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Closing Nigeria's Edible Oil Fortification Gap:

Why we're missing the mark, and how to strengthen fortification programming to boost vitamin A status in Nigeria

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Introduction

Large-scale food fortification is a proven, cost effective strategy to reduce micronutrient deficiencies in populations. A meta-analysis in low- and middle-income countries showed that large-scale food fortification (LSFF) reduced anemia by 34%, goiter by 74%, and neural tube defects by 41%. LSFF also protects nearly 3 million children annually from vitamin A deficiency, demonstrating its significant public health impact in resource-limited settings. Nigeria keyed into this agenda–alongside several countries–over two decades ago, legislating the mandatory fortification of oil, wheat flour, maize flour, and sugar. Unfortunately, the ensuing reports from the NFCMS show that the returns on investment are being undermined by several factors, such as low compliance to standards by processors and continued consumption of un-monitored loose bulk oil by families with lower purchasing power.

The existing macroeconomic challenges in the country, such as inflation, insecurity, raw material seasonality are interconnected with and worsen the food systems imbalance, fostering an environment conducive for inconsistency in compliance and proliferation of unfortified oils.

Over 3 billion people worldwide suffer from micronutrient deficiencies. The effects of malnutrition casts economic, social and developmental burdens on individuals, communities and countries: the impact stunts economic growth, strains healthcare systems, and results in significant productivity losses due to workers' illness.

The success criteria for food fortification include commercial factors such as industrial processing of selected food vehicles to enable efficiency of scale, social factors such as high consumption as well as reach of the food, as well as biochemical considerations such as the compatibility of micronutrients with the food matrix and bioavailability of the same. Considering these wide range of criteria, vegetable oil, sugar, salt and wheat flour were selected as food vehicles for delivering essential vitamins and minerals to Nigerians including vitamin A.

With just five years to achieving the Sustainable Development Goals, amidst complex interconnected economic challenges threatening food security, it is critical for all stakeholders to re-evaluate the approaches including but not limited to the policies,contextual programmatic environment needed to strengthen the existing systems, whilst enabling innovative solutions corresponding to the needs of the population.

This brief highlights the missing gaps in the vegetable oil fortification landscape, as well as opportunities that can potentially optimize the delivery of essential nutrients through the industry as a whole without leaving any business or consumer behind.

Results of the 2024 Nigeria Food Consumption and Micronutrient Survey (NFCMS) was published in April 2024, providing the most up-to-date nationally representative data on the nutritional status of Nigerians.[4] The survey assessed the micronutrient status and dietary intake of women of reproductive age (15-49 years), non-pregnant adolescent girls aged 10-14 years, and children aged 6-59 months.[1, 4] A representative sample of 14,820 respondents was selected, and data were collected on socioeconomic factors, dietary intake, anthropometric measurements, and micronutrient status using biomarkers.[1]

The survey revealed a high prevalence of vegetable oil consumption among Nigerian households, with **90% of surveyed households reportin**g its use.[1] The study *also* indicated that vitamin A fortification of vegetable oil – which is mandatory in Nigeria – is currently suboptimal. **Only ~31% of household vegetable oil samples collected for the survey were found to be fortified with vitamin A**, and among those found to be fortified, the average concentration of vitamin A was **less than 50%** of the national standard (2.6 mg/kg vs. 6.0 mg/kg).[2]

