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Intervento

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- *Check against Delivery* –

The role of academies of science in the “Leonardo world”

Scientific advice for European citizens and policy-makers at the
European Commission

Let me start by expressing how much I appreciate the honor of being here today and to talk about an issue which is – and here I am rephrasing and shortening the title of my presentation – the role of science in shaping our future. The structure of my presentation will be as follows: First, I would like to say a few words on science, the science system and its challenges. Second, I would like to make a few remarks about the challenges academies have to meet within our science system.

Third, I will address the important role science and scientists play in the provision of advice to policy-makers, politicians and above all to our fellow citizens in order to complement what we have done in the past, namely to educate and to inform people about science via something commonly called ‘public engagement’, which calls for a more intense and truly honest dialogue with the public to enable an informed populace, able to contribute competently in discussions and make informed decisions concerning our future, but also us scientists need to listen to the needs and wishes of the public.

And fourth, I will voice some considerations, what it takes to consolidate and further build the European Research Area, which elements are needed and where the current plans for the next research framework programme for the years 2021 through 2027 are probably not yet where they should and could be.

There is no doubt that the world we are living in is a so-called “Leonardo world”, a term created by Jürgen Mittelstraß, a German philosopher who indicates with these semantics that we, people, scientists, and engineers, largely contributed to what is surrounding us, I mean to our world as it is.

And there is no doubt that the challenge, the responsibility to further improve the “conditio humana” and hence to tackle all the challenges ahead of us, be it climate, be it energy, be it health, can only be tackled by science, by better science and most likely by more science. However, science must be interconnected and truly problem-oriented, since the problems we are facing are not disciplinary problems only.

The great challenges don't care about disciplinary functions and borders. And one of the major challenges within science has been and is to grasp these complexities with inter-disciplinary or, again as Mittelstraß would put it, with trans-disciplinary approaches.

Universal geniuses like the founder of my academy, Gottfried Wilhelm Leibniz, or Isaac Newton, founder of the Royal Society in London, or even Leonardo, are no longer available or possible. Therefore, we have learned to organize science, especially of course - but not only the field of big science - into consortia and in many cases into regional and, where appropriate, into supra-national or even globally acting teams. And yes, this has led to an interdisciplinary working attitude, which, regrettably however, in most cases is still interdisciplinary within the natural sciences, including engineering, less so with the Social Sciences and Humanities.

Bridging the gap with humanities and social sciences is still a major effort we have to undertake since, as I mentioned before, big challenges keep appearing ahead of us. And these challenges need deep reflection, a true risk-benefit analysis which goes beyond technology and economics. Therefore, I would like to mark this true interdisciplinarity as the first of a number of “desiderata” we still have in science and within the science system.

There is no doubt that the way we have approached our problems both in the past and present has been and still is highly successful; the scientific achievements in our various disciplines are breathtaking. This is true for e.g. medicine, where I come from, where we have begun to understand diseases at a molecular level and also treat them at this level. Another example of our enormous scientific success during the last decades is the field of space research, where scientists have managed to land a satellite called “Philae” after a 10-year journey on a small comet with the size of 12 square kilometers, among many other exciting currently on-going projects to further deepen our understanding of outer space.

Of course, there are many more examples in all fields. All of these achievements have a direct impact on our daily life, but they also increase the expectations people have towards science and the desire of those who, by profession, have to care about science – to be specific, not only scientists, but also politicians and managers.

Scientific breakthroughs increase the desire for new solutions to solve future challenges, and of course decision makers want to spend money on research more on those areas which promise new products, new processes and new solutions. This is what we call product-oriented or applied research.

It is less and less understood that there is a correlation between curiosity-driven research and applied research. Curiosity-driven research is the beginning and the humus of all. Without this type of research, the ensuing applied research will soon die out. There is no clear sequential order between curiosity-driven and applied research. But we know today that there is an interactive relationship between these two.

Some curiosity-driven research has an immediate impact on applied research, but sometimes it takes 15 or 20 years to obtain results in applied research as it for example happened in what we call biotechnology today. There, it took from the late 19-forties and 19-fifties to the 19-eighties and 19-nineties of the last century to create a new industry out of the early research efforts.

