



## Toward an International Decade of Science for Sustainability

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Carlos Alvarez Pereira

Good morning everybody. I am Carlos Alvarez Pereira, vice president of the Club of Rome. Welcome to the session organized by the International Year of Basic Sciences for Sustainable Development to promote the idea of an International Decade of Sciences for Sustainability, sciences at large, sciences in plural, including all disciplines. We hope to have a very engaging conversation rather than a series of monologues in this session. And we will invite you also in the second part of the session, to intervene, to discuss among yourselves and then with all of us, the topics of this session. Or let's say, the topic of what is the role of sciences, in plural, for the future of the world, for sustainability.

The Club of Rome is a quite strange animal. It's a network of individuals all across the world sharing a concern for the future of humanity, and doing that since long. We are now a 55 years old organization which became famous when we published in 1972 the report *The Limits to Growth*. And if I have to summarize, what we do is: we are good, we ask better questions, not more than that. So we are sort of agent provocateur asking the questions that people don't want to ask or prefer not to ask. And at the time the question was: is development, human development as we knew it and as we still know it, possible for everybody in equitable ways on Earth or could it lead to collapse? Human development understood as an ever increasing level of consumption of material and energy consumption to ensure well-being. We made possible that researchers got engaged into that inquiring into that question, and I think we obtained two results. One was that yes, prosperity could lead to collapse if we didn't change our relationship with the biosphere. So in many of the scenarios, the *Limits to Growth* was showing that collapse of population under the combined effects of exhaustion of non-renewable resources and pollution could happen. The second thing and most important is that we actually have the choice, the message of the Club of Rome was to open the space of possibilities to do otherwise because in some scenarios we could anticipate or foresee a balance between equitable human well-being for everybody and what we now call the planetary boundaries.

But actually, we didn't learn in these 50 years. Our analysis is that now we are living in the collapse that we were talking about as a possibility. We are there. So we didn't learn, we didn't change our pathways in order to balance well-being, human well-being and the biosphere. And now we are asking new questions, in particular, in this context and in the context of the collaboration of the International Year of Basic Sciences for Sustainable Development. And the question is the basic question is: what do we need to learn what we already know? Learn in the sense of changing, changing our ways of living so that we accommodate ourselves to be again part of the biosphere and we stop destroying it and we stop destroying each other, which is something it seems we are good at. Last year, or at the end of 2021, we looked at a very important aspect of this, which is the reconnection of all aspects of the challenges we are looking at. Meaning that there is not an environment on one side that is a matter of analysis of natural sciences and on the other side, society, humans and society. The two are inextricably linked, even if our civilization, modern civilization, is based on the idea of the separation: separation between humans and nature, separation between peoples, between nations, separation between disciplines, disciplines of knowledge. And we bet on this slogan that actually, what we need is equity for a healthy planet, not and, of course at the same time, but to stress the point that global equity is a requisite if we want to live on a healthy planet.

One year ago, we started also a program in the Club of Rome, that I lead, called *The Fifth Element*. The name is a tribute to ancient traditions. As you know, in many of them there are four elements air, water, earth and fire, which are ingredients of



life but are not life by themselves. So they need something else, which is this mysterious fifth element, life itself or energy or living energy. And the message that we wanted to give is that we really need at this moment to reconnect all threads of knowledge, ancient as well as modern. Yesterday we heard a lot about indigenous knowledge and how it has been neglected for centuries now, neglected and destroyed for centuries. But we actually need also that knowledge, that traditional knowledge and wisdom and the best of modern sciences to carry on our task, our mission, which is to contribute to a future of well being, equitable human well being in a healthy or within a healthy biosphere.

So this is also the meaning of the participation of the Club of Rome in the International Year of Basic Sciences for Sustainable Development, which started in July 2022 in Paris. We have with us Michel Spiro, the chair of the International Year, who will give his thoughts at the end of the session. It has been a very exciting time, with plenty of events and interventions all around the world, just to realize that we actually need more than that, more than a year, definitely, and to make a coalition of all sciences, of all disciplines. Science's, curiosity driven sciences, as Michel says, which can be of any domain of knowledge, but also applied sciences, but also humanistic disciplines, arts, social sciences and so on and so on. And including indigenous sciences.

To discuss this, we are here. Today we decided to adopt a certain format, which is: we invite a number of people, some of them are here and others are online, to share their views in response to a few questions that you will see that I will present, from their own experience. What do these questions evoke for them, and in particular this idea of an International Decade for all Science, of all sciences for sustainability? We did our best, and I think we did reasonably well in having people from different geographies, different stages of their careers, even different disciplines as well, to bring life to this session in the form of a real conversation, as I said, not a series of monologues.

And this is enough from my side. I will moderate the whole session, but I will put now the questions that we would like to address, and we don't need to address all of them today. I mean, this is just as I said, we try to ask better questions. If a decade we are in the process of promoting the approval by the General Assembly of the United Nations of an International Decade of Sciences for Sustainability, we have good hope that that will be done in the coming weeks, months. If that happens, what would be your expectations, but particularly, how could we develop strategy to transform the interactions between science, policy and society, which was a topic already discussed in some of the sessions yesterday. What kind of data do we need to improve the links between science and sustainability? And last but not least, how to connect, mobilize and organize people: you, but many other scientists around the world and non scientists, or untypical scientists, people who are not recognized today as scientists. How could we mobilize and organize them around the world for sciences, for this common venture of sciences for sustainability?

So I give the floor. I have imposed, sorry for that, I play here the bad guy, short interventions for our panelists. Let's start with Salvatore Aricò from Italy, but living in France, I think you know, probably all of you, you know him, he's the CEO, since January, of the International Science Council, and after a long career in quite a few endeavors in the multilateral system, in the UN system, including UNESCO. Salvatore, please.

