Integrating UN Food Systems pathways with quantitative trajectories

FABLE Policy Brief
March 2024

Contents

Headlines

- **The UN Food Systems (UNFS) pathways aim to articulate a shared vision** for national food system transformation. Integrated modelled pathways, including those developed by FABLE, can support the prioritisation of impactful actions, and strengthen coherence of targets.

- **UNFS pathways prioritize food and nutrition security and economic development over climate change mitigation and biodiversity protection**. This results in gaps in quantifying parameters essential for integration into the FABLE pathways.

- As a result, around **40% of the tracked indicators used to inform FABLE pathways are not covered by 18 UNFS pathways**.

- This analysis explores how the UNFS pathways and FABLE quantitative modelled pathways can **be better integrated.**

- **We focus on the UNFS pathway in India and Mexico** and find that food security, nutrition, and measures supporting farmers and rural communities are a priority, while crucial areas including biodiversity protection, climate change mitigation, and fertilizer are disregarded.

- **The UNFS pathways should increase quantitative benchmarks to monitor progress** and build a precise roadmap, with the support of quantitative modeling tools used iteratively with stakeholders to agree on targets for food systems.

- **The UNFS pathways highlight countries' priorities for food systems and offer scope for improvement of FABLE tools,** particularly in representing dietary health impacts across population groups, economic development, rural livelihoods, and water.

About FABLE

The Food, Agriculture, Biodiversity, Land-Use, and Energy (FABLE) Consortium is a collaborative initiative to support the development of globally consistent mid-century national food and land-use pathways that could inform policies towards greater sustainability. The Consortium brings together teams of researchers from 24 countries and international partners from the UN Sustainable Development Solutions Network (SDSN), the International Institute for Applied Systems Analysis (IIASA), the Alliance of Bioversity International and CIAT, and the Potsdam Institute for Climate Impact Research (PIK).

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1.Introduction

In September 2021, the UN Secretary-General convened the [Food Systems Summit](#) (UNFSS) **to encourage political and societal involvement in food system challenges and speed up the implementation of actions at the national level**.[1] This UNFSS, the seventh UN Food Summit since 1943[2], was triggered by the slow progress toward achieving the Sustainable Development Goals (SDGs) in recent years exacerbated by interconnected issues, including mounting inflation, the COVID-19 pandemic, climate change, natural disasters, growing food insecurity, and the increasing cost of living.[3]

Integration between the UNFS pathways and quantitative trajectories could strengthen their actionability, guide target setting, and enhance progress monitoring.

In preparation for the Summit, Member States held multi-stakeholder dialogues to develop strategies for sustainable food systems, resulting in 126 [UNFS National Pathways](#) (cf. Figure 1).[3] The UNFS Pathways are designed to be **dynamic, living documents that provide countries with a framework to articulate a vision for food systems**, while also identifying key stakeholders to achieve this vision. But in 2022, out of 118 National Pathways available at the time, only 42 included working steps or an action plan, 16 mentioned responsible institutions tasked with implementation, 9 specified a timeline towards 2030, and 3 included a concrete funding concept.[2]

In July 2023, at the UN Food Systems Summit +2 Stocktaking Moment, countries reinforced their commitment to accelerate global action towards zero hunger, food security, and nutrition (SDG 2). Specifically, countries emphasized **the importance of integrating food system strategies into comprehensive national policies for sustainable development**.[4]

Quantitative integrated modelling pathways assess the potential impact of envisaged actions on multiple objectives[5,6] and show the gaps with the targets within a given timeframe. This enables stakeholders to prioritize actions, set more realistic targets, and adjust strategies accordingly to stay on track towards achieving their goals. Better integration of the UNFS pathways and quantitative modelled pathways would **strengthen their actionability.**

The FABLE Consortium has developed modelling tools and methods to develop long-term integrated pathways for food and land use systems. These involve simulating present and future conditions using available statistics and engaging local stakeholders to define contrasting future national scenarios. The resulting pathways can serve as quantitative roadmaps that facilitate the prioritization of competing land uses and actions in the food system, demonstrating the implications of certain policies and actions on land use dynamics and highlighting the potential synergies and trade-offs.[7]

In this brief, we analyze the quantitative nature of the actions and objectives outlined in the UNFS pathways for 18 countries[a] (cf. Figure 1), with examples from Mexico and India on the possible integration of UNFS and FABLE's pathways. From this analysis, we provide recommendations to facilitate the integration of the UNFS pathways with quantitative FABLE pathways in the future.

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[a] The FABLE Consortium covers 24 countries. By May 2023, only 18 countries represented in FABLE submitted UNFS pathways (Brazil, China, Colombia, Denmark, Ethiopia, Finland, Germany, India, Indonesia, Mexico, Nepal, Rwanda, Russia, South Africa, Sweden, Türkiye, the United Kingdom, and the United States). Argentina, Australia, Canada, Greece, and Norway did not submit a UNFS pathway.

