SOLVING THE GREAT FOOD PUZZLE:

PLACE-BASED SOLUTIONS TO HELP SCALE NATIONAL ACTION

SUMMARY REPORT

THE IMPORTANCE OF PLACE-BASED SOLUTIONS

Unsustainable food systems are currently the number one threat to nature and human health, but this also creates an opportunity for food systems transformation to be the primary solution to multiple crises facing humanity. It is clear that food systems must be transformed globally, not just to minimize the environmental footprint, but to unlock the potential to restore nature and nourish people. It is also clear that there is no onesize-fits-all solution.

Food systems are local and deeply rooted in the cultural heritage and values of communities, and any action at the national (or indeed international or multilateral) level must deeply consider the place-based nature of food systems so that context-specific solutions can be found, shared, adapted and scaled to the extent feasible. At times, the challenge of redesigning our collective approach to transform food and agricultural systems may feel overwhelming. But in this report, we offer a food systems typology with corresponding prioritization of actions as a means to reduce the complexity and aid the acceleration of such transformation.

Kirsten Schuijt
Director General, WWF International

Rebecca Shaw
Chief Scientist, WWF Global Science

João Campari
Global Food Practice Leader, WWF International

BUILDING A GLOBAL FOOD SYSTEMS TYPOLOGY

Given the urgent and high stakes race to solving global problems, a rigorous place-based approach is needed to identify actions that will have the most impact in the shortest time possible. The wide variation in local contexts creates a challenge in identifying consistent actions and key levers necessary to transform food systems, to improve human health while reducing environmental impact. Given this, typologies can help us to identify different sets of actions relevant to groups of countries with similar contexts.

In the global food system typology developed in this study, we used both social and environmental variables (Table 1 and 2). Considering the environment within which a food system is situated is critical given that food systems are the single greatest driver of environmental degradation but are also centrally dependent on the health of local ecosystems and biodiversity. These variables were then used to identify Food System Types for a cohort of countries and expanded to build a global food systems typology (Figure 1).

Table 1.
Seven variables used to develop food systems typology

Typology variable	Justification	Description
Environmental performance [20]	Assessing a country's performance on environmental sustainability is a good indicator of their ability to be able to govern, manage and protect the environment. This variable measures how close a country is to meeting internationally established sustainability targets for specific environmental issues.	Environmental Performance Index from Yale 2022.
Self-sufficiency [21]	Having sufficient land and water resources to produce enough food to meet domestic demand of a Planet-Based Diet* has a large influence on where land conversion and environmental impacts are felt. It also can have a large influence on the type of production system needed to become less import dependent.	Ratio of hectares of available agricultural land to agricultural land needed to produce an EAT lancet diet for all country residents from Navarre et al. 2023.
Food security [22]	The levels of food security within a country can have a large influence on the priority placed on achieving either human health or environmental goals. The often competing demands many countries contend with can force difficult trade-offs between achieving either health or environmental goals in the short term.	Global Food Security Index from Economist Impact 2022.
Water risk [23]	Water availability for food production may be one of the most pressing issues in the near future, especially as climate change continues to impact countries. In addition, continued use or overuse of available freshwater resources can have a large impact on biodiversity and ecosystem services.	Basin physical risk score from WWF's Water Risk Filter 2021.
Biodiversity hotspot [24]	Biodiversity hotspots are regions characterised both by exceptional levels of plant endemism and serious levels of habitat loss. These areas are important because they contain high levels of biodiversity richness and endemic species.	Ratio of hectares hotspot to total country hectares from Conservation International's hotspot GIS data.
Irrecoverable carbon [20]	There are some natural places that we cannot afford to lose due to their irreplaceable carbon reserves. Irrecoverable carbon is ecosystem carbon that if lost, could not be recovered by mid-century, by when we need to reach net-zero emissions to avoid the worst climate impacts.	Total irrecoverable carbon (tons)/ Total hectares land area in the country from Noon et al. 2022.
Level of industrialization [18]	The level of industrialization of a country's food system has a large impact on diets, nutrition, health and environmental outcomes, as well as various supply chain and food environment variables.	Level of food system industrialization (1=traditional, 5=fully industrialised) from Marshall et al. 2021.