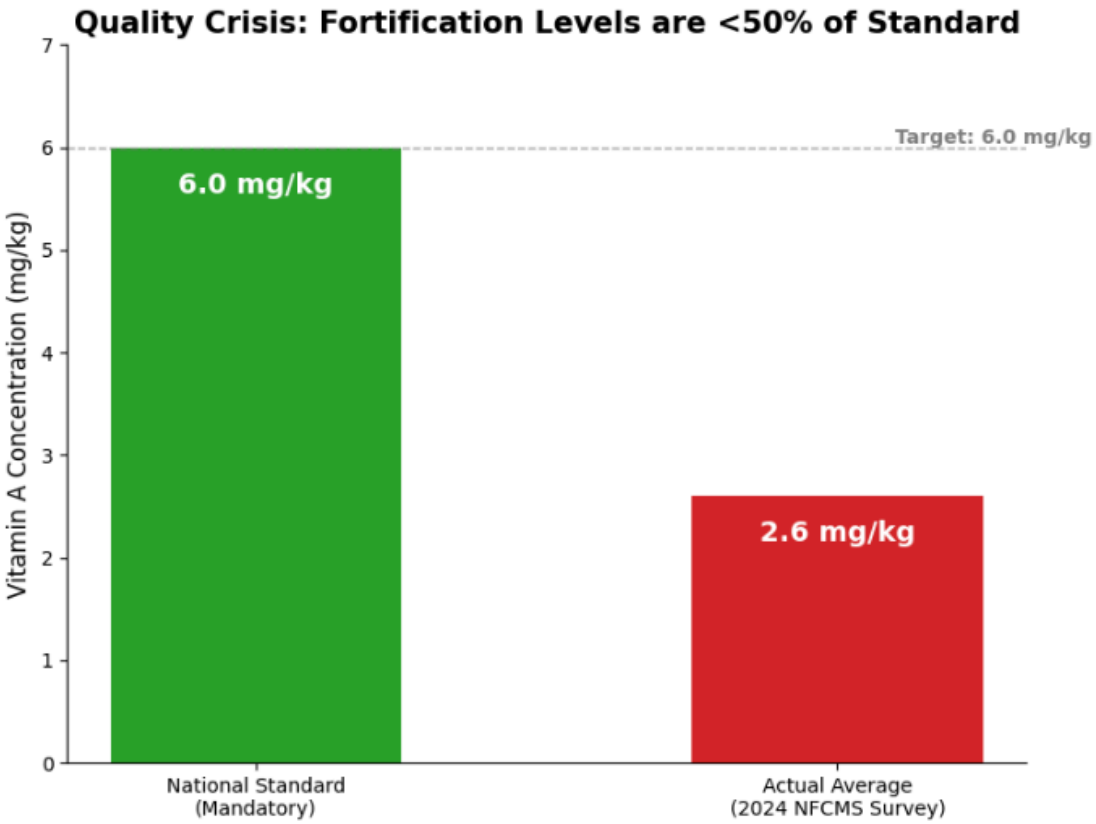

Fig 1: The Quality Gap in Fortified Oil: Even among oils labeled as fortified, the actual vitamin A content averages just 2.6 mg/kg — less than half of the national mandatory standard of 6.0 mg/kg as per 2024 NFCMS.

Relatedly, the NFCMS 2024 highlighted a substantial burden of vitamin A deficiency among Nigerians, particularly children aged 6-59 months, where the adjusted prevalence based on serum retinol was 31%.[2] Persisting vitamin A deficiency – despite widespread consumption of vegetable oil that is mandated to be fortified with vitamin A – indicates that Nigeria's current oil fortification strategy is inadequate.

This brief presents key findings from the NFCMS 2024 that signal the current shortcomings of vitamin A fortification of edible oil in Nigeria, and proposes market-based, collaborative, and sustainable solutions for improving edible oil fortification to combat persistent vitamin A deficiencies in the country.

2. The case for vitamin A fortification of edible oil in Nigeria

➢ Status of vitamin A deficiency

Vitamin A is critical for numerous physiological functions including vision, immune function, growth, and development, particularly in vulnerable populations like children and women of reproductive age. However, vitamin A deficiency is a recognized public health concern in Nigeria, with considerable prevalence among susceptible groups.[2]

Vitamin A deficiency is a significant public health issue in Nigeria, particularly affecting children and women of reproductive age. The 2024 NFCMS revealed high vitamin A deficiency in children aged 6-59 months (31% adjusted prevalence), with variations by age, sex, location, household wealth, and caregiver education. Adolescent girls (10-14 years) also showed substantial deficiency (24% adjusted), with a strong wealth disparity. Pregnant women (15-49 years) had a 22% prevalence, with no significant demographic variations. These findings highlight the need to address vitamin A deficiency in these vulnerable populations due to its critical role in various physiological functions.

- **Dietary intake of vitamin A**

The report also assessed dietary intake of vitamin A, identifying substantial rates of inadequate intake across survey participants. Palm oil, banga (palm nut soup), and palm olein (refined palm oil often fortified with vitamin A) were identified as the primary foods contributing to vitamin A intake, while mangoes and vegetables also contributed particularly in the southern zones.[2] Inadequate vitamin A intake was found in 58% of lactating women, 26% of non-pregnant women, and 12% of children aged 24-59 months, with higher rates of inadequate intake among children in rural versus urban areas.[2] These high rates of inadequacy – particularly among lactating women – suggest that dietary intake alone is insufficient to meet individuals' vitamin A requirements.

- **Edible oil consumption**

Edible oils are a fundamental component of Nigerian diets, serving as a primary source of energy and essential fatty acids.[3] The main types of vegetable oils consumed are groundnut oil (51% of surveyed households) and palm olein/palm oil (44%).[2] The report demonstrated widespread consumption of vegetable oil across the country, with 90% of households reporting its use.[1] Given its widespread consumption, vegetable oil presents a significant opportunity for population-wide delivery of vitamin A through fortification, recognized as one of the most scalable and sustainable solutions to combat malnutrition.

Urban areas exhibited higher rates of household edible oil consumption compared to rural areas (96% versus 85%), likely due to differing access to markets and food availability between urban and rural settings. There was also significant variation in oil consumption across geopolitical zones, with southern zones reporting higher household consumption rates than northern zones. South South, South West, and North Central zones reported 92%, 92%, and 94% household consumption, respectively.