Figure 1. FABLE countries that submitted a UNFS Pathway

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Legend:
- Countries that submitted an UNFS Pathway
- FABLE Countries
- FABLE Countries that submitted an UNFS Pathway
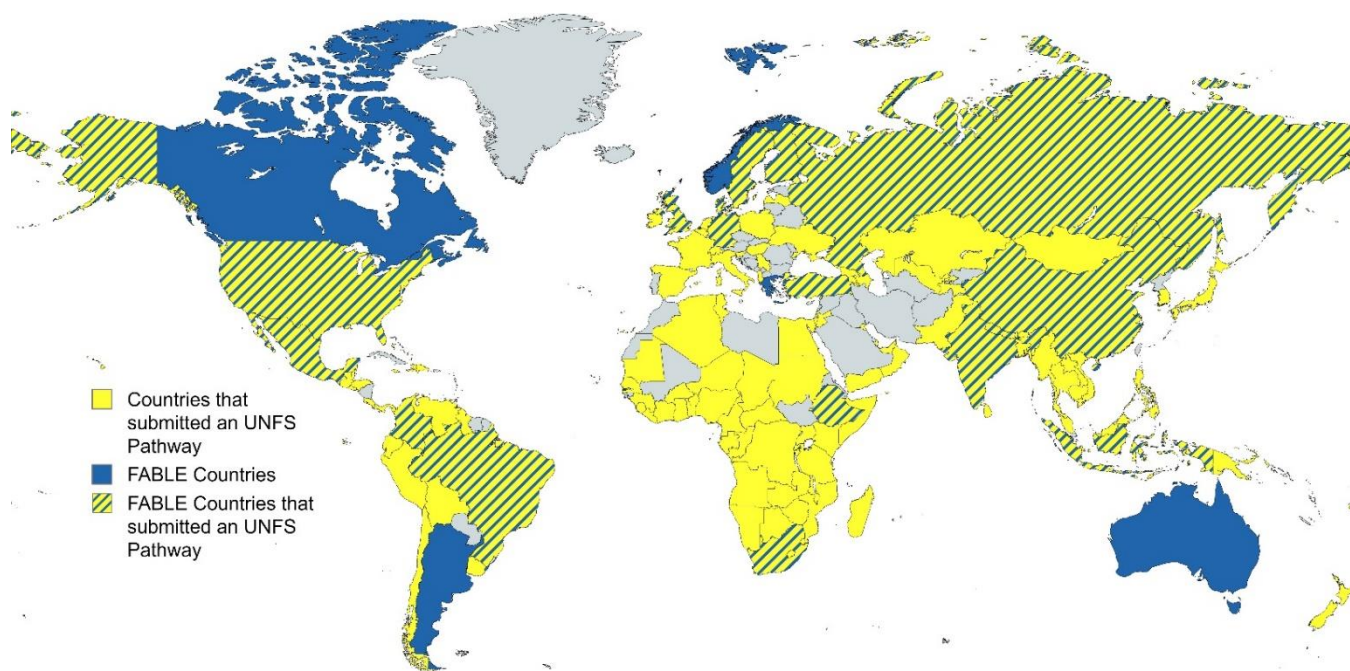
2.Review of the UN Food Systems Pathways

Methodology

We review 18 UNFS pathways along six domains of food systems and 24 indicators that can inform FABLE pathways.

For this analysis, we focus on 18 countries that are represented in FABLE and have submitted a UNFS pathway (cf. Figure 1). We review the UNFS pathways through six domains: food security and healthy diets, climate change mitigation, biodiversity protection, fertilizers use, water use, and economic development, and 24 indicators (cf. Figure 2).

This selection of domains and indicators responds to the scope of the national commitments that FABLE pathways account for. In all FABLE countries, FABLE pathways are computed by local researchers who use the FABLE Calculator[8] (an Excel-based non-optimization model), and in some countries, they use MAgPIE and GLOBIOM (partial equilibrium models).

FABLE identified objectives and actions in the UNFS pathways that could support (1) the quantification of national targets that can be monitored through models, such as the FABLE Calculator, and/or (2) the identification and quantification of levers to achieve sustainable food and land-use targets.

The following criteria guided this analysis:

a. Integrated Food System Approach: Are the UNFS Pathways balanced across the three pillars for integrated food and land-use systems?[b]

b. Measurable Actions and Goals: Can the actions and goals in the UNFS Pathways be quantified and time-bound (e.g., decrease undernourishment by 20% by 2030)?

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[b] FABLE proposes three pillars for sustainable food and land-use systems: (1) efficient and resilient agriculture systems, (2) conservation and restoration of biodiversity, and (3) food security and healthy diets. They are complemented by integrated land- and water-use planning, as well as international trade considerations. This approach is detailed in the FABLE Global Report (2019).[9]

Figure 2. UNFS Pathways commitments and targets by indicators across countries.