* WWF's Planet-Based Diet [21] is modeled after the EAT-Lancet Planetary Health Diet. [1]

Table 2.

Descriptions and country examples for each Food System Type.

Food System Type	Country examples	Description
1	**Brazil, Colombia, Ecuador, Indonesia, Peru, Russia**	Countries that have some of the highest concentrations of biodiversity hotspots and irrecoverable carbon. When coupled with moderate levels of environmental performance, this puts natural areas at medium risk for conversion. Food production is a mix of industrialized and smallholder and artisanal production. These countries have enough or nearly enough land and water resources to produce enough food to meet domestic demand for a Planet-Based Diet. Food security remains too low and must be addressed.
2	**Ethiopia, Guatemala, Madagascar, Morocco, Philippines, Viet Nam**	Countries that have the highest concentrations of biodiversity hotspots but lower concentrations of irrecoverable carbon. When coupled with weak environmental performance, this puts natural areas at high risk for conversion. Food production is driven by smallholder and artisanal production, but industrialized agriculture also exists. These countries do not have enough land resources to produce food to meet domestic demand for a Planet-Based Diet and freshwater risk is moderate. Food security is very low and remains a key priority.
3	**Bolivia, Egypt, India, Kenya, Pakistan, Paraguay, Ukraine**	Countries that have some key biodiversity areas but, overall, lower concentrations of biodiversity hotspots and irrecoverable carbon. When coupled with weak environmental performance, this puts natural areas at high risk for conversion. Food production relies predominantly on smallholders and artisans to produce food, but industrialized agriculture also exists. These countries do not quite have enough land to produce food to meet domestic demand for a Planet-Based Diet and water resources will become a major challenge in the future. Food security is very low and remains a key priority.
4	**China, Italy, Mexico, South Africa, Spain, Turkey**	Countries that have significant key biodiversity areas but, overall, moderate concentrations of biodiversity hotspots and lower concentrations of irrecoverable carbon. Coupled with strong levels of environmental performance, this puts natural areas at lower risk for conversion. Industrialized agriculture is the main method of food production, although smallholder and artisanal production does produce food for personal or domestic consumption. These countries have enough land resources to produce food to meet domestic demand for a Planet-Based Diet, but water resources could become a big issue in the future. Food security is comparatively high but must continue to be addressed.
5	**Chile, Japan, Netherlands, Norway, United Kingdom, United States**	Countries that have lower concentrations of biodiversity hotspots but quite high concentrations of irrecoverable carbon. When coupled with stronger levels of environmental performance, this puts natural areas at low risk for conversion. Industrialized agriculture dominates food production. These countries have enough land and water resources to produce food to meet domestic demand for a Planet-Based Diet. Food security is high.
6	**Argentina, Australia, Kazakhstan, New Zealand, Saudi Arabia, Uruguay**	Countries that have lower concentrations of biodiversity hotspots and irrecoverable carbon. When coupled with moderate levels of environmental performance, this puts natural areas at lower risk for conversion. Industrialized agriculture dominates food production. These countries have an abundance of land to produce food to meet domestic demand for a Planet-Based Diet and water risk remains comparatively low. Food security is high.