3. Branded vs. unbranded edible oil

A smaller proportion of households (25%) consume branded fortified oil compared to unbranded oil (33%). Unbranded oil consumption is more prevalent in rural areas (28%) than urban areas (21%) and is notably higher in the northern zones. Specifically, the North Central (65%), North East (56%), and North West (68%) regions show the highest consumption of unbranded or oil of unknown origin. In contrast, the South South (26%), South West (32%), and South East (23%)

regions report lower unbranded oil consumption. The higher preference for unbranded oil in the north is likely due to the widespread availability of locally produced oils like groundnut oil, its lower cost, and accessibility in rural markets.

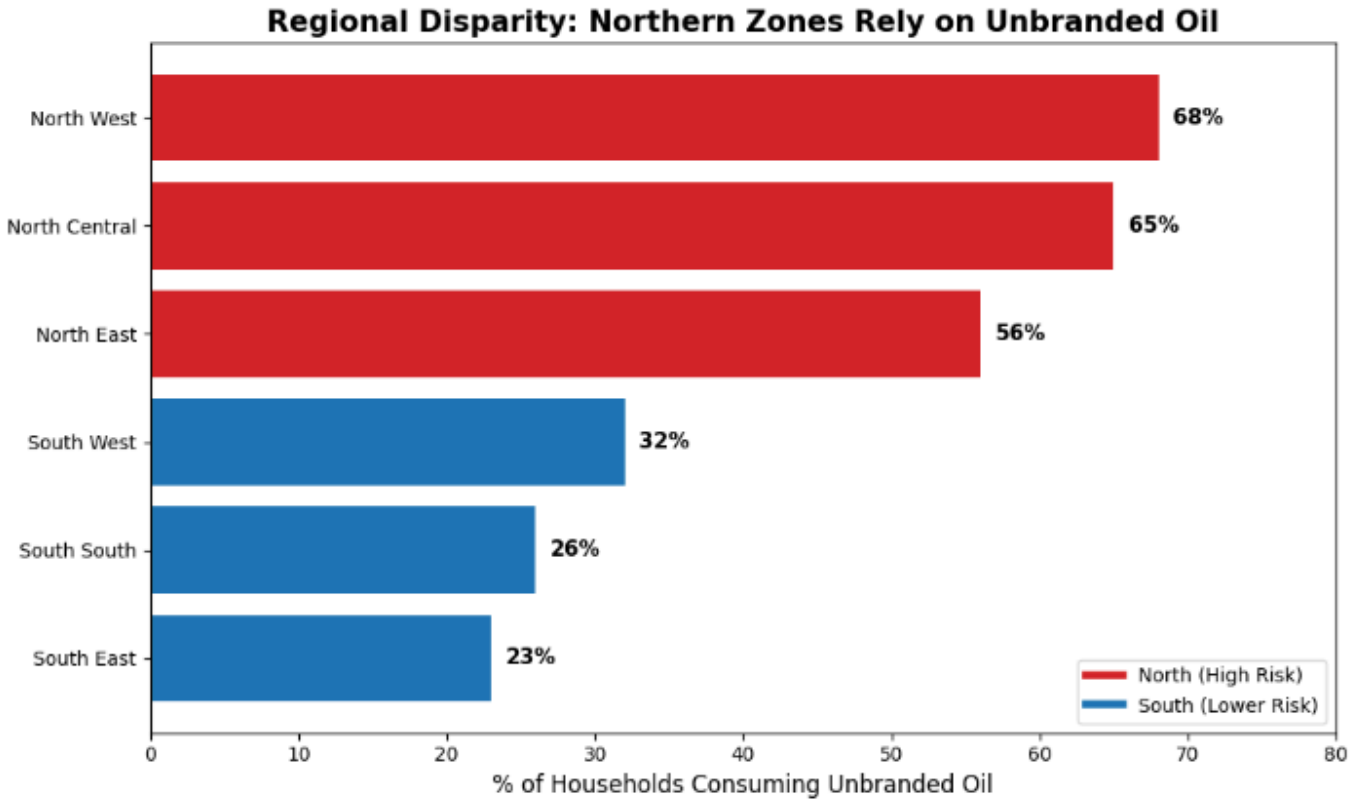

Fig 2: Regional disparity: Northern Zones rely on unbranded oil: A strong correlation exists between the consumption of unbranded oil and regional deficiency hotspots. Northern zones, particularly the North West (68%) and North Central (65%), rely heavily on loose, unbranded oil, which is largely unfortified, effectively excluding these populations from national

4. Levels of vitamin A fortification in edible oil

The NFCMS 2024 included an analysis of household food samples to determine levels of vitamin A fortification. The survey found that only 31% of vegetable oil samples collected from selected households were fortified with vitamin A, indicating a considerable gap between Nigeria's mandatory fortification policy and its implementation.[2] The proportion of households consuming fortified vegetable oil was higher in urban areas compared to rural areas – possibly reflecting better access to branded and processed foods in urban centers – and higher in southern zones compared to northern zones.[2]

The fortified samples contained a mean of 2.6 mg/kg of vitamin A — less than 50% of the national 6.0 mg/kg requirement. This shortfall may result from inadequate initial fortification at the food processor level, or from degradation during transportation, storage, or market exposure; vitamin A's instability under heat and light requires careful handling and supply chain practices.