Sometimes questions arising in applied research necessitate completely new approaches to thinking and experimenting, and sometimes one has to go back to very elementary and basic questions in order to overcome hurdles and solve applied research questions. This even has consequences in the organization of science and in our innovation system. University research which used to be curiosity-driven research today faces the necessity to look into applied research as well. And industry, the classic locus for applied research, in many cases faces an enormous need for curiosity-driven research, often with the help of networks including academia.

So, the relationship between invention and innovation, with innovation being the practical outcome of what has been created before as invention, is highly complex. And there can be no innovation without invention, because in most cases breakthroughs are made in curiosity-driven research. So I would like to state that my second desideratum is the need for curiosity-driven research which must not be scaled down – on the contrary, we need more of this kind of research.

In this context, we have to learn a third lesson: research in the humanities and in the social sciences is not only needed to preserve our cultural heritage. It is not only needed to interpret this heritage and make it available for our current thinking. It is also needed because, in the words of the German philosopher Hans-Georg Gadamer, “Zukunft braucht Herkunft”, or to paraphrase in English: “If you want to prepare for the future, you need to know where you come from”.

The hype about news in natural science or engineering and the excitement which it creates should never make us negate this basic principle – the need to support research in the humanities and the social sciences. And nevertheless, it took more than two years to make the Commission in Brussels who elaborated Horizon 2020, the current framework programme for research in Europe, to understand that humanities and social sciences are not only helpers or, to put it negatively, ‘reflection machines’ of the developments of the natural and technical sciences, because these fields have their own research needs in basic, curiosity-driven research. And, sadly, the role of SSH in the current deliberations on the successor programme “Horizon Europe” is again put into question.

We know of many countries and not only poorer ones that are cutting the expenditures for humanities and social sciences. And this is done in times when, more than ever, we need true interdisciplinarity, which means that not only mathematicians, engineers and material sciences work together but also philosophers, sociologists and others.

The big challenges ahead of us demand and need the work of the social sciences and humanities, disciplines that take part in the dialogue in shaping the best possible way to the future and, from the beginning, add their competencies to the large transformation processes which are a characteristic of our time.

The old traditions, sometimes pursued to find technical solutions, and then, sometime later, even years later, are used to reflect on consequences for our societies, represent an attitude and sequence which no longer works. Large technical programmes need intensive parallel reflections by ethicists, philosophers, lawyers, sociologists and other disciplines. And of course there are more ongoing transformation processes in our societies, such as migration, religious diversity and many others which need research and new concepts in all disciplines.

So, the next topic in my list of “desiderata” is the preservation of the roots of innovation: curiosity-driven research including the humanities and social sciences. And this development within science is paralleled by new ways of communication. Within science we have a massive movement called “open access”, very much supported by the European Commission, where the role of publishers and science journals is questioned or threatened, or as you can also say in a positive way, supplemented by pre-publications and publications on the internet and in social media with blogs and tweets, which are used to distribute scientific results.

Especially social media are used to increase the awareness for scientific results, and Wikipedia, with its enormous amounts of data and information and sometimes even knowledge, gives all of us the impression not only of rapid and easy access to what the world knows, but almost kindles the feeling that the availability of scientific data is identical to a solid knowledge

of and the ability to properly reflect and interpret the data and bring them into context. But this is by no means sufficient for enabling and improving judgment!

A couple of years ago, we had a very simple publication and communication system: the scientist on the one side published his data and his interpretation in peer reviewed journals and if the data were of some interest to the public, science writers in journals on the other side were there to translate it for the public. Only rarely did scientists directly address the public; this would have even been judged as non-scientific and the scientists were regarded as less serious than they should be. Only the most successful were still somehow appreciated by their peers.

Things have changed completely. On top of this and as a consequence, news linked to science, positive or negative, are in most cases not reported by science writers but are first reported by general journalists. And the first reports, as we know, set in most cases the tone and the trend as to how the topic will be discussed in the media from that point onwards. When science writers and scientists, especially in cases where negative events are reported, start to discuss and to reflect on what has happened, the first hype has faded and the interest of the general public has already turned to the next topic. So the next challenge we are facing in science is to prepare ourselves for this new world of communication, be it scientific communication or be it communication with the general public.

