context of a global crisis, it is in the common interest of all to help those who are lagging behind to support their ability to respond to the ongoing COVID-19 crisis and also to develop their research capacity in the long term.

Young scientists should be given a particular opportunity to contribute to the design of any future science system. Young scientists are less beholden to old practices and are more agile. Empowering young scientists to develop proposals and to act would create additional capacity for the entire system to respond and to transform.

Finally, the redesign of the science system would benefit from broadening the definition of whom we include as relevant stakeholders. It is for this reason that the 2nd Consultation will focus on participants from science funders, the private sector dealing with relevant data and analytics, science journalists, and publishers.

Emerging Recommendations

To reiterate – this is a preliminary list of potential recommendations. It is a work-in-progress as discussions with participants and our analytical work are continuing. A longer list with much more detail will serve as inputs for the 2nd Consultation.

However, there are several "buckets of recommendations" emerging:

- Exogenous risks and the resilience of the socio-economic-environmental systems should be a key focus of future research. Attention should be given to the policy contexts, policy implementation and societal responses.
- The move to open science (data, methods, models etc.) should be encouraged. Equivalent standards for data and models must be promoted; inter-model comparison practice in various fields must be developed. Reusable/general-purpose modeling must be prioritised.
- The use of new technologies to improve the efficiency of the peer review system requires further investigation.
- Traditional mechanisms for building and maintaining global research networks are breaking down. Attention should be paid to the development of new mechanisms to encourage scientific cooperation at the regional and global scale. Particular attention needs to be paid to developing networks centered in the South.
- As many solutions rely on public-private research partnerships and on private sector technology platforms, mechanisms to enhance cooperation between public science and the private sector should be identified. Incentives for the public and private sector to share data and knowledge must be developed.
- Measures of combating opposition to and distrust of science are required. Mechanisms for maintaining and increasing trust in science are required.
- The awareness of the general public should be significantly enhanced as to how science operates; in particular the role of the scientific debate should be made more widely known. The public and policy makers should be educated so as to understand that science does not speak with one voice.
- A systems approach should become integral to policy advice. This would require enhanced inter-disciplinarity and stronger cooperation amongst scientists from different fields.
- Mechanisms must be put in place to allow researchers to move rapidly into new areas of policy concern. This entails funding, career evaluations and leadership. Public funding mechanisms should be created in advance to be ready to be activated when needed to support an agile response of the science community to rapidly unfolding exogenous crises (small and easy-to apply-to grants).

This summary list of recommendations will be developed further in the Background Paper for the 2nd Consultation.

References

Rovenskaya E, Kaplan D, and Sizov S (2020). Bouncing Forward Sustainably: Pathways to a post-COVID World. Strengthening Science Systems. Background Paper. IIASA-ISC

Strelkovskii N, Rovenskaya E, Sizov S, and Kaplan D (2020). Bouncing Forward Sustainably: Pathways to a post-COVID World. Strengthening Science Systems. Systems map. IIASA-ISC

List of Participants

Chair: Lidia Brito, Director, UNESCO Regional Bureau for Sciences in Latin America and the Caribbean

- **Zakri Abdul Hamid**, Pro Chancellor, Multimedia University, Malaysia
- **Geoffrey Boulton**, Regius Professor of Geology Emeritus, University of Edinburgh, UK
- **Craig Calhoun**, Professor of Social Sciences, Arizona State University, USA
- **Eran Feitelson**, Head of Advanced School for Environmental Studies, The Hebrew University of Jerusalem, Israel
- **Jim Hall**, Director of Research in the School of Geography and the Environment, University of Oxford, UK
- **Mohamed Hassan**, President, The World Academy of Sciences (TWAS), Italy
- **Martin Lees**, Chair, OECD-IIASA Task Force on Systems Thinking, Anticipation, and Resilience, France
- **Johann Mouton**, Director, Centre for Research on Evaluation, Science and Technology, Stellenbosch University, South Africa
- **Helga Nowotny**, Professor of Social Studies of Science Emeritus, ETH Zurich, Switzerland
- **Connie Nshemereirwe**, Immediate Past Co-Chair, Global Young Academy, Uganda
- **Montira Pongsiri**, Associate on Health, Stockholm Environment Institute Asia Centre in Bangkok, Thailand
- **Nikolas Popper**, Coordinator, Centre for Computational Complex Systems (COCOS), Vienna University of Technology, Austria
- **Thomas Reuter**, Board and Executive member, World Academy of Arts and Science (WAAS), and Professorial Fellow, Asia Institute of the University of Melbourne, Australia
- **James Wilsdon**, Director, Research on Research Institute (RoRI), University of Sheffield, UK