### **Salvatore Aricò**

Thank you, chair. Thank you, Carlos. And good morning, and good afternoon, and good evening to everyone, since we are also connected remotely to a number of participants. I'd like to start with a short intervention. And in particular, I'd like to



take a step back and reflect about the science endeavor and how science can be different things in different contexts. And if when talking about a possible International Decade on Science for Sustainability, I think we need to realize that we are talking about science in an intergovernmental context, which is a different animal, as Carlos said, than science in a purely academic context, for example. So my short intervention is about sharing a message that is that possibly we are talking about science for action. It's about not necessarily applied science. As Carlos rightly put it, science goes along a spectrum that encompasses from basic all the way to applied scientists. That's not the point. The point is to be able to translate the findings of scientific knowledge, scientific research, into a language which is accessible by policymakers and that can lead to action. And this is in my experience and in my understanding, what a process such as the proposed decade would be there for. Perhaps related to that, and then I will stop here, is the fact, the multi stakeholder nature of the exercise. Yes, the context would be the United Nations, but it's important to also bring on board other actors and stakeholders. I particularly appreciate the reference to other knowledge systems and I would like to suggest that when dealing with the interface between science and indigenous local knowledge, for example, it's not about patronizing, a patronizing attitude, it's not about validation of local knowledge by science, it's about dialogues with other forms of knowledge. And finally, let's remember that there is a lot of knowledge in other sectors of society other than academia. For example, the private sector. How do you capture that? So to me this will be an initiative really about science, of course, but perhaps more about really knowledge and what science can do for action in support of sustainability. Thank you.

### **Carlos Alvarez Pereira**

Thank you, Salvatore. Now we have Cristina Caparrós, from Catalonia, from Spain, but she actually does research in conservation medicine. The expression looks already fascinating to me, and she works in Chile, but will move for time also of field work in Brazil. So Cristina, what are your thoughts?

### **Cristina Caparrós**

Good morning to everyone. Thank you to be here. Well, I will continue a little bit with idea of Salvatore. But here I want to point out very briefly why do we expect for this decade? Briefly, I will expect more financing towards science and technology, that finally it's not only the financing, but this financing should also be transferred to policy. But this is something that we've been talking yesterday, we will be talking all the week. And I could put some examples from the country I am living right now, but I don't want to get stuck in that. And continuing with what Salvatore did here is if we want to do transformative strategies, we should connect science with policy and society. So here we enter in the concepts that I am sure that you will know between multidisciplinary, interdisciplinary and transdisciplinarity. So, the important fact is not only to work. For example, I studied veterinary medicine and I am trying to develop research in social sciences. This is a challenge for me because it's not my fieldwork, but is that on what I want to talk, because multidisciplinary speaks about working together between different professional scientists. But transdisciplinarity includes these stakeholders that could be policymakers, but also society. But when I talk about society, I talk about tailored plans on society because society is very diverse and also it's very interconnected. So we must understand on what part of the society we want to work to be able to apply these strategies in a transformative way. Well, maybe later I will put some examples. But this for me is the challenge: how to transfer this generated knowledge from this multi transdisciplinarity approach of sciences and really be able to apply it. So these days I've been here and also I work on that and I still think about how can we do it because it's very difficult to be able to apply it in a general way. Every place will be specific and we must be specific. We must be tailored in every society. So well, thank you.



## Carlos Alvarez Pereira

Thank you, Cristina. Now, if the gods of technology are with us, we could welcome online speaker Encieh Erfani from Iran, living in Italy. She's a theoretical physicist working at the well known International Center of Theoretical Physics in Trieste. And she's also a member of the Executive Committee of the Global Young Academy. Encieh, are you with us? Hopefully, yes. I think she's connected on Zoom, but could we see her on the screen?

## Encieh Erfani

Hello everyone. Thank you so much. Good morning for you there and also good afternoon for the ones that they are joining us online. It's a pleasure to be with you. I'm really glad to pay your attention to the role of the astronomy in the SDGs and learning how we can do with the astronomy, to the development of the science and of course bringing the sustainability that you are looking for. I'm focusing on astronomy because I'm a cosmologist and I wanted to share with you that if we can do it with astronomy to helping the Sustainable Development Goals, of course in other sciences that they are more related to the human life, we can achieve more in a decade that will be focused on the science for sustainability.

So, as you know, astronomy is one of the parts of the basic sciences in the category of the physics that the basic sciences are mathematics, physics, chemistry and biology. And why we call them basic sciences because they provide a fundamental understanding of the natural phenomena and processes in our natural environment that we see. So they are really vital for us. And of course, everybody here participating in this congress, of course you are familiar with the 17 Sustainable Development Goals of the UN that we expected to reach them in 2030. And I'm going to focus to some of them that we can fulfill them by focusing on astronomy and helping for the development.

We already know that for the year in the International Year of the Basic Sciences for Sustainable Development, the idea was to strengthening the presence and visibility of the women, that I will focus also on astronomy, how that can help basic sciences as the source of the international dialogue and peace and sciences as a global public good which could be also extended for the decade of the sciences for sustainability, innovation and economic development, education and human development and meeting global challenges. And of course there are many communities that trying to help for reaching these goals in that last year and we hope to extend it for the following decade.

So for the following decade we are supposed to answer at least four of these questions which I will tell you that how we can fulfill these questions by focusing on astronomy. Let me tell you that by the astronomy we can make the inspiration about science because astronomy is one of the really exciting subjects and of course since we have the skies on top of our head, we always look to the stars and also we really get excited what's going on.

So of course astronomy can help for the education which is the SDG 4 and of course it can help for the progress of the STEM education which is really vital these days. And we know that in STEM education we have a really big gender gap and focusing on the astronomy can help to fulfill some at least decreasing this gap and empowering the women in the case of the astronomy. And there are several organizations that they are working on that, especially the International Astronomical Union, they have the office focusing on the engagement of the women in astronomy.

The other SDG that maybe think that maybe it's mostly related to astronomy is SDG 7, that works about clean energy and we know that we have a Sun as our energy that we can use it for sustainability and of course in some region it's really one of the



main energy that can be used. So of course studying the astronomy and also the evolution of our Sun helps a lot to saving the energy. And of course these days we are hearing about using the mechanism of how we can create energy in Sun to use it as a nuclear energy that in future which would be really a big step in the case of the energy for human beings.

Regarding the SDG 9, which is related to having the industrial innovations, maybe as a people that you are working other subjects you are not familiar with that many progress that we have seen in industry and innovation comes from the astronomy. So we really need some instructors in the case of the astronomy observations and we transfer this knowledge to the other part of the technology and innovation. So that can also be helpful in this one and sometimes whatever we learn from the astronomy could be used in the other aspects of the innovation and industry.

