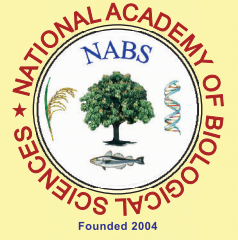




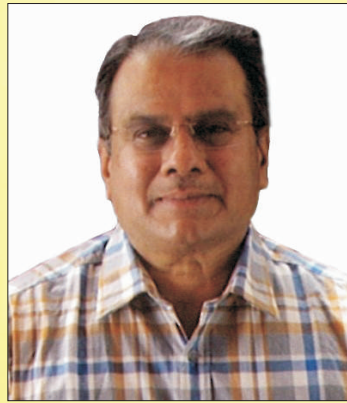
Prof. S. Kannaiyan Memorial Oration



on

**The 2030 Agenda: The Role of Quality Life
Science Education and Research in Achieving
Sustainability in Environment & Agriculture**

delivered by



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*During inaugural function of
13th NABS-National Conference*

**“Current Perspectives for Sustainable Development
in Life Sciences, Environment and Agriculture”**

held at

Periyar University, Salem, Tamil Nadu
on 23rd January, 2023



The 2030 Agenda: The Role of Quality Life Science Education and Research in Achieving Sustainability in Environment & Agriculture

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Abstract

Indian Higher Education Institutes (HEI's) play a specific role in achieving the Sustainable Development Goals (SDGs). A number of SDGs address topics that have been focal points for Indian HEI's and research Institutes throughout their history of research, teaching and societal mission. Furthermore, HEI's traditionally have strong links to stakeholders central to the transformative process, such as the food sector, forestry and renewable energies. However, HEI's and the university system will have to undergo transformations if they want to contribute to a profound shift in societies. Cutting Edge areas of research that are inter-and trans-disciplinary in nature like climate change, bio-economy, soil microbiomes, microbial source tracking and novel materials for bioenergy will have to be mainstreamed in to post-graduate and research programmes of Indian HEI's. Such scientific progress for societal transformation can only be achieved by profound shift in the universities in terms of cognitive, normative and regulative institutional changes. At present, prevailing criteria for excellence, modes of publication and academic career pathways can be an obstacle for innovative research towards achieving the SDGs because they primarily focus on (high level) publications disregarding engagement in other fields of action. To turn universities into living labs for a sustainable future, they will have to define new rules and regulations for scientific work that will allow them to transform their captivation with competition towards cooperative working attitudes. Global cooperation could serve as a unifying message in the 2030 Agenda and would offer an overarching rationale for the normative concept of the SDGs.

Key Words: Sustainable Development Goals (SDGs), Life Sciences, Biodiversity Conservation, Bio-economy, Climate Change and Societal Transformation.

1. Introduction

Environmental change drives social transformations. Societies are and will increasingly be profoundly affected by processes such as climate change, biodiversity loss, freshwater scarcity, waste mismanagement, land degradation and urban air pollution. At the same time, social transformations drive environmental change, both negatively, through unsustainable production and consumption

patterns, and positively, through inclusive and sustainable lifestyles, technologies and social practices thus achieving "Anthyodaya".

Indian HEI's respond to these social transformation challenges by contributing to the development and enhancement of sustainability science, which is

- Science about sustainability, to understand how complex physical, biological and social systems function, and
- Science for sustainability, to support sustainable policies and positive social transformations.

Indian HEIs must contribute to develop sustainability science as a new kind of science by providing interdisciplinary knowledge-based input to tackle environmental challenges must come from Universities. in Indian HEI's must be the drivers of this change and ensure quality inter-disciplinary and trans-disciplinary programmes and research as mandated in the NEP, 2020.

2. 2030 Agenda for Sustainable Development (2030 Agenda)

UN General Assembly adopted the 2030 Agenda for Sustainable Development (2030 Agenda) to set the world on a path of transformation towards a fair and sustainable society that leaves no one behind (UN 2015). The 17 Sustainable Development Goals (SDGs: Annexure-01) stated in the 2030 Agenda are universal, integrated and indivisible. This creates three challenges for implementation: The complexity challenge arises from the encompassing nature of the 2030 Agenda. This raises issues of internal coherence, interdependencies and interactions between individual goals and targets. The indivisibility challenge arises from the complexity of the SDGs and the postulate of the 2030 Agenda to address and reach all goals. The interlinked structure of the 17 goals through their targets avoids silo approaches and "cherry-picking" of selected goals by individual actor groups at the expense of other goals (Gratzer and Winiwarter 2018). The transformation challenge emerges from the combination of the first two challenges, which result in the need for a deep and universal societal change towards fairness and sustainability (WBGU 2017).

3. The role of Life Science Teaching and Research in Indian HEI'S in achieving Sustainable Development Goals.

Indian HEI's and research organizations can be broadly classified as:

1. Those dealing with technology and applied sciences (engineering, mining, manufacturing, etc.), which today are mostly Universities of Technology.
2. Those addressing the research, extension and scientific management of land-use and primary production (agriculture and food production, forestry, genetic and water resources management, often

also fisheries and veterinary sciences,)), which today are mostly Discipline Specific Universities where the focus is Life Sciences and its applications.

