

Opportunities for future research and innovation on food and nutrition security and agriculture – a global perspective from the InterAcademy Partnership

Analysis and synthesis by IAP based on the four regional academy network studies

Summary

All countries face the problem of combatting malnutrition in its various forms: undernutrition and micronutrient deficiencies as well as overweight and obesity. The scale and nature of these problems of course differ across countries and their populations. Latest data from the United Nations indicate worrying trends in global food and nutrition security that must be tackled. Science has the potential to find sustainable solutions for national and global food systems relating to the complex interplay of issues spanning health, nutrition, agriculture, climate change, ecology and human behaviour.

Project Design and Purpose

With this report the Academies of Sciences are expressing their concern about adverse tendencies in food, nutrition and agriculture, and identify science-based initiatives that could contribute to solutions. Academies of science have a substantial history of interest and achievement in these areas. The Academies also took note of important other food and agriculture strategy and assessment papers (summarized in an Appendix). The present work by the InterAcademy Partnership (IAP), the global network of science academies, brings together established regional networks of academies, forming a new collaboration to ensure that the voice of science is heard in addressing societal priorities. The added value aimed for with this academies' programme is to bring the science power of academies to focus on the protracted food, nutrition and agriculture issues. This seems increasingly called for as basic science – well represented in academies - becomes more and more relevant and integrated with applied problem-solving science in nutrition, food and agriculture. Another contribution is the emphasis on food systems and in that context a significant emphasis on health of people and the environment.

The first phase of the IAP project on “Food and Nutrition Security and Agriculture” was designed to comprise four parallel regional academy network working groups (in Africa, Asia, the Americas and Europe) each consisting of experts from across the region, drawing on excellent science, and proceeding from a common starting point represented by an agreed IAP template of principal themes. Reports from these four regional groups were published in late 2017 - early 2018. In the second phase of the IAP project reported here, the focus is on the global level. Outputs from the four regional assessments, together with global analyses were used as resources to generate the present, fifth report.

Framing

Our global focus derives from three key perspectives:

- (i) Science to strengthen and safeguard international public goods, i.e. those goods and services that have to be provided on a scale that is beyond countries and can be achieved better collectively, and we emphasise the generation and use of key elements of science and its exchange as an international public good;
- (ii) International environmental and institutional risks and their transmission in an uncertain and rapidly-connected world, as well as opportunities and risks of innovations and technologies, again, from a science perspective;
- (iii) The Sustainable Development Goals (SDGs), which provide a critically important policy framework for understanding and meeting the challenges. However, they require fresh engagement by science to resolve the complexities of evidence-based policies and programmes, as well as resolving potential conflicts among goals.

We define the desired outcome for food and nutrition security as access for all to a healthy and affordable diet that is environmentally sustainable and culturally acceptable. The major global challenges for delivering food and nutrition security are compounded by the pressures of a growing population, urbanisation, climate change and other environmental change, economic inequality and market instability, as well as political disruptions and social injustices.

A coherent strategy to tackle the challenges must encompass both supply-side and demand-side elements. We take the integrative food systems approach to include all the steps involved in the food value chain, from growing and agronomics through to processing, transporting, trading, purchasing and consuming. We examine issues for resource efficiency, environmental sustainability, resilience and the public health agenda, while also taking account of the local-global interconnectedness of systems.

In considering the triple burden of malnutrition (undernutrition, micronutrient deficiencies and overweight with obesity), we explore a wide range of scientific opportunities. We evaluate how the current scientific evidence base can shape public understanding of the challenges, serve as a resource for innovation and inform policy options, and what the research agenda should be to fill current knowledge gaps. Capitalising on scientific opportunities is something that should pervade public policy widely; it is not just a matter for those funding and prioritising the research agenda and it should involve all of the stakeholders along the value chain.

Broad Recommendations

1. We highlight throughout this report the importance of internationally supporting and sharing basic and applied research for improved food, nutrition and agriculture. Specifically, the report calls for more coordinated action on priority themes of international relevance among different research funders.



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2. Translation of research to innovation requires stronger connections across disciplines and with cutting edge technologies, linkage to science education, training and outreach. Social science and policy research on food, nutrition and agriculture on the one hand, is challenged to enter in deep cooperation with life sciences and basic research on the other hand, and vice versa.
3. Upgrading scientific infrastructure is vital, as is sustained funding support for research, but it is also important to engender more collaboration between countries, to share scientific expertise and facilities and help build capacity in emerging economies. New trans-regional research efforts are warranted, accompanied by commitment to trans-regional engagement between the scientific and policy communities on the SDGs, climate objectives, and cognate matters.