Fig 3: Map of Nigeria showing the concentration of large processors participating in fortification program of TechnoServe

5. Missed Potential: Edible Oil Fortification and Vitamin A Status

The survey results reveal a complex relationship between edible oil consumption, vitamin A fortification, and prevalence of vitamin A deficiency in Nigeria. Despite the high rate of vegetable oil consumption (90%), the proportion of this oil that is adequately fortified with vitamin A remains low; only 31% of household samples were fortified at any level, and of these fortified samples, the mean vitamin A content was less than 50% of the nationally-mandated requirement.[2] This suggests that **the potential for edible oil to serve as an effective vehicle for vitamin A delivery is not being fully realized due to shortcomings in fortification program implementation.**

A notable geographical correlation exists between consumption of unbranded oil and prevalence of vitamin A deficiency. The northern zones, which exhibit the highest rates of vitamin A deficiency across most population groups, also report the highest consumption of unbranded and, likely, unfortified vegetable oil.[2] This pattern indicates that reliance on unfortified oil in northern zones could be a key reason for higher deficiency rates. **The national fortification**

program, which primarily targets branded and industrially-produced oils, appears to have a limited impact in areas where unbranded oil dominates the market. Given the high consumption rates of unbranded or locally produced oil – particularly in rural and northern Nigeria – **it is critical that we proactively address barriers to small-scale fortification.**

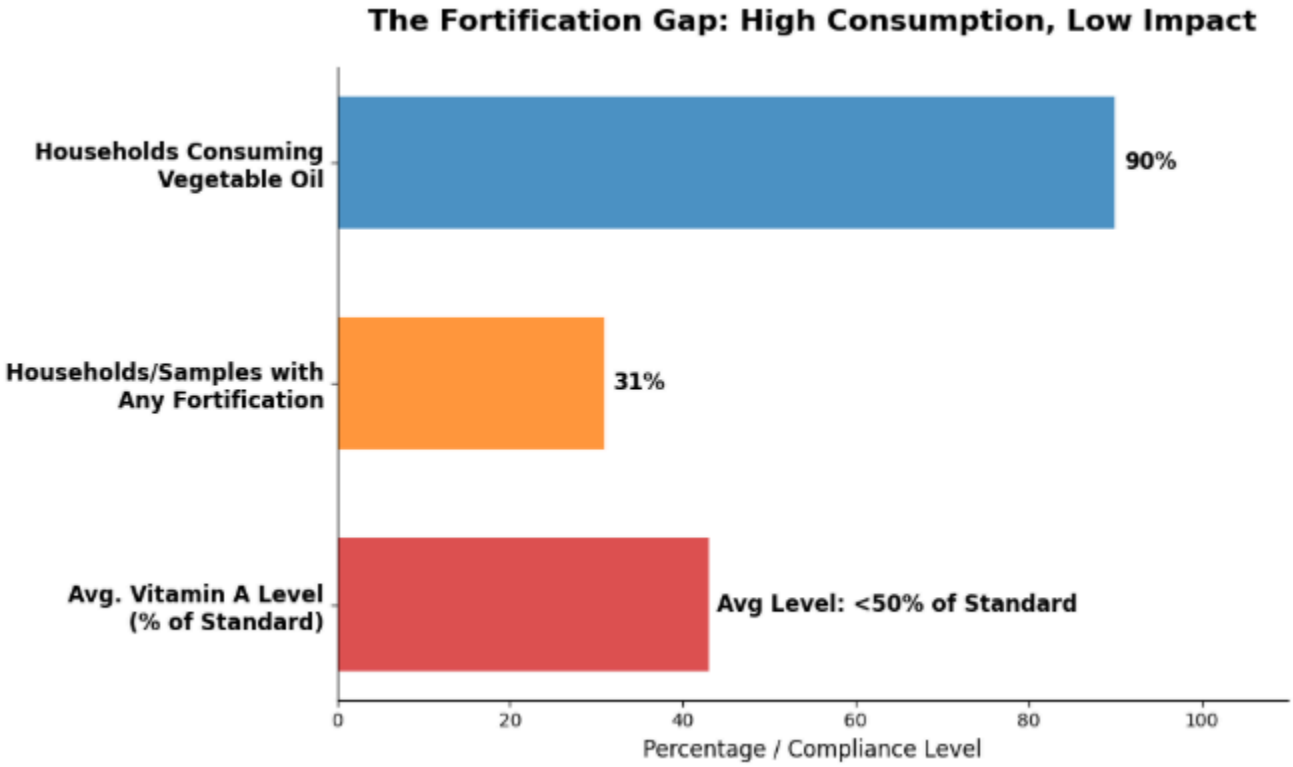

Fig 4: Missed Potential: While edible oil is consumed by 90% of Nigerian households, its public health impact is severely diminished by low compliance. Only 31% of households access fortified oil, and within that fraction, nutrient levels are frequently inadequate. This demonstrates that high consumption alone does not guarantee nutrient delivery.

