Food Systems Transformation:

Imperative of Strengthening Science-Policy – Society Interfaces

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Urgency of Food Systems Transformation

The Role of Science in Food Systems Transformation

Experiences and Lessons

Strengthening Science-Policy-Society Interfaces

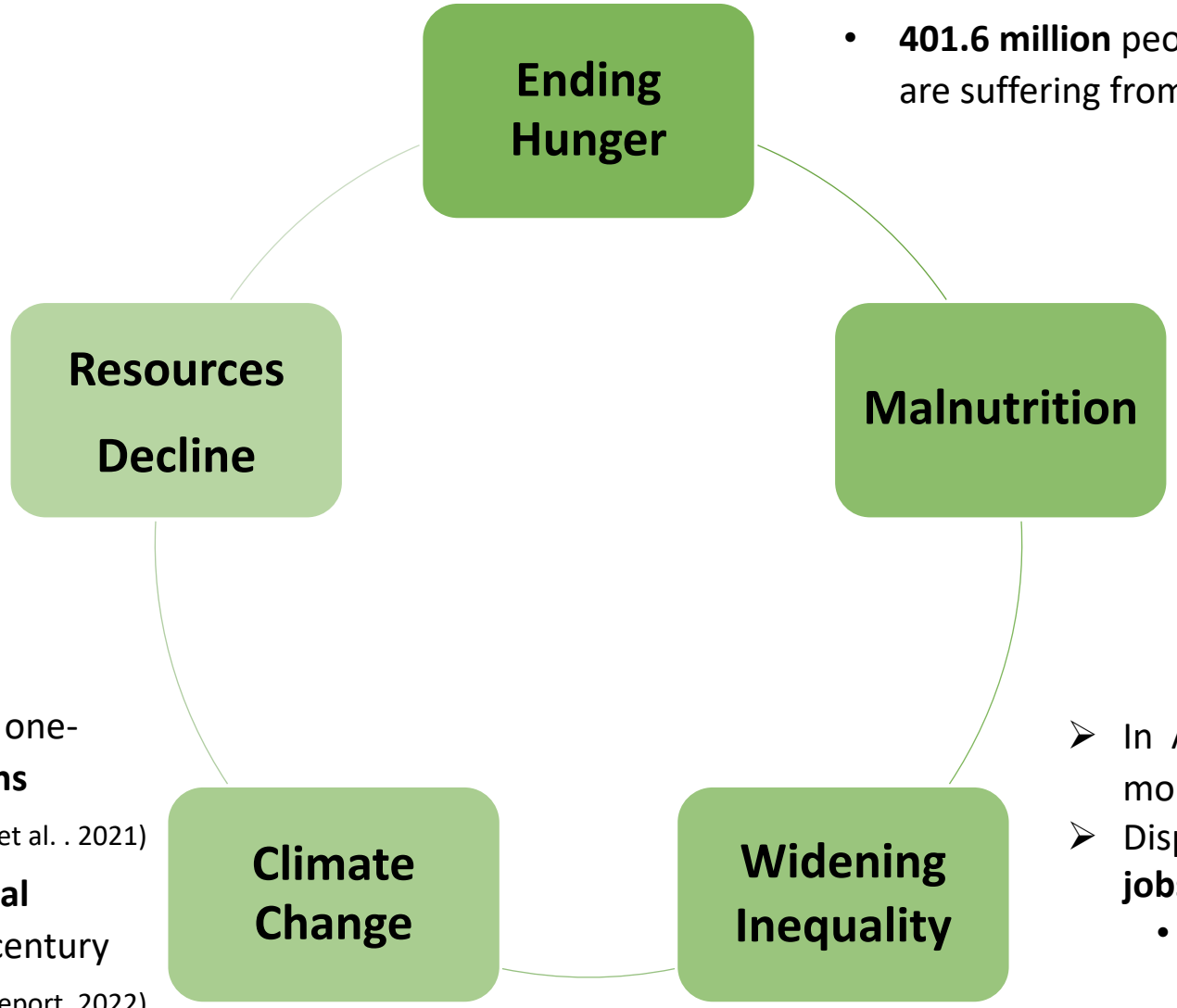
Food Systems must be Transformed Urgently

- Approximately 20% of the world's **land** (30 million square kilometers) has undergone **degradation in 2019**

(The United Nations)

- About 72% of global **freshwater withdrawals** are used for agriculture in2021

(FAO. SOLAW)



- **401.6 million** people, **8.5%** of the population in Asia, are suffering from hunger (FAO. SOFI. 2023)

- Deficiencies in iron, vitamin A, and iodine are non-negligible issues in the Asia
- The number of obese adults in Asia (231.3 million in 2016) has nearly tripled since 2000

(FAOSTAT. 2024)

- Food systems accounted for one-third of global **GHG emissions**

(Crippa, M.,et al. . 2021)

- Current policies lead to **global warming** of 2.8℃ over this century

(UNEP. Emissions Gap Report. 2022)

- In Asia, severe food insecurity is slightly more prevalent in peri-urban areas
- Disproportionate impact on **women's jobs and incomes**
  - larger burden of unpaid caregiving for out-of-school children and sick family members

