

Report on GRC Americas Region Seminar on Covid -19

Organizers: CONICET (Argentina), CONACYT (Paraguay), FAPESP (Brazil)

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Introduction

This is a report on the GRC Americas Region Seminar on Covid-19, that took place from December 09 through December 11, 2020. The event was hosted by CONICET, Argentina, and co-hosted by CONACYT, Paraguay, and FAPESP, Brazil. This report will present the main organizational structure of the event as well as the key ideas and concepts that were discussed during these 3 days.

The Seminar allowed funding agencies in the Americas region to exchange their experiences in handling the Covid-19 pandemic. It also allowed the Americas funding agencies to have a taste of the ways Sub-Saharan Africa, Middle East and Europe have been coping with the pandemic.

The virtual seminar did address some conceptual points that were practically consensual among the participants. These discussion topics include: the global interdependency of the societies, the need to strengthen the international collaboration to face common challenges, the role of equity, diversity and inclusion (EDI) for increasing the quality of the research enterprise, the need to create a support for the week links or transitions in the academic career, the recognition that the installed science capacity was instrumental to give a rapid response to Covid-19 from the research perspective, the need to prepare for future global events as the present pandemic, the need to raise awareness of the role of science in facing the global treats

The webinar was divided in one Opening Ceremony and 5 Thematic Sessions.

Day 1: December 09, 2020

Opening Ceremony

The Opening Ceremony was divided into two parts.

Initially the hosts and co-hosts, Ana Franchi, Conicet, and Marco Antonio Zago, Fapesp, greeted the participants. These speakers stressed the importance of Science and International collaboration to face the challenges posed by the Covid-19 pandemic. In the sequence, the Secretary of the GRC, Michael Bright, also greeted the participants and gave a presentation about the GRC, its principles and organizational structure.

Session 1: An introductory HORCS Roundtable.

Participating agencies: ANID (Chile), CONICET (Argentina), NSERC (Canada), CONACYT (Paraguay), NSF (USA) and FAPESP (Brasil).

This session aimed to provide a forum for the event hosts to present the initiatives taken by their agencies to face the Corona Virus pandemic. The session was Moderated by Dr. Aisen Etcheverry from ANID, Chile. In her introductory remarks she mentioned that Chile is in the process of creating and

implementing a new funding agency (ANID) to better support the scientific community. The idea is to seek for new ways to addressing challenges and establishing funding models as well as to strengthen the collaborations with other agencies worldwide.

The first HORC (Head of Research Council) to speak was Dr. Ana Franchi, President of Conicet. A short video was presented describing the main activities developed by the agency, which included a call for projects, that funded 64 proposals, leading to the development of a low cost Covid-19 diagnostic kit, the establishment of a Biobank on Covid-19 information. The awarded proposals researched the impacts of the pandemic on education, social habits, food security, fake news, among others. There was a mobilization of the whole national science system and the creation of a Special Corona Virus team to coordinate the work of the 17 Conicet groups involved in dealing with the pandemic effects on the country.

The second speaker in this session was Dr. Alejandro Adem, President of NSERC Canada. Prof. Adem addressed the quick mobilization of the whole Canadian society with some 300 initiatives and the NSERC response with the Alliance programs with significant allocation of funds. The Canadian engagement has not been limited to the area of medical sciences. He reported a significant stress on the hospital and on the research system due to the needs related to facing the pandemic. Canada invested many hundred millions of Canadian dollars spread over 3 funding agencies to deal with Covid-19 effects. There were also important investments in the research institutes. He also mentioned that distinct social groups suffered distinct impacts from the pandemic. There is a need to catalog the distinct impacts with the aim to foster a fair competition throughout the society and research ecosystem. NSERC has taken some special initiatives regarding the scientists and proposals funded by the agency, which included funding extension of active grants for one year, which has also been applied to foster tenure career researchers. On important aspect that was highlighted is that the COVID-19 Pandemic is important but that there are larger and long-term challenges, such as the Climate Change.

The third intervention at this session was from Conacyt, Paraguay. Dr. Teresa Casal spoke on behalf of Conacyt's President Eduardo Fellipo. It was reported how Conacyt responded to the pandemic by building Scientific Work teams on 10 research topics. The agency also launched special calls for research and innovation. In the first round some 31 projects have been funded with a budget of about 1 million US\$. Presently there were some other 134 projects under analysis. They also did launch a Prolnova program aiming to support technology-based companies. Conacyt is looking into ways to foster economic reactivation in the post pandemic time.