6 DOMAINS	24 INDICATORS	BRA	CHN	COL	DNK	ETH	FIN	DEU	IND	IDN	MEX	NPL	RUS	RWA	ZAF	SWE	TUR	GBR	USA
Food Security and Healthy Diets	Share of population undernourished																		
	Share of population overweighted																		
	Diet-related non communicable disease																		
	Food security and affordability																		
Climate Change Mitigation	Economy-wide GHG emissions reduction																		
	Agriculture GHG emissions reduction																		
	LULUCF GHG emissions reduction																		
	Carbon sequestration from land																		
Biodiversity Protection	Loss of natural ecosystems																		
	Afforestation/Reforestation																		
	Restoration of ecosystems																		
	Share of total land under protected areas																		
	Cropland under agroecological practices																		
	Harmful agricultural practices for biodiversity																		
	Deforestation																		
Fertilizers Use	Nitrogen use																		
	Phosphorus use																		
Water Use	Water pollution																		
	Water use																		
Economic Development	GDP growth																		
	Self-sufficiency																		
	Farmers' income																		
	Agricultural and processed food exports																		
	Employment in agricultural sector																		

Legend:
- (Blue) Presence of quantitative targets.
- (Yellow) Vague commitment or actions.
- (Red) No mention of actions/targets related to that indicator.

3. Results

We observed that countries prioritize different domains based on their specific challenges and contexts, with some issues being more pressing in certain regions than others.

We found that around 40% of the tracked indicators are not addressed by UNFS pathways of 18 countries (cf. Figure 2, red boxes). Fertilizer use, climate change mitigation, and biodiversity protection are the areas least addressed in these pathways (cf. Figure 3a). Instead, almost all countries prioritized food security, healthy diets, water use and pollution, and economic development.

Around 40% of the selected indicators are completely absent in the 18 UNFS pathways.

**Quantitative targets are broadly absent in most UNFS pathways.** Only 15% of the indicators that include at least one action or objective (cf. Figure 2, yellow and blue boxes) include a quantitative target, such as aiming to achieve 30% of agricultural land farmed organically by 2030 or ending stunting in children under 2 by 2030 (cf. Figure 2, blue boxes). The rest of the indicators tracked include qualitative objectives and actions that do not have enough detail to translate them into quantitative scenarios or targets that could be compared with model results. Therefore, they are difficult to include in models.

Countries focused their UNFS pathways on agricultural production to ensure food security and healthy diets, with 24% of the indicators defining at least one commitment or action related to this policy area (cf. domain (Figure 3a). More than 20% of the "food security and healthy diets" indicators are addressed with quantitative targets (Figure 3b). Moreover, countries are prioritizing undernourishment and food affordability over food quality and diet-related diseases. Notably, obesity and overweight are the least considered, with only the United Kingdom and Indonesia setting quantitative targets to address these challenges.[10,11]
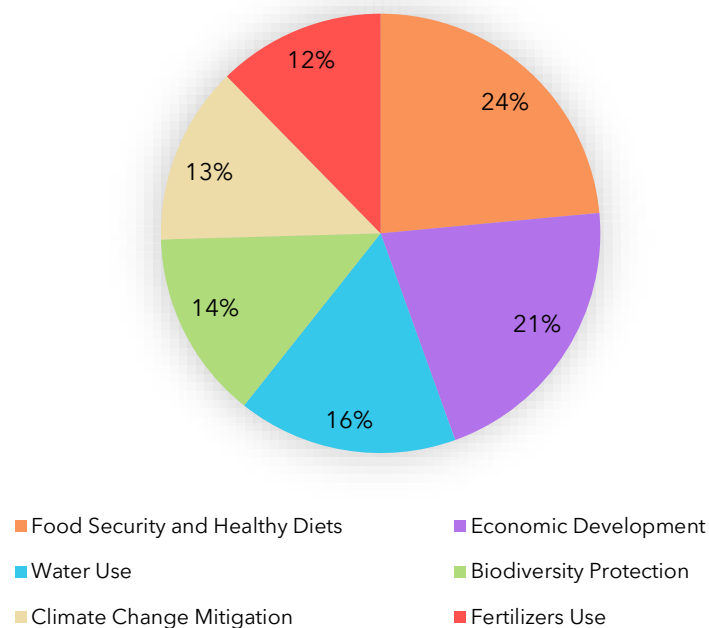
Source: Authors' calculations.

UNFS pathways focus on food security, healthy diets, and economic development, disregarding climate change mitigation, biodiversity protection, and fertilizer use.

