In response to the ***European Commission Call for feedback on Missions***, please find enclosed the CSIC reflections and proposals.

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Reflections on missions

The CSIC shares most of the conclusions of the interim evaluation of Horizon 2020 as well as most part of the so-called Lamy report (***LAB-FAB-APP: Investing in the European future we want)*** to deliver smart and sustainable economic growth without neglecting the importance of enhancing excellent research and innovation.

Since all the CSIC position papers related to Framework programmes have always expressed the need to bring to the forefront the societal impact of the monies spent on research and innovation, we very much appreciate the Commission's determination to include said approach in the ***mission concepts***.

We are at the beginning of the drafting of the European Union 9th Research and Innovation Framework Programme 2021-2027, and for this reason we believe that the ***mission pattern*** should be carefully designed if we want the initiative is to succeed. From we have learned so far about ***missions*** most of the work remains to be done.

Therefore, we encourage the Commission as well as the Council and the European Parliament:

- to establish transparent mechanisms to identify and select missions, paying special attention to their European added value;

- to properly estimate the human and material means required for its accomplishment;

- to verify that both the EU and the Member States are able to afford the costs over time;

- to clearly define the missions management and implementation;

- to design an assessment and warning system to identify problems and threats well before they can compromise the goals set, and

- to define the procedure for discard any mission that during its implementation reporting cannot prove its feasibility and cost-effective.

Mission proposals

Welfare Society

One of the crucial challenges of the European policies is the consolidation of the welfare state. For this reason, it is essential to study phenomena such as aging, childhood and education, leisure, tourism, etc., from the perspective of different sciences, especially including the Humanities and Social Sciences (demographic and human geography studies, economics, ethics, innovation analysis, statistics, etc.). SSH provide tools for interpretation and study of the policies undertaken and SSH researches can guide and influence policy stakeholders.

Past in the Present

One of the biggest problems in the world today is the ignorance of the past. This is paradoxical if one takes into account the European academic tradition. However, this is clearly seen when the society have to face current problems as jihadism, nationalism, ethnic and religious clashes in Europe, etc. Only with the study of the origin of all these phenomena, we will be able to understand and solve them properly. At the same time, the complex societal challenges that we are facing today cannot be explained by physical, environmental and biological causes alone; humans play a central role. Today more than ever it is essential to study the past to face the present.

Global Change

The research on the social and economic repercussions of global change, under its multiple aspects, is an essential task. The analysis of migratory movements, policies of exploitation of resources, use of raw materials, development of transportation systems, habitability of cities, rural life and the consequences of depopulation, new human relations arising from population movements and globalization (slave traffic, child labour, discrimination based on gender, religion, race or age). This mission cannot be addressed either if it is not from a clearly transversal and multidisciplinary approach.

Communication Paths

The fundamental instrument of the human being is language, as a distinctive feature over other species. Language is the basis of thought and knowledge. The study of language and communication can cover all the dimensions of the social fact, and affects such relevant issues today as language and national identity, language and ideology, languages for science and communication (bilingualism, plurilingualism), pathologies of language, language as forensic science, processing of natural language and its application to new technologies, language and Digital Humanities, etc.

Ethics in Science

In any research project or in any innovation process, the social consequences related to ethical and cultural aspects (motivated by customs, traditions, ideologies, religions, etc.) are fundamental. However, these aspects are not taken into account a priori, in the planning of research projects. They are usually only analysed from the perspective of their results and consequences. The social repercussions can be negative, and the rate of success and social transfer of the projects can be affected. This is evident, for example, in biomedical projects (transplants, cloning, stem cells, study of rare diseases) or food research (transgenic crops, religious prohibitions, etc.). These key questions can only be adequately addressed from the scientific methodology of the Humanities and Social Sciences in cooperation with other scientific fields.

Generation of new tools to combat antimicrobial resistance

The global burden of antimicrobial resistance is rising and is associated with increased morbidity and mortality. Microorganisms use distinct strategies for resistance against antibiotics. Thorough knowledge of the biochemical and genetic basis of the different mechanism of resistance is required to design specific new antimicrobial therapies to curtail the emergence and spread of resistance of target microorganisms.

Personalized medicine in rare disease

The new 'omics' technologies lead to a better molecular characterization of diseases and unravel their complexity. The implementation of 'omics', big data and biobanking in the understanding of the molecular basis of the different classes of rare diseases, will provide a rational classification of them and a basis to understand the different degrees of severity within same type of pathology. This knowledge will allow the identification of new biomarkers, the possibility of a diagnosis or a more precise one, and the possibility of treatment with existing drugs or through the development of new ones.

New generation of drugs for the treatment of neurodegenerative diseases

The mechanisms by which the different neurodegenerative diseases occur are poorly understood. The drugs available for their treatment are generally non-specific; create adaptation and remarkable side effects. There is an urgent need for the identification of new targets, concomitantly with the generation of new and more efficient compounds that counteract these molecular alterations, for a more effective treatment of these diseases.

Understanding the development of chronic diseases

Understanding the drivers for the development of chronic diseases in elderly is of vital importance for risk prediction. Identification of these molecular risk factors friendly will led to obtain friendly prevention measures including physical, nutritional habits and mild therapies. The implementation of these programs will maintain and extend the well-being of the elderly.

Enhanced immunotherapy against cancer, autoimmunity, infection and other diseases

The immune system is the natural defence mechanism against infections, cancer cells and other diseases. The generation of new tools to improve an active and passive immunotherapy, specific cytokines, monoclonal antibodies, vaccines, use of immune stem cells, or the directed modulation of the immune system to a more effective response, will open new ways for the treatment of these global illnesses.

