VITAMIN 2026: COUNTRY INSIGHTS

LESSONS FROM PREMIX SUPPLY CHAINS IN INDIA AND KENYA

ATNi
NUTRITION
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IMPACT

ABOUT ATNi

ATNi (Access to Nutrition initiative) is a global foundation headquartered in the Netherlands that actively challenges the food industry, investors, and policymakers to shape healthier food systems. Its goal is to transform markets so that, by 2030, at least half of companies' food and beverage sales are derived from healthy products. ATNi analyzes and translates data into actionable insights, driving financing, partnerships and innovations for market transformation so that all people have access to nutritious and sustainable food. ATNi is overseen by an independent unpaid board and is funded, among others, by the Gates Foundation and the UK Foreign, Commonwealth and Development Office. More information about ATNi's governance and operating policies is available online.

ACKNOWLEDGEMENTS

The VitaMin Premix Supplier Assessment 2025 (VitaMin Assessment) would not have been possible without the generous support of the Gates Foundation. The VitaMin Assessment was developed by ATNi's (Access to Nutrition initiative's) project team, which includes Marina Plyta (Project lead), Nadine Nasser (Research lead), Babs Ates (Research Oversight), Ludovica Ibba (Research Consultant), Irene Santoro, Carly Brown, Chiarra Ferraboschi, Daniela Hernández Morales (Research Support), Rachel Nel (Project and Research Support), with additional support from Greg Garrett, Mark Wijne, Efi Chatzinikolaou, and data team members Eaindra Aye and Aurélie Reynier, and communications team members Veronica Maxey, Katherine Pittore, and Gulden Timur. We would also like to thank colleagues for their support in various steps of the process: Christopher Board (Investor engagement), Philip Eisenhart (Media and PR), as well as ATNi consultants Vivek Arora and Dipika Matthias.

The ATNi team drew on the expertise and advice of the ATNi VitaMin Assessment Advisory Group members: Dr. Anna Zhenchuk, Dr. Helena Pachon, Dr. Laura Rowe, Leo Schulte-Vennbur, and Professor Scott Montgomery. ATNi would also like to thank Dennis Petri for design support, WRENmedia for editing and proofreading, September Studio for web support, and 73Bit for setting up the data platform. The findings in this report do not necessarily reflect the views of the Advisory Group members or their institutions. We extend our sincere thanks to all the individuals and organizations we interviewed for generously sharing their time and insights, which have been invaluable to the development and success of this project.

Suggested citation: ATNi. VitaMin 2026: Country Insights. 2026. Utrecht: ATNi; 2026 p. 1-27. Available from: here.

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ACRONYMS

ATNi	Access to Nutrition initiative
CFTRI	Central Food Technological Research Institute
CoA	Certificate of Analysis
DFQT+	Digital Fortification Quality Traceability Plus
FICSI	Food Industry Capacity & Skill Initiative
FRK	Fortified Rice Kernels
FSSAI	Food Safety and Standards Authority of India
FWGA	Fortified Wholegrain Alliance
GAIN	Global Alliance for Improved Nutrition
HFSS	High in Fat, Sugar, or Salt
NABL	National Accreditation Board for Testing and Calibration Laboratories
NIFTEM	National Institute of Food Technology Entrepreneurship and Management
SEA	Solvent Extractors' Association of India
SME	Small and Medium-sized Enterprise
SOP	Standard Operating Procedure
SSNP	Social Safety Net Programmes
WFP	World Food Programme

GLOSSARY

Consumer	End-user who eats or drinks the final product (e.g. fortified food).
Customer	Entity (e.g. food and beverage company, miller, humanitarian organization, or government agency) that purchases ingredients (e.g. fortificants) from a producer or supplier for further processing or programmatic use.
Fortificant	Refers to both single micronutrient compounds and vitamin and mineral premix blends used to fortify foods and beverages.
Fortificant distributor	Entity that transports and delivers fortificants from producers to customers, typically handling logistics, storage, and supply chain management, without manufacturing the products.
Fortificant producer	Refers to both manufacturers of single micronutrients and companies that formulate premix blends. Mi-cronutrient manufacturers may supply their products directly for fortification or sell them to companies that combine multiple micronutrients into a premix blend, which is also in turn used for fortification. Some companies produce both single micronutrients and premix blends.
Fortificant supplier	Entity that sells or provides fortificants to customers—either fortificants it manufactures itself or fortificants sourced from other producers.
Large-scale food fortification	A nutrition-specific intervention, regulated by government, that deliberately adds one or more essential micronutrients (fortificants) to a staple food or condiment for the purpose of correcting or preventing micronutrient deficiencies in populations at increased risk.
Market-driven fortification	Fortification that is optional and motivated by market demand, but within government-set regulatory limits, where food manufacturers voluntarily add specific micronutrients (such as vitamins and minerals) to food products for commercial reasons.
Premix	Premixes are commercially-prepared, customized blends of vitamins and/or minerals in which each nu-trient component is pre-scaled and precision blended into a form that is then added to food vehicles.

INTRODUCTION

Industrial or large-scale food fortification is a critical public health strategy for addressing micronutrient deficiencies, requiring coordinated action across the entire ecosystem. Governments, regulators, food manufacturers, fortificant producers, distributors, and development partners all play essential roles in enabling responsible business practices that drive effective fortification across the value chain—from supplying quality ingredients to delivering adequately fortified foods to consumers. While ATNi's VitaMin Premix Supplier Assessment evaluates fortificant producers' global commitments to fortification of foods with essential vitamins and minerals, the country case studies in India and Kenya presented in this report offer a complementary perspective—highlighting local realities that shape fortification outcomes.

Kenya represents a mandate-driven, import-dependent system in which staple foods such as wheat and maize flour, salt, and vegetable oils must be fortified by law and rely heavily on imported fortificants. India, by contrast, is a major global producer and exporter of premix inputs, with fortification largely voluntary or programme-driven and delivered through both commercial and public distribution channels.

These contrasting national contexts illustrate the need for global fortificant producers to navigate diverse regulatory environments, supply chain dynamics, and market structures. In both India and Kenya, local suppliers and distributors play a critical role in bridging the gap between global production and national implementation—whether by distributing imported premix or manufacturing fortificants domestically.