Economic development is the second most considered policy area in the UNFS pathways. Notably, 21% of the indicators that include actions or commitments are within the economic development of food systems (cf. Figure 3a). The quantitative focus tends to emphasize considerations related to farmers' income. However, self-sufficiency and agricultural exports are addressed without quantitative targets in any of the countries. India, Indonesia, Mexico, and Rwanda are the only countries proposing quantitative targets for indicators in the economic development area.[11-14]

Water access is a recurrent priority addressed in UNFS pathways, but lacking quantitative targets (cf. Figures 2, 3a, and 3b). Most of the UNFS pathways reviewed reiterated the importance of securing access to water through building water conservation and irrigation infrastructures. Additionally, they emphasized adopting agricultural technologies to save water and promoting crop varieties that require less water. Yet their statements were

not supported by quantitative objectives. Fertilizer use was mentioned by key countries, such as Brazil, China, and the United Kingdom, which committed to regulate further and decrease the use of chemical fertilizers.[10,15,16] However, these commitments lacked time-bound reduction targets.

There is comparatively lower emphasis on climate change mitigation, but when it is addressed, it is often supported with targets (cf. Figures 3a, 3b). Quantitative targets for climate mitigation are in line with climate strategies, such as Nationally Determined Contributions (NDCs) and Long Term – Low Emission Development Strategies (LT-LEDS). Within this policy area, the indicator that shows the highest number of quantitative targets is economy wide GHG emissions reduction. Denmark, Finland, and the United States address the most climate change

mitigation indicators with quantitative targets.[17-19] While climate change mitigation efforts often include targets, the most notable absence across the board is the lack of a GHG emission reduction target for the Agriculture, Forestry, and Other Land Use (AFOLU) sector.

Biodiversity protection is often absent in the UNFS pathways (cf. Figures 3a, 3b). Overall, countries did not connect the UNFS process with relevant biodiversity plans, such as the National Biodiversity Strategies and Action Plans (NBSAPs) and the Kunming-Montreal Global Biodiversity Framework[20]. In this policy area, biodiversity protection is only reflected through quantitative targets for expanding cropland areas under agroecological practices. Among the countries analyzed, Denmark and the United Kingdom addressed the most biodiversity indicators.[10,18]

Figure 3b. Proportion of indicators with quantitative targets
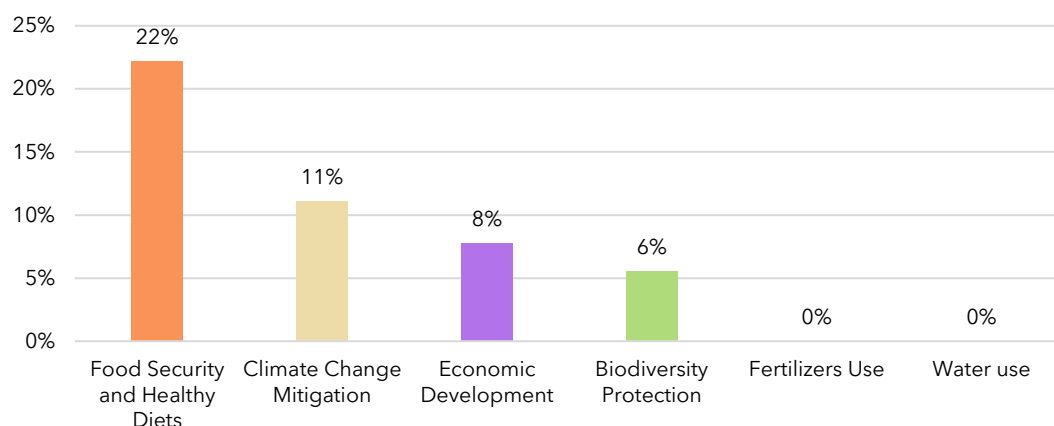
Source: Authors' calculations.

4. Country Cases

FABLE country teams have translated targets and commitments from the UNFS pathways, along with other policy documents, into assumptions underlying a quantitative pathway reflecting national commitments. To illustrate the application of FABLE tools to the UNFS pathways and ways in which both can complement each other, we have focused on two countries: India and Mexico.

India

India's UNFS dialogue has been led by the Ministry of Agriculture and convened by Prof. Ramesh Chand, Member of NITI Aayog, and Union Minister of State.[21] NITI Aayog is the National Institution for Transforming India and acts as a platform for dialogue and collaboration between the central government and the states, aiming to foster cooperative federalism and facilitate effective policymaking and implementation.[22]

India's UNFS pathway emphasizes food security, water, and biodiversity, but lacks specific targets in crucial areas like biodiversity protection, water, and climate change mitigation.