The next presentation was from Dr. Joanne Tornow, Assistant Director for the Biological Sciences of NSF, USA, who spoke on behalf of NSF Director, Dr. Sethuraman Panchanathan. The presentation stressed that international collaboration is central to face Covid-19 and other global challenges. The fast response of NSF to Covid-19 treat was exemplified through the Rapid Response Mechanism, NSF-RAPID. A program which was exceptionally fast and presented many shortcuts, compared to the regular funding schemes. On March 04 there was the first RAPID call, followed by a second on March 05 on computer resources. It was soon followed by a third call on technological translation and support of small business. The number of awards amounted to 1200. One important issue mentioned is that the fast response could be implemented because the funding mechanisms, programs and structures were already in place. It was reported that many new equipment could be produced in a very fast way due to many technological projects that were funded in the past. According to the speaker, the international scientific community should be preparing for the next pandemics, in which the community should be more pro-active, instead of reactive. The pro-active policy should be applied to discover the origins of diseases, improve the computer modelling of disease tracing and response. All these initiatives required coordinated international collaboration.

The last speaker in this session was Prof. Luiz Eugênio Mello, Scientific Director of Fapesp. Prof. Mello reported on the various activities performed by Fapesp to face the corona virus treat. It started with internal measures including repatriation of researchers working abroad, extension of deadlines for reports and calls, among others. The foundation created a website dedicated to sharing all kinds of information about Covid-19. Fapesp also issue two distinct call for research on Covid-19 issues, the first one related to supplementary funds to exiting grants and the second one on small business innovation. Fapesp organized an ongoing series of virtual webinar on Covid-19. By December 2020, seven webinars were broadcasted. Based on a previous experience with Scielo, a Scientific Electronic Online Library, started in 1998 and a depository of scientific papers, started in 1998, the foundation was able to create large public data bank on Covid-19 information. The data bank presents pseudonymized data from over 300 thousand patients. The scientific director also reported on specific conditions in the Brazilian landscape, like uncoordinated response at federal and states levels, the role science and researchers have played in the last months and the increased perception that most present-day challenges are global and required strengthened international collaboration.

Q&A Session.

After the presentations, there was a discussion in the form of questions and answers. This session was able to consolidate conceptually many of the previously mentioned ideas and actions presented.

- There were many common lines of response among the presenting agencies.
- They all implemented rapid responses in terms of funding lines, programs and calls.
- Distinct social groups were hit in different ways by the pandemic. The more vulnerable social groups were hit harder.
- EDI issues are of utmost importance in dealing with the effects of the pandemic on the researcheco-system.
- In the research and academic environment, there is a need to understand the distinct impacts on the various groups to help fostering a fair competition.
- The rapid response could only be implemented because research infra-structure and programs were in place.
- Many products and equipment could be rapidly deployed due to previously funded research and innovation projects that produced them.
- Much of the knowledge applied to face the pandemic was generated by curiosity driven research. The need for the agencies to maintain a broad funding portfolio was stressed.
- The importance of open data and open access and sharing data banks were emphasized.
- The Covid-19 pandemic is a serious treat, but there are currently other even larger global challenges like Climate Change.
- A “covidization” of the research eco-system should be avoided.
- The need to strengthen international collaboration also asks for a more active response from the funding agencies. These pro-active policies should be applied to discover the origins of diseases, predict the outbreak of future diseases, improve the computer modelling of tracing and response.
- Many agencies implemented measures to mitigate the difficulties researchers at all levels were experiencing during the pandemic, such as need for repatriation of researchers abroad, extension of funding grants.

Day 2: December 10, 2020

On day 2, two sessions were organized. The first one aimed to present and discuss the UN Research Roadmap for Covid-19 Recovery and the second one would explore the Experiences of the Covid-19 in the Americas from the EDI perspective.

Session 2: UN Research Roadmap for Covid-19 Recovery.

The session on UN Research Roadmap for Covid-19 Recovery was moderated by Dr. Alejandro Adem, NSERC, Canada. In his introductory words he stressed the fact that the pandemic has clearly exposed many of the existing inequalities in the societies. He argued that the role of the UN document was to enable an equitable social and economic recovery.