This report primarily focuses on the role and potential contribution of fortificant producers and suppliers to strengthening food fortification practices, illustrated through case studies from two countries with varying fortification contexts. Understanding how both global and local actors operate within these systems provides valuable insight into the broader ecosystem of food fortification and the factors that influence its success.

APPROACH TO COUNTRY CASE STUDIES

This research, conducted between 2024 and 2025, draws on insights from stakeholder interviews and a desk-based review of academic and grey literature, policy documents, and market reports were triangulated to produce the case studies presented in this report.

Semi-structured interview guides were designed to mirror the themes covered in the global VitaMin Assessment—namely, support provided by fortificant producers to food manufacturers and distributors to ensure the safe handling and effective use of fortificants, and their contribution to broader efforts to support fortification across the food value chain. The interview guides provide a structured approach to evaluating the contribution of fortificant manufacturers to effective fortification in low- and middle-income countries, and to identifying the policy and market conditions that enable, or hinder, progress. The interview guides were also tailored to different stakeholder groups across the food fortification value chain.

Stakeholder Consultations in India

ATNi conducted key informant interviews with 12 fortificant producers, ranging from large multinational companies to small- and medium-sized enterprises (SMEs), with a primary focus on identifying those involved in producing fortificants or premix for staple foods such as edible oil, milk, wheat and rice.

See Appendix 1 for the complete list of stakeholders interviewed.

While the main interest was in fortificants used for staple products, many of these producers also manufacture fortificants for a wider range of food categories—such as beverages or biscuits in market-driven fortification, as well as premixes for therapeutic foods, infant and clinical nutrition, dietary supplements and micronutrient powders.

Six of the interviewed fortificant producers are also included in the global VitaMin Assessment offering a link between global commitments and local implementation. To complement these insights, interviews were also conducted with five staple food producers (of edible oil, milk, wheat and rice), nine development partners and three government bodies—providing a well-rounded view of the fortification ecosystem.

Stakeholder Consultations in Kenya

In Kenya, interviews were conducted with three fortificant producers (one of which is part of the global VitaMin Assessment)—and two food producers of maize flour, rice, and other processed foods. ATNi also consulted with one government representative, one research institute and three development partners.

See Appendix 2 for the complete list of stakeholders interviewed.

While interviewees were selected to capture diverse perspectives, the number of stakeholders available was limited and may not fully represent all actors within the fortification system. These qualitative insights should therefore be interpreted as illustrative of trends and challenges rather than exhaustive.

FORTIFICATION LANDSCAPE IN INDIA AND KENYA

PERSISTENT NUTRITION CHALLENGES

India and Kenya both face a triple burden of malnutrition, with undernutrition and micronutrient deficiency being persistent public health problems while the prevalence of overweight and obesity is increasing.[1,2] Both countries continue to struggle with widespread deficiencies in key vitamins and minerals, posing serious public health risks, particularly for children and women of reproductive age.

- In India: A 2021 meta-analysis, found vitamin D deficiency to be the most prevalent (61%), followed by deficiencies in iron, vitamin B12, folic acid and iodine.[3] India also has the largest anaemic population globally, with an estimated 67.1% of children under five and 57% of women of childbearing age affected.[4,5]
- In Kenya: Zinc deficiency affects over 80% of children under five, while vitamin A deficiency impacts 62% of children under five and 27% of pregnant women. Iron deficiency contributes to anaemia in one third of children under five and nearly 43% of pregnant women.[1,6-8] Deficiencies in iodine, folate and vitamin B12 further exacerbate health and economic challenges.[9]

Evidence of these persistent micronutrient deficiencies underscores the need for targeted nutrition interventions such as food fortification. While fortification primarily aims to address micronutrient deficiencies, understanding the broader nutritional context is essential for designing effective strategies.

FORTIFICATION POLICIES AND STANDARDS

To combat these deficiencies, both countries have introduced mandatory and voluntary fortification standards for widely consumed staple foods:

- India mandates salt fortification (with iodine) nationwide, while rice fortification is only mandatory within public distribution schemes. Fortification of edible oil, wheat flour, and milk is voluntary, but products must meet national standards when making fortification claims.[10]
- Kenya mandates fortification of packaged wheat and maize flour, salt, and edible oils, with a broad range of micronutrients.

Voluntary fortification of processed packaged food and beverage products—such as cereals, dairy products and fruit juices—is practiced in both countries. In India, the Food Safety and Standards (Fortification of Foods) Regulations, amended in 2021, outline standards and regulations set forth by the Food Safety and Standards Authority of India (FSSAI) regarding the appropriate addition of micronutrients to packaged food and beverage products under the following categories: bakery, cereals, fruit juices.[11] Companies must adhere to voluntary standards should they wish to make use of the front of the pack F+ logo.

These regulations explicitly exclude packaged foods classified as High in Fat, Sugar, and Salt (HFSS) from fortification. Although draft regulations defining HFSS thresholds were issued in 2022, they have not yet been adopted.[12] As highlighted in ATNi's India Index 2023, there is also no clear distinction between 'fortification' and 'enrichment' with micronutrients in India. Under the FSSAI directive, companies may add vitamins and minerals up to one Recommended Dietary Allowance per standardized food product, including HFSS foods.[13] Fortification practices of the 20 largest food manufacturers active in India are described in ATNi's 2023 India Index.

In Kenya, recent ATNi research has flagged voluntary fortification of less healthy packaged items—such as breakfast cereals, fruit juices, spreads, pasta, and noodles—that did not pass the Kenya Nutrient Profile Model assessment, questioning the value of adding nutrients to products widely viewed as unhealthy.[14]

Compliance and Enforcement Challenges

Despite the presence of fortification policies and standards, compliance and enforcement remain significant challenges.

- In India, compliance varies across food vehicles, with fortified products often concentrated in government-led social schemes rather than the broader commercial market.
- In Kenya, maize flour fortification is particularly weak, due to a fragmented industry dominated by small-scale millers.