The Role of Science in Food Systems Transformation

The Role of Science in Food Systems Transformation

Science

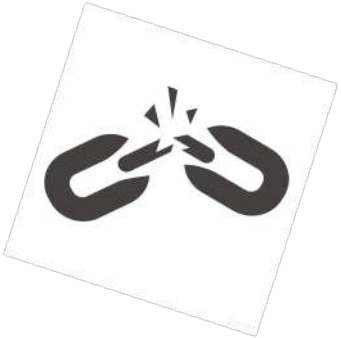
- **Technological innovation**
- Sustainable **resource management** and optimal allocation
- Addressing **climate change**, enhancing resilience
- **Data-driven decision** making, optimize supply chain and reduce waste
- **Policy Support** and Social transformation
- Interdisciplinary collaboration and global **knowledge sharing**
- Scientific **risk management** to enhance inclusiveness
- ……

Food Systems Transformation

Traditional Unidirectional Science-Policy Interfaces

Science has failed to deliver meaningful change

- Insufficient policy-relevant research to support consideration of alternatives
- Time lags between the development of policy questions and research by the scientific community
- A lack of evidence on ‘how’ to implement recommendations
- Inadequate resource allocations and a lack of capacity to interpret and deploy evidence



Obstacles arise through decision-making systems

- A lack of attention to the priorities of diverse stakeholders, especially marginalized actors, including small-scale farmers, women, Indigenous people, and migrant workers
- The disproportionate power exerted by large-scale producers and large food processing companies and retailers
- An unwillingness of policymakers to deal with trade-offs, resulting in inertia as the least difficult position to take (De Schutter, 2017; Singh et al., 2021)

There is an urgent need for novel and more effective forms of “science-policy interfaces” that extend their influence by directly including "society" to become Science-Policy-Society Interfaces (SPSIs)

An Ecosystem of 'Science–Policy–Society' Interfaces

The best available evidence and knowledge must be marshaled in support of policymaking, business decisions, and community-level investments

Principles of SPSIs

- Political legitimacy
- Participation in traditionally excluded and equity-deserving groups
- Transparency and democratic decision making
- Integration of a variety of concerns emerging at different scales and across different sectors of the food system
- Independence and rigour
- Permanent attention to clearly defined and measurable impacts

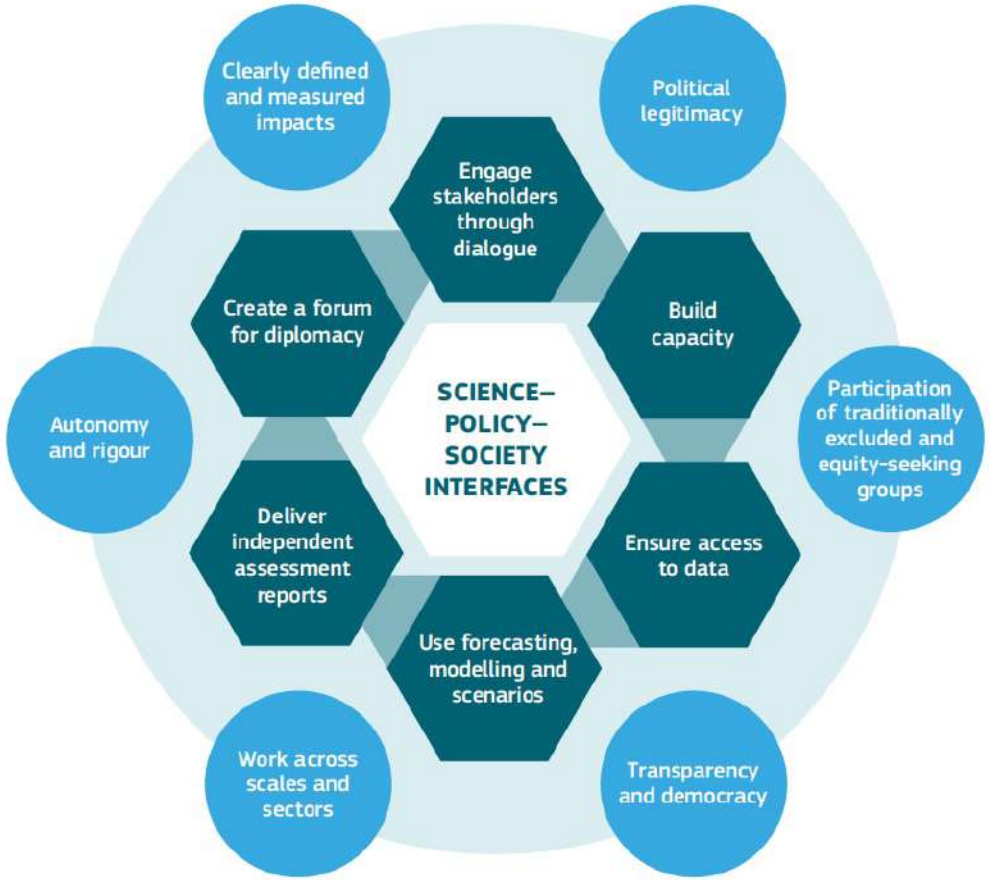


Figure 1. *Principles and functions for SPSIs.*
Blue circles denote principles; green hexagons show functions

