SCIENCE FOR GLOBAL TRANSFORMATION
Preliminary Document – S20 Brasil 2024

Opening Remarks

The imminent G20 meeting in Brazil carries profound global significance, serving as a pivotal platform for major economies to collaborate on addressing critical economic and geopolitical challenges. Brazil's role as the host nation underscores its increasing influence in helping tackle critical global issues, making this gathering particularly noteworthy. The G20 forum facilitates open dialogue among world leaders, fostering cooperation on crucial issues such as trade, finance, sustainable development, education, and science, among others. The outcomes of this meeting can have far-reaching implications, influencing global economic stability and determining the trajectory of international relations.

In addition to its broader economic focus, the G20 meeting in Brazil is assured to play a crucial role in approaching the persistent challenges stemming from the COVID-19 pandemic and the effects of armed conflicts in the global society. As the world continues to grapple with the multifaceted impacts of the pandemic and still faces conflicts in different regions of the world, leaders should likely utilize this relevant group to coordinate efforts in vaccine distribution, economic recovery, strengthening of health systems, and the science and technology necessary to accomplish. The collaborative initiatives and policy decisions emerging from this meeting will play a central role in steering the course toward a more resilient and inclusive global recovery.

Furthermore, the G20 meeting in Brazil presents a vital opportunity to address urgent environmental issues and advance sustainable development. Brazil, as the country that covers great part of the Amazon, a critical global ecosystem, is expected to feature discussions on environmental conservation, biodiversity protection, and climate change mitigation prominently on the agenda. As the world faces escalating environmental challenges, the decisions made at this meeting could define the international community's commitment to environmental stewardship and set the stage for global efforts to combat climate change. Consequently, this G20 meeting has the potential to catalyze significant progress toward a more sustainable and resilient future for the entire planet.

“More than a motto, the slogan “Building a just world and a sustainable planet” expresses Brazil's commitment and desire to promote fair agreements that promote global economic and social development. It also highlights the Brazilian motto for this mandate: the reduction of hunger, poverty, and inequality worldwide, as well as socio-environmental development that includes a fair and inclusive ecological transition”[1].

The science engagement group of the G20 was only established in 2017, comprising 19 countries and a regional body: Argentina National Academy of Exact, Physical and Natural Sciences; Australian Academy of Science; Brazilian Academy of Sciences; Royal Society of Canada; Chinese Academy of Sciences; Académie des Sciences (France); German National Academy of Sciences Leopoldina; Indian National Science Academy; Indonesian Academy of Sciences; Accademia Nazionale dei Lincei (Italy); Science Council of Japan; Mexican Academy of Sciences; Russian Academy of Sciences; King Abdulaziz City for

[1] G20 Brasil 2024 – Slogan and Logo (https://www.g20.org/en/about-the-g20/slogan-and-logo).

Science and Technology (Saudi Arabia); Academy of Science of South Africa; Korean Academy of Science and Technology; Turkish Academy of Sciences; Royal Society (United Kingdom); and National Academy of Sciences (United States); and the European Union.

Previous S20 meetings were held in:

- Germany (2017): Improving Global Health: Tools and Strategies to Combat Chronic and Communicable Diseases.
- Argentina (2018): Food and Nutrition Security: Improving Soils and Increasing Productivity.
- Japan (2019): Threats to Marine Ecosystems and Conservation of the Marine Environment – with Special Attention to Climate Change and Marine Plastic Waste.
- Saudi Arabia (2020): Foresight: Science for Navigating Critical Transitions.
- Italy (2021): Pandemic Preparedness and the Role of Science. / Crises: Economy, Society, Law and Culture. Towards a Less Vulnerable Humankind.
- Indonesia (2022): Recover Together, Recover Stronger.
- India (2023): Disruptive Science for Innovation and Sustainable Change.

With the sense of challenge, the Brazilian Academy of Sciences (ABC) takes on the task of organizing the 8th edition of the Science20 (S20). After a turbulent period during which we faced a pandemic and speeches of distrust in science and democracy, we are glad to see Brazil back on the global scenario, seeking to work multilaterally with other countries to build solutions for common problems.

In September 2015, our countries approved a global agenda, to be achieved by 2030, aiming to free our people from the tyranny of poverty and protect the planet. Bold and transformative measures were outlined, with our governments committing to embrace them to steer the world towards a sustainable and resilient path. These actions are integrated and indivisible and must balance the three dimensions of sustainable development: the economic, social, and environmental. Also, this collective journey is anchored in the commitment that no one would be left behind. We are 7 years away from the established deadline and, with concern, we realize that we are far from the desired and agreed-upon 17 Sustainable Development Goals.

The precept of the Brazilian government for the G20 is "Building a Just World and a Sustainable Planet". The Brazilian Academy of Sciences, as organizer of the 2024 edition of the S20, defined "Science for Global Transformation" as its motto.

Several themes could be discussed under this broad perspective, thus the ABC decided to approach "Science for Global Transformation" in five different task forces:

1. Artificial Intelligence: ethics, social impact, regulation, and knowledge sharing.
2. Bioeconomy: pushing the world toward a sustainable planet.
3. Energy Transition Process: renewable energies, social and economic considerations.
4. Health Challenges: quality, equity, and access.
5. Social Justice: promoting inclusion, ending poverty, and reducing inequalities.

We also call attention that the G20 and consequently the S20 should take into consideration the differences among their countries regarding population demographics. They should be acutely aware of

the far-reaching implications that demographic trends have on various aspects of their societies and economies. G20 nations need to anticipate and adapt to changes in workforce size and age distribution, which will impact social security, pension systems, and welfare programs, and consequently their economic growth and competitiveness. The educational system should consider the needs for both aging and youthful populations. Also, aging of the population influences healthcare demands and expenditures.

Understanding demographic trends is crucial for anticipating technological needs and fostering innovation. Demographics influence the adoption and development of technologies, such as Artificial Intelligence, and should guide investments in research and development.

In summary, awareness of population demographics is fundamental for G20 countries to make informed decisions that shape the well-being of their citizens, drive economic prosperity, and contribute to global sustainable development.

The Brazilian Academy of Sciences is submitting this preliminary document with initial inputs on the five task forces. During our in-person March meeting in Rio de Janeiro, we would like to hear from each Academy their vision and propositions for further discussions within the S20.

ARTIFICIAL INTELLIGENCE: ETHICS, SOCIAL IMPACT, REGULATION, AND KNOWLEDGE SHARING
Task Force 1

Introduction

The progress of artificial intelligence (AI) technologies holds the potential to accelerate scientific advancements and research productivity. AI can empower scientists across diverse fields with these new tools. By integrating digital technologies and data science with disciplines such as physics, chemistry, biology, medicine, materials science, and engineering, the pace of scientific research can be significantly expedited, leading to valuable societal impacts. Although AI is being used in various sectors and phases of scientific research, its complete potential remains largely untapped. As developing nations strive to attain scientific and technological relevance, it is essential to prepare for these transformations by equipping the scientific community with skills and resources to work and develop artificial intelligence technologies. Additionally, it is vital for developing countries to collaborate as partners and active participants in constructing large scientific databases, mastering relevant methodologies and techniques within their respective fields of interest. Achieving this requires investments in infrastructure for data storage, communication, and world-class high-performance processing, as well as the training of qualified personnel capable of harnessing the power of AI technologies.