IIASA-ISC Strengthening Science Systems Team leadership

- **David Kaplan**, Senior Research Specialist, ISC;
  Team Co-Leader
- **Elena Rovenskaya**, Program Director, Advanced Systems Analysis Program, and Acting Program Director, Evolution and Ecology Program, IIASA;
  Team Co-Leader
- **Sergey Sizov**, Science Diplomacy Officer, IIASA;
  Team Alternate Leader

IIASA-ISC Consultative Science Platform: Leadership team and members

- **Benigna Boza-Kiss**, Research Assistant, Transitions to New Technologies Program, IIASA;
  IIASA-ISC Cross-cutting Champion on Poverty and Inequality
- **Åke Brännström**, Senior Research Scholar, Evolution and Ecology Program, IIASA;
  IIASA-ISC Strengthening Science Systems Team Member

- **Jesus Crespo Cuaresma**, Research Scholar, World Population Program, IIASA;
  IIASA-ISC Strengthening Science Systems Team Member
- **Luis Gomez Echeverri**, Emeritus Research Scholar, IIASA;
  IIASA-ISC Consultative Science Platform Leadership Team, IIASA-ISC Cross-cutting Champion on Trust
- **Steffen Fritz**, Deputy Program Director, Ecosystems Services Management Program, IIASA;
  IIASA-ISC Cross-cutting Champion on Data and Privacy
- **Michael Obersteiner**, Senior Research Scholar, Ecosystems Services Management Program, IIASA; *IIASA-ISC Strengthening Science Systems Team Member*
- **Michaela Rossini**, Head, Library and Knowledge Resources Unit, IIASA;
  IIASA-ISC Cross-cutting Champion on Data and Privacy
- **Flavia Schlegel**, Special Envoy for Science in Global Policy, ISC;
  IIASA-ISC Consultative Science Platform Leadership Team
- **Leena Srivastava**, Deputy Director General for Science, IIASA;
  IIASA-ISC Consultative Science Platform Leadership Team

Orientation and Extended Agenda

Objective of the 1st Consultation

IIASA-ISC Consultative Science Platform "Bouncing Forward Sustainably: Pathways to a post-COVID World" aims to harness the transformative power of crisis to imagine a more sustainable post COVID-19 world. The 1st Consultation of the Strengthening Science Systems theme will bring together prominent scientists from around the world to deliberate on the overarching question:

> *What are the key barriers that need to be overcome and what are the enabling factors that need to be reinforced in order to strengthen the capability of the science system to provide adequate input in crises triggered by extreme events like COVID-19?*

The participants will reflect on the recent experience of the COVID-19 crisis and utilize this reflection to imagine a future science system, which is better prepared to deal with exogenous shocks of various kinds.

The background paper prepared by the IIASA-ISC team analyzed critical issues within the science system that have been highlighted by the COVID-19 crisis. The paper identified three axes of improvement that are required so as to ensure that science can react more efficiently and effectively to global exogenous threats: *increased agility, enhanced reliability and a more effective science-policy-society interface*.