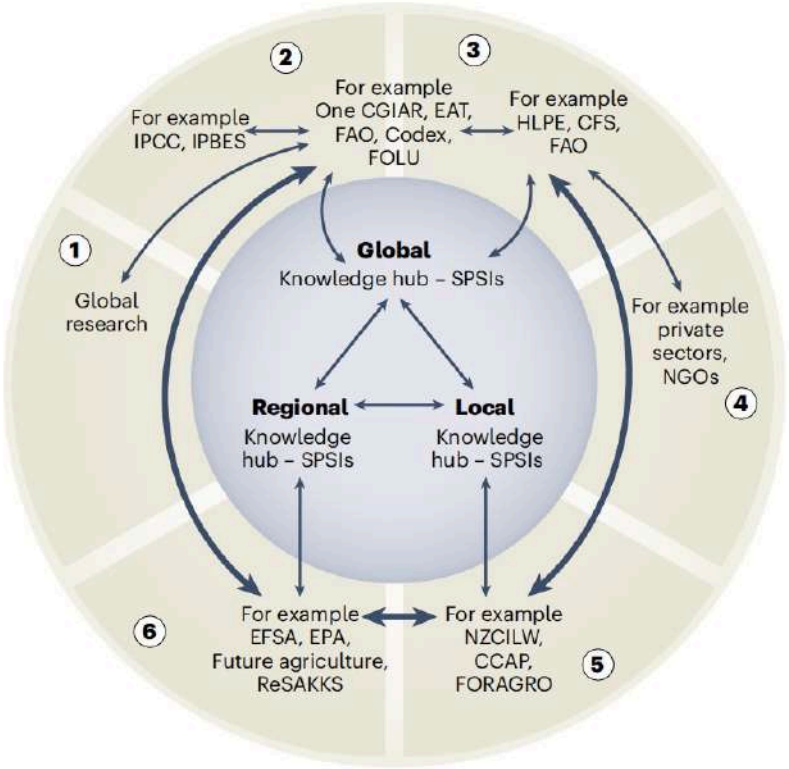
Source: Directorate-General for Research and Innovation of the European Commission, Webb, P., Sonnino, R., Fraser, E. and Arnold T., Everyone at the Table: Transforming food systems by connecting science, policy and society, Publications Office of the European Union, Luxembourg, 2022

Key Functions of Science–Policy–Society Interfaces

*Local, regional, and global scale organizations (inner ring) can collaborate to provide **six key functions** identified (outer ring) for food systems transformation*

- Forecasting and monitoring
- Capacity building
- Data collection and storage
- Independent assessment
- Engagement
- Diplomacy

A potential food systems SPSI



1. Forecasting and monitoring
2. Capacity building
3. Data collection and storage
4. Independent assessment
5. Engagement
6. Diplomacy

Source:Brajesh K. Singh et al., 2022

SPSIs: Experiences and Lessons

Current SPSIs in Food Systems

Name	Outputs
IPCC	Multi-volume assessments and summaries for policymakers (SPMs) based on peer-reviewed literature, data, and model archive; regular cycle (5 years), with special reports interspersed
HLPE of the UN CFS	Analyses of the state of food security and nutrition and scientific advice on policy issues using existing high-quality research; identifies emerging issues
GLOPAN	Using existing high-quality research, data and technical studies and new modelling for policy briefs; foresight reports, analytical tools and convening on policy dialogue
European Food Safety Authority (EFSA)	Regular reports, policy briefs and statutory analyses
Global Forum on Agricultural research and Innovation (GFAR)	Supports the development of a strategic agenda for agri-food research and innovation, catalyses dialogue among all relevant stakeholders and supports the strengthening of institutions and organizations to better link research

ReSAKSS: Bridging the gap between research, policy, and society in Africa

1. Research and Data Collection

- Conducts in-depth research: food security, agricultural productivity, and rural livelihoods
- Collects a large amount of relevant data through surveys, field observations, and collaborations with local research institutions

2. Policy Analysis and Recommendations

- Analyzes the existing policies and identifies the gaps and challenges
- Provides evidence-based policy recommendations to the African governments

3. Capacity Building

- Organizes training programs and workshops for policymakers, researchers, and stakeholders to enhance their capacity in data analysis, policy formulation, and implementation

4. Policy Dialogues and Advocacy

- Brings together policymakers, researchers, and civil society organizations to discuss and exchange ideas on agricultural and rural development policies. Through these dialogues
- Promotes the understanding and acceptance of its research-based policy recommendations and encourages the implementation of relevant policies

5. Monitoring and Evaluation

- Uses various indicators and methods to assess the progress and effectiveness of the policies
- Provides feedback to the policymakers and makes necessary adjustments to the policies to ensure their better implementation and achieve the desired social outcomes.

ReSAKSS
Regional Strategic Analysis and Knowledge Support System
by AKADEMIYA2063

FORAGRO: Shaping Policies and Translating Research Outcomes into Social Impacts across the Americas