Artificial intelligence is a science and a powerful set of general-purpose technologies that offer opportunities to boost economic and social growth in developed and developing countries. AI is increasingly becoming an essential element in the research and innovation ecosystem, with the potential to drive discoveries, innovation, and economic growth in all areas of science and across all sectors of the economy and society. The adoption of digital technologies and data science across various sectors of society have resulted in the silent integration of AI. These technologies offer advantages, but also pose risks and tend to exacerbate economic inequality, disproportionately affecting certain communities over others.

AI and Sustainable Development Goals

The G20, together accounting for 85% of the world's GDP and two-thirds of its population, plays a pivotal role in shaping the global digital technology landscape. Since the establishment of the United Nations Sustainable Development Goals (SDGs) agenda, the G20 has sought to explore the use of digital technologies and innovation to advance the 2030 Agenda. The pervasive influence of AI extends across various sectors, including agriculture, biotechnology, education, engineering, humanities, environment, health, among others, which are important sectors for the SDG transformations. In the context of major global challenges, healthcare systems have become a central focus of the G20 in recent years. The COVID-19 pandemic has underscored the need for coordinated responses among countries and healthcare providers with respect to digital health. In the most recent years, the G20 meetings highlighted the importance of digital health and data modernization in strengthening healthcare systems, where AI is a technology capable of bringing about unimaginable changes. Its ability to analyze vast amounts of data, predict trends, and make forecasts can assist in disease identification, patient care, and efficient resource allocation, ultimately saving lives and reducing costs.

Building Capacity in Artificial Intelligence (AI)

AI education at all levels and research capacity need to be built to allow countries to develop their own solutions to their specific problems and to play their part in the international scientific and technological arena. Harnessing the range of opportunities offered by AI requires understanding and managing the associated benefits and risks. Therefore, effective investments in research, development, and innovation (RD&I) and in human resources development are necessary. These investments should pave the way for seeking solutions to countries' challenges, promoting responsible innovation, contributing to the public good, protecting people's rights and safety, and advancing democratic values.

Several approaches can support the development of talent within the country's educational system and promote a skilled workforce nurtured domestically. Human resources development should promote research and development with public and private investment, encourage collaboration between university researchers and private sector counterparts to foster innovation, and reassess the educational sector at its foundational levels. Educating and training young individuals – who can understand AI issues, exhibit critical thinking, create cutting-edge solutions, and prioritize domestic solutions – represent a fundamental challenge.

Artificial Intelligence in the Developing Countries

AI already plays a significant role in guiding decisions, be it in the private or in the public sector. The rapid advancement of AI technologies raises legitimate concerns, including the potential for mass unemployment that could disproportionately affect large portions of the workforce in developing countries, thereby exacerbating existing inequalities. The adoption of AI in public services requires a comprehensive and reflective assessment of the advancements. This evaluation should encompass not only the immediate costs and benefits but also the implications for democratic institutions and social cohesion. A positive impact would be achieved with the development of AI technology aimed at national issues while aligning with international needs and challenges. This impact should extend to various areas in the social and economic fields. In summary, it's also essential to address topics like: What are the main benefits of AI for society? How can AI be used as a lever for social inclusion? How can AI be used to build more efficient public services?

Developing nations cannot risk to remain solely consumers of AI solutions created abroad. Dependency on other countries and large corporations in this field can undermine national security, sovereignty, and the competitiveness of national companies both domestically and internationally. The lack of technical knowledge in AI will perpetuate growing dependence on major corporations and dominant technology countries. Governments should aim at building capacity to develop AI independently for sensitive systems, reducing their dependence on the private sector. This autonomy is essential for maintaining control over critical products and ensuring the preservation of ethical standards.

Ethical Concerns and Regulatory Measures

Despite potential benefits and opportunities, there is concrete evidence that AI technologies can cause harm to individuals, groups, societies, and the planet. Concerns include privacy violations, the creation of anti-competitive environments, behavior manipulation, and environmental disasters. AI algorithms already enable the identification and exploitation of vulnerabilities and biases, including cases of perpetuating racial issues and other forms of discrimination.

It's imperative to maintain a strong ethical foundation for the public sector's utilization of AI. As AI plays an increasingly significant role in decision-making, it's crucial to prevent its misuse in ways that undermine democracy or infringe upon human rights. It is crucial that ethical and social risk considerations guide the establishment of principles, rules, and legislation to minimize technology risks. Furthermore, it is essential that society participates in discussions about the limits of AI use. Different actors in society have expressed concerns about these technologies. Scientists are interested in protecting national development on par with international advancements, avoiding delays or limitations in scientific and technological progress, and providing equality in scientific and technological development and the generation of innovations and wealth.

Concluding Remarks

The formulation of ethical principles that prioritize the well-being of humankind and the planet health is crucial in the realm of AI. The development and deployment of AI should be aligned with fundamental values such as equity, responsibility, transparency, and safety. Promoting inclusivity and preventing biases, discrimination, and inequalities from infiltrating AI systems is of utmost importance. Furthermore, the discussion surrounding the need for effective controls and regulation on artificial intelligence is essential to mitigate potential risks. To address these concerns, the establishment of a global AI governance structure may be necessary. It should be designed to accommodate and respect cultural differences while bridging gaps between diverse national legal frameworks. By prioritizing ethical principles, promoting inclusive development, and engaging in constructive discussions on AI governance, we can foster an AI landscape that aligns with human values, safeguards against risks, and promotes the well-being of individuals and societies worldwide.

The sense of urgency regarding investments in AI and the formulation of public policies has emerged as a crucial priority worldwide, encompassing both developed and developing countries. There is a need to accelerate discussions on AI regulation worldwide, as this is of key importance for establishing international partnerships and collaborations in the field of AI. The primary challenge in crafting AI national regulation is to ensure that the rules and laws are fair, inclusive, and protect society and democracy while aiming to reduce inequality levels in the country. At the same time, they should not impede or halt the development of emerging technologies. This is a sensitive, dynamic challenge that should be discussed by various sectors of society. The emerging model for AI technologies in various countries shows that the development of AI depends on multiple factors, including the public policies that each country defines for its data, both public and private. The world has become data-driven, forming the foundation for the rapid growth of AI applications in all fields of knowledge, with extraordinary implications for productivity, competitiveness, and global trade.