India's UNFS pathway addresses nearly 38% of the tracked indicators (cf. Figure 2, blue and yellow boxes) and includes quantitative measures addressing farmers' income, employment in the agricultural sector, as well as undernourishment, and food security and affordability, (cf. Figure 2, blue boxes). To address the current surplus in food production relative to demand, efforts are being made to increase farmers' income through accelerating output growth, diversification towards high-value enterprises, and cost reduction, aiming to double farmers' income.[12] Similarly, the PM-KISAN scheme also mentioned, provides income support to all landholding farmers to supplement their financial needs for procuring various inputs related to agriculture and allied activities as well as domestic needs.

Almost one third of the tracked indicators, with at least one action or commitment, focus on food security challenges (cf. Figure 4). For instance, India set as a quantitative target, "balanced nutrition available" for 10 million households by 2024, through programs, such as the "Agri Nutri Garden" initiative.[12] It also includes food-based safety net programs, reaching almost 800 million people in 2020, and close to 120 million children through meal schemes. Additionally, there are food security programs which provide two-thirds of the population with access to 5 kg of grains per person per month at a fair price, as well as programs aiming to enhance child and maternal health through nutrition interventions, benefitting over 19 million pregnant and lactating women and 82 million children under 6 years old.[12] In areas where the UNFS pathway omits quantitative targets, it links with relevant policies.[c]

Water also holds great relevance in India's UNFS pathway yet lacks a concrete target (cf. Figures 2, 4). As the agriculture industry is the biggest employer in India, stable irrigation is an important source of growth and stable income.[12] As such, India's UNFS outlines the priority to expand irrigation coverage and enhance water use efficiency through different programs, including the Pradhan Mantri Krishi Sinchayee Yojana

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[c] This is the case of the Millet Mission, which seeks to accelerate the production and promotion of millets, promoting a healthier dietary choice, ensuring balanced household nutrition, and accessibility to fortified foods across India.

(PMKSY), but targets are missing as well.[12]

India's UNFS pathway mildly addresses the biodiversity loss driven by agriculture. India's rapid economic growth has placed great stress on biodiversity.[23] This has resulted in various threats, including the loss and degradation of habitats, the introduction of invasive species, and the intensification of forest fires.[21,24,25] India's UNFS pathway mentions local initiatives (e.g., in Chhattisgarh, Odisha, Uttarakhand, and Karnataka) to expand cropland areas under agroecological practices or local actions that seek to reduce or halt the use of agrochemicals and other agricultural practices that harm biodiversity.

To halt biodiversity loss in the FABLE pathway, the FABLE India team based its scenarios on other commitments. They included the Bonn Challenge target for afforestation (26 Mha by 2030), in line with the country's commitments under the Convention on Biological Diversity Framework, whereby India pledged to restore 13 Mha of degraded and deforested land by 2020, and an additional 13 Mha by 2030.[26] Additionally, the team built on the National Mission for a Green India target to convert 10 Mha of forest and non-forest land to boost forest cover and quality, sequestering carbon to 60 Mt by 2020 and up to 100 MtCO2e thereafter (c.f. Supplementary information).

For climate change mitigation, FABLE India used existing mitigation targets within climate strategies. FABLE India used targets in India's NDC to build the FABLE pathway, mainly reducing GHG emissions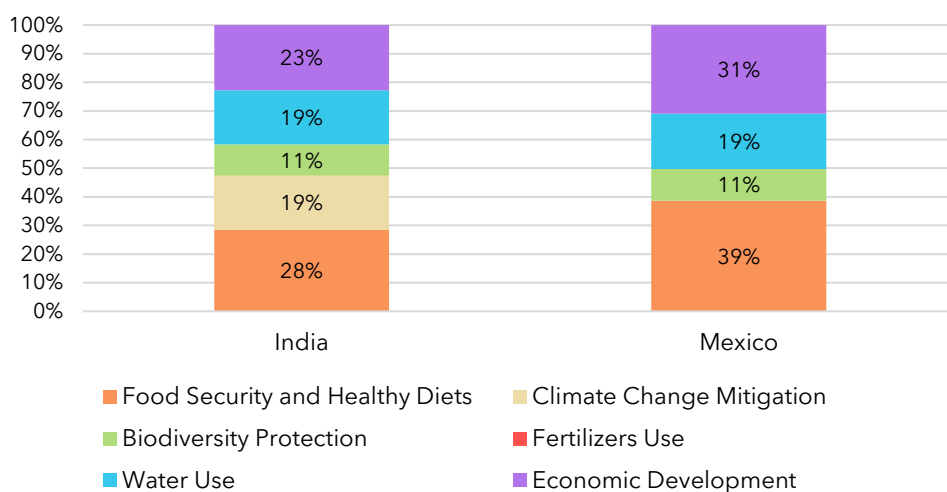 from all sectors to net zero by 2070.[27] As per the updated NDC, India now stands committed to reducing the emissions intensity of its GDP by 45% by 2030, from the 2005 level,[28] and achieving approximately 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. The latter has implications for agricultural production and land use for biofuels. It is worth noting that India does not have a specific emission reduction target for the AFOLU sector.