The intended outcome of the 1st Consultation is to produce a number of statements – about 10-15 in total – containing a diagnosis of the key challenges confronting the science system as well as actionable recommendations to address these challenges. Taken together, the suggested recommendations are expected to have a high potential to improve all three axes. Systems thinking is vital if we are to move the science system to a higher frontier.

Approach

In order to inspire systems thinking on the part of the participants, the Strengthening Science Systems team produced a "systems map" that linked selected issues relevant for the three axes of improvement with each other and ultimately with the axes themselves. While **participants are very welcome to comment on the map and suggest ways to improve it**, it is not the intention to discuss this in detail or to produce a version of the map that could be agreed by all the participants. Apart from illustrating the elements of the science system and their inter-relationship, the systems map allows for the derivation of **key barriers and enablers** that can serve as a basis for the discussion at the 1st Consultation.

Each of the identified barriers and enablers are grouped under one of the three axes for improvement. Barriers and enablers that are relevant for more than one axis are assigned to that where they have the most relevance.

Barriers and enablers which are relevant to more than one axis will be prioritized for consideration in the Consultation. The discussion of any improvement measures will likely involve an analysis of associated trade-offs. The participants are encouraged to deliberate on how to reduce the corresponding trade-offs and how to make the remaining trade-offs acceptable.

Participants in the 1st Consultation are encouraged to reflect on and critically review the proposed points for discussion and to consider providing feedback to the team including important missing issues before the meeting.

Outcome

Based on the deliberations of the 1st Consultation a report outlining some 10-15 draft statements will be prepared by the team. A draft report will be produced after the meeting. Participants will be invited to review and provide feedback on this draft report.

AGENDA

0-5' Welcome

5-25' Self-introduction of participants

25-35' Orientation: Goals of the meeting and the process

35-75' Discussion session 1: *Agility* axis

Critical challenges on which this part of the meeting will focus include:

- Publication: How can the peer-review publication process be speeded up without sacrificing quality? Is there a viable alternative to peer-review in the current form? Can new technologies be of help?
- Flexibility: What mechanisms need to be implemented in research organizations to ensure that they are flexible and able to respond rapidly to new challenges? What incentives could be added at the researcher level and at the institutional level to enhance flexibility? How can resources be allocated optimally to current research projects while retaining resources in reserve so as to be able to respond to sudden and unexpected challenges?
- Data: What incentives would encourage public and private sector to share data? What instruments could be put in place to ensure good data quality?

75-115' Discussion session 2: *Reliability* axis

Critical challenges on which this part of the meeting will focus include:

- Misinformation and pseudoscience: How can fact-checking be enhanced and institutionalized?
- Cooperation: How can coordination and competition at national and global level be balanced? How can political barriers to global collaboration be mitigated?
- Dissemination: How can researchers gain easier access to and navigation of the research results and insights of other researchers?

115-130' Break

130-170' Discussion session 3: *Interface* axis

Critical challenges on which this part of the meeting will focus include:

- Foresight: Should more research be undertaken on analyzing future risks, risk mitigation and adaptation to risk?
- Multidisciplinary perspective: How can science advice be made more comprehensive, multidisciplinary and systemic?
- Communication: How can frequent miscommunication and misunderstanding between scientists and policy makers be overcome? What is the role and the mechanisms of "translators"?
- Trust: How can science-to-policy be rendered more transparent to the public? How can the public have a better understanding of how science works, what science can and cannot do? How should the institutions that ensure the integrity of scientific research be further strengthened?

170-195' Final remarks, summary by the Chair and closing

Results of the Online Survey

The participants in the 1st Consultation were requested to complete an online survey, which asked respondents to address the question: *Which elements should be the most important focus for policy makers to strengthen the capability of the science system and its capacity to provide effective input into policy in crises triggered by extreme events like COVID-19?* Sixteen pre-selected elements were provided. Figure 1 presents the survey results. Figure 2 presents the comparison of elements' assessments in two dimensions – the mean score and the fraction of high scores (9-10).