Socioeconomic disparities are also evident in the data. Vitamin A deficiency is consistently more prevalent among poorer households across all population groups.[2] These households may have less access to fortified oil, or they may prioritize affordability over fortification status, opting for cheaper, unbranded options. This suggests that **socioeconomic factors influence both access to fortified foods and nutritional outcomes.**

Even among households that consume fortified vegetable oil, the low average vitamin A content in the oil raises concerns about the effectiveness of the fortification. Fortification levels might not be sufficient to significantly improve the vitamin A status of consumers, especially those with low baseline intake from other dietary sources. This highlights that **while fortification does not guarantee adequate vitamin A intake; a high level of fortification compliance will ensure a long way to support reach and have public health impact.**

While dietary intake of vitamin A from sources like palm oil, mangoes, and vegetables contributes to overall vitamin A status, particularly in southern zones, the persistently high rates of deficiency, especially in northern zones, suggest that **dietary intake alone is insufficient to meet**

the vitamin A requirements of the population in the absence of effective fortification.[2] Fortification serves as a crucial population-wide intervention, particularly for those with limited dietary diversity or access to naturally vitamin A-rich foods.

6. Addressing the complexities of edible oil fortification in Nigeria

Unlike Nigeria's consolidated wheat flour and sugar sectors, where fewer than 3-5 companies per sector control >70% of the market, the country's edible oil industry is highly fragmented and complex.

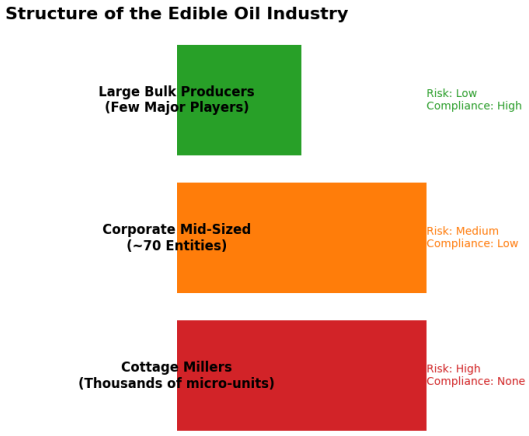

Fig 5: Structure of the Edible Oil Industry: The edible oil industry is not monolithic; it requires a segmented regulatory approach. While a few large bulk producers (top tier) have high capacity for compliance, the vast base of cottage millers (bottom tier) operates with little oversight or technical capacity, representing the most significant challenge to universal fortification.

Though a few large oil processors account for the major branded and fortified products, an estimated 60%, the rest of the sector is loose, bulk, unbranded, micro-scale, or imported. This high level of fragmentation and complexity has limited the potential for effective fortification interventions that adequately address vitamin A compliance and reach. The large, well-known producers within regulatory perimeters are more willing to partner with development programs, participate in capacity-building initiatives, industry leadership forums, and voluntarily participate in the industry self-regulatory index, the MFI. While these few large companies demonstrate commendable levels of commitment to fortification, smaller, unregulated counterparts continue to undermine the overall efforts and objectives of oil as a strategic food vehicle to deliver essential micronutrients.