After the deliberations about the challenges I would like to come back again to academies and their role to shape our future. Academies traditionally are places where many of the best scientists within a region, a country or since the nineties of the last century in Europe convene, perform research, discuss scientific progress, scientific needs and give scientific advice to the public – and in some cases – to politicians. The American Academy of Science was e.g. created to give scientific advice to politicians. Academies are places where the desiderata I mentioned in my talk can be resolved. There is excellence, interdisciplinarity and the possibility to engage in public debates called public engagement. Some of the academies are very successful in this endeavour. So academies can and really do engage in scientific advice for policies, politicians and the general public, but they also create policies for the development of the science systems.

So the virtue of academies to bring together the best experts from all disciplines and to work in interdisciplinary teams is an asset which will undoubtedly become and in fact is already becoming the guiding principle for the way we do research today, inter- and transdisciplinarity as I have discussed before. On top of that, we need to think, to work and to act not only on a regional, or a national, but especially on a European level, if not even on a global level. And therefore ALLEA, the assembly of 58 academies of sciences from more than 40 countries in the Council of

Europe region is a perfect example of how to tackle these challenges in a cooperative and integrated way. None of the issues and problems and challenges I listed before are exclusively national or regional, they are pan-European issues.

Scientific advice for policy: The strength of the sciences is to spot problems earlier than the general public and politicians. It is thus our duty to, early on, make our fellow citizens, our politicians aware of what we expect the future to hold, and how positive solutions could be found. Our advice to society, to politics must not be black and white; it cannot produce final conclusions and try to replace political decisions. Fundamentally what we have to do is, we have to show options, talk about scenarios, and be very frank, open, transparent and honest about what science knows and what science can contribute. Naturally we do that at a national level as I mentioned before.

But in the past we have not been good enough in advising at the European level, as a united European scientific entity. However, this has changed, and this is what we are currently pursuing! Five umbrella organizations of academies within Europe have devised a new system to contribute scientific advice for policy makers at the European Commission. Its name is SAM, Scientific Advice Mechanism and we call the academies' consortium SAPEA (Science Advice for Policy by European Academies). And here, ALLEA, in cooperation with Academia Europaea, EASAC, with FEAM - the federation of the medical academies, - and with EURO-Case, - the association of European engineering academies, - is currently working in European teams to advise the European Commission in questions of relevance for the future of our society. The advice is channelled through a group of seven scientists: The group of chief scientific advisors.

For the first time, Ladies and Gentlemen, academies have been proactively invited by the European Commission to provide advice for their policies. Therefore it is one of the major efforts we are currently undertaking.

At the same time, we not only need scientific advice for policy, we also need policies that guarantee the quality of science, secure its environment and ensure science is given the breathing room, the money and the resources it needs within Europe to produce valuable results. It is hence one of our major obligations to care for the scientific infrastructures within Europe, to establish that all countries within Europe are in a position to receive research grant money, which almost always is distributed competitively. This means we need policies which enable the science systems in all countries to really become competitive partners within this new Europe. A major challenge which cannot be resolved by lowering academic standards, but only by improving the quality and enabling the

different science systems to become competitive on more or less even footing.

And this latter topic leads immediately to the field of the European Research Area. Science, no doubt, is a forerunner and example for globalization, and even more so, it is also a best practice example how Europe can come together and develop a basic and common understanding within, I would say, all European countries. What I have said before about science and how science should be performed, what obligations science has, leaves no doubt, that the way we do science has very deep roots in the times of the Renaissance and the times of the European Enlightenment, which in itself is an interesting process that was decentralized but followed a common desire and a common goal: to free the individual, to create autonomy for the sciences and above all to give science a solid, empirical, evidence-based foundation, and what since Newton can be called 'basic laws'.

It is what John Miller, a pronounced representative of the Scottish Enlightenment, called 'independence of the inquiring mind'.

I think it was Ralf Dahrendorf who first spoke about the European Research Area which today is a powerful instrument to support scientific research and science-based industrial development in a very special way. Currently, the expected next research framework programme "Horizon Europe" is under preparation. Horizon Europe was officially presented by European Commissioner Carlos Moedas in June 2018, and is currently being discussed both in the European Parliament and the European Council. Horizon Europe will run from 2021-2027 with a budget, as proposed by the Commission, of approximately 100 billion Euros.