Both countries face limited enforcement capacity, weak regulatory oversight and technical gaps that hinder the effectiveness of fortification efforts. Table 1 presents an overview of the current fortification regulatory frameworks in India and Kenya, along with current levels of compliance.

TABLE 1

FOOD FORTIFICATION STATUS AND REGULATORY FRAMEWORK IN INDIA AND KENYA

	India	Kenya
Mandatory Fortification	• All edible salt with iodine • Rice for public distribution with iron, folic acid and vitamin B12	• Salt with iodine • Packaged wheat flour and packaged maize flour with iron, zinc, folic acid, vitamins A, B1, B2, B3, B6 and B12 • Edible oils and fats with vitamin A
Voluntary Fortification with Standards	• Milk and edible oil with vitamin A and D • Wheat flour and rice with iron, folic acid and vitamin B12 • Processed foods: a) Cereal products–including breakfast cereals, pasta and noodles, with iron, folic acid and vitamin B12; b) Bakery wares–including bread, biscuits, rusks and buns–with iron, folic acid and vitamin B12; c) Fruit juices with vitamin C[15]	• Rice with Vitamin B1, B3, B6, B9, B12, iron and zinc[16] • Processed foods such as cereal based foods • Dairy products • Juices and beverages • Sugar
Percentage of staple food that is fortified	• Edible oil (43%)[17] • Milk (36%)[18,a] • Rice (>30%)[b] • Wheat (1%)[19]	• Edible oil (87%)[9] • Wheat flour (84%) • Salt (62%)[20] • Maize flour (46%)
Compliance with National Fortification Standards	• Highly variable, based on stakeholder input • Industry structure fragmented for flour, milk, rice • Fortified foods often targeted to social schemes not broad market	According to a 2017 market surveillance report conducted by the Kenya Bureau of Standards and the Food Safety Unit, compliance to food fortification standards is low.[6] • 38% of salt samples complied with the national East African standard. • 27% of wheat flour samples complied with legal provisions for zinc and iron. • 2% of maize flour samples met all regulatory requirements for three micronutrients that were assessed (iron, zinc, and vitamin A). • While iodized salt is produced by three large companies that supply the local market and wider East African region, an estimated 47 millers fortify maize flour (out of approximately 103 commercial mills and hundreds of smaller millers and posho mills that sell unpackaged, unfortified maize flour).
Regulatory Enforcement Bodies and Responsibilities	• Food Safety and Standards Authority of India (FSSAI): development and publication of fortification standards, regulation of manufacturing practices, surveillance • Central government and Food Corporation of India: overseeing and monitoring of the Public Distribution System responsible for the distribution of rice with FRK	• Ministry of Health: coordination and overseeing of fortification initiatives • Kenya Bureau of Standards: development and publication of fortification standards, certification of premix suppliers, market surveillance issuing import permits

[a] This figure represents the percentage of fortifiable milk being fortified in India coming from milk cooperatives and the private sector.

[b] This calculation is based on 2023-2024 PATH India data on rice intended for domestic consumption, supplied through both the open market and social safety net programmes (SSNPs)–including school meals, public distribution systems, and child services. While 100% of the rice provided through SSNPs is fortified, the share of fortified rice in the open market is unclear due to limited data. Therefore, this calculation excludes quantities of fortified rice sold in the open market.

PERSPECTIVES ON FORTIFICANT QUALITY AND SUPPLY

Given the complexity of fortification systems and the variation across commodities and markets, the following sections explore selected supply chains in India and Kenya—highlighting the key drivers and barriers to effective fortification and the role of fortificant suppliers.

RICE FORTIFICATION IN INDIA

The rice fortification value chain in India is uniquely complex due to its unprecedented scale, technical intricacies, and multi-stakeholder coordination. It involves a wide range of actors - from farmers, paddy traders, premix suppliers, fortified rice kernels (FRK) manufacturers, thousands of rice millers and blenders, and the government procurement and distribution systems. Through strong public-private partnerships and support of development agencies, India is building one of the most robust ecosystems for rice fortification.[21]

WHY RICE IS A STRATEGIC FORTIFICATION VEHICLE

With over 65% of India's population consuming rice as a staple, rice fortification presents a major opportunity to reduce micronutrients deficiencies–particularly iron deficiency anaemia.[22,23] In 2021, the Government of India launched a nationwide initiative to distribute rice fortified with iron, folic acid and vitamin B12 through the targeted Public Distribution System and Other Welfare Schemes, targeting the most vulnerable.[24] The initiative started went into a scale-up phase from 2022-2024 is 100% funded by the Government of India and is currently in an extended implementation phase until December 2028.[c]

BOX 1

IMPACT OF INDIA'S FORTIFIED RICE PUBLIC DISTRIBUTION SCHEME

A recent preprint reports on a study assessing changes in anaemia prevalence among non-pregnant women after approximately 20 and 30 months of fortified rice distribution as part of the Government of India's pilot scheme in Odisha and Uttar Pradesh, respectively. Findings from the cross-sectional household survey conducted in 2023 show that anaemia prevalence declined from 48.5% to 40.9% in Uttar Pradesh and 71.8% to 67.2% in Odisha with notable reductions in moderate and severe anaemia. However, mild anaemia increased—likely due to a shift of the moderate and severe cases of anaemia to the mild category—and daily consumers of fortified rice showed higher anaemia prevalence linked to poor socio-economic conditions and low dietary diversity.