Another point which maybe it's not really familiar for most of us is SDG 11, which is connected to the sustainable cities and communication, which is really close to my heart because as an astronomer we are always looking for the darkest skies because we are really losing darkest skies, which is really important for astronomy observations. But the points that people don't realize that keeping the darkest skies means that we should reduce the light pollution, and of course reducing the light pollution helps to save the energy, which is really important and it's really connected to SDG 7. And of course we know that the light pollution affects the biodiversity and we are losing biodiversity because of the light pollution, immigration of the birds and also even the life of the insects and the other animals is affected by that. And also even the lifestyle of human beings is related to the light pollution that we are really using the somehow dangerous frequency of the light for lightning our cities. So helping to the preservation of the dark skies will be very helpful.

And I also want to emphasize regarding the quiet skies because in the astronomy we're also looking for the astronomy and the wavelengths that relate to the radio astronomy. And of course, with the technology of the mobile and the other instruments, we are losing the quiet sky. So it's really important also to keeping quiet skies for the astronomy and also for the health of the humanity.

And regarding the SDG 13, which is one of the really hot topics regarding the climate action, we know that by the observations of the stellar evolutions and also with the atmosphere of the other planets, we can understand that. What's going to happen for our planet in future. For example, by detecting what's happening in Mars or in the other planets in all the solar systems. So having these observations can help for the greenhouse gases and also the composition of the atmosphere in other planets.

So it's really important to take that also into account. And maybe I just should really want to emphasize SDG 16, which is for the peace, justice and strong institutions, because we know that in the astronomy you can do also the astronomy diplomacy. You heard about many projects that have done regarding to connecting the science and also policymakers. One great example, the Square Kilometer Array now in Africa. And of course many projects that can be done regarding the astronomy. And of course one of the questions that we wanted to answer was related to the data. And we know that astronomy and cosmology is a topic with huge data. So then if we can collect the data here and we can use it in a good way, that will be also helpful for the innovation and industry in the other aspects too. So I think giving examples about what astronomy could do, we know many projects has done regarding astronomy tourists in many, many countries and that helps also a lot for the economy of the region. For example, in the Chile, we have a great statement for the observations and helps a lot for the economy of the Chile, at least the local region. As I mentioned, astronomy for diplomacy happened in several regions, for example, in Cyprus, and astronomy for reduced inequality, for empowering women. And one of the great projects that have done in some regions



targeting the refugee committees, because as I said, astronomy is a really inspiring subject. So of course it can be helped for the mental health if you have the sky observations in the refugee camp. So you see that even an astronomy which looks that it's not related to our ordinary life can have too much effects on the case of the SDG. So as a cosmologist, I can say that we have done not that much regarding the protection.

### **Carlos Alvarez Pereira**

Thank you so much for this quite impressive overview of the contributions of astronomy to the SDGs. And you highlighted in passing something about science diplomacy. Maybe we will have the occasion to go back to that later. Now we have another speaker online, Nicole Redvers. She's based in Canada. She's from one of the First Nations Deninu K'ue, and she's a researcher in indigenous planetary health. So Nicole, we welcome to the session and we are all ears.

### **Nicole Redvers**

Wonderful. Well, I want to take the time here today to reflect on the International Decade of Sciences for Sustainability through the lens of indigenous science. And before looking forward, it's important to consider how has the way that we are currently learning, but teaching, researching and even applying knowledge, how has that way affected the progress of science itself? And have we narrowed our use of previous knowledge? Or more appropriately, have we marginalized certain knowledge systems based on an assumed base of scientific superiority? And of course, in the intro it was noted, but I also believe we absolutely have, in the spirit of scientific hegemony that has really pervaded most branches of Western research, practice and inquiry, this idea of knowledge democracy has not really prevailed. So before we can address issues of equity, of sustainability in regard to any given topic, we must also understand how even ways of knowing, ways of being in the world, and even ways of carrying out inquiry are steeped in consideration of social justice, but also the mere democracy of our knowledges. But I also believe that in the spirit of Westernized scientific hegemony that has pervaded our knowledge systems, we have often forgotten how to be creative, often pushed into boxes of narrow bases of reality which have stifled our ability to innovate in a truly profound way.

But most importantly, how can we get ourselves out of the mess that we have created by continuing to destroy the planet, our only home, through different ways of thinking? How do we go from anthropocentric or human centric approaches to eco-centric? Despair to hope, domination to participation, fear to wonder in awe, disconnection to reconnection, knowledge translation to relational care? All of these elements of consideration because the idea of how we formulate our relationships are rooted in a framework of knowing that prizes interconnectedness as a basic and fundamental natural law within our Indigenous sciences. So how do you turn this interconnected relationship to all entities into a methodology for research practice? Well, of course, there's already a methodology. There's been a scientific method in existence for thousands of years in how to live and know the world around us in a sustainable way. Traditional Indigenous knowledge systems are based on sacred natural laws which then define our traditional protocols, which then give a framework for both old world but also modern world ways of knowing. Now, as the basis, it's the fundamental understanding that we are only one small part of a greater system. And this lens, this hierarchy, how we view the hierarchy of ourselves over all other beings on the planet affects how we consider our research questions and how we look towards solutions.

We are all interconnected with no hierarchy between us when it comes to how the natural systems operate in the world. And this understanding needs to have a firmer grounding in the field of Western science if we want to make it through our



compounding global crises. So I want to just briefly orientate us now to the concept of epistemological pluralism. It's a big word, epistemological pluralism, but it recognizes that in any given research or practice context, there may be several valuable ways of knowing and that accommodating this plurality can lead to more successful, integrated study and practice. Now, there are varied narratives and realities in our world and each is rooted within the land and experience of the peoples that live there. But Western science's overarching interest has often been to infer phenomena to understand the world. However, we need to be mindful when there might be an implicit interest to find ways to influence, control, and perhaps even eventually modify these phenomena for human benefit alone. And with underappreciated connections to indigenous science, the pendulum in the 21st century is, thankfully now slowly swinging towards the need for a systems orientated, ecologically based networking approach. And this approach may seem more aligned to the complexity of planetary health and other complex systems with which we interrelate.