a. Data discrepancies

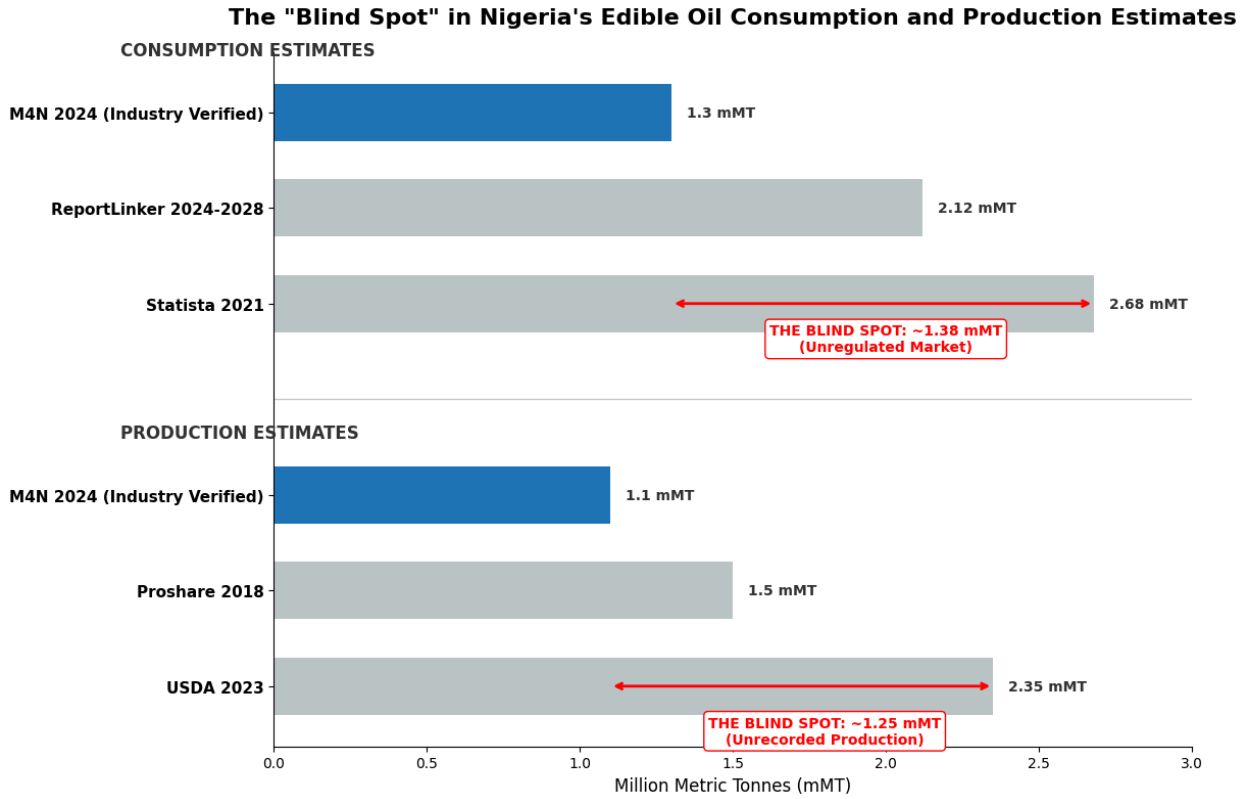

Figure 6: *The Data Disconnect. Current national estimates (grey bars) significantly overstate the size of the formal, regulated market. The "Blind Spot" (red) represents the estimated volume of unregulated, unbranded oil that evades fortification standards — approximately 1.38 mMT in consumption and 1.25 mMT in production.*

Various sources provide inconsistent data on Nigeria's edible oil consumption and production. The USDA's 2023 "Oilseeds and Products Annuals" estimates 12.5kg per capita consumption, totaling 2.66mMT based on the 2021 population, with a production of 2.353mMT from palm, soy, and groundnut oils. ReportLinker's "Nigeria Edible Oil Industry Outlook 2024–2028" projects a lower 2023 consumption of 2.12mMT. Importantly, neither report quantifies the fortifiable market.

In contrast, the TechnoServe Millers for Nutrition through industry leader interviews, estimates a domestic industrial production to be 1.3mMT, aligning with Proshare's 2018 domestic production figure of 1.5mMT, with the priority millers on the program accounting for circa 900,000mt.

While external models suggest Nigerians consume up to **2.68 million metric tonnes (mMT)** annually, verified industry data tracks only **1.30 mMT** moving through formal, fortifiable channels. Similarly, while agricultural reports estimate local production capacity at **2.35 mMT**, the operational reality of formal processors is significantly lower at **1.10 mMT.**

The difference between these estimates — approximately 1.38 mMT in consumption and 1.25 mMT in production represents the "Blind Spot" of the Nigerian edible oil market. This gap comprises the unregulated, informal, and "invisible" sector:

- Cottage Millers: Thousands of micro-scale producers in rural hubs (e.g., Gombe, Kano) who operate outside the formal regulatory net.

- Loose & Bulk Oil: Unbranded oil sold in open markets, which bypasses the industrial fortification and labeling standards required of corporate processors.
- Unrecorded Flows: Cross-border trade and informal imports that do not pass through standard quality control checkpoints.

This "Blind Spot" explains why vitamin A deficiency persists despite mandatory fortification laws. Current regulations effectively target the **Visible Market (1.30 mMT)** — the corporate, branded oils that are easier to monitor. However, a massive portion of the population is consuming oil from the **Invisible Market (the ~1.38 mMT gap)**, where fortification compliance is non-existent.

Based on this industry perspective, TechnoServe has synthesized the edible oil market (Fig 7), identifying 'fortifiable' (corporate, registered, packaged, branded, likely fortified) and 'attainable' (willing to participate in support initiatives) market segments for targeted program interventions.