Therefore the study suggests that rice fortification alone is insufficient to reduce anaemia if not integrated with strategies addressing sanitation, education, and dietary diversity.[25] An ongoing evaluation in six regions of the country assessing fortified rice's impact in reducing iron deficiency anaemia is expected to be completed by the end of December 2026.[26]

c Following completion of this research (2024–2025), the Government of India announced a temporary suspension of fortified rice distribution under certain welfare schemes while reviewing concerns related to nutrient stability and shelf life. This development does not materially affect the report's analysis of premix supply chains and fortification systems, which is based on conditions during 2024–2025, but may influence the future implementation context of rice fortification programmes in India.[42]

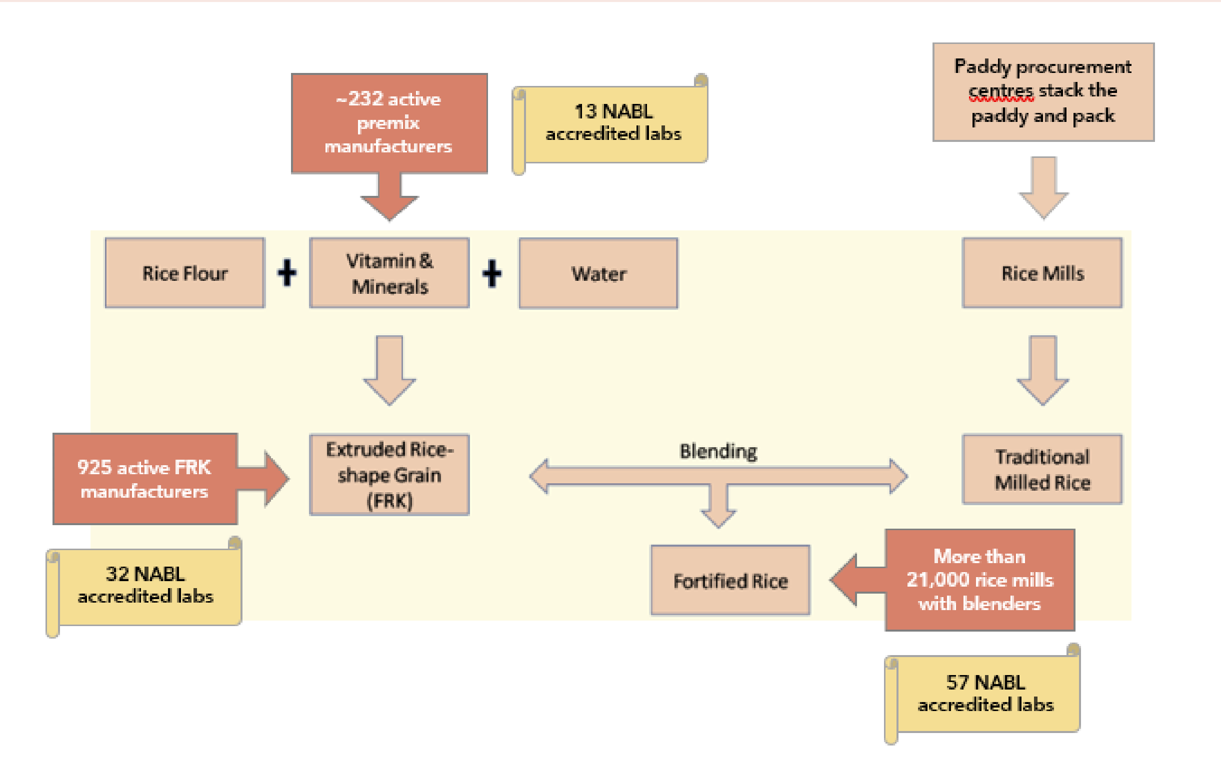
THE ROLE OF FORTIFICANT SUPPLIERS

Fortified rice is produced by blending fortified rice kernels–FRK– which are either coated rice kernels or extruded rice-shaped kernels prepared with a mix of vitamins and minerals–with regular rice. In India, extrusion is the recommended technology due to its superior micronutrient stability during processing, storage and cooking.[15] FRK dough is typically made from unfortified rice flour, a micronutrients premix, water and steam.[27]

Given that most fortified rice in India is distributed through government-run food distribution programmes, FRK manufacturers must obtain a license from the FSSAI for manufacturing the product. FSSAI maintains an approved vendor list used by state governments to select FRK suppliers for their fortification programmes. Procurement and supply for government-run food distribution programmes is carried out by the Food Corporation of India.

The high demand generated by government schemes has led to rapid growth in the FRK market, attracting both exclusive FRK manufacturers and integrated suppliers who handle blending and premix production. According to a milling industry publication in India in 2023, the rice blending capacity in the country was estimated at 15.6 metric tons per month, with 18,227 mills having the blending infrastructure for fortified rice.[28] While this expansion has increased supply capacity, it has also introduced quality control risks. The price of FRK is a key factor in procurement decisions, but the pressure to offer competitive pricing can lead to trade-offs in fortificant quality, unless regulatory oversight and supplier incentives are strengthened. The figures presented in the flowchart in Figure 1 are sourced directly from the FSSAI website.[26]

FIGURE 1
RICE FORTIFICATION IN INDIA, FLOWCHART



Source: Government of India, Department of Food and Public Distribution, Ministry of Consumer Affairs, Food and Public Distribution[26]

CHALLENGES AND GAPS IN RICE FORTIFICATION

Cost Barriers

Access to financing for rice fortification machinery remains a significant barrier for small-scale millers, who often find the required investment unaffordable.[15] According to a World Food Programme (WFP) report, FRK manufacturers have had to bear the full cost of machinery due to limited government support, which restricts scalability and discourage broader industry participation.[21]

A fortificant manufacturer interviewed by ATNi noted that while it is more cost-effective for rice millers to blend in-house, these setups typically lack the technical capacity to verify the potency of the added vitamins and minerals—posing risks to the nutritional effectiveness of the fortified rice.

Quality Assurance and Testing Limitations

Although development partners acknowledge that the fortified rice supply chain in India operates with reasonable efficiency, maintaining consistent product quality remains a key challenge.

Stakeholders emphasized that inadequate rice fortification often stems not only from issues with fortificant quality, but also from poor handling and storage of fortificants. It was stressed that fortificants' quality can degrade if not stored or applied correctly, especially in high-temperature or humid environments. This highlights the need for training of FRK producers, distributors and rice millers on proper handling practices as well as clearer guidance on quality control throughout the supply chain.

To ensure product integrity, the Department of Food and Public Distribution has issued Standard Operating Procedures (SOPs) for Quality Management of FRK and fortified rice. Testing is conducted at four levels—covering the premix, the FRK, the final fortified rice—under the Bureau of Indian Standards Certification Scheme.[29-31]

Despite these efforts, stakeholders have raised concerns about:

- FRK standards being less prescriptive, allowing flexibility in how requirements are met often leading to inconsistent quality and production practices.
- Fragmentation of the FRK supplier base, which complicates quality monitoring and oversight.
- Lack of ongoing quality checks, as verification is only required at the initial licensing stage with a test report from a NABL accredited lab followed by mandatory inspection. Subsequently, an updated test report is required every six months, however inspections are not mandatory.