Worldwide, such HEI's are focusing on primary production, local environment and health which have research stations, and conduct field experiments in their own vicinity, thus having strong ties to their regions. This regional core gives them added leverage in SDG implementation. While many Indian HEI's currently focus on biotechnology, bio-engineering, agricultural productivity, their identity and their perception is still that of discipline specific Institutions and not that of trans-disciplinary organizations that are required profound societal transformation through SDG's. The SDGs pose a challenge to all Indian HEI's, but they can take a specific role for the following reasons:

1. A number of SDGs directly or indirectly address the water-food-energy nexus, which have been focal for Indian HEI's throughout their history in research, teaching and societal mission.
2. Indian HEI's traditionally have strong linkages to producers, government authorities, interest groups, etc. . . across many industries central for a transformation, such as the food sector, forestry and renewable energy production. Therefore, they can readily involve themselves into implementing the SDGs.
3. Given their traditional focus on "mission-mode" research (e. g., increasing agricultural yields, regulating water resources, vaccines, pollution management, new energy materials), Indian HEI's have taken on and continue to pursue integrative approaches, for example, by complementing perspectives from natural and technical disciplines with those of the social sciences (rural sociology, forest policy, water governance, . . .). They can thus offer expertise in integrating knowledge from natural, technical and social sciences to provide solutions for many of the global challenges posed by sustainable development.

4. Thematic Challenges for Life Science Research for Sustainability:

Poverty and food production: Concepts of sustainable agriculture that aim at reaching the SDGs will have to explicitly address equity and equitable land and resource distribution (SDGs 10 and 5) to avoid trade-offs between intensification of production and poverty (by, e.g., providing access to land and agricultural technology for the rural poor). Further trade-offs exist between intensification and long-term ecological consequences (e.g., soil degradation, biodiversity losses and eutrophication. Future sustainable agricultural and food systems will have to operate within ecological boundaries (e. g., improving/maintaining soil fertility, safeguarding sustainable nitrogen and phosphorus cycles, reducing greenhouse gas emissions and water use, maintaining agro-biodiversity on managed land, reduce pesticide problems) and will have to adhere to economic and social sustainability principles. Such integrated concepts will have to combine sustainability strategies in agriculture/land use with sustainable consumption patterns for sustainable livelihood security in India.

Climate Change: SDG13 acknowledges that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change. Indian HEI's have both the competences and the obligation to provide research on climate change effects (Kromp-Kolb et al., 2014). but also on the development of adaption and mitigation measures (e. g., by afforestation and their potential of sequester and store significant amounts of carbon, by reduction of land use change, reduction of food waste and meat consumption) (Smith et al., 2013, Muller et al., 2017). They can also analyze the consequences in an integrated and systemic way in context with the ecological, economic and social dimensions and indicators of sustainability.

Bio-economy: Bio-economy is the "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" (European Commission 2012). Indian HEI's must offer a comprehensive framework to critically reflect on sustainable intensification and bio-economic strategies, particularly on the pitfalls of increasing inequality and poverty through unequal access to technologies and resources and negligence of regional values added.

Soil-ecology: Soil biodiversity (underground biodiversity) multiple gaps of knowledge limit our capacity to protect soil biodiversity and function and to further reduce current uncertainty in soil biodiversity. First, understanding prokaryotic functional diversity is highly challenging, as 85 out of the currently established 118 phyla have not had a single species described to date (Overmann et al., 2019). This issue needs to be addressed by gathering meaningful taxonomic and functional information for both dominant and not-yet cultured prokaryotes. Targeted culturing efforts are needed to further identify new taxa and link them to sequencing data. Identifying those locations of the planet wherein unknown taxa are most likely to exist could also help in this fundamental endeavor (Delgado-Baquerizo, 2019). A recent assessment showed numerous gaps in soil biodiversity knowledge globally (Guerra et al., 2020), which should be covered with joint efforts and capacity building in the Indian HEI's to ensure sustainability.

New Materials: As we look to transportation options that further improve energy efficiency and safety and move us beyond the current fossil fuel paradigm, fore-front materials research and life science paradigm shift is needed in Indian HEI's to incorporate the following in teaching and research:

- Improving combustion efficiencies
- Biomaterials for Fuel cells
- Microbial Hydrogen Production and 2G/ 3G Biofuel production.

Advancing our science and technology in Indian HEI's, from fundamental breakthroughs in materials and life sciences to improving manufacturing processes, is critical to our energy future and to establishing new businesses that drive economic prosperity and societal transformation.