The Indigenous scientific method, which could be described as contextual, holistic, symbolic, nonlinear, relational, not limited by time and uses the collective observation of its people to explain natural phenomena through real but also through metaphoric narratives. And I often state that it's become very apparent: we cannot solve complex problems from the same worldview that created them in the first place, as it will continue to perpetuate a disconnect between us and the planet as relatives. So when it comes to the basic sciences, the difficulty sometimes within the Western context is to be able to create agendas that are able to connect different scales of influence. Indigenous sciences do this flawlessly, as our ceremonies, our knowledges naturally embody understandings of the micro to the macro, to the metal level of the world as being fundamentally interconnected.

And lastly, with this, indigenous scientists teach us to stop the narrative of aligning so called separate sectors such as human, animal and planetary health, but instead seek to better focus, describe and operationalize instead the interconnectedness between systems with a focus on relationships instead of variables alone, and by focusing on relationships between the variables as opposed to the variables themselves, while being inclusive of traditional indigenous knowledge systems that embody this way of science innately, we will have a better chance of dealing with our multiple crises, including the pandemics, biodiversity loss, climate change.

We need more indigenous presence, more indigenous voices, amplifying and leading through thought experiments with real time implementation of solutions on the ground. We need Western systems to finally stand up and step back and listen to the longest stewards of the land within the International Decade of Sciences for Sustainability.

### **Carlos Alvarez Pereira**

Thank you so much, Nicole, for illuminating our blind spots from other perspectives and perspectives which are actually blending ancient wisdom and modern science. Now we come back to the stage to Diego Fernando Mina from Ecuador, not far from here, from Panama. He is a researcher in agronomy at IRD. And I think you want to speak in Spanish, right? Good. Let's hear a bit of Spanish, please.

### **Diego Fernando Mina**

Thank you, Carlos. Yes, well, what do we expect? I guess we all hope for better food safety, for progress in clean energy, in all these concepts, in better conservation of the environment, of renewable resources. But I was listening to everyone's



interventions and I was thinking, well, for me there are two basic things. The first one is scientific progress and I think that all countries have it to a greater or lesser extent, we do it. But what still remains in my mind is this other term of collaboration. What Cristina mentioned, what Salvatore mentioned, in terms of multidisciplinary, transdisciplinary, interdisciplinary. I think we still have challenges in how to build bridges between institutions. I come from the academia, so many times there is still a big disconnection between what is happening outside, as the last speaker said about the cosmovision of the indigenous people, of any ethnic group, there is still that disconnection of the local problems that exist there, while we as academics or as scientists, maybe we are thinking about other types of problems and how to solve them. Many times we have not yet reached those levels of transdisciplinary collaboration that would help us precisely so that what we expect after this decade can actually be more than a theoretical expectation, but can be something applicable, something that we can actually see transformed into reality. So, I think that collaboration is key to build these bridges and to improve this part of sustainability.

### **Carlos Alvarez Pereira**

Thank you Diego. Let's go back to where we once belonged, to the mother continent and to the intervention by Marielle Agbahoungbata from Benin. She's a researcher in chemistry working with X rays technology.

### **Marielle Agbahoungbata**

Thank you. Good morning and good afternoon, everyone. Thank you very much for this opportunity. I would like to share with you briefly the thought about what can be a solution or strategy to link together science, policy and society. I mean regional research facilities. So let's start with the problem.

So when you talk about science in most African countries, especially in developing countries like my country, Benin, in West Africa, it seems very far from the population concerns, but also sometimes very far from policymakers concerns because they think that science requires a lot of investment, but for few short term results. But at the same time, scientists are very angry because in our country we do not have enough resources in our laboratory to do high quality scientific research. And between them you have the society who does not really understand what we are doing. So the idea is to bring together all these people to have a sort of roundtable where they can share ideas, they can put together the effort towards the development of science for sustainability. So the idea is to contribute to the philosophy that you all know, which is leave no one behind. The regional facilities, as you know, can provide a lot of resources. We can have a lot of techniques at the same place, for instance in the country, but for the whole sub region, or for the region, we can have also scientists from several countries, scientists from several science fields, but also people who are not scientists, for instance, engineers. So we have a sort of inclusiveness when we work in regional research facilities.

But also there is something very important is that this can give the opportunity for people to interact, to develop international research projects, because in most of our countries we have almost the same issues regarding agriculture, health, energy, etc. So it is very important that we bring together our ideas to develop a common research project that can provide us with sustainable solutions. And we have also the opportunity to do scientific mediation for the society through programs like science popularization, etc. So this is, I think, a strategy which can help us to link all these people around science and sustainability. So my expectations from the International Decade of Science for Sustainability, this is a very great idea and I'm very happy, thank you very much, to bring this idea is to improve the awareness of the people around this topic and also to support the existing initiative like large facilities, I mean African Light Source, but also not only advanced light source, but





regional research facility, like what we are doing at ESTEC lab here in Berlin, which is the platform for the sub region. And finally to contribute to the development of new regional facilities in East Africa, Central Africa, etc. Thank you very much.

### **Carlos Alvarez Pereira**

Thank you so much. Marielle. I would like to have before, as I said, I will ask our audience to participate and actually to work a little bit on the same questions. But before that I would like to have a second round, even shorter interventions, and either for you to react to something that you heard or I mean, the question comes to my mind because of this fascinating story that we heard yesterday about the creation of Panama. You did that in the opening session and then we had the incredible visit to your bio museum. And honestly, I must recognize I didn't have that in my mind, how the creation, through forces which were completely beyond control of any human capacities created this land, this small land compared to the two continents that it was connecting. And that creation changed the whole world. Very impressive example of dynamical system theory, if you wish. Small effects creates a whole change. So maybe we are connecting. As you saw, we had speakers from all continents, from different disciplines, different degrees of experience involving completely different kinds of research. The connection between different pieces leading to a systemic change, or could it lead to a systemic change? Salvatore?