The role of science in AI is pivotal for shaping the future trajectory of societies worldwide. Breakthroughs in machine learning, cloud infrastructure, and data processing and analytics have become crucial in this landscape, involving stakeholders from diverse sectors and playing a vital role in driving discoveries across all scientific areas. In the context of the G20, the Science20, through its members, can harness global conversations, together with other key multilateral organizations (such as the UN, OECD, and the World Economic Forum), about the governance of artificial intelligence technologies, the sharing of knowledge, the development of scientific tools, besides the discussions on ethics, privacy, and regulation.

BIOECONOMY: PUSHING THE WORLD TOWARD A SUSTAINABLE PLANET
Task Force 2

Introduction

The world is coming to a point of non-return in the XXI century concerning:

a) climate changes related to the effect of greenhouse gas emissions from fossil energy sources, burning and anaerobic fermentation of biomasses, methane from ruminants' digestion, and the use of soluble fertilizers rich in nitrogen.
b) the global economy, from the onset of the Industrial Revolution on, is settled mainly on natural finite resources.
c) ever-increasing consumption of industrial goods, which produces daily megatons of non-recyclables that cause an impact on human health and the environment, unbalancing soil health and aquifers.

The protection of the biodiversity has historically contrasted with an economic model based on the exploitation and extraction of natural resources, leading to the loss of substantial portions of different biomes. It seems that the current scenario of biome exploitation leads to severe losses in the biodiversity they harbor. It is in this scenario that researchers from various fields of knowledge are dedicated to discussing and modeling alternative forms of development that can combine these two tasks. These efforts appear to be coalescing around a concept that is still evolving: bioeconomy.

Science uniquely contributes to overcoming the world's challenges nowadays in different fields. Sequestration of CO2 into biomass is a viable alternative. However, to increase the stock of stable carbon (C), it is urgent to find ways and means to develop knowledge and technology for C sequestration into chemicals with a long half-life. Biomass production in the ongoing technological packages requires soil amendments and mineral sources to produce soluble macro and micronutrients.

The world has limited sources for industrial production of soluble phosphorus and potassium fertilizers. This opens an avenue for international cooperation to build scientific knowledge to unravel the role of soil microbiota on soil remineralizers (rock dust). In doing so, a more sustainable agrifood system spearheaded by the private sector shall occur. Crop diversification using the potential of plant biodiversity is linked to improved nutrition and tackling the effects of global warming on food and bioenergy production.

Human health, nutrition and livelihood are hurdles to overcome at the global scale. In less developed countries, poverty, lack of housing and jobs, associated with tropical diseases and malnutrition, impair the social and economic development of the nations, creating an unbalanced world. In the long term, all countries should work together, looking forward to healthy and stable economies and building peace and well-being for human society.

The living systems are the way to build up chemicals of a distinct nature for different purposes using direct or indirect solar energy. Furthermore, they can recycle a vast range of biomasses for industrial purposes/or environmental health, besides having a central role in the bioeconomics related to human, animal, and plant health.

Bioeconomy Concepts

A standard definition of bioeconomy is a crucial step for bioeconomy deployment within the G20 countries, building up partnerships essential in meeting the UN requirements aiming at a long-lasting sustainable, economic, and social development coupled with an ever-healthy environment.

Looking at the bioeconomy programs and related policies of the countries members of the G20, it is clear that the concept of bioeconomy varies depending on the region's technological, social, and economic development. To make this point, let us look at a few cases:

- The International Advisory Council on Global Bioeconomy (IACGB) defines bioeconomy as "the production, utilization, conservation, and regeneration of biological resources, including related knowledge, science, technology, and innovation, to provide sustainable solutions (information, products, processes and services) within and across all economic sectors and enable a transformation to a sustainable economy"[2].
- According to FAO, "bioeconomy is the production, utilization, conservation, and regeneration of biological resources, including related knowledge, science, technology, and innovation, to provide sustainable solutions (information, products, processes and services) within and across all economic sectors and enable a transformation to a sustainable economy"[3].
- The European Commission defines a bioeconomy as "the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy"[4]. The bioeconomy is meant to be sustainable, as it promotes the responsible production and consumption of goods without causing detriment to the natural environment.
- In the United States, bioeconomy can be defined as "the portion of the economy based on products, services, and processes derived from biological resources (e.g., plants and microorganisms). (…) Executive Order 14081 prescribes a "whole-of-government approach to advance biotechnology and biomanufacturing towards innovative solutions in health, climate change, energy, food security, agriculture, supply chain resilience, and national and economic security"[5].
- Germany defines bioeconomy as "the production, exploitation and use of biological resources, processes and systems to provide products, processes and services across all economic sectors within the framework of a future-oriented economy"[6].
- The Brazilian Center for Strategical Studies (CGEE) understands that bioeconomy is "the economy based on the production and consumption of goods and products made from biological resources. Modern bioeconomy emerges as a new paradigm of development needed to ensure the

[2] The International Advisory Council on Global Bioeconomy (IACGB) – What is Bioeconomy (https://www.iacgb.net/GLOBAL).

[3] Food and Agriculture Organization of the United Nations – Sustainable bioeconomy and FAO (https://www.fao.org/documents/card/en?details=cb7445en#:~:text=Bioeconomy%20is%20the%20production%2C%20utilization,enable%20a%20transformation%20to%20a).

[4] Publications Office of the European Union – Blue Bioeconomy Forum (https://op.europa.eu/en/publication-detail/-/publication/c8b2f69f-4314-11ea-b81b-01aa75ed71a1/language-en).

[5] Congressional Research Service – White House Initiative to Advance the Bioeconomy, E.O. 14081: In Brief (https://crs-reports.congress.gov/product/pdf/R/R47274).

[6] The Federal Government – National Bioeconomy Strategy (https://www.bioeconomy-international.de/lw_resource/datapool/_items/item_169/summary_bioeconomy_strategy.pdf).

sustainable development of life on Earth because it is based on renewable biological resources, the advancement of science and technology, the discovery of new materials and processes capable of regenerating nature and restoring the resilience of ecosystems"[7].

Bioeconomy is present today in the production of vaccines, industrial enzymes, fertilizers, biofuels, cosmetics, among many other examples. Furthermore, it should seek to value the role that local communities play in the conservation of territories, studying their traditional modes of production and resource management to find sustainable solutions for production chains in dialogue with science and technology.

In general, we can say that a bioeconomy model should aim to meet certain criteria:

1) Preserve and protect natural resources. The natural resources present in any biome are the result of long geoevolutionary processes that provide the foundations for more sustainable and inclusive production chains. Drastically interrupting these processes can lead to irreversible losses.
2) Adopt appropriate technologies. Using natural resources efficiently requires technologies for the main production bottlenecks without causing environmental harm. Importing technologies is not enough, as some of these solutions were developed for other contexts with different specificities and are not universal. Therefore, it is necessary to invest in local science and technology designed for local problems.
3) Respect local communities. Traditional communities possess profound knowledge about the environments and their natural resources, and their involvement is essential in building an inclusive and sustainable economy.

