INTERNATIONAL FOUNDATION FOR SCIENCE

IFS STRATEGY ANNEX 5

Thematic Research Areas

CONTEXT

The global challenges for humankind in the next decades are staggering. With accelerating climate change and continued population growth at a rate of about 1% per annum, the social, economic and ecological challenges will be massive. Poverty, economic inequality, environmental degradation, dwindling water resources, need for employment opportunities, and land and water issues will prevail and may be accentuated by resulting conflicts, making worse injustices and threats against democracy and food security. In particular, the challenges are great in Sub-Saharan Africa, which is expected to double its population by 2050 from today's 1.3 billion.

On one hand, some positive development cannot be denied, such as the more-than-halved extreme poverty since 2000. On the other hand, some statistics for absolute numbers of people in food security and conflict migration have turned to negative more recently, and evidence of climate change shows that societal transformation needs to increase in pace. In this direction, the UN Sustainable Development Goals (SDGs) of the 2030 Agenda are a unique effort with global commitment. It is also a toolbox for understanding the how social, economic and ecological processes need to interlink in human and global development.

At the same time as increasing complexity of challenges and societal transformations are realised in the policy sphere, there are also trends for crude simplifications and even "alternative truths" by more short-sighted special interests and increasingly isolating echo-chambers in social media.

In this last aspect, especially in Low- and Lower-Middle-Income Countries (LLMICs), the need to catch up with human resources and national ownership in the evidence base for how to prioritise development and transformation is much needed. Along with other regional and international organisations committed to increasing investment in science, technology and innovation (STI) to ensure a sustainable planet, IFS is contributing to the understanding and resolving of national and global problems by enhancing the science capacity of early career scientists in LLMICs.

IFS'S FOCUS

Although higher education has expanded in the regions, especially in Africa, research capacity and science literacy remain weak. Any scientific literature analysis reveals that scientists in the north and in multilateral institutions still dominate the research agenda for development in "the south".

Most early career scientists in LLMICs have no research funding. A lack of critical mass of researchers in certain fields in certain countries can result in researchers feeling isolated. Unsurprisingly, many leave their home countries in search of better professional and personal opportunities to undertake research. This weakens the possibility of LLMIC researchers influencing the setting of global research agendas related to poverty and hunger reduction. If able to conduct research in their home environments and institutions, early career researchers in LLMICs are better able to assess the value and validity of research and innovation initiatives that focus on developing solutions. The slow and inefficient recruitment of young and experienced researchers may also impede the transformation of LLMIC universities with siloed research agendas into institutions ready to meet multidisciplinary research challenges.

There are many examples where research has been put into use by the early career scientists that IFS has supported since its inception. With comparatively small levels of funding from IFS, these researchers have made modest but innovative contributions to addressing national and global problems. IFS's experience shows that enhancing the research capacity of promising early career scientists helps them engage in and contribute to research on local and regional aspects of global challenges. Beyond the awarding of individual research grants to early career scientists, IFS also provides access to mentoring and contacts within international scientific networks.

APPLYING FOR AN IFS GRANT

IFS welcomes applications from early career researchers in the natural and social sciences. Applications can be discipline-oriented as well as multidisciplinary or interdisciplinary in character. We support original research proposals that are innovative and/or relevant to local or national development needs and problems, and that aim to generate fundamental and/or applicable scientific knowledge. Proposals may be submitted within the three thematic research areas of:

- Biological Resources in Terrestrial Systems
- Water and Aquatic Resources, and
- Food Security, Dietary Diversity and Healthy Livelihoods

THE RESEARCH CLUSTERS

The three thematic research areas are arranged to facilitate the applicant's identification of an appropriate framework for their submissions. Since many topical areas within the three areas are overlapping, research topics that integrate or cut across them are also welcomed and encouraged. The proposed research may only address a specific component of a particular research theme but awareness of its interconnections with other themes can help position the research within a broader perspective and provide a deeper contextual understanding for the study.