For water use for agriculture, FABLE India drew from the PMKSY program, mentioned in India's UNFS pathway,[21] as a basis to project a future scenario involving a doubling of irrigated areas compared to the 2020 value and a reduction of 30-37% of water use by 2050. The same local initiatives (e.g., in Chhattisgarh, Odisha, Uttarakhand, and Karnataka) to expand areas under agroecological practices cited in the India UNFS pathway, were translated into 2 Mha expansion by 2024.

FABLE India designed additional scenarios on deforestation or the evolution of agricultural exports based on commitments and targets from various policy documents (e.g., the National REDD+ Strategy and the Agriculture Export Policy).[29,30]

There are limitations to the FABLE modeling tools in representing key aspects of the UNFS pathway. For instance, measures targeting specific population groups (e.g., children, pregnant or lactating mothers, smallholders, or women farmers) cannot be modeled with FABLE tools. Additionally, since FABLE tools focus on AFOLU, nutrition measures, such as school meals, increased access to fortified foods, or interventions carried out at the food processing phase cannot yet be modeled in FABLE.

Figure 4. Distribution of indicators with at least one action or commitment by policy areas across countries

India
- 28% Food Security and Healthy Diets
- 19% Climate Change Mitigation
- 11% Biodiversity Protection
- 19% Water Use
- 23% Economic Development

Mexico
- 39% Food Security and Healthy Diets
- 11% Biodiversity Protection
- 19% Water Use
- 31% Economic Development

Legend:
- Food Security and Healthy Diets
- Climate Change Mitigation
- Biodiversity Protection
- Fertilizers Use
- Water Use
- Economic Development

Source: Authors' calculations.

Mexico

Mexico's UNFS Pathway focuses on food security, nutrition, self-sufficiency, and rural livelihoods with an emphasis on increasing the agricultural productivity of smallholder farmers.

Mexico's UNFS dialogue was convened by the general director of the National Center for Preventive Programs and Disease Control, under the Ministry of Health. Between April 15 and September 3, 2021, ten national dialogues and one subnational dialogue were held in Mexico, with 1,132 participants, representing more than 90 institutions and organizations.[13]

In Mexico's UNFS pathway, there is an emphasis on quantitative actions for food security and affordability, farmers' income, and agricultural employment (cf. Figure 2, blue boxes). Actions and goals in these three domains are linked with existing programs and policies that demonstrate a higher degree of operationalization.[13] For instance, Mexico's UNFS pathway refers to the sectoral program for agriculture, approved under the National Development Plan 2019-2024,[31] which outlines concrete actions to increase agricultural productivity, food self-sufficiency, rural employment, and food security.

Nutrition holds the highest priority in Mexico's UNFS pathway, with all the indicators for food security and healthy diets addressed. The pathway proposes actions, such as new dietary guidelines and prioritizing the link between healthy dietary guidelines to regional diets, to ensure their relevance and practicality for different areas of the country (cf. Figure 4).[13] These measures were modelled in the FABLE pathway through an average dietary composition, based on the National Health Program 2020-2024.[32] This diet consists of cereals (34%), vegetables (5%), fruits (6%), dairy (8%), nuts and seeds (5%), oils (11%), legumes (12.1%), eggs (3%), poultry (4%), beef (1%), other red meat (1.1%), and fish (1%).

The UNFS pathway includes additional measures to ensure food security and nutrition, that cannot be modeled with the FABLE Calculator. These include, for example, enhancing the legal framework for ensuring proper and sustainable nutrition, limiting advertisements for foods high

in critical ingredients (e.g., sodium, saturated fats, trans fats, and added sugars), banning the use of partially hydrogenated oils in food production, and enhancing the monitoring for flour fortification programs.[13] Additionally, the UNFS pathway includes specific measures aimed at segments of the population that cannot be captured with FABLE tools.[d]

With 48% of the rural population living in poverty,[33] Mexico has focused its UNFS pathway on supporting smallholder farmers in adopting agroforestry techniques and increasing agricultural productivity and self-sufficiency through agroecological practices for domestic consumption.[13] These measures include continuing policies aimed at capacity building in agroecological practices, reducing glyphosate usage, and assisting farmers in accessing agri-food value chains to trade surplus produce. For the FABLE Pathway, FABLE Mexico projects 75% of cropland using agroecological practices by 2050. This scenario considers that 75% of cropland is managed by small and medium farmers, 80% of farmers have already adopted at least one agroecological practice (e.g., covering crops or reducing tillage) through the Sowing Life program in 2018, coupled with the Ministry of Agriculture's target to achieve 100% adoption by 2024[24], a goal that remains unmet.

