



**Food
Fortification
Initiative**

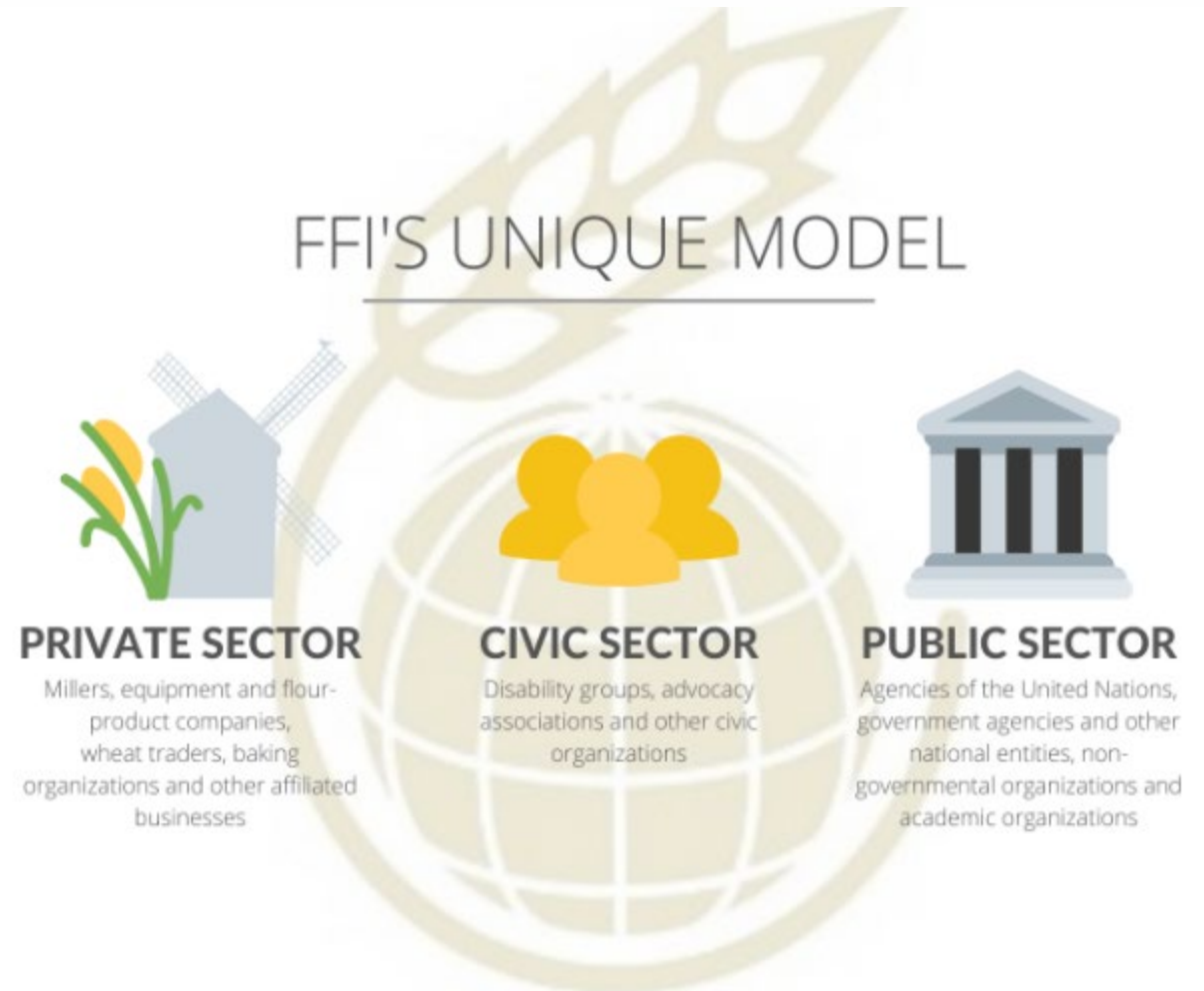
Enhancing Grains for Healthier Lives

Strengthening Nutrition in South Asia Through Food Fortification

Dr. Parveen Bhalla, FFI India Project Lead
December 2025

About the Food Fortification Initiative (FFI)

- 20+ years of experience in food fortification
- Provides evidence and technical assistance to public, private, and civic stakeholders globally, helping them to plan, implement, and monitor the fortification of industrially milled wheat flour, maize flour, and rice
- Based in Atlanta, Georgia, USA, with regional staff in Central Asia, Africa, and South Asia



A woman with short dark hair, wearing a light-colored patterned top and a necklace, is holding a baby in her arms. She is looking down at the baby with a gentle expression. The background is a blue wall and a wooden door with a handle. The lighting is soft, coming from the left side.