Green Chemistry to reach the great challenge of energy saving and environmental preservation

The areas/sectors of interest will include: Chemical/Pharmaceutical industry, Biotechnology sector, etc…The goal will involve innovative research on the development of alternative sustainable technologies that support the development of competitive bioindustries. This mission will focus on: i) the application of innovative technology to establish industrial procedures, ii) the development of environmentally improved routes, synthetic methods (including biocatalysts) and processes to products of interest.

Bio-based Economy to reach the great challenge of Sustainability

The areas/sectors of interest will include: Agriculture, Food, Chemistry, Biotechnology… The goal will include the sustainable processing (including Bioprocessing) of biomass into a variety of marketable Bio-based products (chemicals, materials) and Bioenergy that can be the optimal strategy to sustainably convert biomass into a portfolio of biomass-derived intermediates and products that will form the base for the future Bio-based Economy. This mission will include the utilization of renewable resources and the use of biotechnology alternatives to chemistry-based solutions in these processes.

A global understanding of the Universe (anticipating the picture of the Universe by 2040)

Human cultures depend on ideas about the origin of the Universe and the place of man in it. Today, a cosmology based on physics and describing the evolution from the Big-Bang to the rise of molecular complexity is emerging and pervades all advanced societies. The picture could be essentially complete in two decades. Progress in this global view, with great social and technical implications, needs a concerted investigation in many fields including astrophysics, high-energy physics, gravitation, nuclear and molecular physics. Major instrumental developments and big data analysis will also be required.

Reachable nanomedicine (spreading the use of nanomedicine for citizens in the next decade)

One of the great challenges facing medicine this century is the development of early diagnosis techniques for numerous diseases as well as the development of techniques for the regeneration of damaged organs and tissues within our body, as well as personalized treatments. Finding a good solution to these activities could have a great impact on the quality of life of our society in the near future. The nanomedicine groups three main areas: nanodiagnosis with nanoparticles or biosensors, the controlled release of drugs (or nanotherapy) and regenerative medicine.

Connecting Europe using Quantum Technologies (enabling Europe to lead the second quantum revolution in the next decade)

The great success of the Quantum Technologies Flagship has driven the leadership of Europe in QT. Its top research institutions and companies cover all aspects of QT from basic physics to electronics and computing science. In the next years the QT Flagship is expected to unlock the full potential of QT, addressing all the aspects form communication, computing, simulation and sensing and metrology, with the final goal to bring commercial products to the market. The ambitious target on QT should extend in FP9.

Towards an energetically clean Europe (Increasing then use of clean energy in the next decade)

Although European countries consume less energy than 10 years ago, mainly thanks to the increase in energy efficiency, and the share of renewable energy in the EU's energy consumption doubled, from 9% to around 17% in the last decade, fossil fuels remain the dominant energy source in Europe. Along with this the search for viable solutions to eliminate radioactive waste is still a pending issue. The problem has been widely considered in H2020 (save, clean and efficiency energy) nevertheless to reach a solution there is still a long way that FP9 should face.

Zero-waste cities or advanced waste handling processes (50% reduction of landfill waste in all European large cities during the next decade would be a great achievement)

Capannori was the first town in Europe to declare the goal of zero waste. Since then the model has spread across Europe. There are three main interplaying actuations to reach this goal: legislate, burn and recycle. Recycle has been limited to pilot programs involving small companies, thus remaining largely unexplored. This would be a challenging mission, which would necessarily need, for its full development, to integrate artificial intelligence-based handling processes, computer vision, learning algorithms, state-of-the-art sensor-based systems, and robotic technologies.

Precision Chemistry for Precision Medicine

Choosing the right drug and dose for a given patient necessitates the inclusion of many environmental and internal variables. Some critical aspects are: (a) monitoring and changing what we eat and breathe to account for personal variation in exposure and sensitivity; (b) developing revolutionary forms of "vaccination" avoiding resistance; (c) bringing down the price of medicine. The initiative involves the call to both public and private sectors to partner and collaborate and the engagement of patients and volunteers, e.g. trying to use mobile devices to encourage healthy behaviours.

Fossil fuel-free petrochemistry: A future after oil, gas and coal

Petrochemicals have been the mainstay of the chemical industry for a century and an exponential growth in demand is projected for petrochemical-based products in the form of man-made fibres for clothing, ubiquitous plastic artefacts, cosmetics, pharmaceuticals, etc…, all drawing upon the same finite oil, gas and coal feedstock. A sustainable future requires foundational approaches implying changes in the infrastructures and lifestyle, capitalizing into "reusing and renewing": the reconversion of plastics into petrochemicals, shifting to biomass or agricultural feedstock, or making CO_2 the direct carbon source.

Solving the Renewable Energy Storage Problem
In a 2 cent / KWh scenario for 2020 for solar PV and Eolic, deduce the priority for nuclear energy (both fusion and fission), and focus on: i) low cost, low impact batteries ii) water Dumping options iii) efficient grid/balance distribution/storage networks. BONUS: eliminate pollution, capture CO2 at centrals

Distributed Solutions for Energy, Computing and Food
Integrating local provisioning systems for energy and computing reduces the dependency from multinationals and promotes better living conditions in rural places. Research required developing and deploying autonomous systems and interconnecting them

Assistant Robots for Elderly People:
A basic assistant that can help with basic functions and remind about duties, medicines, etc., and accompany in short daily itineraries to promote active life

Automatic Basic Justice: an AI system that scores above usual justice systems for basic questions.
The system will be proposed as a first option to help in reducing the large load of professionals. It will also help to prepare the info-day the dispute goes ahead. The system could be also used to score the probes before requirements are started.

Tutor System at the Hospital: an AI system that supports patients and families indicating them the best options and offering a second opinion using the same info that doctors have.
The system will also raise alarms to doctors and families when no action is taken on due time.