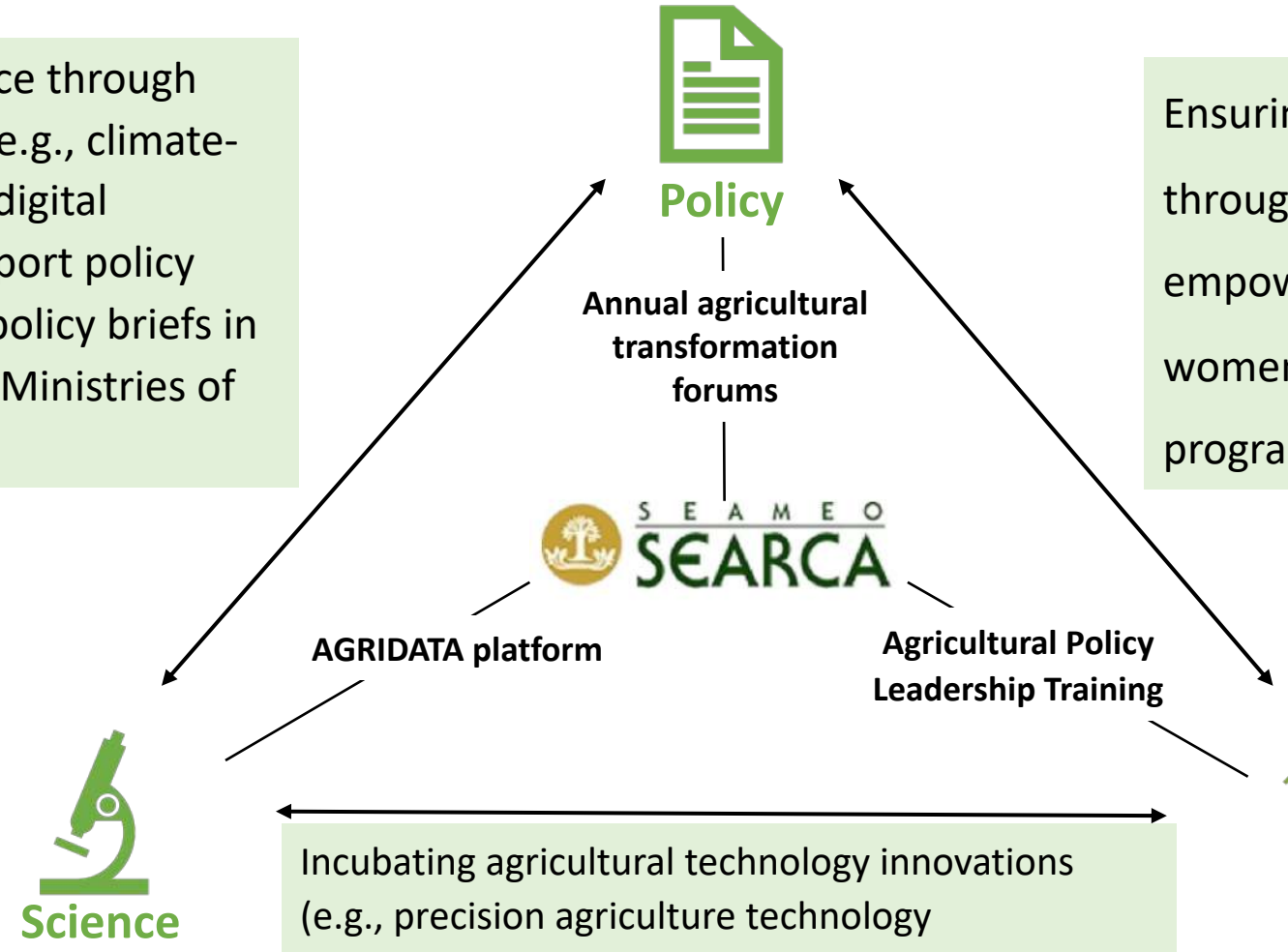
- ***Knowledge Integration and Sharing***
  - Consolidates agricultural research findings from national institutions, universities, international organizations (e.g., FAO, IICA), and the private sector. It identifies regional challenges (e.g., climate change, food security) and synthesizes evidence-based recommendations through reports, white papers, and technical guidelines to inform policymakers.

In Peru, FORAGRO's "Potato Disease-Resistant Breeding Program" was adopted into national policy, reducing crop losses by 30% and benefiting 100,000 smallholder farmers.

- ***Policy Dialogue and Advocacy***
  - Organizes high-level forums, workshops, and multi-stakeholder meetings to engage governments, academics, and communities. For instance, advocating for policies like subsidies for smart farming technologies in response to the "digital transformation of agriculture."
- ***Capacity Building & Technology Transfer***
  - Conducts training programs to equip farmers with new technologies (e.g., water-saving irrigation, disease-resistant crops). Collaborating with local governments to establish pilot zones demonstrates the benefits of research outcomes, facilitating technology adoption.

SEARCA: A Catalyst for Agrifood Systems Transformation through SPSIs

Generating evidence through research projects (e.g., climate-smart agriculture, digital agriculture) to support policy formulation (e.g., policy briefs in collaboration with Ministries of Agriculture)



Ensuring policy inclusivity through community empowerment initiatives (e.g., women farmer leadership programs)

Incubating agricultural technology innovations (e.g., precision agriculture technology dissemination) and implementing them through farmer training programs.

Building Interface Capacity: SEARCA's Strategic Priority for Systemic Change"

SEARCA holds a crucial position in the agricultural development of Southeast Asia.

- ***Capacity building***
  - Enhance individual professional skills (modern agricultural technologies, agricultural management , and agricultural education methods)
  - Strengthen institutional implementation capabilities (helping to improve internal management systems, optimize research and teaching processes, and enhance personnel management and resource - allocation capabilities)
- ***knowledge creation and dissemination***
  - Support and participates in cutting - edge research in the agricultural field
  - Disseminate research achievements and advanced agricultural technologies o a wide range of agricultural practitioners, researchers, and policymakers
- ***Policy advocacy***
  - Translate scientific knowledge and social needs in the agricultural field into policy language to influence the decisions of policymakers
  - Encourage policy - making to not only consider economic factors but also fully combine scientific research achievements and social development needs to ensure the scientificity and feasibility of policies
  - Encourage all sectors of society to participate in the policy - making process to enhance the social acceptance of policies