A heavy global burden of micronutrient deficiencies

2 billion +

People worldwide suffer from the effects of micronutrient malnutrition.¹

1.2 billion

Women of reproductive age have at least one micronutrient deficiency.¹

372 million

Half of all preschool-aged children have at least one micronutrient deficiency.¹

¹Stevens, G., et al. Micronutrient deficiencies among preschool-aged children and women of reproductive age worldwide: a pooled analysis of individual-level data from population-representative surveys. *The Lancet Global Health*. 2022

Food fortification saves & improves lives

- Iron and folic acid, two of the most common nutrients added to fortified flour, can prevent anemia and birth defects
- 250 million women of reproductive age are affected by anemia¹
- 204,430 babies were born with folic acid-preventable birth defects of the brain and spine in 2022²
- Fortification is linked to higher work productivity and GDP³
- Consuming foods fortified with folic acid reduces the risk of cardiovascular disease⁴



¹ World Health Organization. The global prevalence of anemia in 2011. 2015.

² Wagh, K. et al. A global update on the status of prevention of folic acid-preventable spina bifida and anencephaly in year 2022. Birth Defects Research. 2024.

³ Horton, S. and J. Ross. The economics of iron deficiency. Food Policy. 2007.

⁴ Ismail, S. et al. Intended and unintended benefits of folic acid fortification—a narrative review. Foods. 2023.

Fortification works: Haryana, India example

	PHASE 1 (baseline)	PHASE 3 (end-line)		Reduction in prevalence after fortification project
Test parameters	Deficiency or insufficiency (%)	Deficiency or insufficiency (%)	P-value	
Anemia <12 g/dL	51.21 (46.37, 56.56)	41.24 (36.52, 46.57)	<0.001	20%
Severe anemia <8 g/dL	3.2	2.2	-	33%
Serum folate <7 nmol/L (deficiency)	8.89 (6.42, 12.32)	4.31 (2.67, 6.96)	0.009	50%
RBC folate <748 nmol/L (insufficiency)	79.46 (75.45, 83.68)	50.00 (45.16, 55.36)	<0.001	38%
RBC folate <305 nmol/L (deficiency)	8.11 (5.75, 11.43)	1.08 (0.41, 2.87)	<0.001	87%
Vitamin B12 ≤300 pg/mL (insufficiency)	81.67 (77.83, 85.70)	56.03 (51.24, 61.35)	<0.001	31%
Vitamin B12 <200 pg/mL (deficiency)	59.84 (55.05, 65.04)	23.45 (19.51, 28.18)	<0.001	64%

UNMET POTENTIAL

Most of the world's industrially milled grains are not yet fortified

	WHEAT FLOUR	MAIZE FLOUR	RICE
	million metric tons	million metric tons	million metric tons
Available for human consumption	424	80	336
Industrially milled	338	29	266
Industrially milled and fortified	104	11	35
% industrially milled and fortified	31%	39%	13%

Source: Unpublished data. Food Fortification Initiative. 2025.

Photo: Ray Witlin

A woman wearing a red sari with a colorful pattern is sitting in a field of young trees. She is looking down and to the right. The background is filled with thin tree trunks and green foliage. The text "Country snapshots" is overlaid in white, bold font, with a vertical line to its left.