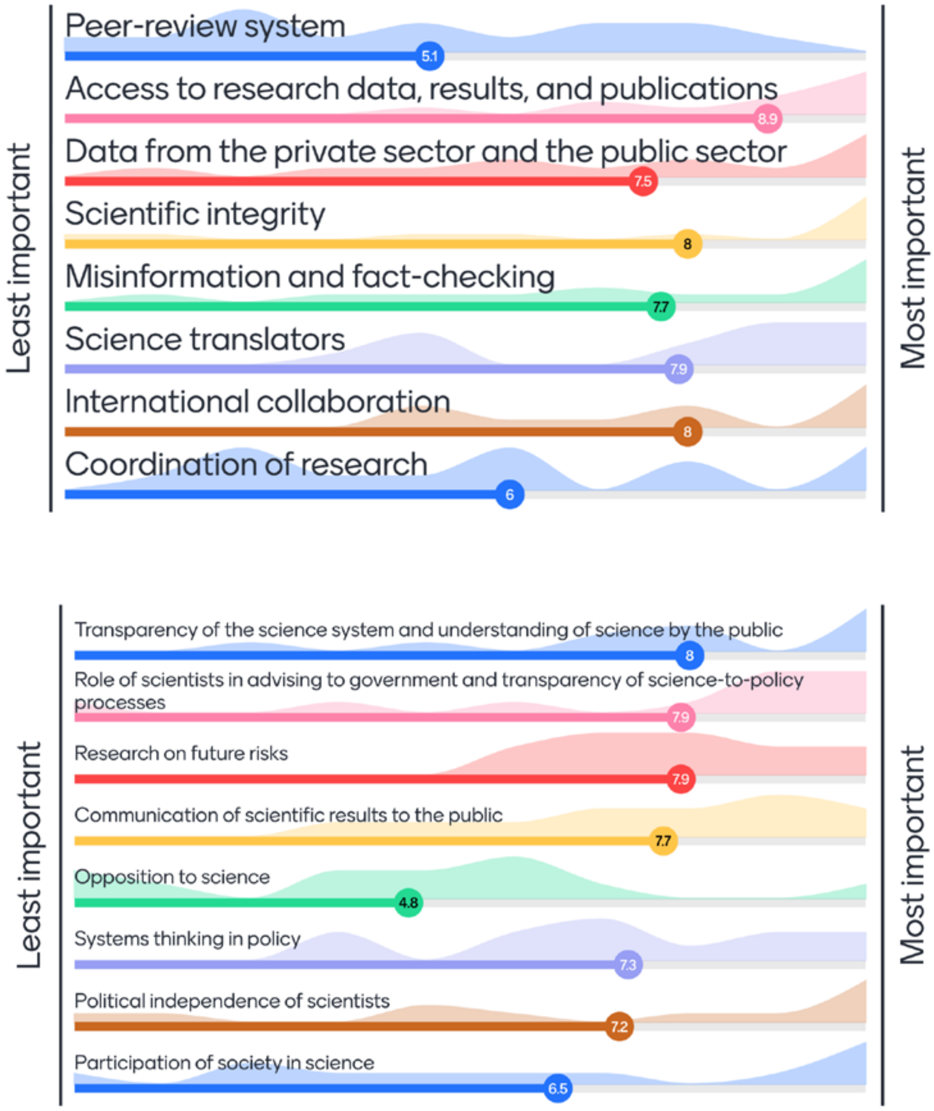

Figure 1: Survey results. Score distribution (shaded areas) and mean scores (numbers in circles) for each of the sixteen presented elements based on 14 (left panel) and 12 (right panel) responses by the participants. Score=1 means the lowest importance; score=10 means the highest importance.