### **Salvatore Aricò**

Starting perhaps with the last objection by Carlos. So science is about generating knowledge. It is about questioning that very knowledge generated through the scientific method, admitting errors, reducing uncertainty. It's a process. Science is not a form of truth. It's a process. In fact, it's a rather humble process. And in this regard, I think I'd like to react to an element in the presentation by one of the speakers who joined remotely that focused on indigenous knowledge and suggest that, yes, it is very important that we don't get bogged down with knowledge systems which might be too Western or Westernized or colonized. But I'd like to suggest that science as a practice is universal and should be universal. While there is a need to decolonize knowledge systems, I think there is a need to go back to the very principles of science which is about trying to understand the world, generating knowledge, questioning that knowledge, improving that knowledge. And in doing so, we must bring on board other knowledge systems and promote dialogues among those different knowledge systems. I also wanted to say I like the emphasis on sustainability rather than sustainable development, because sustainability is something that unfortunately is shared by everyone, the rich and the poor. There are very rich countries in terms of GDP which are faced with huge sustainability problems.

Let me give you an example. When we talk about food security, we think about the Global South. But there is another aspect of food security, which is malnutrition. Malnutrition is so widespread also in countries which are very much on top of the list when it comes to GDP. So all of that to say that I think would be a very good way to promote further dialogues between the Global North and the Global South between different knowledge systems. And I think some of the interventions around the table are very useful if one will be able to capture what Cristina said, for example, about the continuum that goes from discipline based science into interdisciplinarity and eventually transdisciplinarity. So it really is an opportunity to achieve multiple goals in terms of what science can do for society.

### **Carlos Alvarez Pereira**

Thank you. Cristina?

## **Cristina Caparrós**

Well, I will take some of the things that the different speakers mentioned and about that, about the generation of knowledge. I wanted to be a little bit more specific and I will talk about my expertise because it's what I can talk. But I'm trying to make, not to speak so general, so go to more specific things. How can we generate this knowledge to generate, transformative or policy, finally, that it's applicable? So first of all, it can be indigenous or it could be urban societies, it can be any society. We must focus, we must define on what we want to work, right? And when we have the problem, we have the people or the people involved, the stakeholders, right? Because it's not only society, it could be policymakers. When I say society, I mean business, I mean everything, every people that could be involved. What I see or what I understand here is that we should build what I scold in literature and what I understand is the social ecological systems. This gives us a map of what is happening with a problem that we want to address. It could be very specific, it could be more general, but the important thing is that we understand the different factors that are being connected between them. When we have this map built and it's something that it could take a very long time, and here we should work with other disciplines, here is when we can be transformative and we can apply transdisciplinarity. Because here we can talk to the policymakers and the different stakeholders and say: okay, here this is a leverage point where we can do a change. And for me this is how to apply more specifically these whole conversations that we are having, everyone on his or her experiences. This is how I would work a little bit with that. And I know that there's different ways to work with that, but it's just to be a little bit more specific.

## **Carlos Alvarez Pereira**

Thank you. Cristina. Encieh, a short reaction or comment or whatever from your side?

## **Encieh Erfani**

Yeah, thank you. Actually, as Salvatore mentioned, we need to create knowledge, but the other point is that how we can transfer this knowledge, especially for the society and they are not really aware that what's going on. For example, I mentioned about astronomy and people really see it really far from the Sustainable Development Goals, and also how we can engage policymakers to invest the budget and also their attention to implement regarding the science, especially the basic science that comes to their mind that maybe it's not going to be related to the applied science to be able to solve the crisis and the global challenges that we have. So the main point is that we create knowledge, but that knowledge should be accessible. And of course, that's the point of the open science. And when we also talk about open science, we always consider scientists access of the science to the scientists, let's say in the case of the libraries on the other articles. But we never understand that we should make this science, in a simple words, to be accessible for the human beings. We learned by COVID even really fundamental things which is related to our health is not really acceptable by public and we had several problems of how to engage public by considering the really simple laws, by simple like washing your hands and all these things. It seems that we have a really fundamental problem in transferring knowledge to the public. And I think it's really important. Doesn't matter how much we are developed in the case of the scientific creation, even in the case of the innovation, we will be able to transfer this kind of the knowledge in a simple way to all the generations. Not just saying that the young people that they have access to the social media and also to some instruments that they can really learn these things and transferring it to all the generations, even the older generations that they don't have access to the social media and electronical devices to really learn. And of course, different languages. One of the problems that we have in the case of the transferring of

science is language, because what we produce especially is in English. And we cannot really expect that all the people understand all these scientific points in English so we should be able to translate them to the whole human being and main part is the policymakers that can understand these problems, fundamental issues, and invest the budget and also the attention to implement them.

### **Salvatore Aricò**

I really appreciate your indulgence, Chair, but I wanted to react on a point that Encieh just mentioned, which I think is very important, and that is about trust in science, and the perception that the public has about science. And because we are facing mistrust, misinformation, it's a very critical moment to instate trust in science. Now, how to do that? I think this is an important element of the discussion as well.

### **Carlos Alvarez Pereira**

Absolutely. And definitely this will be part, this is already part of the conversations we are having in the International Year, but it will definitely be part of the International Decade. And it's not an easy one because there is always a tension of: could we take for granted that people have to have trust in science because we are scientists and that's it? And you know well that if you say to people, trust me, like that, they will not trust you. Because there is something problematic in that expression, in imposing the trust. So it's a very important matter. Nicole, from your perspective, very short statement because we have to go forward in the session.

### **Nicole Redvers**

On something that hasn't been mentioned yet in regards to the conversation and that's the institutional structures that exist in universities, whether or not it's grant funding agencies or otherwise. And one of the challenges, of course, is this kind of sustainability work on a general scale is not prioritized from an evaluation standpoint of faculty or even on grant applications. So to be able to have performance metrics within universities that uplift the ability to work in transdisciplinary environments, the ability to gain status within universities as a transdisciplinary researcher is very, very difficult. And most of this is not on the radar of most research chairs within basic science departments. So the communication strategies at the university level, including grant funders, I think, are a huge barrier for moving this work forward without further communications, not only to the public and other stakeholders, but to universities themselves and institutions that have historically prioritized individual expertise and not working across teams and disciplines.

### **Carlos Alvarez Pereira**

Thank you. Very critical as well. Diego?