In Mexico's UNFS pathway, 58% of the tracked indicators are not addressed (cf. Figure 2, red boxes), primarily related to climate change mitigation.[13] In the FABLE pathway, this dimension is reflected through GHG emission reduction targets for AFOLU. FABLE Mexico used the 2022 NDC, specifically the economy-wide target of a 35% reduction in emissions by 2030 compared to its baseline,[35] to monitor

the pathway performance on this indicator, without clarity on what the target is for the AFOLU sector. Mexico's sectoral program for agriculture, approved under the National Development Plan 2019-2024, included a quantitative target to reduce GHG emissions from the agriculture sector by barely 0.4% compared to 2017 value, to reach 86,750 MtCOe by 2024.[31] In addition, Mexico committed to the Global Methane Pledge across all sectors by at least 30% below 2020 levels by 2030.[36] Given these contrasting targets, the UNFS pathway could be an opportunity to propose a coherent long-term emission reduction target for AFOLU that is collectively agreed upon and is consistent with existing national commitments.

Biodiversity is partially covered in the UNFS pathway, mostly through measures aimed at phasing out glyphosate use. These measures focus on the publication of gazettes detailing weed control practices and annual recommendations on import quotas for glyphosate to facilitate its gradual decrease. However, the FABLE Calculator does not quantify the use of herbicides. To reflect biodiversity protection in the FABLE pathway, FABLE Mexico built a scenario that brings in the net-zero deforestation target by 2030 and the deforestation halt goal in carbon-rich ecosystems by 2030, based on the National Forestry Program (2020-2024). The scenario also reflects Mexico's commitment to safeguarding 30% of its territory by 2030[36]. To account for fertilizer use, the team simulated a 20% reduction in the maize yield gap, driven by the distribution of fertilizers through the "Fertilizers for Wellbeing" program, which provides small-scale producers with 450kg of fertilizer per hectare.[37]

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[d] For instance, the Sowing Life program, mentioned in the UNFS pathway, includes specific measures aimed at providing economic support to people in socially disadvantaged municipalities who own 2.5 hectares of land and employ agroforestry practices, ensuring they can meet their basic food needs.

5. Recommendations

The FABLE modeling framework can complement the implementation of the UNFS pathways, but stronger quantitative benchmarks are essential to operationalize the transformation.

The UNFS pathways represent an initial effort to engage nations globally in committing to the transformation of their food systems. These pathway documents are valuable sources of information, offering insights into a country's existing food system, priorities, recent progress, and forthcoming initiatives. Compared to past summits, UNFSS 2021 exhibited significantly greater inclusivity, effectively rallying nations and stakeholders through a variety of dialogue formats.[2] The UNFS pathways have the potential to drive collective effort and can serve as a valuable guide for action; yet their capacity to support decision-making can still be improved through modeling exercises.

The modeling of the UNFS pathways has revealed the priorities set by countries for their food systems and highlighted areas where FABLE modeling tools need development. While most UNFS pathways prioritize measures concerning food security, nutrition, economic development, and rural development, the indicators in the FABLE Calculator are currently limited and need further enhancements to reflect this reality. For instance, there is a need for improved representation of targeted measures for specific population groups, such as mothers, children, smallholder farmers, and women farmers. Despite addressing undernourishment, the Calculator still lacks the ability to reflect important health outcomes from the food system, such as stunting, wasting, and non-communicable diseases, along with specific scenarios related to nutrition interventions like food fortification. On economic development, the Calculator has recently included an agricultural cost module, including scenarios on cost and labor, but it is not enough to reflect rural livelihoods measures, such as social protection systems for farmers, or farmers' income. Notably, the Calculator could benefit from further improvements to represent measures focused on improving irrigation efficiency and tackling water pollution. These are some of the domains that the FABLE Consortium members envision collaborating on to continuously enhance the tool and accurately reflect the food system in the coming years.

The UNFS pathways require stronger quantitative benchmarks to be monitorable with quantitative tools, such as the FABLE pathways. The UNFS pathways need to include a higher number of targets and quantitative benchmarks to become effective tools that guide operationalization at the sectoral and sub-national levels. The use of quantitative modeling tools iteratively with stakeholders at the UNFS Summit dialogues could offer a pragmatic solution to address the current absence of quantitative benchmarks in the UNFS pathways. This participatory approach enables stakeholders to refine and establish clear benchmarks tailored to specific contexts within the food system through evidence-based discussions and analyses. This framework can be used for engaging stakeholders to review and identify potential bottlenecks or points of policy incoherence where further dialogue is needed. This approach can promote increased transparency, inclusivity, and informed decision-making, ultimately enhancing the effectiveness and accountability of the UNFS pathways in advancing sustainable food systems.