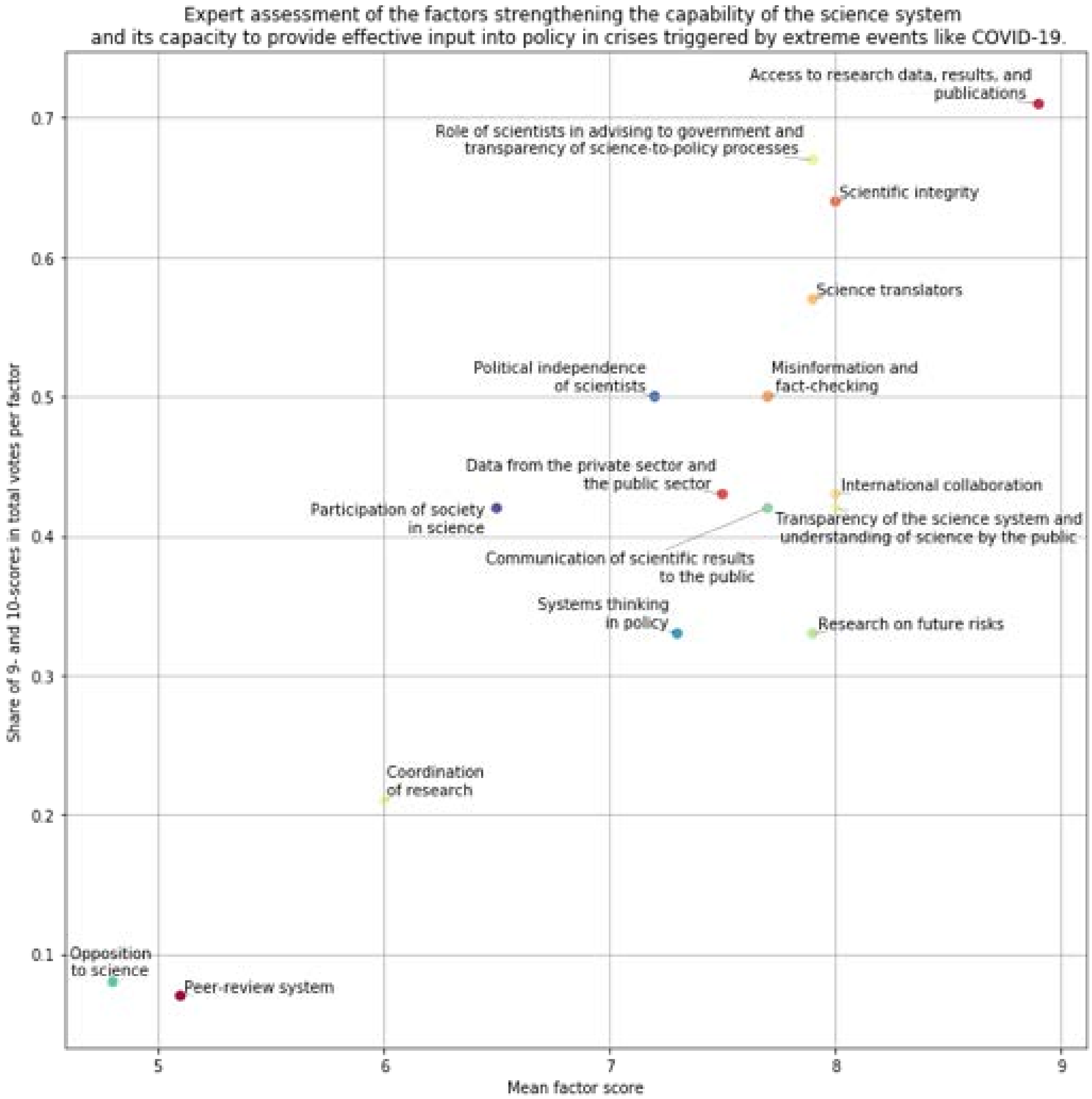

Figure 2: Comparison of elements' assessments. On the horizontal axis is the mean score and on the vertical axis is the fraction of high scores (9-10).