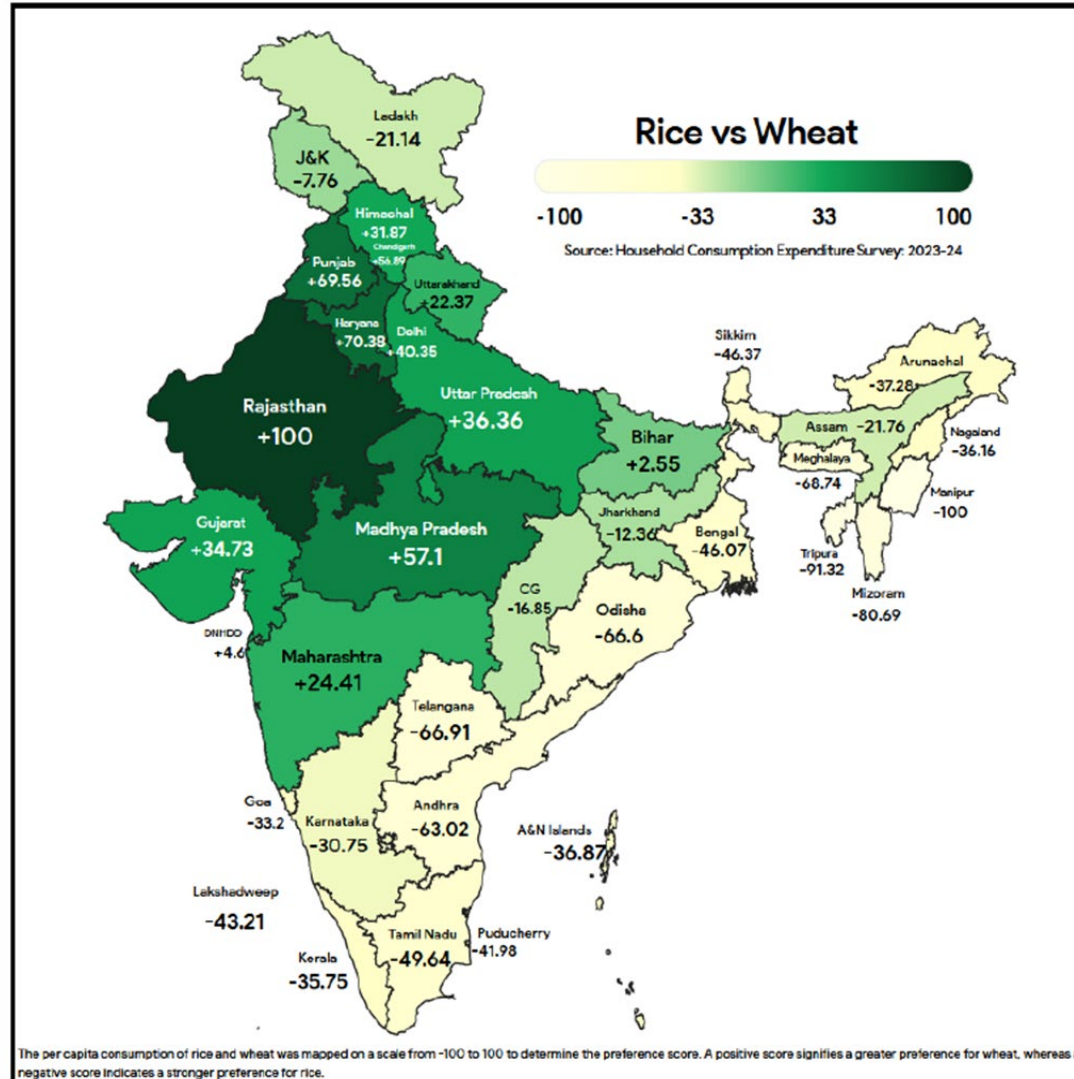
Country snapshots

India



	Wheat flour	Rice
Average consumption (grams per capita per day)	163	181
Fortification legislation	Voluntary	Voluntary
Number of industrial mills (>20 metric tons/day)	1200	-
% Flour/rice produced in industrial mills	30	-
% Industrially milled flour/rice that is fortified	1	26
Fortification opportunity	Distribution through social protection programs and open market (where applicable)	Open market (where applicable); currently fortified through social protection programs