EFFORTS TO STRENGTHEN THE SYSTEM

Institutional Support and Innovation

Recognizing the challenges in FRK and rice fortification, the Government of India, with the support of development partners, has been working to strengthen the monitoring system and improve fortification practices, ensuring the initiative delivers on its intended health and nutrition outcomes.

India's rice fortification ecosystem is supported by the Innovation Hub for Rice Fortification, which fosters comprehensive capacity building, innovation, and facilitates knowledge transfer to ensure consistent and high-quality fortification practices. This consortium brings together key stakeholders such as:

- Food Industry Capacity & Skill Initiative (FICSI);
- National Institute of Food Technology Entrepreneurship and Management (NIFTEM);
- Central Food Technological Research Institute (CFTRI).

These actors provide specialized expertise to strengthen the production and quality of fortified rice nationwide.

Among the actors, FICSI plays a pivotal role through its Rice Fortification Resource Centre, which supports FRK producers in overcoming challenges related to premix selection, formulation, and quality control. Their guidance ensures that fortified rice meets nutritional standards while maintaining consumer acceptability and includes best practices for storage and handling to preserve nutritional integrity. These efforts are reinforced by FSSAI which receives technical support from other stakeholders such as PATH and WFP.

Digital Tools for Traceability

FSSAI has developed the ForTrace portal, an online platform with the goal to make quality checks an integral part of the production process and ensure traceability in the production and distribution of fortified rice.

To ensure that every batch meets the required safety standards, the platform incorporates a digital tracking system starting from the manufacturing of FRK. The system documents production volumes, quality parameters and distribution patterns.[32]

Quality control measures for manufacturers producing premixes and FRK:

- Daily Record Maintenance of data on production, sales, and raw material consumption.
- Batch-wise Lab Testing: Upload of lab tests results of each batch of fortified product, integrated with the INFoLNet portal where lab test reports can be accessed in real-time.
- Check compliance with FSSAI Standards to ensure that all products meet national safety and nutritional guidelines, integrated with the Food Safety Compliance System platform and IoT qualified sensors, a real-time tracking system which monitors storage conditions.

This coordinated approach could contribute to better public health and nutrition outcomes in India, positioning rice fortification as a scalable and sustainable solution to micronutrient deficiencies.

PERCEPTIONS OF THE ROLE OF FRK PRODUCERS

Premix suppliers are critical enablers in the fortified rice value chain, serving as the foundation for successful and scalable fortification efforts. The quality, composition, and stability of the premix directly influence the efficacy and safety of fortified rice, making supplier expertise and quality control critical. Suppliers must ensure regulatory compliance, bioavailability of nutrients, and compatibility with extrusion technology.

Beyond supplying ingredients, leading premix providers often offer technical support and R&D collaboration that help rice millers and FRK manufacturers meet both FSSAI guidelines and procurement specifications from government schemes (see Box 5 in the 'Engagement with Customers and Distributors' chapter of the VitaMin Premix Supplier Assessment 2025 for more details). As India scales up rice fortification, the expertise and capacity of premix suppliers will remain a cornerstone of the ecosystem's success.

EDIBLE OIL FORTIFICATION IN INDIA

WHY EDIBLE OIL IS A STRATEGIC FORTIFICATION VEHICLE

Although not mandated, 70% of India's packaged edible oil sold in the commercial market is voluntarily fortified, reaching over 630 million consumers. Its widespread availability, affordability and daily consumption make it a powerful vehicle for delivering essential micronutrients like vitamins A and D.[33]

Fortifying edible oil is technically straightforward: the fat-soluble vitamins A and D (purchased individually or combined in a premix) blend easily into oil, requiring only moderate heating (40-50 °C, or lower for soybean oil). This can be considered cost-effective, as the oil and premix can be uniformly distributed with ease, without the need for any elaborate technology. The majority of fortified oil in India is produced by 300 large and medium oil companies in the organized sector.[34] Packaged edible oils are fortified and sold in consumer pack (ranging from 500mL up to 15L) and re-packaged in smaller quantities (100-200 mL) by kiosks, particularly in rural areas where consumers rely on daily wage and have low purchasing power.

THE ROLE OF FORTIFICANT SUPPLIERS

Fortification of edible oil relies on a consistent supply of high-quality fortificants, either as individual micronutrients or a blended formulation. Indian premix producers depend heavily on imported single micronutrients from China and Europe, where production is largely concentrated. These imports—typically facilitated through local distributors—come from major global suppliers such as dsm-firmenich and BASF. Of the twelve premix producers in India interviewed, seven reported sourcing vitamins from these companies, while some supply minerals to these same companies. Premix producers also emphasized that—apart from cost—key criteria in selecting micronutrient suppliers include efficient delivery systems that not only ensure timely arrival but also preserve fortificant quality.

India also manufactures minerals and premixes domestically and exports premix blends to countries including Kenya, Nigeria, Dubai, Bangladesh, and Thailand. All Indian fortificant manufacturers interviewed confirmed serving both domestic and international markets, highlighting India's strategic role in the global supply chain.

CHALLENGES AND GAPS IN EDIBLE OIL FORTIFICATION

Cost Barriers

Fortification costs remain a major hurdle, particularly for SMEs. Fluctuating raw material costs further strain efforts to maintain adequate fortification levels and the price of premix directly impacts product pricing and fortification decisions.[33] Both food producers and the Solvent Extractors Association (SEA) of India raised concerns about affordability and market competitiveness. While the price of premix itself is not high, limited regulatory oversight leads to inconsistent quality and price variation across suppliers. In addition, the high costs of testing premix and fortified products lead to reliance on random sampling rather than comprehensive quality checks. In the next section on 'efforts to strengthen fortification', stakeholders propose actions to ensure fair pricing of fortificants by enhancing transparency and stimulating market demand.