Environmental justice: Equal rights to services, resources and opportunities, policy coherence and integration, gender equality, equitable benefit sharing, and inclusive decision making are mentioned as dimensions of SDG 16. The work of Indian HEI's in areas as diverse as spatial planning, hydrology, soil research and agro-economy as well as biotechnology and breeding is rife with potential issues of environmental (in-) justice. Themes include the question if and how patents on life forms should be possible, and what kinds of benefit-sharing models could be developed, but also how participatory planning can be implemented, for example, when it comes to delineating nature reserves. Integrated river basin management, especially in cross-border cases between nations of different economic power is another field where trade-offs between SDG10 and 15 can be expected and need to be addressed in research. While Indian HEI's do not focus on legal training, almost all fields in which they operate (land use related issues, introduction of new technologies in food production, spatial planning, etc.) have a legal dimension, which needs to be systematically integrated as an SDG issue in research and training.

5. Creating a Platform for Sustainable Development Goals through life science Research and Education at Indian HEI's.

Indian HEI's can take concrete steps towards reaching the SDGs in four fields of action: 1. Provide education for sustainable development; 2. conduct research in fields relevant to the 2030 Agenda; 3. drive and support political and societal transformation; 4. transform their own institutions in order to align with sustainability goals.

Provide education for sustainable development: Indian Graduates and Post-Graduates require particular capabilities, skills and values to facilitate social change (Wiek et al., 2016). When graduates will need to break boundaries between disciplinary knowledge pools and cultures as well as between theory and practice, their learning for sustainability must be dynamic in concept and content and will have to advocate the value of diversity and diverse viewpoints (Wals and Benavot, 2017). Indian HEI's will have to accept the responsibility to create learning opportunities for students to develop critical thinking, cooperative work, innovation and communication.

Conduct research to identify concepts, strategies and measures to support the implementation of the Sustainable Development Goals: The complexity of the SDGs calls for inter- and trans-disciplinarity in research and development Research for sustainable development in general and 2030 Agenda in particular needs systems-oriented approaches and approaches drawing on impartial knowledge pools

that seriously attempt to integrate different scientific approaches (Holm and Winiwarter, 2017). A stronger integration of social sciences into these research processes allows an implementation-oriented synthesis of knowledge as mandated in NEP, 2020.

6. Structural Challenges for Indian HEI's in implementing Life Science based Trans-disciplinary Education and Research

Lack of reflection and discourse on new technologies: Many new developments such as in bio- or nanotechnology are discussed controversially in society. Yet it is difficult, if not impossible, for Indian HEI's to define a common standpoint that would be accepted across all departments. As a consequence, an open debate is often avoided. However, the development of integrated pathways towards achieving the SDGs will only work, if universities create spaces for reflection and discourse.

Implied hierarchies of disciplines: While most Indian HEI's claim to integrate different disciplines, in reality; for example, when it comes to distribution of resources, there is often an implied superiority of "hard" natural and technical sciences over "soft" social sciences. Differentiation between disciplines regarding performance indicators is lacking. Interdisciplinary co-operation is jeopardized by unequal status.

Regionally relevant knowledge vs. globalized scientific research: The role of Indian HEI's to contribute to sustainable development in their regional environment is limited or even counteracted by current trends in academic performance indicators. Highly relevant knowledge for regional contexts might not be relevant on a global scale and thus cannot be published in international high impact journals. Engagement with local communities is usually not valued as highly as publication numbers and conventional bibliometrics.

7. CONCLUSION

To be able to contribute to a transformation, that is, as has to be emphasized, a profound shift of society, universities and the university system will also have to transform in terms of cognitive, normative and regulative institutional changes. At present, prevailing criteria for excellence, modes of publication and academic career pathways can be an obstacle for innovative research towards achieving the SDGs because they primarily focus on (high level) publications disregarding engagement in other fields of action. To turn universities into living labs for a sustainable future, they will have to define new rules and regulations for scientific work that will allow them to transform their captivation with competition towards cooperative working attitudes. Global cooperation could serve as a unifying message in the 2030 Agenda and would offer an overarching rationale for the normative concept of the SDGs. Cooperation and competition are seen as two separate guiding principles and modes of operation

within and between universities. Developing a nexus between them and strengthening the cooperation principles necessary to enable Universities to fulfil the claims of the 2030 Agenda will be required.

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ANNEXURE 01 : LIST OF SUSTAINABLE GOALS

GOAL 1: No Poverty

GOAL 2: Zero Hunger

GOAL 3: Good Health and Well-being

GOAL 4: Quality Education

GOAL 5: Gender Equality

GOAL 6: Clean Water and Sanitation

GOAL 7: Affordable and Clean Energy

GOAL 8: Decent Work and Economic Growth

GOAL 9: Industry, Innovation and Infrastructure

GOAL 10: Reduced Inequality

GOAL 11: Sustainable Cities and Communities

GOAL 12: Responsible Consumption and Production

GOAL 13: Climate Action

GOAL 14: Life Below Water

GOAL 15: Life on Land

GOAL 16: Peace and Justice Strong Institutions

GOAL 17: Partnerships to achieve the Goal



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