Grain Consumption: By State



- Wheat constitutes around 40% of the total grains distributed under PDS
- After rice, it is the 2nd most consumed grain in India

Fortified rice journey in India

The government of India has been distributing fortified rice in 15 states as part of a pilot scheme that began in 2019

- Phase I (2020-2022): Covered ICDS and PM-POSHAN
- Phase II (2022-2023): Expanded coverage to the Targeted Public Distribution System and other welfare schemes in 291 districts
- Phase III (2023-2024): Extended to remaining districts

Type of rice	Jan 2023 (in million MT)	Sep 2024 (in million MT)
Fortified rice	0.8	2.0
Unfortified rice	1.98	0.7

Aid from the Central Government

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Cabinet okays fortified rice supply under welfare schemes till Dec 2028 at Rs 17,000 cr cost

The decision was taken at a meeting of the Union Cabinet, chaired by Prime Minister Narendra Modi.

 **Ajith Athrady**

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What's Brewing



PM Modi to launch projects in Varanasi on Sunday

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India's fortification standards are not in line with WHO guidelines

2018 FSSAI wheat flour fortification standards have lower levels of folic acid and vitamin B12 than 2016 standards

Micronutrient	2016 standards per kilogram atta (follows WHO guidelines)	2018 standards per kilogram atta (does not follow WHO guidelines)	Difference from WHO guidelines
Folic acid	1300 mcg	75 – 125 mcg	13x below WHO guidelines
Vitamin B12 (cyanocobalamine or hydroxycobalamine)	10 mcg	0.75 – 1.25 mcg	10x below WHO guidelines
Iron	20 mg of sodium iron EDTA	28 mg – 42.5 mg of various iron compounds or 14 mg – 21.25 mg of sodium iron EDTA	----

FSSAI: Food Safety and Standards Authority of India
mg: milligram
mcg: microgram

** FSSAI - Avg wheat flour consumption in India 200-250 grams per person per day

Afghanistan



	Wheat flour	Rice
Average consumption (grams per capita per day)	364	58
Fortification legislation	Mandatory	None
Number of industrial mills (>20 metric tons/day)	38	2?
% Flour/rice produced in industrial mills	81	79
% Industrially milled flour/rice that is fortified	71.2?	-
Fortification opportunity	Verify supply chain diagnostic and industrial milling profile. Check monitoring protocol and program performance	Focus on wheat flour

Bangladesh



	Wheat flour	Rice
Average consumption (grams per capita per day)	36	453
Fortification legislation	Voluntary	Voluntary
Number of industrial mills (wheat \geq 100 metric tons/day, rice \geq 8 metric tons/hour)	15	230+
% Flour/rice produced in industrial mills	41-78 (reach 59 million-urban)	27.5
% Industrially milled flour/rice that is fortified	0	0
Fortification opportunity	Mandate wheat flour fortification	Watch rice industry; recommend fortification mandate if consolidation of industry

Bhutan



	Wheat flour	Rice
Average consumption (grams per capita per day)	32	337
Fortification legislation	None	None
Number of industrial mills (>20 metric tons/day)	0	
% Flour/rice produced in industrial mills	-	89
% Industrially milled flour/rice that is fortified	-	10
Fortification opportunity		Supply chain diagnostic and industrial milling profile needed

Maldives



	Wheat flour	Rice
Average consumption (grams per capita per day)	131	138
Fortification legislation	None	None
Number of industrial mills (>20 metric tons/day)	-	-
% Flour/rice produced in industrial mills	100	100
% Industrially milled flour/rice that is fortified	-	-
Fortification opportunity	Mandate fortification of imports	Mandate fortification of imports

Nepal



	Wheat flour	Rice
Average consumption (grams per capita per day)	111	249
Fortification legislation	Mandatory	Voluntary
Number of industrial mills (>20 metric tons/day)	-	-
% Flour/rice produced in industrial mills	25	56
% Industrially milled flour/rice that is fortified	36.8	0
Fortification opportunity	Strengthen compliance for wheat flour fortification. Supply chain diagnostic and industrial milling profile needed	Supply chain diagnostic and industrial milling profile needed