The UNFS pathways can serve as a platform to develop targets on climate change mitigation, adaptation, and biodiversity protection for food systems.
Biodiversity provides ecosystem services, such as pollination, soil fertility, and natural pest control, which are essential for agriculture[38]. The UNFS could include specific actions and targets to halt biodiversity loss driven by agriculture. Further, they could encompass measures aimed at increasing crop and livestock productivity through biodiversity-friendly agricultural practices. Such practices not only optimize agricultural land use, but also facilitate species inhabitation in managed landscapes and promote movement between natural land areas.[39] In terms of climate mitigation, the UNFS pathways could function as a platform for food system stakeholders to collaboratively deliberate and reach a consensus on an emission reduction target tailored to the agricultural and land-use sector. This target should be suitable for their AFOLU context and in harmony with other food system goals.[40] Currently, adaptation is a dimension lacking in both the UNFS and FABLE pathways. Acknowledging this gap, FABLE aims to integrate adaptation considerations, specifically focusing on the impact of climate shocks on agriculture and resilience, as part of its ongoing tool improvements.

Taking into account trade spillovers is crucial for both FABLE and UNFS pathways.. Globally, agricultural supply chains contribute significantly to spillover effects such as deforestation and water scarcity.[41] FABLE tools currently incorporate trade assumptions to maintain global consistency across national pathways and will further include bilateral trade flows to depict spillovers more accurately in the future. These enhancements and findings could guide future versions of UNFS pathways by demonstrating how actions in one country can impact food and land use systems in others.

Financing food systems transformation has taken center stage as the primary area of support sought by Member States.[3] It is imperative to secure adequate financial resources to facilitate transformative actions and scale-up initiatives aimed at fostering sustainable changes within food systems.[3] A clear understanding of specific goals and the pathway to achieve them is fundamental to assessing the financial requirements necessary for this transformative process. The consolidation of the currently fragmented food finance architecture is an indispensable step toward realizing this transformation, with modeling exercises serving as vital tools for both guiding and assessing progress in the pursuit of essential financial support. Recognizing the importance of this endeavor, FABLE aims to advance its modeling developments for costing its pathways in the future by assessing the associated financial requirements from each trajectory, and accompanying countries in their food system transformation.

The UNFS pathways can serve as a platform to develop targets on climate change mitigation, adaptation, and biodiversity protection for food systems.

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Supplementary material

Comparison between the UNFS Pathways commitments and FABLE India National Targets: India and Mexico.

Recommended citation

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Annex

Methodology for analysis and computation of the Figures 2, 3a, 3b, 4.

The shares have been computed using the maximum number of indicators – 18 countries multiplied by 24 indicators = 432; the number represents the combination of the country and indicator which are mentioned in the UNFS pathway (e.g., share of the population undernourished in Brazil, in China … in the USA, share of population overweighted / obese in Brazil, in China, ... in USA, etc.). Of these indicators, 261 embody at least one action or target. Among these 261, 38 indicators presented at least one <u>quantitative</u> action/target.

Figure 3a and Figure 4 – Distribution of indicators with at least one action or target across countries within different policy areas.

Some domains (food security and healthy diets, climate change mitigation, etc.) contain more indicators than others. "Food security and healthy diets" has 4 indicators, "climate change mitigation" has 4, "biodiversity protection" has 7, "fertilizer use" has 2, "water use" has 2, and "economic development" has 5. To avoid having a domain that has a higher share of indicators with actions/commitments due to a higher number of indicators, we first divided the number of indicators with actions or commitments by domain (i.e. if "food security and healthy diets" presents 3 indicators covered, the % would be 75). Then, the sum of these six weighted shares was normalized to 100%. This allowed for the representation of results as a % for each domain, which was then used to construct Figure 3a and 4.

Here, we demonstrate a practical example. Indicators with at least one action/commitment by domain for country x: "food security and healthy diets" has 3 indicators covered out of 4 (3/4 = 0.75), "climate change mitigation" 1 out of 4 (0.25), "biodiversity protection" 2 out of 7 (0.29), "fertilizer use" 0 out of 2 (0.00), "water use" 1 out of 2 (0.50), and "economic development" 3 out of 5 (0.60). The sum of the weighted shares is 2.39, and then normalized to 100%. With 2.39 being 100%, the shares of the policy areas would respectively be: 31% (equal to 0.75/2.39), 10% (0.25/2.39), 12% (0.29/2.39), 0% (0/2.39), 22% (0.5/2.29), and 25% (0.6/2.39).

Figure 3b - Proportion of indicators with quantitative targets

The proportion represents the share of indicators with quantitative targets among all the indicators, grouped by domain.

Here, we demonstrate a practical example. For "Food Security and Healthy Diets", 16 indicators with quantitative targets have been identified, out of 72 possible indicators (18 countries and 4 "Food Security and Healthy Diets" indicators). Therefore, 22% of the indicators identifies quantitative targets.