### **Diego Fernando Mina**

Yes, I am thinking a lot about this point of having confidence in science. That is, how to do science that is also fun, but that people have confidence in science. Many times, as Encieh said, we do science but this knowledge is not well transmitted. We do science to keep it in a university library where nobody else, not even the person who did the research, reads it again. I am thinking a lot about the transfer of knowledge, the transfer of science to people who are not specialized precisely in hard

sciences. I do not know if mechanisms such as those that are being explored now, for example, doing citizen science to return those results or even take advantage of this topic that is now very common among young people in social networks. Science can also go beyond a paper that may not reach everyone in the same way, but I think about the ways to transmit that science, to release that knowledge that we generate at the university, which is often very valuable, but does not return to the place where the application of that knowledge is needed. So, yes, it is true, trust in science must be strengthened, but also the transfer of knowledge must be sensitized to non-specialists who are not in the academic field.

### **Carlos Alvarez Pereira**

Gratias Diego. Marielle, from your side?

### **Marielle Agbahoungbata**

Just a very short sentence. I agree with you that it's very important that policymakers trust in science, and for this, communication is a good strategy, I think. And we need to communicate by using their language: statistics, what they can have the quick wins in order to convince them that the research can provide the results for a long term, but also we can have some quick wins in the short term. So I think the communication, by using the language, the language that can understand is very important.

### **Carlos Alvarez Pereira**

Thank you. So now, first of all, I would like to thank all our panelists because I know I asked you a nontrivial exercise of thinking out of your usual frameworks and engaging in this conversation, which is not the typical thing that people are asked to do in conferences like this. So thank you for your efforts and I would like you to give, or all of us to give them an applause of thanking.

And then, as announced, I would invite you, all of you, to talk among yourselves and let's bet on the capacity of humans to self organize. This is not a classroom exercise. I will not impose on you who has to speak with whom, but we would like you to reflect in small groups, or we have 20/30 minutes to do that in small groups to reflect on the questions we had. But also, I mean the questions which are just invitations to this broader conversation. So I'm sure that from what you have heard, you got inspired, you got some ideas, you got maybe additional questions. So if you could group yourselves in suitable small groups of discussion maybe the people at the back of the room can come to first rows.,

We are in a very big room and plus together with the air conditioning it makes that things like look a little bit cold but with humanity you will get warmth as well. And please organize yourselves like remove the chairs to group yourselves and have a discussion and have in mind that in 20 or 30 minutes I will ask some of you to say something about what you have been discussing. Go ahead, feel free, don't be shy, do as you wish. Do we have the slides on the screen? Perfect. So these were the initial questions but you can really discuss whatever you think might make sense.

...

### **Carlos Alvarez Pereira**



We have time for people from the different groups to intervene. So. Camilo.

### **Camilo Delgado-Correal**

The first issue that we discussed was related with the fake news. So this is a problem that we need to solve. We need to move all of the outreach activities, we need to make a bridge between the scientists and the making policy and the society. That's very important to do it.

The second thing that we discussed were related that there is a task for the academies of science that we need to support the development of the trustness for the scientists and the community because sometimes this bridge has been broken so we need to fix it. So the Science Academy has the main responsibility to do that. And the third thing that we discuss that we need to work on this interdisciplinary research to get these solutions to the development around the sustainability. And the fourth thing that we discussed was related that we need to develop some tools in scientific communication for the researchers work who could socialize the results to the public that is going to be more inclusive now. Because the problem is that sometimes the communication that we use is very specific and this general devices doesn't understand. We need to work on that. Thank you.

### **Enrique Forero**

Well, first, very proud to have Camilo here who's a member of the Young Academy of Colombia. Second, very proud to have the members of the liaison committee of the regional focal point for Latin America and the Caribbean of the International Science Council. Third, very proud to have five invited guests from the focal point and the ISC who will be discussing with us the present and the future of the focal point. We will have an extended liaison committee tomorrow which is extremely important for us. We discussed several issues and I'll probably mention them in this order. It's not easy to put ideas together in two minutes but the first one is education. We think that it's extremely important that we improve education at all levels, specifically and particularly at the lower levels of the education. Children have to start learning how to have a sustainable society and there are many ways to do it, I'm sure. But one of them is to make sure that in curricula schools, education for sustainability is included. Children are the future of the world and they have to learn what to do and how to do it. We as grown ups have failed to do that. We haven't been able to change things even though there have been so many efforts throughout the years. And that, of course, goes hand in hand with the day to day of society. We're talking about the fact of having too much sugar in foods and how in many countries that has been a priority. And governments are actually putting these signs on these foods that are high in sugars so that people don't consume them. But still people go to the ones that don't have the sign and that's something that takes time for them to decide, okay, let's look at the one that has the sign because that's good for me.

The other thing that is important is, and it has been mentioned many times now, is that scientists have to learn how to communicate with society, how to do outreach. And even there was a suggestion for the decade and that's to have a school of outreach for scientists, that we really have a place to go to learn how to talk to politicians and how to talk to the media and how to talk to society. Because we try very hard, but we don't know how to do it very well.

And that goes hand in hand with scientific diplomacy. We have to learn to talk to politicians. We have to learn how to do diplomacy at that level. And Peter Gluckman, the president of the International Science Council, has created a term "track to



diplomacy". You have the diplomats that do diplomacy. But we need to be in the track to the second level of diplomacy. We have to try to be able to talk to politicians in their own terms. We have to be able to communicate with them. And that, again, has to do with the previous one.

Another important issue, and this is where we come to the somewhat negatives that the decade has to look into. One is financing. Financing is a very serious problem in all of our countries. I insist, in Latin America at least, countries invest less than 0.5% of their GDP in science and technology, less than 0.5%. And there are countries who report 0.03. How can we make real changes if there is no money available to do them? And money is necessary. We need to have money to do the things that we want to do. And with those budgets, with those kinds of budgets, it's very difficult to do real science.

And that again has to do with political instability. You have a government that goes for four years if there is no other dictatorship and that goes forever. But if you have a government for four years that is positive about science, that try to understand what scientists do and support science, four years later there is a changing government and science is forgotten. Everything that was being done is erased. No one cares about it. And that's one of the real problems. And that, again, has to do with the brain drain. We invest a lot of money training very good scientists who leave the countries because they don't have future. I'm going to finish right now that has another aspect and that's that we depend on government for our future as scientists and governments change, so funding changes. And unless funding agencies understand and the international community understands that we cannot do what we want to do with the funding that we have available, it's very difficult to get to good results. So that goes to all the funders and to the rich countries. The rich countries want for us to do a lot of things. Where is the money to do it? So anyway, thank you. That's my group.