Pakistan



	Wheat flour	Rice
Average consumption (grams per capita per day)	254	33
Fortification legislation	Voluntary	None
Number of industrial mills (>20 metric tons/day)	1080	500
% Flour/rice produced in industrial mills	32	90
% Industrially milled flour/rice that is fortified	5	0
Fortification opportunity	Explore supplementation programs or other staples	

Sri Lanka



	Wheat flour	Rice
Average consumption (grams per capita per day)	90	351
Fortification legislation	Mandatory	Voluntary
Number of industrial mills (>20 metric tons/day)	2	-
% Flour/rice produced in industrial mills	100	56
% Industrially milled flour/rice that is fortified	-	-
Fortification opportunity	Check monitoring protocol and program performance	Verify supply chain and if feasible mandate fortification in the open market and social protection programs

For more information:

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**Food
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Initiative**

Enhancing Grains for Healthier Lives

A woman wearing a red shawl with a blue and white floral pattern is working in a field. She is looking down at something in her hands. The background is filled with green plants and trees. The word "Appendix" is written in large white letters across the center of the image.

Appendix

Globally, fortifying flour with folic acid prevented about 63,520 brain and spine birth defects in 2022—an average of **174 healthier babies every day**



What is food fortification?

Fortification adds vitamins and minerals during processing so that foods are more nutritious.

Vitamins and minerals are combined in a powdery premix to add to flour during the milling process.
Photo: CDC Foundation



A photograph of a woman in a patterned dress and headwrap handing a 10,000 CFA franc banknote to another woman in a market setting. In the background, there are several sacks of grain, some labeled '5 KG' and 'Gendarme Saint-Louis'. The scene is brightly lit, suggesting an outdoor market.

Large-scale food fortification is one of the most cost-effective development investments that exist.

- Copenhagen Consensus^{1,2}

¹ Horton S., et al. Best practice paper food fortification with iron and iodine. Copenhagen Consensus Center. 2008.


² Hoddinott J., et al. Investments to reduce hunger and undernutrition. Copenhagen Consensus Center. 2012.

FORTIFICATION: A COST-EFFECTIVE SOLUTION



VACCINES

ALL ANTIGENS

 **\$45** per person
16:1 benefit-cost ratio



FORTIFICATION

WHEAT - IRON AND FOLIC ACID
SALT - IODINE

 **< \$15** per person
27:1 benefit-cost ratio

Fortification of wheat flour costs **less than \$15** per person per year. For every \$1 spent, **fortification saves a country \$27** in health costs and lost productivity.

Source: American Society for Nutrition

1. Ozawa, et al. 2016. Return On Investment From Childhood Immunization In Low- And Middle-Income Countries, 2011–20. Uncertainty range 10-25.

2. Immunization Delivery Costs in Low and Middle-Income Countries, April 2019. Fully-vaccinated child defined as those receiving DPT3. Median value of delivery \$24.86. Range: \$8.13 – \$96.16. Vaccine costs are approximately \$20 per fully immunized child (BCG, measles, pentavalent, pneumococcal conjugate, rotavirus, inactivated poliovirus), Gavi and UNICEF, 2019.

3. Unpublished analysis by GAIN/BMGF. Data drawn from: 1) Horton, S., Alderman, H., Rivera, J., 2008. Copenhagen Consensus 2008; 2) Horton, S., Ross, J., 2003. The economics of iron deficiency; 3) Decline in the prevalence of neural tube defects following folic acid fortification and its cost-benefit in South Africa Sayed, A.R., Bourne, D., Pattinson, R., Nixon, J., Henderson, B., 2008; 4) Food Fortification in a Globalized World, Chpt 31, Table 31.1.