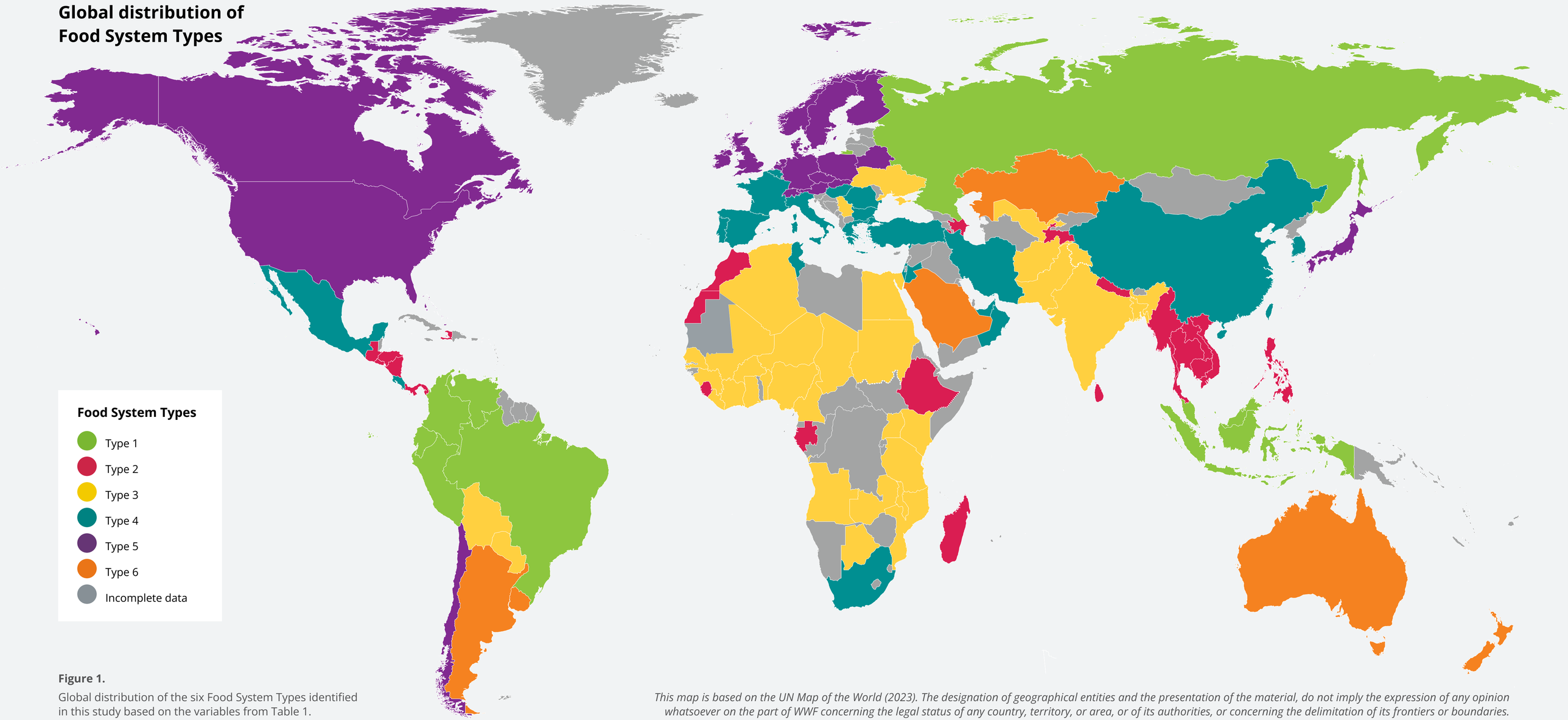

Figure 1.

Global distribution of the six Food System Types identified in this study based on the variables from Table 1.

This map is based on the UN Map of the World (2023). The designation of geographical entities and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of WWF concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

IDENTIFYING THE HIGHEST-IMPACT ACTIONS

To effectively analyze the similarities and differences in actions needed across Food Systems Types, 20 transformation levers (Table 3) have been identified through a comprehensive literature review and expert consultations. Their potential to transform a particular Food Systems Type is outlined in Table 4.

Table 3.

Twenty transformation levers that have been identified as having a high degree of potential to transform food systems. These levers are important across all food system types but their potential for transformational change varies across food system types.