The first session speaker was Dr. Marisa Creatore, Lead writer for the UN Research Roadmap. Dr. Creatore presented this Roadmap as a complement to the UN Report on Covid-19. She recognizes that the pandemic has far-reaching impacts and has uncovered social and economic fragilities and non-equity issues. The economic recovery will require multi-faceted strategies. She also stated that the Roadmap framework is based on 5 pillars, aiming to lead to a new future with transformative social changes. The five pillars encompassed Health Services and Systems, Social Protection and Basic Services, Economic Response and Recovery, Macroeconomic Response and Multilateral Collaboration and finally Social Cohesion and Community Resilience. Dr. Creatore reported on the effort performed by 5 Steering Groups involving 250 experts, that produced the Roadmap within 10 weeks. The final report has 25 Research Priorities, a Framework for understanding the challenges and opportunities ahead as well as Scientific strategies to address the full research ecosystem. The roadmap points out that Equity, Resilience and Sustainability are necessary aspects of a better recovery. She also stated that All people, systems and generations are interdependent and face shared risks and responsibilities. The Science strategies for a better recovery in the UN Roadmap include, Data Infrastructure, Implementation science, Rapid learning systems, Knowledge mobilization and the Science of science.

The second speaker of the session was Dr. Victor Sánchez, National Secretary for Science, Technology and Innovation of Panamá. He stressed that in Panama the pandemic made all social and economic problems much clearer than previously assumed. Panama has been hit by a very high unemployment rate. The role of Scientific Research has become more evident and has assumed a larger importance in Panama. The UN Research Roadmap for Covid-19 Recovery was reported to have been very instrumental in revising Panama's strategic vision on its effort to build a national scientific system.

The fourth speaker in the session was Dr. Evaldo Vilela, President of CNPq, Brazil. He has been now for eight months in office and reported on the efforts CNPq has developed to create an EDI friendly and resilient research roadmap. CNPq has also chosen to act on some of the UN Roadmap strategies, especially on the topics of Data Infrastructure, Implementation of Science, Rapid Learning Systems and Knowledge mobilization. He described the efforts of the agency to cope with each of those topics.

The last speaker of the session was Dr. Federico Torres, Vice-minister of Science and Technology of Costa Rica. Dr. Torres presented the Costa Rica perspective for economic recovery based on the Bioeconomy perspective. He justified this choice by enumerating some positive aspects of the bioeconomy, which may lead to a long term sustainable economic growth. He mentioned some aspects of this perspective which included the increased resilience and sustainable use of biodiversity, the strengthening of sustainability of a post fossil resources society and the scientific application of knowledge in biological and life sciences. He reported on the five strategic axes, Bioeconomy for rural

development, Biodiversity for development, Biorefinery of residual biomass, Urban bioeconomy and green cities and finally advanced bioeconomy. Dr. Torres described the alignment of Panama's recovery strategy with the UN Sustainable Development Goals.

Q&A Session.

After the presentations, there was a discussion in the form of questions and answers. The main addressed issues were:

- The UN Roadmap is a very comprehensive and useful document and a source of many excellent ideas.
- The document has helped some agencies to calibrate their national programs in terms of research priorities.
- Some agencies in the Americas Region found the UN Roadmap instrumental to revising the vision and strategies for consolidating a national science system.
- Collaboration among the countries and agencies is essential for the recovery.
- A proposition to create a Life Sciences Hub for Latin Americas was presented.
- There is an opportunity for increasing the role of science in the national systems.
- Post Covid-19 recovery presents long- and short-term challenges. Resilience and the EDI implementation are long-term perspectives.
- Investment in science should be counter-cyclical.

Session 3: Experiences from the Covid-19 in the Americas from the Equity, Diversity and Inclusion (EDI) perspective.

This session aimed to raise the awareness among the various funding agencies as to the importance of the EDI perspective to create a high-quality research environment. It also meant to address the Impact of Covid-19 on research productivity from an Equity, Diversity, and Inclusion (EDI) perspective

The session was moderated by Ana Maria Almeida from Fapesp. In setting the stage Ana mentioned that "few among us would deny the impact of this pandemic on our understanding of how inequality affects science, how it affects research. Suddenly, the hidden ways in which inequality shapes the experiences of researchers and the knowledge they produce became quite apparent, not only for society at large but also for parts of the scientific community that were not aware of such a bias. The fact that socially-induced caretaking duties impact differentially the work of talented scientists, the fact that some drugs work better for men than for women, the fact that health, educational and economic policies that do not take inequality into consideration when conceived increase inequality when implemented, all of these have been more broadly discussed now due to the challenges brought by the pandemic."