Based on the mentioned above, ABC proposes the following definition: bioeconomy is based on the production and commercialization of goods derived from renewable biological resources for the production of bio-based products, food, feed, and bioenergy, in compliance with the United Nations Sustainable Development Goals.

International Bioeconomy Strategies

- European Union: "The EU bioeconomy strategy envisions a transition towards a low-carbon, resource-efficient economy. It focuses on leveraging biomass, fostering research and innovation, and promoting sustainable production and consumption. Europe's strengths lie in its strong policy frameworks, robust research and development infrastructure, and collaborative networks. However, limitations include the need for improved coherence among diverse policy areas, scaling up bio-based industries, and addressing potential conflicts between food and non-food uses of biomass"[8].
- United States: "The US economy strategy emphasizes the economic potential of bio-based products, energy, and manufacturing. It aims to drive rural development, reduce dependence on fossil fuels, and promote environmental sustainability. The strengths of the U.S. strategy include its innovation-driven approach, strong private sector engagement, and abundant biomass

[7] The Brazilian Center for Strategical Studies (CGEE) – Bioeconomy in the Americas 2030 (https://www.cgee.org.br/documents/10195/734063/3445_Bioeconomy+in+the+Americas+-2030.pdf).
[8] Iluminem – Bioeconomy strategies in the Global South should not copy those of the Global North (https://illuminem.com/illuminemvoices/bioeconomy-strategies-in-the-global-south-should-not-copy-those-of-the-global-north).

resources. However, challenges stem from fragmented governance across states and inconsistent policy support"[8].

- China: "To promote the integration and innovation of biotechnology and information technology, as well as accelerate the development of biomedicine, biological breeding, biomaterials, bioenergy, and other industries to enhance the bioeconomy in scope and strength. Under the plan, the bioeconomy will become a key driving force to boost high-quality development by 2025"[9].
- Global South: "Bioeconomy strategies (…) must explicitly be anchored in a strong sustainability paradigm, combining alternative visions of the bioeconomy, alongside the bioresource vision; these include the biotechnology and bioecology visions. The former emphasizes the application of advanced biological technologies, including genetic engineering and synthetic biology, to develop innovative bio-based products, processes, and services for various sectors"[8].
- South Africa: "Envisaged outcomes within the next five years, and beyond, are to carve a niche for South Africa in the globally competitive pharmaceutical industry"[10].
- Brazil**:** Brazil is leading food and feed production in the tropics based on the continuous investment in science and technology within the national institutes, the universities, and the Brazilian Agricultural Research Corporation (Embrapa). Since the beginning of 1970, Brazil has developed industrial expertise in bioethanol production, followed by biodiesel production, expanding its circular bioeconomy, and linking energy generation with food and feed production.

Perspectives on Bioeconomy

- Fostering bioeconomy innovations in biogenic raw materials is crucial to transitioning from fossil energy to a biological way of "harvesting the sun" to produce bioenergy.
- Investment in new sources of food, energy, chemicals, and medicines derived from plants and microorganisms from native biodiversity in different biomes will create a more sustainable bioindustry.
- Research, development, and innovation in the agrifood system worldwide aiming at new inputs, such as biofertilizers, biological control, plant protection, and post-harvesting, will have a tremendous impact on local economies, generation of new jobs, and the health of the population and the environment.
- Health bioeconomy has enormous challenges in providing good health conditions for the world population at an accessible cost. To achieve this goal, basic scientific research, technology, and innovation in different areas are mandatory.
- Strategic investment in the perspective of a more sustainable bioeconomy will reduce the pressure on land for food, feed, and energy production.

In a recent meeting in Poland (6-8 November 2023), the Environmental Biotechnology Division of the European Federation of Biotechnology invited scientists from academia and industry to discuss the

[9] The State Council The People's Republic of China – Bioeconomy prominent on growth agenda (https://english.www.gov.cn/policies/policywatch/202205/11/content_WS627b169ec6d02e533532a879.html).
[10] Republic of South Africa Department Science and Technology – The Bio-Economy Strategy (https://www.gov.za/sites/default/files/gcis_document/201409/bioeconomy-strategya.pdf).

"Green Deal Biotechnology" focusing on circular bioeconomy, stating seven significant challenges related to the Green and Blue Bioeconomy[11]:

- Recovery of resources, including rare resources and novel bio-based value chains
- Healthy soil and food security
- Bioelectrochemistry for energy and water recovery
- Wastewater treatment
- Nanotechnology in environmental biotechnology
- Marine biotechnology
- Emerging micropollutants in aquatic and terrestrial environments

Final Remarks

The Amazon bioeconomy, together with the bioeconomy from other biomes around the world, should aim to address the challenges of intersectional inequalities and poverty in the regions, aiming to sustainability that implies the protection of the biodiversity, diversification of production, and equitable benefit sharing. There is still a path to other innovations that can indeed combine environmental conservation, respect for cultural diversity, and prosperity.

By revealing mechanisms of interaction among living beings in various biomes, pathways are opened to develop bioproducts and technologies that increase plant tolerance to pests, diseases, flooding, etc. Detailing interactions among living beings also allows for identifying the vocation of each biome and the strategies that should be adopted to maximize production, including replacing chemical fertilizers and pesticides.

The G20 should create a consensus on the role of bioeconomy as one of the strategies for tackling the world's challenges in this century concerning global warming, poverty, and human and animal health.

Research, innovation, and dissemination of knowledge in bioeconomy among the key stakeholders are critical steps in the ongoing transition from the actual industrial development model to a more sustainable model meeting the UN Sustainable Development Goals.

[11] Environmental Biotechnology Division of the European Federation of Biotechnology – Green Deal Biotechnology (https://www.efbiotechnology.org/green_deal/).

ENERGY TRANSITION PROCESS: RENEWABLE ENERGIES, SOCIAL AND ECONOMIC CONSIDERATIONS
Task Force 3

Introduction

Goal 7 of the Sustainable Development Goals (SDGs) points the need to "ensure access to affordable, reliable, sustainable and modern energy for all"[12]. The energy transition is essential for achieving this goal, being a crucial shift in how we generate and consume energy, driven by the global imperative to combat climate change, address resource depletion, and enhance energy security. At its core, the energy transition involves departing from fossil energy sources, including oil, coal, and natural gas, and adopting renewable energy sources to establish a more sustainable and resilient future. This transition not only promises to reduce our environmental impact but also carries significant social and economic implications.

Although the results of COP28 were below the expected outcome, countries made a commitment to triple renewable energy capacity and double energy efficiency by 2030, moving away from fossil fuels in energy systems. Renewable energy, encompassing sources like solar, wind, and hydropower, represents a beacon of hope in our pursuit of a sustainable energy future. Unlike finite fossil fuels that contribute substantially to greenhouse gas emissions, renewable energy sources are characterized by their abundance and reduced environmental impact during electricity generation.