The proposal foresees a three-pillar structure, with pillar one on "Open Science" including funding for the ERC, for Marie Skłodowska-Curie Actions, as well as research infrastructures. Pillar two is labelled "Global Challenges" and is supposed to receive the lion's share of the overall budget (more than 50 billion). It hosts five so-called "clusters" (Health; inclusive and secure societies; Digital and industry; Climate; energy and mobility; Food and natural resources) as well as the European Commission's in-house science service JRC. The newly established European Innovation Council (EIC) is located in pillar three ("Open innovation") alongside the European Institute of Innovation and Technology (EIT) and funding for 'European innovation ecosystems'. In addition to the three pillars, the proposal includes a funding line for "Strengthening the European Research Area" with a special focus to support the less competitive research systems in Europe.

Let me make a couple of points concerning this new program. First of all it is interesting to note, that pillar one which used to be 'Excellence in research' is now named 'Open science', which clearly underlines the

strong will of the European Union to support all different aspects of open science such as citizen science, open access and I would add open communication with the citizens, which, as I mentioned before, is one of the core elements of what academies contribute to shaping our future and helping science to do what science needs to do in order to build a valid future for all of us.

The second point of this, let's call it criticism, is that it is not yet fully clear, to what extent interdisciplinarity is really fostered within the framework programme. I would like to comment on the evaluation of the current horizon 2020 programme.

This evaluation clearly revealed that social sciences and humanities are and were totally underrepresented within the programmes. Even in those fields which were clearly marked as social challenges the contribution of social sciences was inadequate at a level of 50% of the money spent. In some cases the **semantics** (??) were used, however without concrete scientific contributions.

And therefore I want to reiterate: True interdisciplinarity in my sense is, if not only physicians, physicists, mathematicians, biologists work together, but that natural scientists work together with social scientists, philosophers, ethicists in order to discuss and to develop models for a holistic view of progress, products, processes and infrastructures. It is no longer valid and feasible to introduce new technologies, new products without looking at what we can call social acceptance, acceptance by the people. Why is it, that people run after new technologies provided by Apple and Microsoft and try to get out from, let's say, the green bio technology. This being true irrespective of the fact that more and more information tell us that the protection of personal data is endangered in the virtual IT world – probably much more than in the analogue world!

So, what I want to say is that we need to better understand and to better communicate with the public about new developments and we need research why this differing approach to new technologies does occur.

This is something which clearly needs to be improved in the next framework programme and everybody has to be aware that challenges are not of technical nature only and most of them, if important, influence us as a society as a whole.

There is however a third point which I would like to raise building on what I mentioned some minutes ago: I would like to put much more weight on an issue which is called capacity building. Programmes which help especially those countries, where the science system is less developed, largely overlapping with the so called 'EU 13 countries'. Currently they practically cannot take part in elite programs of the European Commission, because their infrastructure is not yet as developed as it should be. So, it is one of the mandates that we all have: if you really want to create Europe,

if we want to build the European Research Area, support them with structural funds, dedicated to improving science infrastructures.

The first approach would be that we make the commission understand, that the currently existing structural funds should include scientific institutions and not only building roads or supporting agrobusiness. Education and science are probably the most important sources of future development and they are infrastructure in the very best sense.

My second point in this context is what I would call ‘institution building’. We need more European institutions for research and also for education. The idea of President Macron to create a few excellent universities is, as I believe, a perfect idea. If one would feel that it is probably too complex, one could start with universities which offer mainly or possibly exclusively in the beginning post graduate studies and include the undergraduate studies at a later point. What is really important too are European research institutions and here we do have excellent benchmarks. Look at CERN in Geneva, look at the EMBL in Heidelberg, just to name two of them, where they have solved all the critical issues which currently prevent us in many cases from truly European cooperation. They have solved the issues of salaries, they have solved the issues of pensions – everything. One could learn from those institutions and create more. Does it really make sense to not have European institutions for climate research or energy research? Even areas of health research could benefit from a truly European approach. The advantage would be that European countries could contribute financially to these European institutions, according to their interests and according to their financial power. And probably even more interesting that also countries like Switzerland, like Norway, and probably soon the UK could be part of these European institutions as share- and stakeholders. It could be an elegant solution, that we as scientists will not lose the contact and the impact of our British colleagues, if Brexit should occur.

And this at the same time would really boost European attitudes, European mentality and European careers of young talents. All this is unfortunately not fully incorporated in the political will behind the horizon program.

The creation of the European Research Area is an ongoing process, which deserves the help of all of us – because it allows us Europeans to be at the forefront of scientific progress, to responsibly develop further our Leonardo world and to secure our welfare and a value based “*conditio humana*”.