Current SPSIs in China's Food Systems

Name	Outputs
Key Open Laboratory of National Agricultural Policy Analysis and Decision Support System, Chinese Academy of Agricultural Sciences	• Build the National Agricultural Economy and Policy Database and develop policy simulation systems (such as the WTO Agricultural Negotiation Support Model) • Regularly release the "China Agricultural Policy Analysis and Decision Support Report" • More than 40 research achievements were directly used in the policy design of the "Soybean Revitalization Plan" of the Ministry of Agriculture and Rural Affairs
Rural Economy Research Center of the Ministry of Agriculture and Rural Affairs (RERC)	• Take the lead in formulating the "National Plan for Agricultural and Rural Modernization (2021-2025)" • Establish a fixed rural observation point covering 2,000 counties and cities across the country • Cooperate with the Development Research Center of the State Council, and jointly submit the policy proposal of "Paths for Building a Strong Agricultural Country" in 2024
Science and Technology Development Center of the Ministry of Agriculture and Rural Affairs	• Operate the National Key R&D Program Agricultural Green Technology Achievement Transformation and Docking Conference. In 2025, 152 technologies were signed, and the contract amount exceeded 1 billion yuan
Rural Economy Department of the National Development and Reform Commission	• Establish a four - step mechanism of "project research - expert review - policy pilot - national promotion"
Expert Guidance Group for the Whole Process Mechanization of Crop Production of the Ministry of Agriculture and Rural Affairs	• Cooperate with China Agricultural University to open the "Senior Talents Training Course for Agricultural Mechanization", training more than 3,000 grassroots technical personnel annually.

China: Seed Revitalization and the Industrialization of Biological Breeding

Driven by Science

- "Major Project for Cultivating New Varieties of Genetically Modified Organisms" (2008-2020)

Policy Coordination Supported by Thinktanks

- The "Action Plan for the Revitalization of the Seed Industry" in 2021

Innovation and Transformation

- In 2022, the coverage rate of improved crop varieties in China exceeded 96%, and the area of self-bred varieties accounted for more than 95%

Source: Ministry of Agriculture and Rural Affairs

China: Digital Agriculture and Smart Farm Practices

➢The Beidahuang Group has built a "unmanned farm"

- In 2022, the rice yield per mu reached 620 kilograms, reducing labor costs by 30%

Technology Integration

Policy Support

- The "Digital Agriculture and Rural Development Plan (2019-2025)"
- As of 2023, more than 100 digital agriculture pilot counties have been established nationwide

- Alibaba's "ET Agricultural Brain" optimizes planting decisions through AI algorithms, covering areas such as orchards and animal husbandry, helping apple farmers in Shaanxi Province increase the commercialization rate of apples by 20%

Social Participation

China: Ecological Agriculture and Policy Synergy

Scientific Evidence

- Chinese Academy of Agricultural Sciences have confirmed that the paddy field fish farming model can reduce the use of chemical fertilizers by 30% and methane emissions by 40%

Policy

- The Ministry of Agriculture and Rural Affairs included the ‘integrated rice-fish farming’ in the “National Plan for Agricultural Sustainable Development”

Local Innovation Pilot

- Zhejiang Province has implemented the "Million Project of Ecological Circular Agriculture"
- In 2022, the comprehensive utilization rate of livestock and poultry manure in the province reached 92%

Source: China Organic Fertilizer Association

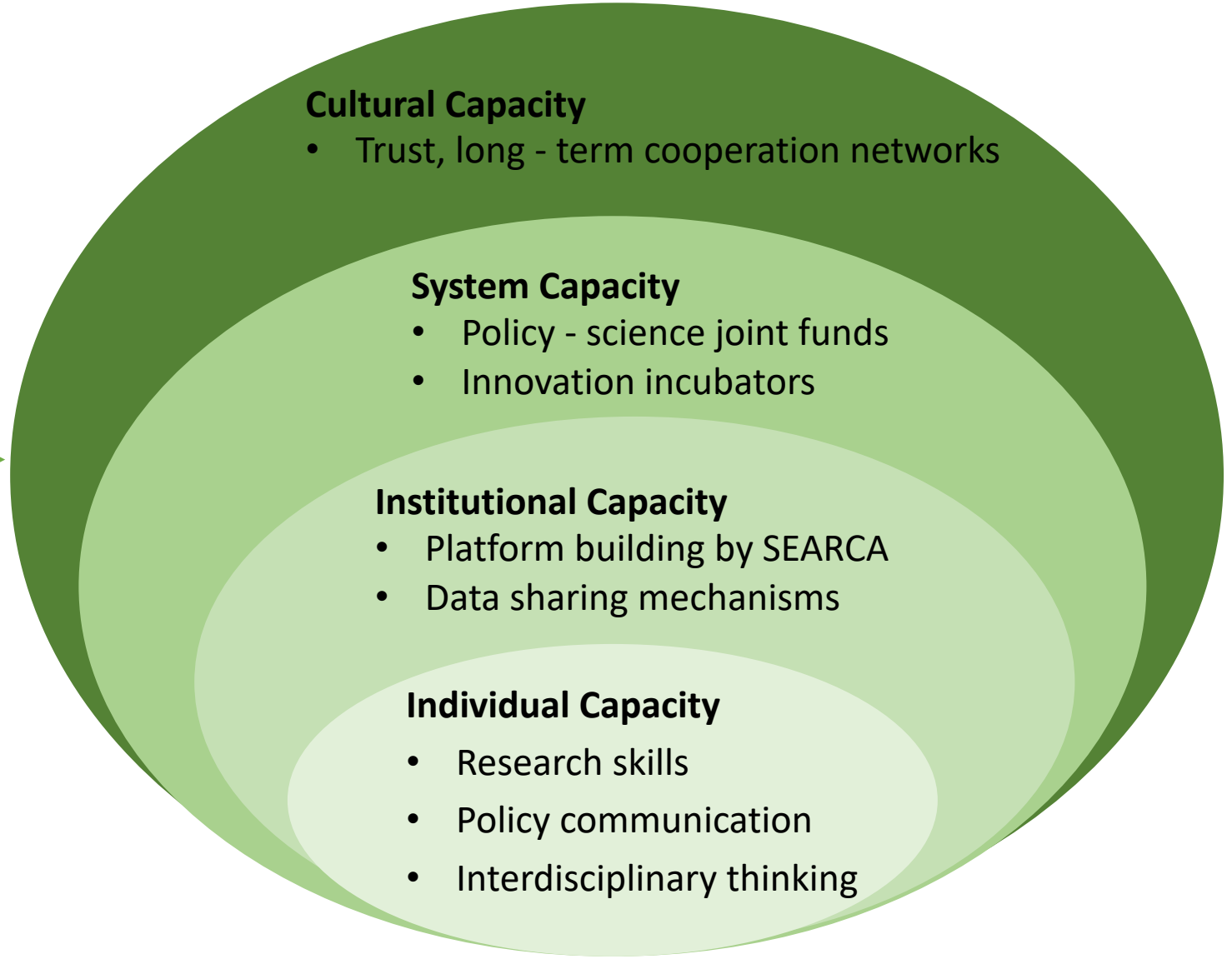
Accelerating Science-Policy-Society Interfaces