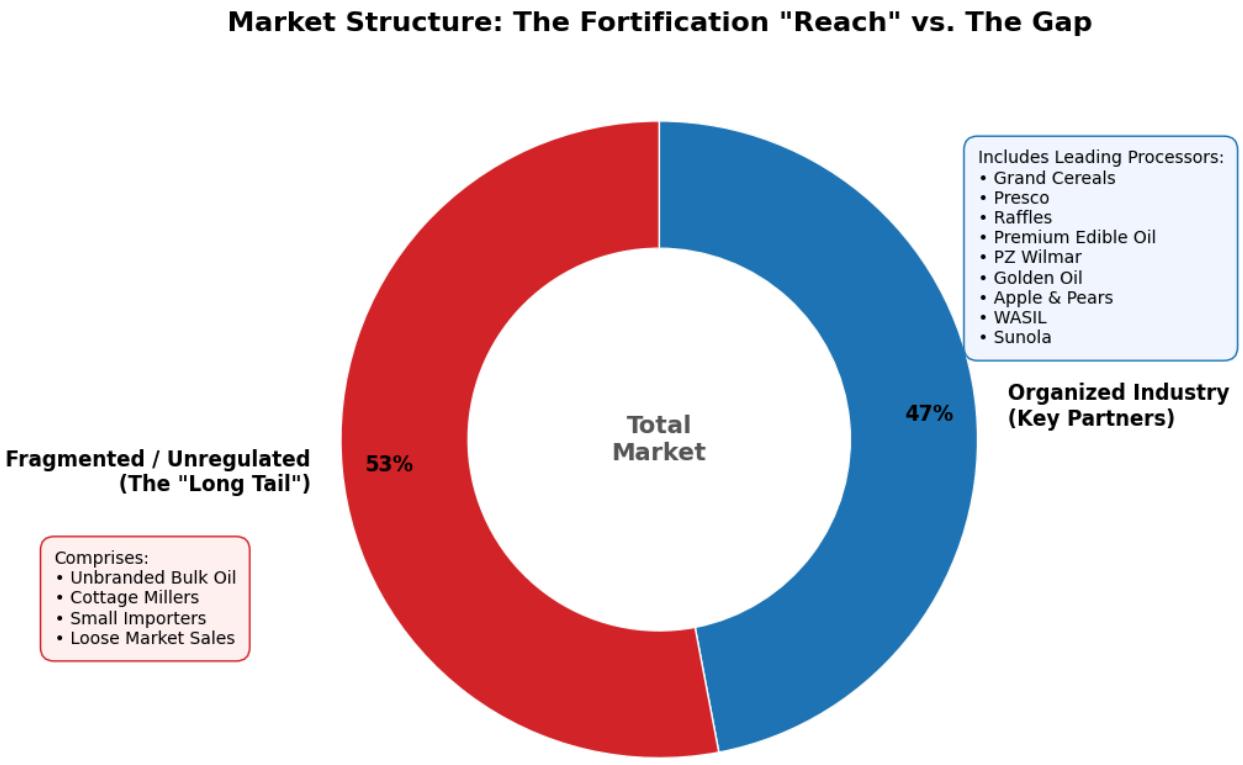

Figure 7: Edible Oil Consolidated versus Fragmented Market Dynamics: Current fortification strategies rely heavily on the organized industry (47% market share), leaving the majority of the market — the fragmented and unregulated "long tail" (53%) — unaddressed.

- The underserved and unregulated segment

Nigeria's edible oil production landscape can be categorized into three sub-groups. Firstly, cottage millers operate mainly in remote urban and rural areas, utilizing basic equipment to produce groundnut or palm oil. These small-scale producers primarily serve local communities

and generally lack awareness of vitamin A fortification. Integrating them into fortification efforts requires multi-faceted approaches including public awareness campaigns, education, behavior change communication, and developing appropriate fortified products. The groundnut oil production hub in Gombe state, with its numerous youth-owned micro-mills producing around 150,000 liters daily during peak seasons and employing over 10,000 people, exemplifies this category. Similar hubs exist in Kano and other Eastern states.

Secondly, corporate mid-sized enterprises comprise a significant number of mills across Nigeria's six geopolitical zones, as indicated by 2019-2021 market studies, reporting over 70 registered entities. However, a substantial portion of these mills were found to be non-operational or operating below half their capacity. For this group, relevant interventions should focus on improving supply chain and margin management, promoting best practices in fortification, and optimizing product offerings.

Finally, a few large-scale producers focus on bulk refined oil sales to business buyers, who then handle downstream distribution, often resulting in unbranded or repackaged products for consumers. These producers generally have a better understanding of fortification and possess the necessary capacity to implement fortification systems. Strengthening regulatory monitoring and enforcement is crucial to ensure their commitment to fortification.