### **Carlos Alvarez Pereira**

Many thanks Enrique, for these quite exhaustive analysis. We take good notes for the International Decade. We had also two groups online. So I would like to ask Encieh now if you would like to share with us the thoughts from the group you were in.

### **Encieh Erfani**

Yeah, thank you very much, Carlos. Actually we could just have a time to discuss about the first question: what is our expectation about a decade? So what we talked was that we should also consider the social sciences and its impact in the decade. And of course, many people also mentioned that we should also consider the next generation and the engagement of the young scientists, because we really need to have the young scientists and also promote the next generation to do science. And one of the main points is that we have scientists, but unfortunately the academia is not a good place to stay because of the many challenges that the young scientists have. So we should be able to have a program to keep young scientists in the academia if we respect the scientific research. And of course engagements of the kids, because they will be the ones who will live in a world that need be more sustainable. So we really need to translate them what we mean by the Sustainable Development Goals, but their local languages, especially in the rural places, that even the national language is not the main language for them.

And one of the main points that mentioned, as I said, that the environment in the academia we should also care that the scientific production is directed somehow by the states and then the money that they invest on that. So it becomes like a capitalism. Now, in the case of the science environment, so we should really be careful about that. Otherwise we would just go to

the direction of the science. Maybe it's not going to lead to the sustainable development goals in future. And as I said, maybe we really need also reform in the case of the scientific environment, academia. And one of the main point is that if we want to translate our knowledge as a scientist to policymakers, we need to train more scientists and encourage them to become diplomats, to train more science diplomas with the scientific background because otherwise it would be really difficult to make a lobby with the politicians that they are coming from the political background, which is a really main issue. We should encourage more scientists to get involved and really be passionate about the science diplomacy. And of course, one of the main point is that we should also show the impact of the science in the life of the people because even in the case of the basic science, people are not aware that how the basic sciences have influenced their life. That's why maybe they don't respect science and in particular basic science. So we should also invest time and energy on that to show that okay, you see the aspects of the basic science in your ordinary life, but it's not really transferred knowledge for you so you just use it without knowing that this is the science that you are using it in your ordinary life.

### **Carlos Alvarez Pereira**

Thank you. We had here a small group in the back, but I'm sure it had a lot of insights.

### **Speaker**

One thing that we mentioned at the very beginning, our colleague was saying on clarity and efficiency of some regulations. So for example, in Brazil they had put a rule that they needed to get rid of all landfills in Brazil or most of them and actually there was no change in the productions or the general lifestyle. So how can you get rid of landfills when you actually didn't change other things? And the other thing we talked about was the communication between private and public sector at this point in the processes that we are in, how can we improve the communication between or collaboration between the private and public sector so that we are all on the side of sustainability and the future of science? I mean, for sustainability.

### **Carlos Alvarez Pereira**

Thank you. We have here a group of people from his area, right from the countries here in Latin America.

### **Speaker**

Well, in this group we were people from Costa Rica and Panama. In response to the first question, we thought that the way, the expectations would be to inform. To inform in a didactic and fun way, especially to young people, who are the future generations. And very important, the formation of projects that involve different areas. Well, in our group we have industrial engineers, biologists, science teachers. So how can each of us adapt the information to our area of study to make it more understandable? Information, for example, that is given to us in this congress, how would I take that information to high school students? That information may be difficult to understand. To answer the second question, it would be like a relationship there. Are policies, there are laws in different countries that protect the environment and so on. However, there is no respectful response from society and that is due to misinformation. So, with the help of science, with a language that can be understood by the society that is not an expert in the subject, these laws and their importance can be understood.

### **Speaker**



Regarding the third question, the types of data we need to improve the links between science and sustainability, it is necessary to improve in the science part, because it is to take it from a holistic point of view as well, because we cannot focus only on the scientific ego to fill ourselves or to take that recognition, if we are not going to take to a public purpose to improve our society and that society grows both sustainable, environmentally, and human, because we have to have a balance in both. And the fourth question, how do we connect, mobilize and organize people around the world around science for sustainability? Well, we are here in this congress from different countries, so in this way we can connect and also creating links as they already exist, because internships, international scholarships for all the people who study this kind of sciences. And to replicate all the good things of the countries: there are green cities; as we were commenting here with our colleague, Costa Rica has a very strong ecotourism, it is its strength as a country. So, I am going to show off to Panama that we have the negative carbon of three countries out of almost a hundred countries that we are in this world. So, there we balance ourselves. That is our response through congresses, scholarships and so on.

### **Carlos Alvarez Pereira**

Gracias. There is a second group online. Could we have Cyrus Walther bringing to us in a very short manner because we are now running out of time?

### **Cyrus Whalter**

I will already present the perspective points of my group. I have three key points that I would like to share. The first one here is on the second question, where the really key focal point is to educate, similar to the first group, educate scientists how to speak to politicians and improve their knowledge on science diplomacy. And that can be done through examples, as it is already done in neuroscience through science diplomacy workshops and schools directly in groups teaching scientists on how to communicate with politicians and key stakeholders efficiently. And the second point here that I would like to mention is the development and support of statistical and mathematical sciences such that data science and evidence based decision making can be done on the stakeholder level really much. And the last point that is on my list that I'd like to mention to you in the realm is the opportunity to have neurosciences as one focal point since it is heavily connected to a lot of other subjects and research topics in such a way that it is also very much connected to sustainability on the processes of sustainable learning, and as well in the part of economical sustainability such that everybody has the equal chance to learn efficiently new skills and educate themselves for the better world.

### **Carlos Alvarez Pereira**

Thank you Cyrus, for the concise summary. And here, last but not least, who is okay?