Key Challenges

- Insufficient R&D capacity in developing countries of Asia-Pacific
- Gaps in actionable knowledge
- Under-appreciation of sustainability issues
- A lack of attention to the priorities of diverse stakeholders, and especially marginalized actors
- Disjointed policies

Enhance Capacity in the Interface

Capacity is not just training—it's enabling ecosystems.



Multisectoral Taskforces

To engage different stakeholders and ensure that diverse communities, perspectives, and viewpoints are respected, a task force could continue facilitating the food systems dialogues.

- Establish effective governance mechanisms at all levels under an integrated approach that cuts across political, sectoral, and geographical boundaries
- Enhanced monitoring ability and government accountability are important to track our progress
  - Leverage the data revolution and big data analytics for quality, evidence-based evaluation
  - Stakeholders will need to track progress toward multiple development goals and use data to guide policy action

Multilateral institutions could consider *cooperating with member states* to fund smaller and agile groups with narrower mandates that would address specific knowledge and data gaps.

Sources: *Webb et al.*, 2022

Providing Extra Resources and a Mandate to Work across the Entire Food System

Multi-lateral agencies such as the United Nations, the Rome Based Organizations (e.g., FAO), or the European Commission adopt the current SPI landscape to work across the entire food system, including input suppliers, producers, processors, retailers and consumers.

- Stakeholders seem less satisfied with their interactions with multinational corporations and regional integration organizations, especially with research institutions/academics. These interactions can be limited due to differences in priorities, resources, and organizational cultures.
- In APC, we could work beyond traditional horizons and stakeholders by convening dialogues or other processes to engage stakeholders to achieve consensus on different topics.

Persistent Challenges Identified by Stakeholders

Forecast, Assessment, and Data Support

- Working with key players in today's landscape of SPSIs to **produce rigorous assessment reports analogous** to those produced by the IPCC for climate change
- **Supporting data portals**, including FAOSTAT and the EU-FSDN, to increase the accessibility, interoperability, and harmonization of data. Establish higher standards in terms of data quality and different level hubs (global and regional)
  - complement databases already hosted by the United Nations and other organizations such as the World Bank
- There is a need of national metrics that can help to check and monitor progress of food systems transformation
  - For large countries (China, India, Indonesia, etc.), **indicators** at the sub-regional level is important

Tailored Strategy for Regional Specific Agendas

Fund smaller and agile groups with narrower mandates that would address specific knowledge and data gaps.

- Receive a mandate to create a blueprint for a longer-term political process that would explore what groups would be best placed to coordinate SPSIs and what kinds of institutional structure could lead to legitimate political SPSIs.
- Develop regionally relevant (and publicly available) capacity-building modules to explore topics such as healthy diets, improved nutrition, etc., and embed these modules within in-country extension services.