HOW WE WORK

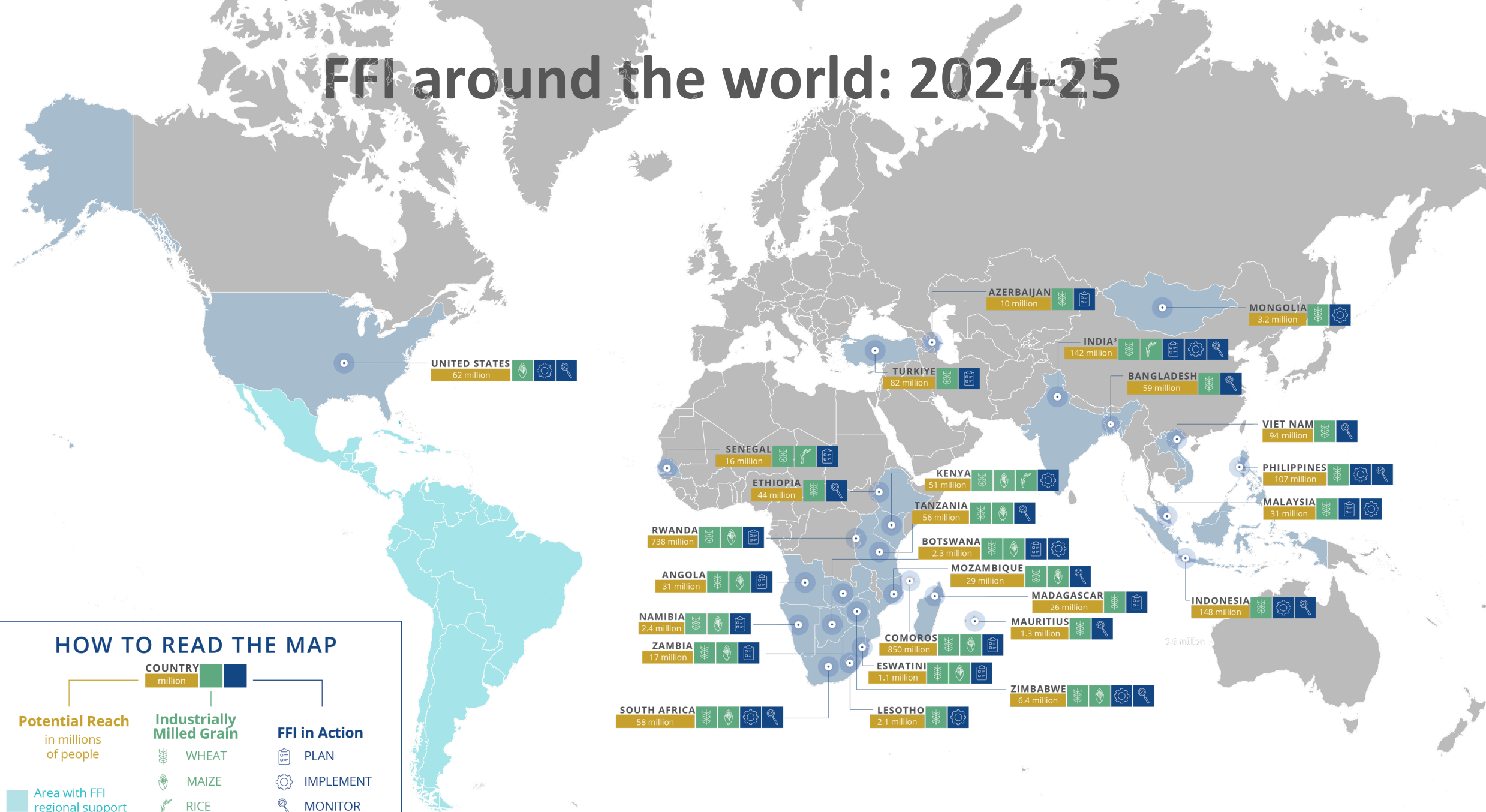
**We support
and empower
locally**

FFI around the world: 2024-25

HOW TO READ THE MAP

COUNTRY		million
	Potential Reach	in millions of people
	Industrially Milled Grain	
	WHEAT	
	MAIZE	
	RICE	
	FFI in Action	
	PLAN	
	IMPLEMENT	
	MONITOR	

Area with FFI regional support



The global gap

An additional 76% of birth defects of the brain and spine¹ and 34% of global anemia cases² could still be prevented through adequate intake of iron and folic acid.

¹ Wagh et al. 2024.

² Keats et al. 2019.

Photo: Benedicte Kurzen