Quality Assurance and Testing Limitations

Stakeholders across the edible oil value chain—premix manufacturers, food producers, and development partners—identified several barriers to fortificant quality assurance:

- Lack of standardized testing protocols for both fortificants and fortified end-products, even in NABL-accredited laboratories, leading to inconsistent results.[3]
- Lack of national premix standard to ensure consistency in fortificant quality and support the development of standardized testing protocols. This is particularly challenging due to the customized nature of premix blends.
- Overreliance on Certificates of Analysis (CoA), which are often self-reported and may lack independent verification.
- Poor oversight of micronutrient quality sold through traders, who repackage bulk premix into smaller batches—often to smaller companies with limited procurement power. These smaller batches are often compromised on quality due to inadequate handling and storage.

In addition, ATNi's case studies conducted in 2022 with three oil millers in India identified key bottlenecks to implementing and sustaining adequate fortification in the edible oil sector. These include limited internal capacity, gaps in technical expertise, and a lack of appropriate equipment for fortification.[33]

EFFORTS TO STRENGTHEN FORTIFICATION

Quality and Price Assurance

Despite these challenges observed in India—particularly around cost, quality control, and compliance—several stakeholders have proposed actionable solutions aimed at improving uptake and effectiveness across the food industry:

- **Price regulation:** SEA of India and fortificant manufacturers advocate for government-regulated price caps on vitamins and minerals, with quarterly reviews, to help stabilize costs and prevent cost-driven withdrawal from fortification. An oil producer emphasized the need for greater cost transparency, a concern echoed by a fortificant producer who noted that some premix blends on the market are priced lower than the minimum cost of their raw materials.
- **Consumer awareness:** raising awareness about the health benefits of fortified oil is seen key to stimulate demand and improving compliance.
- **Guidance for fortificant selection:** all fortificant producers interviewed emphasized the need to raise awareness about fortificant quality among millers and food producers. Several suggestions were raised to guide the selection of good quality fortificants.

    - One oil producer developed procurement guidelines based on storage and quality criteria and partnered with a lab to create standardized testing protocols.
    - A fortificant producer proposed affordable, rapid in-house testing tools for SMEs to verify premix quality.
    - Another suggested a 'nutri-score' system to help food producers identify high-quality premix options.

Digital Tools for Traceability

The Digital Fortification Quality Traceability (DFQT+) project, led by the Global Alliance for Improved Nutrition (GAIN), is a global initiative designed to strengthen the quality assurance and traceability of fortified edible oils through a digital, user-friendly system.[35] This system enables producers and authorities to generate, manage, and share real-time, secure data on fortification quality—from production to market—thereby supporting government oversight, informed decision-making and efficient resolution of bottlenecks.

While DFQT+ is being piloted in Nigeria and Bangladesh, in India, it is being adapted through consultations with FSSAI and major oil producers to address local needs while ensuring data confidentiality. By enhancing data exchange and transparency, the initiative presents a significant opportunity to improve the consistency and effectiveness of oil fortification in India and ensure the delivery of fortified, quality-assured oil to Indian consumers.

PERCEPTIONS OF THE ROLE OF FORTIFICANT PRODUCERS

Fortificant suppliers play a pivotal role in India's edible oil fortification efforts. Their products—whether single micronutrients or blended premixes—enable the effective delivery of vitamins A and D through oil, one of the country's most widely consumed foods. The consistency of sourcing, reliability of delivery, and rigor of quality assurance among suppliers directly determine the success of fortification efforts, especially as India balances domestic production of fortificants with reliance on global imports. By fostering greater transparency, traceability, and fair pricing, and by supporting small and medium-sized refineries in quality control measures, suppliers can help overcome current implementation challenges. As India strengthens its fortification ecosystem, the capacity and reliability of premix suppliers will remain central to its success.

MAIZE AND WHEAT FLOUR FORTIFICATION IN KENYA

Kenya has a long history of fortification, starting with the introduction of voluntary salt iodization in 1972, which later became mandatory in 1978, and more recently expanding to other staples.[6] Voluntary fortification of wheat and maize flour and edible oils began between 2000 and 2004 with standards for flour being established in 2009.[9] In 2012, the Government of Kenya amended the Food, Drugs and Chemical Substances Act (Cap 254) to mandate fortification of wheat flour, maize flour, and edible oils and fats with specified micronutrients, and this was reaffirmed with updated standards in 2015 to align with the East African Community standards.

Fortification law in Kenya focuses on packaged products because monitoring compliance of roller mills across the country is logistically and technically feasible compared to the smaller hammer mills, which operate on a small-scale basis, with many functioning as toll mills that process grain brought in by customers. These also lack appropriate fortification technologies, such as dosers.[36]

WHY FLOUR IS A STRATEGIC FORTIFICATION VEHICLE

Maize is the most widely cultivated staple crop in Kenya, especially among smallholder farmers who grow it for both household consumption and income. It is the country's primary staple food, with per capita annual consumption reaching 62 kg, followed by wheat.[37,38]

Maize flour production is highly fragmented, with approximately 150 registered large-scale millers and an estimated 10,000 small and medium-sized enterprises.[39] Most of the maize supply is domestically produced, but output varies annually due to weather conditions and fluctuating demand.

On the other hand, wheat flour production is largely centralized and industrialized—due to its reliance on imported wheat—which supports more consistent adherence to fortification standards. The consumption of wheat flour is primarily urban-centric, and the milling industry is moderately concentrated, with around 24 large and medium-sized millers, further facilitating fortification enforcement. In 2021, 86% of wheat was imported, although this dynamic shifted with government restrictions on wheat imports in October 2023.[6,38]

THE ROLE OF FORTIFICANT SUPPLIERS

Kenya relies on imported fortificants—primarily sourced from Europe, India, and South Africa—due to the absence of domestic production capacity. The Kenyan market is served by a small number of registered international and regional suppliers, who must be approved by the Ministry of Health. One of the global fortificant producers interviewed shared that partnering with local distributors helps expand market reach, especially to remote areas. However, the company emphasized the importance of selecting distributors with not only strong infrastructure and logistics capabilities, but also technical knowledge of fortificants and safe handling practices. The company explained that it maintains regular communication with its distributors to ensure products are delivered in good condition and meet quality standards.