The increasing utilization of hydrogen, biofuels, and ocean energy introduces a new perspective to the renewable energy landscape. Hydrogen, with its versatility and clean energy potential, can be produced through various methods, including electrolysis or by reforming natural gas with carbon capture and storage. Its significance lies in its capacity to efficiently store and transport energy, making it invaluable for mitigating the intermittency of renewable sources like wind and solar power. Hydrogen also holds great potential for decarbonizing sectors like transportation and heavy industry. In industries such as steel manufacturing, hydrogen can replace carbon-intensive processes, resulting in substantial reductions in greenhouse gas emissions. Biofuels, derived from organic materials like crops, algae, and waste biomass, provide a renewable and low-carbon alternative to fossil fuels. They can be used in existing internal combustion engines and play a crucial role in reducing emissions in the transportation sector. Ethanol and biodiesel, for example, are already widely used and embraced as means to decrease the carbon footprint of the transportation sector.

Ocean energy sources, including tidal, wave, and ocean thermal energy, harness the power of the world's oceans to generate electricity. These sources have the advantage of being highly predictable, as ocean tides and waves follow natural patterns. Unlike wave and tidal energies, the ocean thermal energy is reasonably constant. Notably, ocean energy offers high energy density, contributing significantly to the renewable energy mix. Additionally, ocean energy projects can be integrated with other coastal infrastructure, such as desalination plants, providing a more comprehensive approach to sustainable development.

[12] United Nations – Goal 7 of the Sustainable Development Goals (SDGs) (https://sdgs.un.org/goals/goal7#targets_and_indicators)

Perspectives on Energy Transition

Incorporating hydrogen, biofuels, and ocean energy into the energy transition is essential for diversifying the energy mix and achieving a more sustainable and resilient future. These technologies complement traditional renewable sources like solar and wind power, offering solutions for energy storage, transportation, and baseload power generation. Moreover, the energy transition can foster energy independence. Renewable energy sources are more evenly distributed across the globe compared to fossil fuels, which are often concentrated in specific regions. This decentralization of energy production helps reduce dependence on a few energy-exporting countries, enhancing energy security and reducing geopolitical tensions.

An important economic benefit of the energy transition is job creation. The renewable energy sector has emerged as a significant source of employment opportunities, spanning from the manufacturing and installation of renewable energy systems to their ongoing maintenance and research and development. These opportunities extend beyond highly industrialized nations, contributing to local economies and fostering growth in regions that need it the most.

The transition to renewable energy sources also drives technological advancements. As governments and businesses invest in research and development, innovations in energy storage, efficiency, and grid management become more prevalent. These technological breakthroughs not only benefit the energy sector but also have far-reaching impacts on various industries and society.

Social considerations are paramount in the energy transition. It is crucial to ensure that everyone has access to clean and affordable energy, addressing the persisting issue of energy poverty in many parts of the world. The transition offers an opportunity to rectify this imbalance and uplift people from poverty. Community engagement is another crucial dimension of the transition. Renewable energy projects often take place at the local level, providing communities with the chance to be actively involved and empowered. Community-owned renewable energy projects enable residents to have a stake in their energy production, share the benefits, and take control of their energy future.

A fair transition is critical in the energy transition process. As we move away from fossil fuels, it is essential to consider the well-being of workers in the fossil fuel industry. An unbiassed transition involves providing support, retraining, and alternative employment opportunities for those affected by the decline of fossil fuel industries, ensuring that the transition is equitable for all. Environmental justice is a central issue in the energy transition. Vulnerable communities have historically borne the brunt of pollution and environmental degradation associated with fossil fuel production. The transition to renewable energy can help rectify these injustices by reducing pollution and protecting marginalized communities.

The renewable energy sector has the potential to stimulate economic growth. Direct job creation is just one facet of this growth, as the industry also stimulates demand for materials, equipment, and services. Furthermore, the increasing affordability of renewable energy technologies contribute to augmenting the financial resources available to individuals and businesses by means of decreased energy expenditures, thereby fostering economic expansion.

Likewise, the energy transition reduces the economy's vulnerability to price volatility and supply chain risks associated with fossil fuels. By diversifying the energy mix, economic resilience can be enhanced reducing the impact of global energy market fluctuations. The intermittency of certain renewable energy sources, such as wind and solar power, depends on weather conditions, which can be unpredictable. This presents several opportunities for the development of new technologies in energy storage and grid infrastructure to guarantee a consistent energy supply.

Political and regulatory obstacles need to be addressed to avoid hindering the energy transition. Some governments may resist change due to vested interests in the fossil fuel industry or a lack of understanding of the benefits of renewables. Overcoming these obstacles requires strong political will and the development of supportive regulatory frameworks.

Social acceptance is another hurdle. While many communities embrace renewable energy projects, others may resist them due to concerns about aesthetics, noise, or perceived impacts on property values. Public education and stakeholder engagement are essential to address these concerns and gain community support.

Challenges

"Coal still supplies just over a third of global electricity generation even though it is the most carbon-intensive fossil fuel. While coal is being gradually replaced in most countries for power generation, it will continue to play a crucial role in iron and steel production until newer technologies are available. (...) To have a place as a cleaner energy source in the decades to come, governments and the coal industry need to develop and deploy less polluting and more efficient technologies, including but not limited to carbon capture, utilization, and storage"[13].

Brazil brings back for discussion some points already raised during previous S20 editions, especially in India, in order to speed up the process of energy transition. S20 needs to undertake a coordinated, concerted effort to provide sufficient resources for scientific breakthroughs to catalyze exponential energy technologies.

Intermittent renewable energy generation technologies, such as solar and wind, is most dependent on efficient storage, so energy storage technologies like batteries and green hydrogen need to be further developed and have their costs reduced, so that solar and wind generation can be made dispatchable.

Final Remarks

Bioenergy, ocean energies (tidal, wave, and thermal), hydrogen, solar energy, wind energy, biomass, and other potential sources of renewable energy are mandatory fields of research and technological development to promote energy transition. This process is driven by the need to address climate change, enhance energy security, create economic opportunities, and promote social and environmental justice. While challenges exist, the benefits of the energy transition far outweigh the obstacles, offering us a pathway to a sustainable and resilient future. This transition is not just a necessity; it is an opportunity for a better world for all.

[13] International Energy Agency – Coal (https://www.iea.org/energy-system/fossil-fuels/coal).

HEALTH CHALLENGES: QUALITY, EQUITY, AND ACCESS
Task Force 4

Introduction

Goal 3 of the Sustainable Development Goals (SDGs) outlines targets aimed at ensuring healthy lives and well-being for all, across all age groups, and target 3.8 specifically calls for countries to "achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all"[14]. The achievement of universal health coverage with an emphasis on equity, community involvement, and participation holds the potential to drive improvements in various aspects of health, spanning mental health, chronic disease management, maternal and child health, and child development.