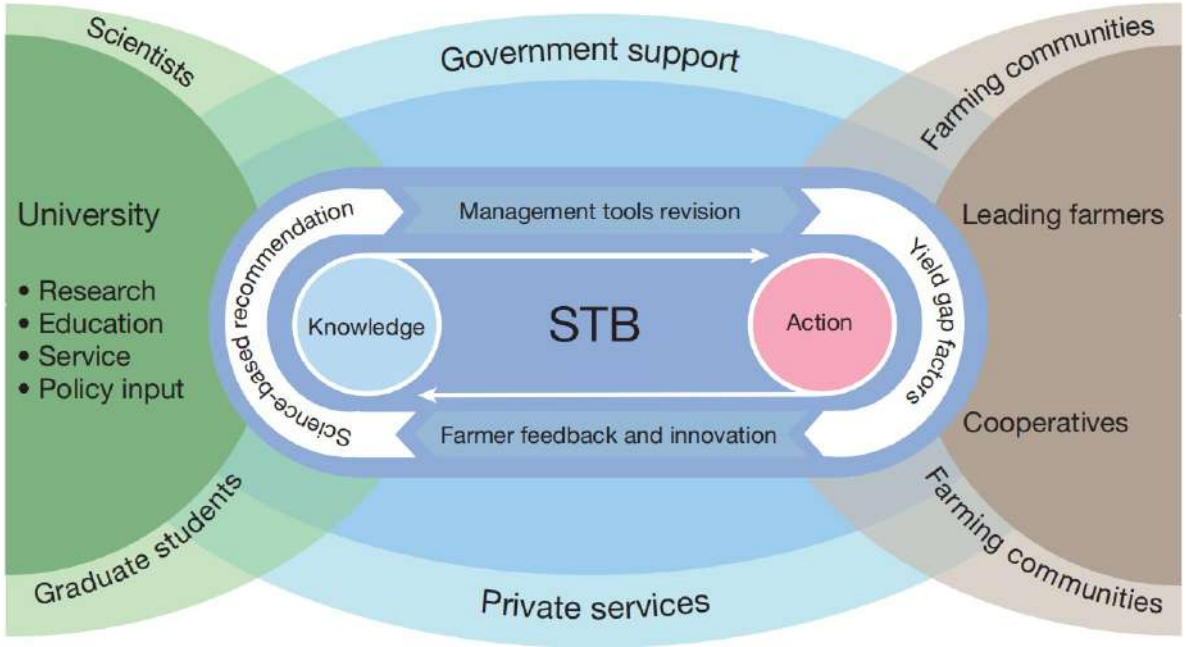
Sources: *Webb et al.*, 2022

Localize the Process of Research and Innovation

The Science and Technology Backyard (STB), crafted by China Agricultural University, is an innovative form of SPSI. It aims to directly integrate scientific advancements into rural farming, enhancing productivity, sustainability, and community well-being

- **Direct Engagement**
  Connects researchers with farmers, ensuring technologies meet local needs
- **Tailored Solutions**
  Focuses on creating agricultural technologies and practices customized for local environments
- **Sustainability**
  Emphasizes eco-friendly practices to ensure long-term agricultural success
- **Education & Training**
  Provides farmers with the knowledge and tools to implement advanced agricultural methods

An Illustration of the STB Mechanism



Source: Weifeng Zhang et al., 2016

Creating a "Network of Networks"

- Fund a global coordination hub to identify constraints and needs experienced by local and regional partners and generate multi-directional linkages between science, policy, and community members
  - Increase the voice of developing countries
  - Expand the current system to explicitly engage new players, such as the private sector and civil society
  - International organizations could also play a crucial role in accelerating the construction of the SPSI (e.g., CGIAR)