### **Anne-Hélène Prieur-Richard**

Good morning everyone or good afternoon online. I'm Anne-Hélène Prieur-Richard from the Belmont Forum. But we had a group with people from the five continents so that was really rich discussions and so we started also from the point of science society and policy interfaces and we noted three points. The first one or four, I should say first one is that we agree that we should train scientists to different kind of communications, but we also think that communications to different audiences is a job in itself. So that we should also have in our research projects or research organization communicators and finding



some funding for those people as well. The second point to be addressed is that if we want to scale up, really sustainability science, which means inter and transdisciplinary, we need to change a bit our systems, to evaluate our researchers and to do also some impact oriented assessment and not only high publications assessment. So that was another point, and it's related to what was mentioned by one of the panelists about additional changes. So that goes, I think, hand by hand with it. So it's starting. We have an example in Switzerland, in the funding agency, where they are starting to change how they process those kind of projects, but that's really limited for the moment. And we also talk about education of young, the youth, in fact, the little ones, not only to science in general, but to the features of science. So the complex issue of uncertainty, risk assessment, long term, why we need long term research because those kind of ideas, although they are complex, we should find ways to educate the little ones and at different age for when they will be in their different careers, not always in science, can have that in the back of their mind.

### **Carlos Alvarez Pereira**

Thank you. Thank you to all of you. We have plenty of insights. It's very clear, because it has been repeated almost all across the board that there is a gap in the relationship between scientists and society, policymakers, diplomats. So we take good note of that for the contextualization of the International Decade. Now, before going to the closing, to the concluding remarks, I would like to give yourselves an applause for your work because I think it was great. Thank you. Thank you for having participated in this exercise. And now I leave the floor to Michel Spiro, who is the president of the International Union of Pure and Applied Physics and also the chair of the International Year of Basic Sciences for Sustainable Development, which will continue until the end of this year. Closing Conference in Geneva on the 15 December. But of course, we look forward to the approval of this International Decade of Sciences for Sustainability. So Michel, please, your concluding remarks.

### **Michel Spiro**

Thank you, Carlos. This will not be concluding remarks, it will be closing remarks. I cannot conclude, really, this session, which was very lively and very fruitful. I appreciated very much the format and the work you did, Carlos. So I will start by first thanking the organizers of this SRI Congress, 2023, to having permitted this session under the flagship of the International Year of Basic Sciences for Sustainable Development (IYBSSD). So this was really a great opportunity to have this session within this reference Congress SRI 2023 in Panama. I want to thank the moderator, Carlos Alvarez Pereira who acted also as a master of ceremony, for having chaired this session remarkably. I think he deserves an applause. I want to thank all the speakers and all the participants to this session. They also deserve an applause. And I want maybe you don't know I want to thank also Luc Allemand, Secretary General of the International Year, who helped behind the scenes to prepare from Paris this session.

First a few words on the International Year of Basic Sciences for Sustainable Development, which we are celebrating this year and the year before. International Year was proclaimed by consensus by the United Nations General Assembly on December 2, 2021, at the initiative of Honduras. By the way, the writer of the resolution of Honduras is in the room. So this was proclaimed by consensus and the resolution was supported strongly by many countries. It is placed under the auspices of UNESCO. The opening ceremony took place on July 2022 at the UNESCO headquarters in Paris, while the closing ceremony will take place at CERN in Geneva on December 15, 2023. The program of this International Year is very rich and dense. Hundreds of events already took place worldwide. A large variety of topics have been treated with particular focus on the contribution that basic sciences, guided by curiosity, can give to sustainable development. What is the rationale behind this



international year? Basic sciences, as I said, are curiosity and inquiry driven. They increase the pool of knowledge that future generations will use to face their problems. They are the foundations of education and the sources of discoveries which turn into applications. They then contribute to serve an inclusive sustainable development. Altogether, education, discoveries, applications and inclusive sustainable development can boost collaborative and open basic sciences.

This is a virtuous circle that we promoted during the International Year of Basic Sciences for Sustainable Development and that we want to promote after. Basic sciences can alert humanity on crisis to come and provide directions and ways to manage them. Already in 1972, as Carlos said at the beginning, the Club of Rome, which actions was guided by curiosity and inquiry, sued alerts on the limits to growth and indicated possible ways to manage them, thanks to the contribution of basic sciences and the knowledge it generated.

However, although essential, basic sciences are not enough alone to ensure a sustainable future to the society, we need all sciences, all knowledge and a good connection to the society and to decision makers, what we call transdisciplinarity, to grasp the sustainability issues, to act towards sustainability. To achieve this goal, we shall need you, teachers, scientists, society at large, with the private and public sectors, decision makers, intergovernmental and multilateral system to share this vision and act accordingly. Sciences for sustainability are presently very fragmented thematically. We can see that in this Congress, with a huge number of sessions.

They are fragmented also geographically, approached in different ways in different countries, and organizationally: lot of subsystems of organizations for this sustainability sciences. This might be appropriate to get quick, local and efficient actions. But in addition, a worldwide organized system approach with a long term strategy would be essential to reach an effective global action and to face global challenges. Both society and science at large, knowledge and transformation, must be embarked in a coherent way to target equity, diversity, inclusion, leave no one behind, as it was said, and target a healthy lively planet with a circular economy fueled by decarbonated energy. We need to mobilize to connect and globally organize people around the world on sciences for sustainability. Probably a type of spider web network organization must be invented. Curiosity, emulation and collaboration should be the keywords behind that. We need to develop transparent strategy, especially through the science-policy-society nexus. The IPCC and IPBS models could be reinforced covering all sustainability teams, climate, biodiversity, ocean, continents, health, with added peer appointed scientists and with a coherent transformative roadmap as an imperative for governments based on acquired knowledge and data. Data indeed are essential. They should be verified, integrated and serve as strategic milestones and compasses.

A data integrated digital twin earth model could be considered as a central target activity in this spider web type of organization. In fact, that is what I said is rationale behind this International Decade of Sciences. Again of all sciences, all knowledge for action towards sustainability, including citizen and indigenous knowledge science. This decade must be run bottom up from scientists and social knowledge to the intergovernmental and multilateral system. We hope that a resolution in that direction will be passed soon at the UN General Assembly.

## **Carlos Alvarez Pereira**

Thank you, Michel. So we are done with this session. But this might just be the beginning of a beautiful friendship. And in any case, it's the continuation, one more step in this venture of mobilizing all sciences and all threads of knowledge towards desirable futures. You talk about sustainability, but it's the futures we would like to see happening. So you are all of course



welcome and invited to be part of this venture because it will not happen without you. It has to happen together. Many thanks to everybody, to the people who have been participating and attending online and to all the speakers here and online. And I wish you the best for the continuation of the Congress and for own research and engagements. Thank you.