In recent years, small and medium-sized food producers in Kenya are increasingly relying on the first East African nutrient premix blending factory established by Sanku in Dar es Salaam, Tanzania in 2023.[40] Sanku has also played a strategic and collaborative role in Kenya's national food fortification efforts, working closely with the Ministry of Health and other stakeholders to combat micronutrient deficiencies.

CHALLENGES AND GAPS IN WHEAT FLOUR FORTIFICATION

Cost Barriers

A major barrier to fortifying maize flour is the high cost and limited access to premix, which disproportionately affects small-scale food producers. A study found that while all large-scale maize millers in Kenya fortify their flour, only 45% of medium-sized and 24% of small-scale millers were doing so.[41] According to a miller, low compliance in the informal sector—which accounts for about 60% of maize flour on the market—allows unfortified products to be sold at lower prices, especially in rural areas and urban slums. This creates a competitive disadvantage for compliant producers and results in inadequately fortified products reaching the populations most in need of micronutrients.

Premix manufacturers shared that smaller millers are often reluctant to fortify even when technical assistance is available, highlighting the need for stronger incentives—such as affordable fortification equipment and fair premix pricing. Stakeholders also noted that, as an imported product, the misclassification of premix can result in import duties, which in turn increases the overall cost of fortification. Low consumer awareness of fortification further reduces demand for fortified products and weakens enforcement of standards.

Quality Assurance and Testing Limitations

The fragmented structure of the maize supply chain limits effective regulatory oversight and enforcement of fortification standards, correlating with the lowest fortification coverage (see Table 1).[39] Compared to other fortified staples such as salt and edible oil, maize fortification faces significant logistical challenges due to the hundreds of mills—many of which are small-scale, unregistered posho mills.

In addition, development partners have expressed concerns over the inconsistent quality of imported premixes and need for more robust verification processes. A food producer in Kenya explained that regulators only have the capacity to test for select micronutrients, and those not included are often overlooked and fail to meet required standards.

The company shared that to maintain premix quality, it sources customized blends directly from manufacturers rather than through intermediaries. It says this is possible mainly because it has the capacity to purchase in bulk and store it up to six months. On the other hand, smaller food producers have limited procurement power and typically require smaller batches that align with the scale of their operations. The company also noted that smaller food producers often lack adequate facilities to store larger quantities of premix, and therefore resort to procuring through traders, which increases the risk of compromised premix quality compared to sourcing directly from the producer. Development partners highlighted several risks associated with procuring fortificants through traders, including poor storage practices, loss of traceability, and product dilution to increase margins—resulting in degraded quality. Traders also frequently operate across borders, complicating regulatory compliance and monitoring efforts.

EFFORTS TO STRENGTHEN FORTIFICATION

Recognizing the challenges faced by smaller millers in Kenya, development partners and premix suppliers have been implementing initiatives to improve access to fortificants and support effective fortification practices.

Support to Small-sized Millers

- Interviewed stakeholders anecdotally reported a rise in fortification and improved practices among small and medium-sized millers since the establishment of *Sanku's* premix blending plant in 2024 in Tanzania. They note that the localized production of premix helps avoid the logistical complexities and costs associated with transporting large stocks across borders. The shorter supply chain also enables delivery to small millers within a week, compared to the months it previously took when sourcing fortificants from larger suppliers. Moreover, by making premix available in local currency, *Sanku* offsets costs for millers. This shift has enabled more timely and affordable access for small and medium-sized millers, contributing to improved fortification practices.

- *Sanku* has also been supporting small millers in Kenya by offering smart dosing equipment (with sensors and alert systems to monitor premix levels more proactively) and free technical maintenance, to support consistent and accurate fortification practices, along with iron spot checks to monitor fortification uniformity. *Sanku* also attempted to commercialize smaller premix packages (5 kg) to tailor to the needs of smaller-scale millers; however, a cost analysis revealed that the initiative could not be sustained. To address persistent gaps in monitoring and enforcement, Sanku is now also focusing on increasing training of food inspectors.

- *Nutrition International* provides comprehensive support to strengthen food fortification efforts in Kenya, particularly among small and medium-sized millers. Their work includes sensitizing millers on premix and fortification standards, delivering tailored technical assistance and training on SOP development. Additionally, they conduct assessments to monitor compliance and ensure the effectiveness of fortification practices.

- The *Fortified Wholegrain Alliance (FWGA)* established in 2024 plays a transformative role in Kenya's food fortification landscape by bridging gaps in the informal milling sector and promoting the consumption of nutritious, culturally accepted wholegrain foods. Through initiatives like "Unlocking Fortification Through Posho Millers," *FWGA* empowers small-scale and micro millers with technical training, equipment support, and market linkages to produce fortified wholegrain and multigrain flours. *FWGA* also drives demand creation through social and behaviour change campaigns and collaborates with county governments to align with broader health, education, and agricultural priorities. *dsm-firmenich* and *GAIN* are core partners of this alliance, *Sanku* and *Technoserve* are implementing partners, and the *East Africa Grain Council* is an institutional partner.

Quality Assurance and Testing

- While there are standards establishing the minimum requirements for the import and supply of food fortification premix and fortificants within Kenya—which apply to both manufacturers and suppliers, as well as food industries that import premix and fortificants—Kenyan food manufacturer highlighted the need for stricter controls at the point of import to improve the quality of premix entering the country. Development partners emphasized the need for monitoring not just imports, but also intermediary trading and storage, where quality deterioration often occurs, later in the supply chain.

- A Kenyan food producer shared that fortificant manufacturers have been supportive by conducting quality checks on premix nearing expiry. The company noted that it can send a sample back to the premix manufacturer, who then assesses how much longer the premix can be safely stored and used.

- Stakeholders also recalled a portal managed by the Ministry of Health that once required food manufacturers to log premix usage and production data, helping enforce compliance. However, stakeholders explained the platform is no longer functional—possibly due to funding gaps.