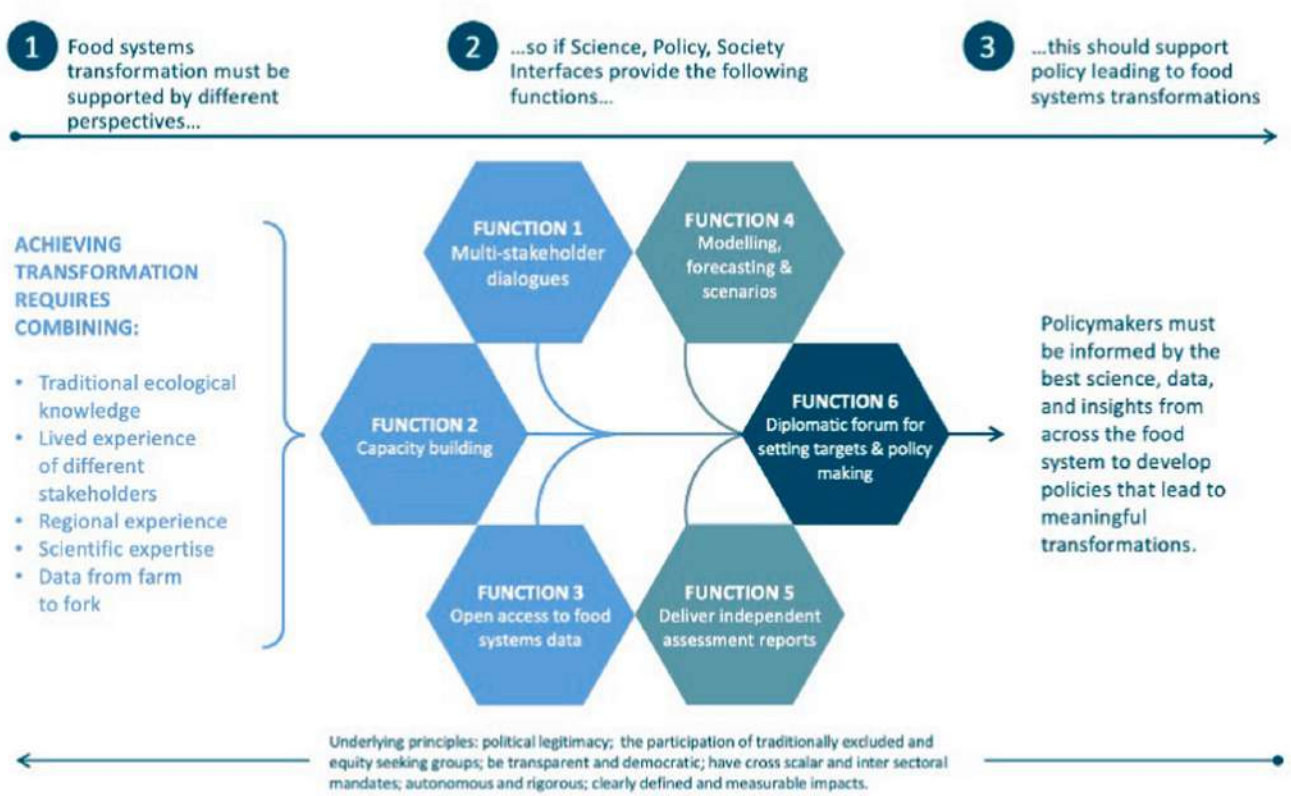
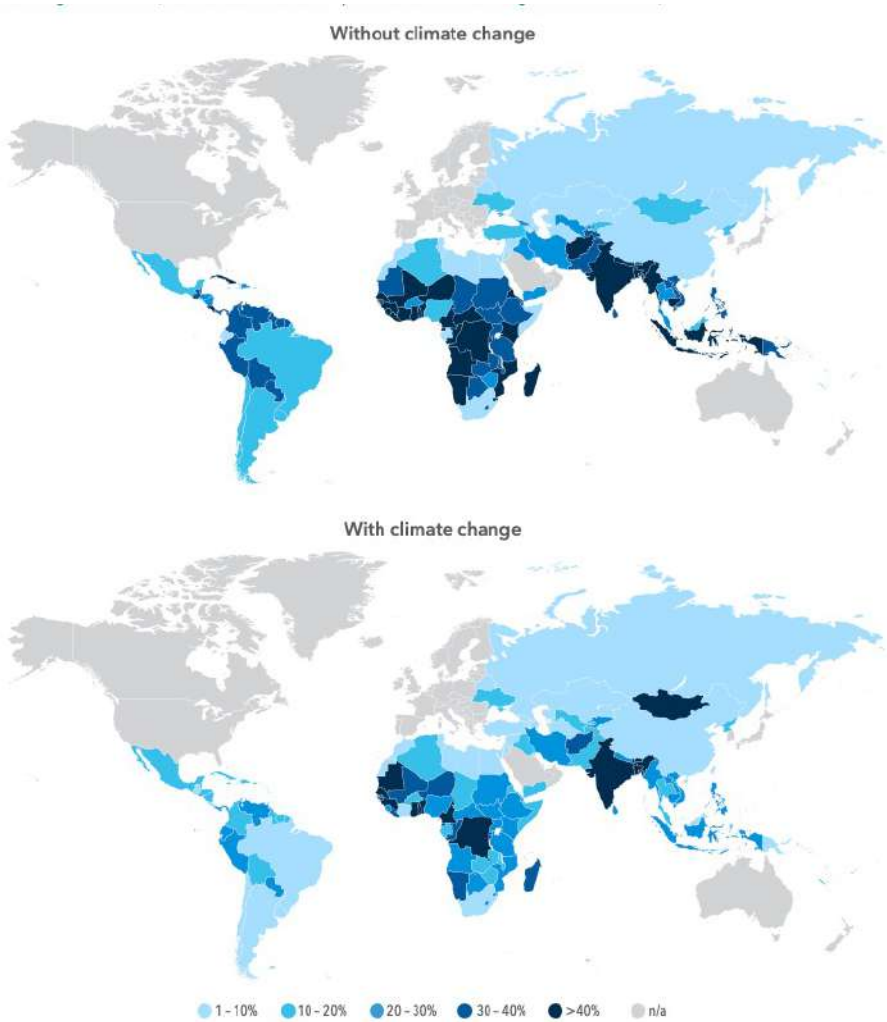


Figure: Singh, B. K., Fraser, E. D., Arnold, T., Biermayr-Jenzano, P., Broerse, J. E., Brunori, G., ... & Webb, P. (2023). Ensuring societal considerations are met when translating science into policy for sustainable food system transformation. *Trends in Food Science & Technology*.

Invest Efficiently through Collaborative Dialogues and Research

Supporting for integrated data portals, a higher degree of capacity building, and convene regional assessments that attempt to forecast/model trends in the food system.

- Administer competitively allocated funding to support tasks related to the functions required by SPSIs. This might include issuing calls for proposals to conduct regional assessments, convene multi-stakeholder dialogues (globally or in targeted regions or scales), and create future scenarios and policy pathways.
- Reprioritize related investments to achieve multiple wins in Asia-Pacific.
  - E.g. facing climate change
- All voices should be heard and all stakeholders must be empowered
  - Women
  - Minority
  - Youth
  - Smallholders (farmers, fishers, foresters…)



Impact of investments in agricultural R&D, water management, and market access infrastructure on hunger reduction (% reduction in 2030 compared to no climate change scenario in 2030)

Source: IFPRI, 2022, Research for the future: Investments for efficiency, sustainability, and equity

World Agrifood Innovation Conference (WAFI)
Linking Science and Innovations to Policy and Society

- **The 2024 World Agrifood Innovation Conference (WAFI)** drew **2000** delegates, Participants actively participated in thorough discussions and workshops focused on the theme of ***'Climate Change and Food Systems Transformation***,' ultimately culminating in the formulation of the Pinggu Consensus
- **Subforum: Technological Innovations and Low-Carbon Transformation**

Academy of Global Food Economics and Policy