Recommendations for international scientific priorities

1. Developing sustainable food and nutrition systems, taking a systems perspective to deliver health and well-being, linked to transformation towards the circular economy and bioeconomy. The research agenda includes: understanding drivers of efficiency and risk worldwide; clarifying issues for fair and rules-based trade and equitable and resilient markets; exploring emerging post-harvesting opportunities in food science, technology and engineering, e.g. for food safety and food processing and reduction of food losses and waste.
2. Emphasising transformation to a healthy diet and good nutrition. How is it constituted? How is it measured? How is it delivered? The research agenda includes: exploring how to influence consumer behavioural change and private sector actions for healthy food choices; assessing implications for diet and nutrition across the life span; understanding health co-benefits of climate change mitigation; studying mechanisms for the associations between diet-gut microbiome-disease.
3. Understanding food production and utilisation issues, covering considerations of efficiency, sustainability, climate risks and diversity of resources. The research agenda for primary production includes: evaluating impacts of climate change on food systems and natural resources; assessing new farming structures and technologies; characterising options for neglected and new food and feed sources, and for food from the oceans/aquaculture and for diversified food systems in response to regional and cultural differences.
4. Capitalising on opportunities coming within range in the biosciences and other rapidly advancing sciences. Choices should be made at the national and regional levels but based on global sharing of evidence. The research agenda includes: improving crop protection from abiotic and biotic stress; promoting animal health and feed conversion efficiency; clarifying how technology can augment precision agriculture e.g. using sensors to collect and monitor agronomic information.
5. Addressing the food-energy-nutrients-water-health nexus, recognising that boundaries are blurred. The research agenda includes: developing scenarios for balancing objectives and improving ability to analyse risk and opportunity in trade-offs



between different ecosystem services, such as related to water and land use systems; assessing critical competition, bioeconomy and circular economy issues for food-energy interdependencies; improving the evidence base for cost-effective soil management and for assessment of transboundary air pollution and diseases.

6. Promoting activity at the science-policy interfaces and reconciling policy disconnects. Addressing the scientific themes in the priorities listed in preceding items will help to inform a wide range of policy actions and, in turn, requires policy support to facilitate scientific endeavour. Research policy support in international food, nutrition, and agriculture is needed across multiple dimensions, for example to reform international trade frameworks to avoid trade conflicts, generate robust but flexible and proportionate regulation of emerging technologies, agree international standards in food safety, and to coordinate initiatives for the circular economy and bioeconomy. It is also vital that the scientific community engages with the users of research and the public-at-large, including involving them in strategic decisions about planning research.
7. Consolidating and coordinating international science advisory mechanisms. The work required to initiate and maintain a coherent policy framework necessitates attention be given to constituting an International Panel for Food and Nutrition Security and Agriculture, thereby serving to strengthen science strategies and support for research in these fields of vital importance for the world population and support international governance mechanisms and policy with evidence.

Actions to be taken by academies

IAP encourages and supports its academies and their regional networks in progressing the priorities listed in the preceding items. In these regards, key academy responsibilities should include:

- (i) International advisory roles – supporting existing strategic collaborations such as G7 and G20 and participating in the proposed International Panel on Food and Nutrition Security and Agriculture.
- (ii) Academy science policy advisory capacity-development – by sharing knowledge and expertise within the regional academy networks.
- (iii) Monitoring progress in science and innovation – at national, regional and global levels, including helping to clarify issues for cutting edge research, technologies and innovation. Thus, IAP will revisit the issue addressed in this report in coming years to assess progress and needs for adjustment.
- (iv) Science and technology capacity-building – within the broader community, at national, regional and global levels, including contributing to enhancing collaboration and building critical mass.



Outlook

IAP sees the need to be more ambitious in identifying the scientific opportunities for sustainable and healthy diets. Agriculture and food systems are vital for achieving most of the 17 SDGs, including the goals of ending hunger and extreme poverty by 2030. There is need to catalyse and coordinate new commitment to research and innovation, and to mobilise those resources in engagement between the scientific community, policy makers and other stakeholders. Global and local sustainability of nutrient availabilities and utilization and water are at risk under climate change and economic and political disruptions. Achieving healthy populations requires national actions supported by new international approaches to food systems' improved functioning. These are to be increasingly science and knowledge based, as addressed in this report.