Strategic action areas	Transformation levers	Definition
Natural resource management	Optimize land use (NRM1)	Use all agricultural lands to their maximum potential including using existing agricultural land to feed humans and optimizing crop yields on these lands through better food production practices that more efficiently use water and fertilizers, reduce pollution from chemical inputs, preserve ecosystem functions, and contribute to resilient landscapes.
	Restore biodiversity (NRM2)	Develop and implement food production practices that restore biodiversity in active food producing land/waters and restore less productive areas to natural habitat for biodiversity conservation.
	Increase carbon storage (NRM3)	Develop and implement food production and blue foods management practices that increase carbon stores in below- and above-ground biomass and blue carbon.
	Increase food and agri- diversity (NRM4)	Support the production and consumption of a diversity of terrestrial and aquatic foods and protein sources (e.g. legumes, nuts and nutri-cereals) through agrobiodiverse systems including agroecology and regenerative agriculture.
Governance and institutions	Support smallholders (GOV1)	Redesign development and extension programmes to all farmers/fishers, including women, to provide financial assistance, develop new business models, infrastructure, and agricultural assets to grow/catch nutritious and sustainable, traditional foods and access to markets.
	Improve land tenure rights (GOV2)	Improve land tenure rights and develop actions that encourage collective ownership and Indigenous land rights.
	Strengthen commitments and implementation (GOV3)	Coordinate and strengthen national-level commitments and implementation on shifting to healthy diets, reducing food loss and waste, and scaling nature-positive food production.
	Foster multi-stakeholder collaboration (GOV 4)	Supporting multi-stakeholder collaboration using a multi-level and participatory approach for addressing interrelated issues across economic, social and environmental dimensions.

Strategic action areas	Transformation levers	Definition
Education and knowledge	Strengthen research & development (ED1)	Increase research and development opportunities with food producers, and domestic universities, to expand nature-positive food production practices that support production of healthy foods.
	Improve data collection and measurement (ED2)	Improve data collection and measurement of current behaviours, environmental impacts and progress of national-level commitments contributing to international health, climate and biodiversity targets.
	Increase public awareness (ED3)	Launch engaging and compelling communication and behaviour change campaigns about healthy and sustainable eating and reducing food loss and waste.
	Promote healthy, sustainable and traditional foods (ED4)	Promote healthy, sustainable and traditional food cultures associated with good nutrition by supporting and protecting healthy and traditional foods and protein sources (e.g. legumes, nuts and nutri-cereals), providing information about healthy and traditional dishes and protein sources and through public awareness campaigns.
Technology	Adopt high-tech methods (TECH1)	Adopt high-tech nature-positive food production methods such as the sustainable use of non-conventional water sources and controlled environments for food production, and precision and digital agriculture technologies.
	Develop supply chain infrastructure (TECH2)	Develop supply chain infrastructure (e.g. roads and transport systems) and post-harvest storage technologies, packaging, and processing techniques for nutritious foods to reduce loss and waste of nutritious foods.
	Develop alternative proteins (TECH3)	Develop and promote healthy alternative protein sources such as plant-based and cell-based meat alternatives that are high in nutritional value.
Trade	Support healthy food imports and exports (TRD1)	Design trade policies to prioritize the supply of nutritious foods over manufactured foods high in fats, sugars and salt.
	Develop nature-positive supply chains (TRD2)	Develop trade policies (e.g. deforestation- and conversion-free) that support nature-positive food production, such as trade agreements and traceability tools, and changes in markets.
Finance	Redirect subsidies and increase de-risking investments to improve production (FIN1)	Redirect agri-food subsidies and from staple crops and harmful production practices and increase de-risking investments to increase nature-positive production of nutritious foods.
	Finance school food and public procurement programmes (FIN2)	Finance school food and public procurement programmes that promote and enable healthy and sustainable foods.
	Provide financial incentives and taxes to improve consumption (FIN3)	Provide financial support that increases the availability, affordability and appeal of nutritious foods and implement taxes that decrease the affordability of foods high in fats, sugars and salt.

Table 4.

The potential of individual transformation levers to transform different Food System Types are ranked from higher (dark green) to lower (light green) potential.