Before applying for funding under one or more of these three research areas, applicants should familiarise themselves with the descriptions and rationales, as outlined below, so as to identify the most appropriate area(s) for their research proposal.

Although the research areas and their activities are given certain boundaries, they are circumscribed by the overarching and broader context of climate change which is of urgent and global concern. As well the research area activities have a primary objective to provide knowledge and suggest its application in support of the realisation of sustainable development locally, regionally and globally in line with the SDGs.

BIOLOGICAL RESOURCES IN TERRESTRIAL SYSTEMS

This includes (but is not limited to) research on:

BIODIVERSITY: Biodiversity in managed land-and water-use systems and innovations to increase biodiversity in land-use management and in forest and landscape restoration as well as in sustainable intensification in agriculture and aquaculture. Links between rural development and livelihoods and biodiversity in managed systems and surrounding landscapes. Links between urban demands, scalable value chains and biodiversity in rural food and biomass production. Dynamics for, and adaptation to, climate effects on biodiversity.

FORESTRY: Innovative approaches to use forest management to promote rural development in tropical forest areas and to combat poverty driving deforestation. This could include improved tenure security, economic incentives, synergies or trade-offs with improved livestock management and agriculture, innovative management practices especially for climate adaptation, forest policy development, biometrics and mensuration, biotechnology, role of changing disturbance, terrestrial ecology, community ecology, forestry economics, ecosystem services, soil, silviculture, wood science and wood-based energy.

ANIMAL PRODUCTION: The role of livestock economies in changing rural societies, links between changes in practice and family economy and gender. Promotion of sustainable livestock production systems and efforts to eradicate and prevent the spread of animal diseases, including those that can be transmitted to humans (zoonoses). More efficient livestock management in relation to spatial distribution of land-use. How livestock contribute to more inclusive market economy for smallholders. The interaction between livestock production and forest composition, land rights and climate change. How the consciousness and knowledge of the impact of animal production on climate change can be enhanced and lead to changes in the composition of animal rearing and their management and changes in local and global nutrition and diets.

CROP SCIENCE: A broad area that can include sustainable agronomy, economics of agricultural change, gender in agriculture, eco-physiology, crop diversity, genetics, plant biotechnology, plant-microbe interactions, plant pests, soil fertility and plant nutrition, measures to reduce post-harvest and other food losses and waste throughout the food supply chain, crop water use and soil water balance, crop quality, and soil contamination by

heavy metals and organic pollutants. How changes in crop composition and spread of crops to existing or new land areas or territories impact on climate change. How the choice of crops and their management can, through mitigation or adaptation, help build resilience to climate change.

UNDERUTILISED SPECIES: Plants that are under-researched but are seen to have valuable uses locally and whose wider utilisation could prove to be beneficial in terms of nutrition, income earning and in relation to climate change. A special feature is the many uses of products for human consumption that are part of indigenous and local food cultures. Other species might be used for food, nutrition, fuel, fibres and fodder, for example. Threats and challenges from dominance of few crops.

NATURAL PRODUCTS: The isolation, identification, characterisation and synthesis of compounds from living organisms with potential for nutritional, medicinal, biological, industrial and pest control applications.

RENEWABLE ENERGY: Biomass fuels (directly from trees and crops, or processed into fuel alcohol or biogas, for example), wind, solar (photovoltaic, heating and cooling), hydro power, wave power and geothermal energy; physical, social and economic opportunities and obstacles in the transformation from fossil to alternative fuels which can impact positively on climate change.

CLIMATE CHANGE will impact on all other sectors; causes of climate change and its impact on, and possibilities to adaption for social, economic and ecosystem across sectors and geographical areas; understanding of, and impact of, the different aspects of climate variability such as temperature, rainfall patterns, and ocean acidification will be important for the identification of initiatives in direction of climate adaptation and mitigation.