The first speaker on this session was Prof. Londa Schiebinger from Stanford University. The title of her presentation was "A global evaluation of funding agencies policies on sex/gender/intersectionality for research." Prof. Schiebinger presented Stanford's Global Initiative on Gendered Innovations. The questions addressed included if the creative power of sex, gender, and intersectional analysis can be harnessed for innovation and discovery. Some important aspects of integrating sex, gender, and intersectional analysis into research are a) enhancement of excellence and reproducibility in science and technology, b) stimulation of innovation and creativity, c) fostering of social equality by ensuring that research results benefit the whole society. Presently there is the need to fix "Numbers", "Institutions" and "Knowledge" about the EDI issues, also regarding research initiatives. The talk presented a large number of examples showing that the research that does not include sex, gender

and intersectionality may be wrong, cost lives and money. Many programs and engineering systems fail but fail more often for women and people of color. Some examples in the Health Technology were also presented, soap dispensers, heart-rate monitors, pulse oximeters that won't work well for darker skins. Existing facial recognition systems are also strongly biased towards men and lighter skins. Biological sex differences were also illustrated on the description of two routes to pain.

The second speaker in the session was Dr. Aisen Etcheverry, National Director of ANID, Chile. She did report on the EDI challenges in Chile. There is clearly a gender gap, characterized by the fact that at the beginning of an academic career women are about 50% of the researchers. This percentage fall for awarded PhD grants and comes to less the 30% when considering leadership in research centers. The numbers have been stable for the last decade. She reports of a new institutionality in Chile, in which women are in charge of large number of authorities. ANID has launched a Gender Equality Roadmap in which some actions are listed to fill the gender gap. She stresses that a conscious discussions and interventions are required to create a more gender balanced research environment. ANID is not only concerned with gender inequality, but also on EDI issues. Dr. Etcheverry mentioned that in Chile, diversity also includes geographical and territorial issues, much inline the previously mentioned intersectional analysis. She stressed diversity as a key factor for excellence in science.

The third speaker was Dorothy Ngila form the NRF, South Africa. She made a presentation on the "Implementation of the GRC Principles on Equality and Status of Women in Research". This is an integral part of the GRC Gender Working Group (GWG) activities, aiming to understand trends, practices and experiences of the GRC participating organizations related to gender equality issues. After presenting a timeline of GRC GWG (Gender Working Group) for the last 5 years, she described a survey conducted by the Gender Working Group of the GRC, on Gender Disaggregated Data which had three distinct phases. She presented the key findings of the survey. A full report will be launched in May 2021. In this survey participated 65 GRC member organizations within 56 countries, covering all the 5 GRC regions. Some key findings include information that "GRC participating organizations recognize the importance of appropriate actions regarding gender in research", also that "no specified standards on collection and reporting of gender disaggregated date in grant-making function" is available. It was also perceived that the scope of data collected varied by region and type of data. The majority of collected gender disaggregated data ha a focus on performance indicators considering funding applications and PIs of funded projects. Only a small percentage of organizations collected data beyond gender, with ethnicity and disability being the key considered aspects. Of the participating funding agencies, 54% have internal policies and guidelines on sexual harassment and bullying. The GWG also prepared a set of recommendations for the GRC participating agencies regarding EDI (Equity, Diversity and Inclusion) issues.

The fourth speaker in this session was Dr. Joanne Tornow, for NSF, USA. She described the NSF response to the pandemic regarding the EDI perspective. She mentioned many strongly impacted groups, like the Historical Black Colleges, the Rural Institutions, Underrepresented groups, women, early career faculty as well as trainees, fellows and postdocs. She described an NSF work to gather information impact of Covid-19 pandemic regarding EDI. Information were obtained from many sources such as Scientific Societies, National Associations, NSF-funded research and from individual researchers. She described that NSF set focus on career vulnerable transition points: from undergrad to grad students, from grad student to postdoc, from postdoc to early career faculty and from early to mid-career faculty. She also addressed new programs NSF new programs and supporting activities.