Furthermore, SDG 10 emphasizes the significance of reducing inequalities and leaving no one behind in the pursuit of sustainable development. This underscores the critical need to address global health inequality, particularly in terms of sharing resources and technologies to combat health crises while fostering international solidarity. A robust health system relies on effective communication strategies to disseminate health information, conduct health campaigns, and counter disinformation. These strategies should embrace a "whole-of-society" and "whole-of-government" approach, encouraging international collaboration, strengthening global capacity building, and engaging communities and healthcare professionals at the forefront, such as community health agents, as key contributors to raising awareness and sharing knowledge with the population.

It is important to consider that, to achieve quality, equity, and access in health, challenges related to other dimensions of health, such as food security, housing, clean water and sanitation, and most of the SDGs, must be faced.

Data Science and Precision Medicine in Health and Surveillance

The evolving understanding of the complex interactions of genetic, environmental, and behavioral mechanisms in disease raises questions about the need for the development of personalized markers for risk stratification that can be used to recognize individuals at various risk levels for developing disorders, as well as approaches in disease prevention and treatment. On the other hand, precision medicine has as its principle the collection, processing, storage, and sharing of a large set of data obtained from patients, normal individuals, the environment, microorganisms, and others. This large set of data should induce a better knowledge of the biological processes involved in diseases, which may eventually lead to the development of more efficient therapies aimed at specific disease mechanisms. Precision medicine presents an ambitious task of understanding and applying knowledge about individual variability in genes, environment, and lifestyle. Furthermore, it has an enormous challenge in making the discoveries and applications accessible to all, aiming at the treatment and prevention of diseases. Precision medicine also includes genomic vigilance for infectious diseases, thus contributing to preparedness for future pandemics. Precision medicine relies heavily on Open Science and Big Data (large health information databases and prospective cohorts).

[14] United Nations – Goal 3 of the Sustainable Development Goals (SDGs), Targets and Indicators (https://sdgs.un.org/goals/goal3#targets_and_indicators).

Digital health transformation is crucial for supporting strong universal health systems. Three issues are of utmost importance: (i) incorporate telemedicine to expand healthcare to remote and hard-to-reach areas; (ii) improve the collection and use of data to support better epidemiological and sanitary surveillance and response, health system planning, and performance evaluation; and (iii) promote data integration, so that death and birth registries, inpatient and outpatient records, and routine examination data are integrated (for example, through the use of a national ID number). In addition, linking administrative health data and social data from various information systems (such as on education, social protection, work, housing) allows the construction of large databases, adding value to population health studies with large sample size. Big data is a powerful tool to investigate social inequalities (including access to health services), identify vulnerable groups, and assess the impact of policies and programs. Efforts must also support the integration of molecular and epidemiological surveillance to better enable health systems to promptly detect and respond to the emergence, reemergence, and persistence of pathogens, as well as to antimicrobial (antibiotics, antiseptics, and antifungals) and antivirus resistance.

Gender and Health

Gender plays a significant role in health outcomes and experiences. Understanding the intersection of gender and health is essential for developing effective healthcare strategies, promoting equity, and ensuring that healthcare systems meet the diverse needs of individuals of all genders. Biological, social, and cultural factors contribute to differences in gender health.

Women have specific needs beyond their reproductive cycle, with disparities on risks of diseases/infections across the entire life course. In many countries, women are most of the health workforce, responsible for childcare, for assisting the elderly and sick people at a familial and societal level. Emerging and persistent infectious diseases such as Zika virus have substantial impact on the adverse pregnancy outcomes. Sexual and reproductive health services were greatly affected during the COVID-19 pandemic, including contraception, abortion, prenatal care, and childbirth.

Historically, medical research has not always included adequate representation of genders, leading to gaps in understanding health issues specific to each group. Achieving gender´s health equity should be a main goal of public health systems and policies.

Bridging the Gap in Mental Health

Evidence indicates that around 5% of the working-age population grapples with severe mental health conditions, while an additional 15% are affected by more common mental disorders. Furthermore, it is estimated that one in two individuals will experience mental ill-health at some point in their lives, impacting their employment prospects, productivity, and wages. The direct and indirect costs associated with mental ill-health can exceed 4% of the GDP. The pandemic has further exacerbated the burden of mental disorders, necessitating policy changes to address this emerging challenge.

Epidemiological data reveal a high prevalence of mental disorders globally, particularly affecting vulnerable groups such as women, migrants, those with low literacy, individuals in low social classes, unskilled workers, the unemployed, people living in deteriorated urban areas, those exposed to violence, and the socially excluded. Notably, social inequalities and violence play a significant role as determinants

of poor mental health. Moreover, modern western culture, marked by competitive environments, social inequality, and loneliness, is contributing to the rising rates of mental disorders, including depression. Periods of isolation, social withdrawal, and the economic impacts resulting from health crises are expected to increase the prevalence of mental disorders and depression, particularly in low-income countries. By 2050, approximately two-thirds of the world's population will reside in large urban centers. The combination of frequent floods, landslides, heatwaves, and climate threats, coupled with the growth of impoverished social conditions, can foster a pervasive sense of insecurity, especially among the young and elderly living in urban areas.

Approximately half of adults with a mental illness developed the condition before the age of 15, emphasizing the importance of early identification and treatment to reduce costs and disease burdens. The pooled adolescent suicide rate has risen worldwide and was the fourth leading cause of death among 15-29-year-olds globally in 2019 (WHO). Bullying involvement in any form can adversely affect young people's social adjustment and result in lasting mental health consequences, underscoring the need to strengthen ties between the educational and health systems and develop preventive interventions in schools to reduce violence and prevent substance abuse. Social media has transformed the way information is created and consumed, with implications for contemporary culture.

Furthermore, a substantial portion of individuals with mental health conditions, including treatable disorders like depression and anxiety, lacks access to adequate mental health care. Epidemiological studies in Brazil estimate that the access gap for mental health services exceeds 50% for adults and adolescents. Individuals with mental illness often experience physical health problems that can lead to increased mortality, poorer health outcomes, and higher costs for the healthcare system. Notably, individuals with severe mental illnesses, such as acute depression, bipolar disorder, and schizophrenia, die, on average, 20 years earlier than the general population. Digital psychiatry, through the use of technology, such as apps, telemedicine, and other digital tools, can enhance mental health services and support, offering improved accessibility, personalized care, patient engagement, better communication, and increased efficiency.