		Food system types*				
Strategic action areas	**Transformation levers**	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Type 5**
Natural resource management	Optimize land use (NRM1)					
	Restore Biodiversity (NRM2)					
	Increase carbon storage (NRM3)					
	Increase food and agri-diversity (NRM4)					
Governance	Support smallholders (GOV1)					
	Improve land tenure rights (GOV2)					
	Strengthen commitments and implementation (GOV3)					
	Foster multi-stakeholder collaboration (GOV4)					
Education and knowledge	Strengthen research and development (ED1)					
	Improve data collection and measurement (ED2)					
	Increase public awareness (ED3)					
	Promote healthy, sustainable and traditional foods (ED4)					
Technology	Adopt high-tech methods (TECH1)					
	Develop supply chain infrastructure (TECH2)					
	Develop alternative proteins (TECH3)					
Trade	Support healthy food imports and exports (TRD1)					
	Develop nature-positive supply chains (TRD 2)					
Finance	Redirect subsidies and increase de-risking investments (FIN1)					
	Finance school food and public procurement programmes (FIN2)					
	Provide financial incentives and taxes to improve consumption (FIN3)					

* Type 6 countries are expected to perform similar to Type 5 countries but no Type 6 countries were assessed for this study.

Lower potential of lever to transform a particular Food System Type

Medium to lower potential of lever to transform a particular Food System Type

Medium potential of lever to transform a particular Food System Type

Medium to higher potential of lever to transform a particular Food System Type

Higher potential of lever to transform a particular Food System Type

FROM THIS ANALYSIS, EIGHT IMPORTANT TAKEAWAYS EMERGED:

1.

Food system transformation is not possible without better natural resource management.

Natural resource management levers have been identified as having high potential for impact in most countries, but especially in Food System Types 1, 2 and 3, which also have many landscapes considered as food system hotspots with increased risk of nature being converted for agriculture.

2.

The potential of education to transform diets and nutrition must be unlocked.

Education and knowledge levers were ranked high across most Food System Types, with increasing public awareness about healthy eating and reducing food waste consistently identified as having higher transformation potential.

3.

Smallholder support must be scaled and amplified to create impact on the ground.

Smallholder needs and issues manifest in a number of ways across the 20 transformation levers, with support for these strategies a high priority in Food System Types 2, 3 and 4, which are home to the majority of the global population and where smallholders dominate food production.

4.

Implementation of food system transformation will be undermined if infrastructure is not improved.

Developing infrastructure shows highest potential in Food System Types 2, 3 and 4, where 'basic' infrastructures such as roads, transport systems and cold storage facilities are needed to facilitate efficient movement of goods and mitigate the risk of food spoilage and loss.

5.

Redesigning finance and trade is critical for all countries.

Finance and trade levers are ranked especially high in Food System Types 1 and 5, which are often countries that use deforestation - and conversion-free regulations. However, all countries have ranked redirecting subsidies and increasing de-risking investments as high.

6.

Strengthening the scientific evidence for sustainable food production can accelerate its adoption.

Strengthening research and improving data collection and measurement have high potential for impact in most Food System Types, but continued focus on existing, green-revolution era, high-input farming practices and lack of funding remain barriers.

7.

There are no silver bullets – high-tech solutions must be balanced with other actions.

Adopting high-tech food production methods is seen to have lower potential for impact than many other levers and the focus for food system transformation should be less about developing new technological solutions or innovations and more about investing in low-hanging fruit solutions or social innovations.

8.

Alternative proteins get attention but may need more time before driving global impact.

Developing alternative proteins, such as plant-based and cell-based meat alternatives, was ranked as one of the lower potential levers in most countries and was conspicuously absent from most expert rankings of top 10 levers in individual countries.

In a high-stake, high-uncertainty environment, a strategic and collaborative approach to selecting actions that will have the highest impact in the shortest time possible is crucial for achieving health and environmental goals. Potential actions abound, but selecting those that will truly help to transform a food system is difficult, especially given the overwhelming complexity of food systems. The *Great Food Puzzle* is designed to make this process easier for anyone working on food system transformation by reducing this complexity and offering all stakeholders a starting point. This report is not intended to be prescriptive and should not be used in that way. Local knowledge and expertise will always be the most important resource to ensure that actions taken will have the greatest impact for both people and the planet.

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