Q&A Session.

After the presentations, there was a discussion in the form of questions and answers. The main addressed issues were:

- The creative power of sex, gender, and intersectional analysis can be harnessed for innovation and discovery and to produce excellence in science.
- Diversity is a key aspect for excellence in research.
- There is a need for conscious intervention to fill the EDI gap.
- Many agencies have active programs to promote Equity, Diversity and Inclusion.
- There is a need to identify the more strongly impacted and vulnerable groups and develop a fair and consistent positive policy.
- The GRC report from the Gender Working Group sheds light on the current status the gender issue on many funding agencies.
- The funding organizations should pay special attention to career vulnerable transitions points: from undergrad to grad students, from grad student to postdoc, from postdoc to early career faculty and from early to mid-career faculty.
- Effects of the pandemic should reflect on loss of productivity for the next 2 to 3 years.

Day 3: December 11, 2020

Session 4: Cross-Regional Experiences.

This session aimed at sharing the Americas experiences regarding research under Covid-19 pandemic with other GRC regions, notably, Sub-Saharan Africa, Middle East and North Africa and Europe. The moderator for the session was Michael Bright, from UKRI and executive secretary of the GRC. In his stage setting speech he mentioned the challenges UK are facing with the two pandemic waves, that has caused large number of deaths and has had a strong impact on the economy. He also addressed the role of science that has been on public display through many media. He described the launch of large research projects on social sciences. He also mentioned the anti-vaccine movement and the role information and social media has to face this treat. He stressed the need for international collaboration among countries and agencies, setting thus the stage for the talk to be presented next.

The second speaker of the session was Dr. Abdullah Alradadi, General Director for RDI National Planning and Coordination from KACST, in Saudi-Arabia. He presented the Saudi-Arabia case as one case in the MENA region. Dr. Alradadi's presentation focused on the issue of how the Saudi Arabian national innovation eco-system and the research community worked under the Covid-19 pandemic. He also reported on the status of scientific research on clinical trials in the country. He described the national innovation system and its components at the various TLR levels. The idea was to look at the ID value chain and to understand its weakness and strengths. He looked at the number of publications on Covid-19 as a proxy to efficiency of the system and mentioned the number of clinical trials in the various countries, including Saudi Arabia. At his conclusion he mentioned that Universities with more sophisticated infrastructure presented more publications in the treatment phase. Institutes with less infrastructure concentrated their efforts in the detection and monitoring phases of the disease. More mature institutes acted faster in terms of publications. The level of collaboration had a great influence on the publication rate. In general, the level of collaboration was higher on Covid-19 papers than on other topics. The existence of a university hospital was vital in enhancing the level of publication and clinical trials. This information will be crucial to the further development of the framework for the Saudi research and enterprise ecosystem.

The third contribution was presented by Dr. Phethiewe Matutu, from the Executive Group for Strategy, Planning and Partnerships of the NRF, South Africa. Dr. Matutu's presentation was divided

into three parts. In the first part she presented the NRF-SA response to the Covid-19 pandemic. The second part described the Covid-19 Africa Rapid Grant Fund for SSA. In the third part she did address the Sub-Saharan Africa (SSA) funding agencies responses to Covid-19. Regarding the first part she did present the NRF Vision 2030 entitled “Research for a Better Society”. According to her reporting, the response of the SA government to the pandemic has been comprehensive, positive and informed by science. The pandemic has had a severe economic and social impact of the most vulnerable society groups and these groups must receive priority support from the government. The scientific research funding has been heavily skewed towards clinical trials. She also reported the urgent need to fund social science research in SA. Regarding the Covid-19 Africa Rapid Grant Fund for SSA the concept was to have an Africa-wide fundamental response to the pandemic. Three main funding streams were identified: journalism, science advice and research. The Fund was launched in May 2020 and reached 17 countries. A total of 526 proposals were submitted and 80 projects were funded. It is worth mentioning that 46% of the funded projects had women as PIs. Some lessons learned include the fact that gender and diversity across the research management pipeline had an impact on final projects awarded. Research managing capacity still a challenge in many research institutions and funders.