Strategies to address the mental health challenges, which was made worse by the pandemic, should include: (i) to invest in prevention programs at elementary and middle schools; (ii) to adopt evidence based psychosocial interventions to keep an adequate environment for the development of children and adolescents; (iii) to target socially vulnerable populations and discriminated social groups; and training primary care teams to solve common mental health problems, needs based assessments and long-term support for the management of older patients in their own homes; (iv) to invest in technology developments such as telemedicine, mobile apps, and web-based algorithms to promote coordinated care; (v) to scale up remote and brief protocols of cognitive behavioral therapy, interpersonal therapy and psychoeducation for preventing and treating common mental health problems.

Investing more in primary care is one cost-effective way of treating mild-to-moderate mental disorders. Primary care practitioners are already expected to diagnose, treat, and manage these types of disorders and are often the first port-of-call. However, in many cases, primary care providers lack the resources, time, and expertise to care for mild-to-moderate mental illness effectively. In addition, ending stigma and discrimination in mental health should be a priority. Despite the large burden that mental ill-health

imposes on people and on economies, many countries continue to neglect mental health care, and the unmet need for treatment remains high. Making mental health care policy a priority would enhance people's well-being and have significant social and economic benefits.

Climate change, food and water security, and health

According to the WHO, "climate change is impacting health in a myriad of ways, including by leading to death and illness from increasingly frequent extreme weather events, such as heatwaves, storms and floods, the disruption of food systems, increases in zoonoses and food-, water- and vector-borne diseases, and mental health issues. Furthermore, climate change is undermining many of the social determinants for good health, such as livelihoods, equality and access to health care and social support structures. These climate-sensitive health risks are disproportionately felt by the most vulnerable and disadvantaged, including women, children, ethnic minorities, poor communities, migrants or displaced persons, older populations, and those with underlying health conditions"[15].

Climate change, loss of biodiversity, and pollution have a direct and indirect impact on human health and the sustainability of societies worldwide. To address the global crisis of climate change, biodiversity loss, and pollution for a sustainable future, we urgently need transformative interventions in institutions, governance, and social systems at all levels, from local to global. Investigating the interplay between socio-economic factors and environmental hazards, including climate change, should be a top priority.

Historically, environmental changes, including climate change, occurred gradually over millions of years, shaping humanity's stable relationships with their environments and food production. However, since the industrial revolution, this balance has been disrupted, giving rise to a new environmental era known as the Anthropocene. This period is characterized by rapid population growth, pollution in various forms (water, land, air), and increased greenhouse gas emissions, especially carbon dioxide, leading to significant temperature anomalies. These environmental changes directly impact food and water security and, in turn, human health. Extreme weather events caused by climate change reduce agricultural productivity, leading to higher food prices, particularly in economically disadvantaged countries, exacerbating food insecurity. It is crucial to acknowledge the neglect of populations highly dependent on their local environments for sustenance. Climate change also affects the quality and availability of water, a critical resource for food production and human health.

Climate change has far-reaching effects on zoonotic diseases and arboviruses. As global temperatures rise and weather patterns become increasingly unpredictable, these changes create favorable conditions for the expansion and altered distribution of disease vectors, such as mosquitoes and ticks. This expansion, in turn, heightens the risk of transmission of zoonotic diseases, like Lyme disease, West Nile virus, and Zika virus, to humans. Additionally, climate-related shifts in habitat and migration patterns of wildlife can bring humans into closer contact with animal reservoirs of diseases, facilitating spillover events. The warming climate can also extend the transmission seasons for arboviruses, making outbreaks more frequent and severe. These trends underscore the urgency of addressing climate change as a critical factor

[15] World Health Organization – Climate Change (https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health).

in mitigating the risks associated with zoonotic diseases and arboviruses and highlight the need for proactive strategies in public health and environmental management.

In summary, climate change, food and water security, and health form a critical triad that must be carefully managed to ensure a good quality of life worldwide. Neglecting the robust scientific information on environmental protection puts present and future generations at risk.

Communicable and Non-Communicable Diseases

Infectious diseases, also referred to as communicable diseases (CD), arise from microorganisms like bacteria, viruses, parasites, and fungi that can spread from person to person, either directly or indirectly. Some are transmitted through insect bites, while others result from consuming contaminated food or water, like some types of hepatitis. Also, sexually transmitted infections (STIs) like HIV and viral hepatitis spread through exposure to infectious bodily fluids such as blood, vaginal secretions, and semen are considered as CDs.

Among the CDs, we need to consider the group of Neglected Tropical Diseases (NTDs), that correspond to a set of 20 infectious conditions that affect the poorest populations, predominantly in tropical and subtropical regions[16]. NTDs account for around 11% of the global disease burden, affecting more than 1 billion people worldwide. Many neglected tropical diseases result from unsafe water, inadequate housing conditions, and poor sanitation in the region. Over the last decade, the number of people requiring interventions against NTDs has decreased by 25%, with an 80 million decrease between 2020 and 2021 alone. The burden of disease, measured in disability-adjusted life years, is steadily decreasing. It is most relevant to acknowledge this achievement as preconized by the "Ending the neglect to attain the Sustainable Development Goals: a road map for neglected tropical diseases 2021-2030"[17].

Collaboration Strategies for an Inclusive and Equitable Shared Future:

- Adoption of whole-of-society and whole-of-government approaches, enabling strong international collaboration, global capacity building and engaging communities and community health agents as protagonists in sensitizing and sharing knowledge with the population.
- Strengthen networks and foster collaboration between research groups among countries and regions.
- Reinforce global surveillance capacity, open science and information sharing for early detection of health emergencies and public health events of international concern.
- Technology transfer for collaborative development of priority health technologies.
- Invest in research for low-cost treatments for communicable and non-communicable diseases.
- Invest and share in research for AI in health.

[16] Hotez PJ, Aksoy S, Brindley PJ, Kamhawi S (2020) World neglected tropical diseases day. PLoS Negl Trop Dis 14(1): e0007999. https://doi.org/10.1371/journal.pntd.0007999.

[17] World Health Organization – Ending NTDs: together towards 2030 (https://www.who.int/teams/control-of-neglected-tropical-diseases/ending-ntds-together-towards-2030).

SOCIAL JUSTICE: PROMOTING INCLUSION, ENDING POVERTY, AND REDUCING INEQUALITIES
Task Force 5

Introduction

Scientific development plays a pivotal role in promoting human and social well-being. The history of recent centuries reveals how humanity has benefited from the advancement in scientific knowledge, enabling significant transformations in people's lives and society. Major technological innovations have led to remarkable progresses in food production, energy generation, transportation, communication, the development of vaccines, the cure of diseases, and various others are examples of achievements that represent significant milestones in the civilizational process. Lives have been saved, life expectancy has grown remarkably, resources have multiplied, providing well-being and comfort.