Awareness and Responsibility

- Interviewed food producers in Kenya emphasized the need for awareness campaigns to encourage fortification and foster a sense of responsibility across the industry. They note that many producers remain unaware of the health benefits of fortification and its potential to prevent micronutrient deficiencies. One premix manufacturer noted that some millers mistakenly believe the government is asking them to add harmful chemicals to food. To counter such misconceptions, stakeholders recommend targeted campaigns for both producers and consumers—to increase demand, build trust, and debunk myths surrounding fortification.

- Food producers also expressed uncertainty about the country's progress in addressing micronutrient gaps. They suggested that a national report on the nutritional status of the population could help demonstrate the impact of fortification and guide necessary adjustments.

PERCEPTIONS OF THE ROLE OF FORTIFICANT PRODUCERS

Fortificant suppliers are central to Kenya's maize fortification efforts, enabling the delivery of essential micronutrients for maize flour, a staple consumed widely across the country. With no domestic production capacity, Kenya relies on a limited pool of approved international and regional suppliers, whose partnerships with technically capable local distributors are vital for reaching remote areas and maintaining product integrity. Their technical support is also essential for building the fortification capacity of smaller-scale food producers and for enhancing confidence in their products through quality control measures—such as testing fortificant stability and shelf life.

The establishment of Sanku's premix blending facility in Tanzania has significantly improved access by shortening delivery times, reducing costs, and offering tailored support such as smart dosing equipment and technical maintenance. However, persistent issues—including high premix costs, inconsistent quality from traders, and limited regulatory oversight—underscore the need for continued supplier vigilance and collaborative efforts to raise awareness around fortification, reduce the costs of fortification, and ensure nutrient delivery to vulnerable populations.

CONCLUSION AND RECOMMENDATIONS

HOW FORTIFICANT SUPPLIERS CAN SUPPORT NATIONAL FOOD FORTIFICATION

The country case studies in India and Kenya provide insights into the pivotal role fortificant producers and suppliers can play in advancing fortification practices, demonstrating both practical approaches and potential impact. Country-specific learnings also highlight the market and policy conditions that can further support progress in fortification and incentivize responsible business practices.

Larger premix suppliers have an opportunity to improve accessibility of fortificants and enable effective fortification practices. Drawing on the examples shared by various stakeholders in the fortified rice, oil, and flour value chains in India and Kenya, **global and local fortificant suppliers can and should:**

- **Source and produce high-quality micronutrients and premix blends** tailored to customers' fortification needs while ensuring full compliance with national fortification standards and dietary requirements.
- **Collaborate with local distributors and development partners** to expand market reach.
- **Work closely with distributors** to ensure they have the technical capacity to preserve product quality during transport.
- **Accommodate smaller food producers** by offering fortificants in smaller packages.
- **Support the correct handling and use of fortificants** by providing tailored technical assistance—particularly to smaller-sized companies and food producers new to fortification.
- **Support quality assurance and quality control activities** throughout the fortification value chain.
- **Foster greater transparency, traceability, and fair pricing.**

These efforts make high-quality fortificants more available and affordable across diverse market segments and help smaller-scale food producers build capacity and confidence in implementing effective fortification practices, thereby ensuring that fortification benefits reach those who need them most.

However, the country findings also reveal several challenges—particularly faced by small- and medium-sized premix suppliers—that limit the effectiveness and reach of food fortification efforts. Cross-cutting challenges include weak regulatory standards and enforcement, which tend to focus on mandatory fortification. Such mandates may be limited to specific staples or public distribution schemes (e.g., rice fortification in India) or packaged products (e.g., Kenya, where fortification is required only for packaged flour, while most small-scale millers produce unpackaged flour). Other challenges include limited technical capacity and quality assurance, supply chain disruptions, and unregulated pricing resulting from a lack of a level playing field.

Governments must therefore ensure a level playing field through implementing evidence-based policies, clear standards, and robust monitoring systems, as well as capacity building, to enable consistent and effective fortification practices. Food producers also play a key role in driving demand for high-quality ingredients and greater transparency from suppliers.

The global VitaMin Premix Supplier Assessment 2025 report outlines detailed recommendations for industry and policymakers to drive successful fortification practices and maximize impact (see pages 48-50), which are also relevant for India and Kenya.

In addition, the VitaMin Premix Supplier Assessment 2025 report highlights the **need for sector-wide alignment to clearly define the role of fortificant producers** and to establish explicit expectations and minimum performance standards, to fully leverage their contributions to improved fortification outcomes. While the country case studies in India and Kenya presented here provide practical insights and examples, **continued dialogue is needed to guide and promote responsible practices among fortificant suppliers** to advance improved fortification and healthier food markets globally.

APPENDIX

APPENDIX 1
LIST OF CONSULTED STAKEHOLDERS IN INDIA

Stakeholder Category	Organization
Micronutrient/Premix manufacturers	AQC Chemlab Private Limited
	BASF
	Celrich Products Pvt Ltd
	dsm-firmenich
	Fermenta Biotech Limited
	Hexagon
	NuTaste
	PD Navkar Bio Chem Pvt Ltd
	Piramal
	Pristine Organics Pvt Ltd
	Ravi Minerals
	Sudeep
Food producers	AWL Agri Business (formerly Adani Wilmar)
	ITC Limited (wheat flour, rice, processed foods)
	Karnataka Co-operative Milk Producer's Federation Ltd (milk)
	Mother Dairy (milk & oil)
	Patanjali Foods Limited
Oil industry associations	Solvent Extractors' Association of India
Private Laboratory	FARE Labs Pvt Ltd
Development partners	Food Fortification Initiative
	Food Future Foundation
	Fortify Health
	GAIN
	Gates Foundation
	Nutrition International
	PATH
	Technoserve
Government and research institutes	Bureau of Indian Standards
	FSSAI
	NIFTEM

APPENDIX 2
LIST OF CONSULTED STAKEHOLDERS IN KENYA

Stakeholder Category	Organization
Micronutrient/Premix Manufacturers	Amesi Group
	dsm-firmenich
	Sanku
Food Producers	Capwell Industries Limited
	Mombasa Maize Millers
Development Partners	Eastern Africa Grain Council
	GAIN
	Nutrition International
Government and Research Institutes	Jomo Kenyatta University of Agriculture and Technology
	Ministry of Health

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