WATER AND AQUATIC RESOURCES

This includes (but is not limited to) research on:

AVAILABILITY OF WATER RESOURCES, AND THEIR CONSERVATION AND USE: For example, improving the existing availability and supply of water in rivers, lakes, reservoirs, aquifers and for households through improved ways of water harvesting; wastewater treatment; groundwater banking control, issues relating to pollutants; understanding land use changes; understanding and predicting the frequencies and consequences of severe weather (floods and droughts); impact on the hydrological regime due to global climatic, demographic and economic changes**;** understanding the multiple uses of water, i.e. determinants of water use in the agricultural, domestic, commercial, public and institutional sectors; promotion of more efficient water use; optimizing the economic return for water used, for example, by developing improved crop varieties for use in dryland, rainfed and irrigated agriculture.

ISSUES ASSOCIATED WITH WATER-RELATED INSTITUTIONS: Roles and responsibilities of water institutions, how water policy and legislation is developed and how rights to water are monitored and enforced, for example, developing legal regimes that promote groundwater

management and best use of surface water and groundwater, improving equity in water management legislation, developing new methods for estimating the value of non-market attributes of water resources and exploring the use of economic institutions to protect public policies and cultural values related to water resources.

FRESHWATER, BRACKISH AND MARINE AQUATIC ORGANISMS AND THEIR ENVIRONMENTS: For example, understanding the behaviour of aquatic organisms and ecosystems; promoting, enhancing and supporting more sustainable management of aquatic resources in marine, brackish and freshwater environments; and providing livelihoods for coastal and freshwater riparian communities and their trading partners through sustainable fisheries and aquaculture

FOOD SECURITY, DIETARY DIVERSITY AND HEALTHY LIVELIHOODS

This includes (but is not limited to) research on:

How AGRICULTURAL AND/OR LIVESTOCK PRODUCTION can contribute to rural development in a diversified and sustainable manner, economically, socially and with concern for the environment, biodiversity and climate change.

How to promote and enhance FOOD SECURITY for households and individuals by addressing issues such as food production, nutrition, cultural factors linked to food consumption, food safety and hygiene, and various factors that affect the access to food such as land tenure, sharing of food, work opportunities, price variation/volatility, credit and other financial services; food security both in rural and urban settings, as well as linkages between rural and urban areas in the quest for enhancing food security; issues, processes and/or factors that may contribute to sustaining food security for household and individuals over time.

PRIMARY HEALTH CARE and its role in promoting links among food, nutrition and health.

The role of EXTENSION SERVICES to help improve the conditions through spread and uptake of new techniques and crops to increase productivity and at the same time take account of the need for climate adaptation and mitigation; analyses of various training and education initiatives of smallholders, men and women; and public, private or farmer field schools, as examples.

Enhancement of IRRIGATION through construction of dams or various types of water sources including reuse of treated wastewater and water, and harvesting and storage; organization of irrigation schemes to secure sustainability in terms of both access to water and cooperation among participant farmers, households and irrigation agencies. Take account of how irrigation systems, their direct and indirect effect, relate to climate change and how design and organisation of irrigation schemes can address this.

SUSTAINABLE AGRICULTURAL PRACTICES, rural infrastructure and storage, reduction of post-harvest losses and waste of food in the food supply chain. How west products from agriculture (and livestock rearing) can be used as alternative energy sources that do not

impact negatively on the climate

MARKETS AND TRADING SYSTEMS, including strengthening of urban-rural linkages, traditional seed supply systems, developing appropriate agricultural cooperatives, and the role of public and private investment in sustainable agriculture. Raise consciousness and identify strategies/solutions as to how trading routes/systems can be shortened so that transport, both in terms of cost, energy and climate impact, can be minimized.

FOOD VALUE CHAINS, from research to production, storage, packing transport and marketing; whose interests assert the most influence and control along the value chain? How can participants in value chains enhance their food security in sustainable ways without impacting negatively on the climate.

VULNERABILITY AND RESILIENCE of agricultural systems and adaptation to climate variability.