Science provides an important way to understand the world, which can inform policy and personal decisions, improve human and ecological health and well-being, and promote knowledge and innovation. Technology and innovation are essential for economic development and social progress. Together, they expand the potential of knowledge. Their advancement should normatively and empirically enhance the well-being of society. Nevertheless, they can also be potential instruments of disasters and injustices. The existential risks faced by humanity are evidence of this latent ambiguity. The climate crisis, concerns about the uncontrolled advancement of AI, pandemics, and nuclear threats are dramatic illustrations of the inherent ambiguity of science and technology as sources of progress, but also of their complete negation. The ambiguous duality of science and technology manifests in the patterns of distribution of socially produced goods. The advancement of knowledge and production techniques contributes to the spread of the appropriation and use of resources that can increase well-being but can also lead to the appropriation of resources and privileges that exacerbate social inequalities within and between countries. New strategies and mechanisms are necessary to ensure that the products of science and technology reach society in a more equal, fast, and effective manner.

However, despite extraordinary progress, the world continues to be afflicted by glaring social disparities that, in many ways, even widen. Poverty remains a scourge that afflicts vast segments of the global population. This reality is marked by large human contingents facing food deprivation, lacking shelter, devoid of medical care, and deprived of access to clean water and basic sanitation.

When we investigate the roots of this problem, we understand that the core issue is not resource scarcity but rather its unequal distribution. In this context, while some of humanity struggles to satisfy their hunger, another segment suffers from obesity. Even more bewildering, some of the resource-poor population becomes obese because, lacking education and vulnerable to irresponsible advertising, they consume processed foods that lead to weight gain and health problems. If it is true that the extremely unequal distribution of resources is grave enough to create such disparate living conditions, the problem will worsen even more if sustainable use of natural resources is not respected, as scientific analyses of the problem anticipate.

Among the Sustainable Development Goals set by the United Nations, the elimination of poverty in all its forms is the first listed. As emphasized by the UN, "each country must implement appropriate measures, actions, and strategies to ensure sustenance for all and reduce the exposure and vulnerability of the

poorest classes." Eradicating hunger, promoting health and well-being, ensuring access to clean water and sanitation, besides quality education, are some of the crucial conditions for achieving this goal.

Although poverty and inequality can be distinct, as evidenced by the fact that it is possible to reduce poverty without reducing inequality, there is no doubt that the world we live in offers a reality in which poverty and inequality are deeply intertwined. Since the French Revolution, equality has emerged as a modern ideal opposed to the hierarchy of the feudal world. By demystifying the illusion that people are naturally born different and destined to be noble or commoners due to their family origin, the modern world legitimized the ideal of equality. However, we know that this ideal has been vehemently denied in practice. In recent decades, although the gap between the poorest and richest countries may have narrowed, social inequalities persist internally and, in many cases, expand. Thus, this ideal moves further away as a significant part of the planet witnesses the widening disparity in terms of income, education, and access to goods.

Social inequality, characterized by the unjust distribution of resources and opportunities among various social strata, such as income, education, health, and employment, deprives large segments of the population of their well-being. Reducing internal and external disparities, a fundamental condition for social inclusion, is the path to be pursued, regardless of age, gender, disability, race, ethnicity, origin, faith, or economic status.

Perspectives on the Role of Social Sciences and the Humanities

The purpose of science is to generate knowledge and make discoveries that enhance social and human wellbeing, thereby fostering the reduction of social inequalities. It is crucial for scientific advancements to be pursued with ethical considerations and a consciousness of their consequences. All branches of science are inherently social; nevertheless, social sciences and the humanities play a key role. Some examples are discussed below.

- The digitalization of economies and societies is an ongoing global phenomenon that carries significant implications that can benefit from insights from the social sciences and humanities. These issues include the impact of digital transformation on employment and the necessary skills that should be provided by the quality education, in order to develop effective strategies and policies. It is necessary to explore how access to technology, digital skills, and digital resources can either exacerbate or alleviate existing disparities. Addressing these issues can help in formulating inclusive and equitable approaches to digital development. By actively engaging with these topics and leveraging insights from the social sciences and humanities, countries can effectively navigate the complexities of digital transformation and contribute to inclusive and sustainable digital development on a global scale.
- It is imperative to conduct studies that thoroughly investigate the nature and extent of the problem of science-related disinformation, understand its varied impacts, and identify effective measures to curb its dissemination. The detrimental effects of disinformation on digital media have had a profound impact on society. Building national and global strategies to combat disinformation needs the involvement of science and the scientific community, besides an active participation from civil society. The dissemination of false information concerning scientific matters can lead to adverse consequences, as it was the case on the alleged efficacy of

hydroxychloroquine and ivermectin for the treatment of COVID-19. The G20 countries are well-positioned to foster collaborations in global initiatives focused on combating disinformation in health and science.

- Scientific literacy plays a crucial role in enabling all individuals to comprehend and engage with future scientific endeavors. In order to tackle the complexities of sustainable development, it is essential for governments and citizens alike to grasp the language of science and cultivate scientific literacy. Today's challenges surpass the confines of traditional disciplines and encompass a wide range of scientific domains, spanning research, knowledge advancement, and their practical implementation. By fostering scientific literacy, we can create an environment where everyone is equipped to understand and actively participate in addressing the multifaceted challenges of our time.
- Social sciences and humanities are most relevant to help achieve the 17 Sustainable Development Goals (SDGs), which requires coordinated efforts from governments, civil society, businesses, universities, and other sectors. The collaboration between science and society can lead to: (1) promoting education, social equality, and fair treatment for all genders and sexual orientations; (2) focusing on health, well-being, and achieving demographic balance; (3) transitioning to sustainable energy and industry practices to reduce carbon emissions; (4) ensuring sustainability in food production, land use, water management, and ocean health; (5) developing sustainable cities and communities that are inclusive and resilient; and (6) harnessing the digital revolution for sustainable development. By working together, these transformations can pave the way for achieving the SDGs outlined in the 2030 Agenda.

Final Remarks

The members of the G20, representing the world's 20 largest economies, play a central role in the fight against poverty and social inequalities. Implementing programs aimed at eradicating hunger, expanding education, and providing housing and sanitation access is an ethical and moral imperative. Initiatives such as basic income and direct resource transfers quickly impact the nutrition and health of large portions of the population. The revision of tax structures must also be considered essential in this process. The adoption of progressive taxes on higher incomes, as well as wealth taxation, are crucial measures to promote social justice. Policies for racial and social inclusion, gender equity, and combating all forms of discrimination are equally crucial for building a fairer society.

It is also important to remember that reducing inequality, in addition to being an ethical imperative, is a decisive condition for enriching the human resources available for the advancement of society. Last, but not least, social justice constitutes a powerful antidote in the fight against violence, intolerance, and the crystallization of significant social divides that weaken trust levels and degrees of solidarity that constitute the social fabric of life. Social inclusion, poverty eradication, and the reduction of inequalities are vital resources for collective life. In this sense, science in all its specialties, honoring the social value that legitimizes it, has a valuable tool in the production and dissemination of knowledge to fulfill its role.