The fourth contribution came from Dr. Bonnie Wolff-Boenisch, Head of Research Affairs in Science Europe. Dr. Wolff-Boenisch presented the European perspective to the topic. She described the concepts that guided the construction of the program for the GRC Regional Seminar on Covid-19 in the European region. She mentioned the results of a questionnaire leading to different measures. These include dealing with fast-track calls, the repurposing of research proposals, remote review panels, grants extensions, legal frameworks, among others. The whole seminar will take place on January 14, coordinated by Science Europe and the German DFG.

Q&A Session.

As in the previous sessions, after the presentations, there was a discussion in the form of questions and answers. The main addressed issues were:

- What issues would the agencies handle differently in a future unexpected event?
- How to maintain the research and management structure beyond critical events?
- How to enforce preparedness of the councils and society?

Session 5: Experiences from the Covid-19 in the Americas regarding the Interdependency of the Global Scientific Enterprise.

The idea of this fifth session was to discuss how the Americas funding agencies understand the Interdependency of the Global Research Enterprise and to try to look into the future. The session was moderated by Dr. Lélío Fellows, Head of international Relations at CNPq, Brazil.

The first presentation was given by Dr. Ana Chan, National Secretary of Science and Technology, Guatemala. She stressed the idea of global interdependency of the research from the perspective of Guatemala, mentioning especially the SDG 19 implied in an increase of scientific research. Also, the 17 SDGs do stress the linking between players to solve global problems. Guatemala is working to build a research system based on these notions. She discussed that research collaboration should aim at a better quality of life with sustainability. It was her understanding that during the Covid-19 crisis, communication among scientists around the globe has increased, but that regional and global joint research collaborations must still grow. The Covid-19 made clear how important is the role science plays in dealing with these global treats. It should be clear that government, industry and society as a

whole should allocate more resources to science, considering that scientific knowledge might be the basis to overcome global treats.

The following presentation was made by Dr. Delia Aideé Orozco Hernández, Deputy Managing Director for Technological Development, Cooperation and Innovation from Conacyt, Mexico. Dr. Orozco presented Mexico's penta-helix model for innovation. Besides the classical triple helix encompassing academy, industry and government, the Mexican model included societal actors and environmental aspects. These last two components allow for the incorporation of communitarian, traditional and ancestral knowledge into the loop. Regarding the Conacyt response to Covid-19, she did mention fast calls related to Covid-19, which funded 126 projects in 24 provinces with 12 thematic priorities. These priority areas included clinical trials, education, communication, management, medical equipment, population and territory, social and cultural practices, environmental stability of the virus, psychological wellbeing, alternative therapeutics and diagnostic tools. She did report on a successful development of lung ventilators at much lower costs than the models existing in the market. Dr. Orozco also reported on the efforts of the agency to articulate the STI capacities in the health sector, including drug development, scale-up of production platforms and processes optimization. Besides having identified national priorities, these priorities were related to the 2030 UN agenda. In Mexico, the importance of scientific knowledge has been increasingly recognized and also its evolution to applications and technological developments and innovation.

The third speaker of the session was Ing. Flavio Cafaja, President of ANII, Uruguay. He did present the Uruguayan experience in dealing with Covid. He reported on the development of Diagnostic tests for Covid and development of 2 types of ventilators for Covid-19 patients. They did work on creative solutions to improve the confinement and quarantine conditions. They did support the development of medical equipment and gadgets and also of Serological Tests to fight the pandemic. Among the lessons learned Ing. Cafaja mentioned that they performance was in great measure the result of accumulated experiences of researchers in public sectors, private companies and new ventures that have been funded by ANII since 2008. They developed a "Challenge" managing instrument, which proved to be very effective and efficient. But he also reported some drawbacks, especially in the development of some ventilators.

Q&A Session.

As in the previous sessions, after the presentations, there was a discussion in the form of questions and answers. The main addressed issues were:

- Conacyt and ANII expressed the possibility of a joint effort to improve lung ventilators.
- The previously accumulated knowledge basis has been fundamental to expedite the agencies' responses.
- Many countries are aiming to build and support a medical specialized industry.
- There is an effort to align research priorities with the UN 2030 agenda.

Information about Participating Entities

- Number of LA Participating Countries (11)
- Number of LA Participating Funding Agencies (12)
- Non-America Participants: GRC-UKRI, NRF- South Africa, KACST-Saudi Arabia, Science Europe
- Total number of Participants: 45