Description	Market segment		
	Corporate enterprise	**Cottage-level agripreneurs**	**Large bulk producers**
Size(volume/day	10-20ton	200litres-1000litres	200tons-1500tons
Equipment	Fabricated or imported mill	Rudimentary local oil press	Imported mills
Process	Manual	Manual	Semi-fully automated
Market	Specific regional markets	Local rural communities	B2B bulk distributors, Wholesale, Re-packaging
Fortification Awareness	Low	Low-Mid	High
Compliance status	Low	None	Mid-High

7. Recommendations

To effectively combat vitamin A deficiencies through vegetable oil fortification, the following key areas require focused attention and collaborative action:

1. Enhanced Regulatory Framework and Enforcement:

- Strengthen the monitoring of vitamin A levels throughout the vegetable oil supply chain, from production to retail, through regular testing and public reporting.
- Increase penalties for non-compliance with the national fortification standard (6.0 mg/kg) to drive adherence.

2. Leveraging Digital Innovation for Self-Regulation and Traceability:

- Promote widespread adoption of the Micronutrient Fortification Index (MFI) by the industry as a mechanism for self-regulation, complementing government oversight.
- Scale the Digital Food Fortification Traceability Plus platform to improve resource allocation for regulation and monitoring, particularly in underserved industry segments.

3. Incentivizing Compliance:

- Recognize and incentivize compliant producers through government benefits such as tax breaks, reduced tariffs, and participation in social safety net programs (SSNPS), utilizing tools like the MFI for verification.

4. Expanding Fortification Coverage:

- Develop and implement strategies to extend vitamin A fortification to locally produced and unbranded vegetable oils, especially in high-consumption areas like the Northern regions. This may involve technical and financial support for local producers or community-based programs.
- Investigate the feasibility of fortifying groundnut oil due to its significant consumption.

5. Improving Consumer Awareness and Education:

- Launch comprehensive public awareness campaigns to highlight the importance of vitamin A and the benefits of fortified foods.
- Provide clear information on identifying fortified products and address misconceptions about quality or cost, tailoring messaging to different regions and socioeconomic groups.

6. Enhancing Supply Chain Management:

- There is a considerable gap between Nigeria's demand for edible oils and its domestic production.
- Immediate and comprehensive policy interventions are necessary.
- Strategic measures must attract substantial investment into the local edible oil industry.

- Policies should aim to:
    - Modernize existing production facilities.
    - Establish new and efficient processing plants.
    - Promote advanced agricultural practices to increase oilseed yield and quality.
- Creating an enabling and supportive ecosystem for existing businesses is paramount, including:
    - Streamlining regulatory processes.
    - Providing access to affordable financing.
    - Investing in infrastructure (transportation, storage).
- Fostering growth and innovation will help Nigeria:
    - Reduce reliance on imports.
    - Conserve foreign exchange.
    - Create employment in agriculture and manufacturing.
    - Achieve greater food security in the edible oil sector.
- The data highlighting this deficit emphasizes the urgent need for proactive and sustained government support.

7. Promoting Dietary Diversification and Biofortification:

- Support and expand agricultural programs that increase the availability and affordability of diverse vitamin A-rich foods, including fruits, vegetables, and animal-source foods.
- Intensify efforts to promote the production and consumption of biofortified crops like orange maize and orange-fleshed sweet potato in regions with high deficiency.

8. Strengthening Vitamin A Supplementation Programs:

- Enhance the reach and effectiveness of existing vitamin A supplementation programs for young children (6-59 months) and women of reproductive age, particularly in high-prevalence areas with low fortified food coverage.
- Ensure a consistent supply of high-quality supplements and improve outreach to underserved communities.

9. Investing in Further Research:

- Support research to better understand the consumption patterns of unbranded oils and the challenges to effective fortification in different Nigerian contexts.
- Conduct research on the cost-effectiveness of various intervention strategies to inform policy decisions.

10. Fostering Collaboration and Coordination:

- Strengthen collaboration and coordination among government agencies, the food industry, NGOs, research institutions, and international partners to develop and implement effective strategies against vitamin A deficiency.

Key Tables for the Report:

- **Table 1: Prevalence of vitamin A Deficiency by Population Group and Indicator (NFCMS 2021)**

Population Group	Serum Retinol (Unadjusted %)	Serum Retinol (Adjusted %)	MRDR (%)
Children (6-59 months)	54	31	1.2
Adolescent Girls (10-14 years)	32	24	N/A
Women (15-49 years)	12	N/A	0
Pregnant Women (15-49 years)	22	N/A	N/A

- **Table 2: Household Consumption of Edible Oil by Geopolitical Zone (NFCMS 2021)**

Geopolitical Zone	% Households Consuming Vegetable Oil	% Households Consuming Branded Fortified Vegetable Oil	% Households Consuming Unbranded/Unknown Vegetable Oil
North Central	94	N/A	65
North East	N/A	N/A	56
North West	N/A	N/A	68

South East	N/A	N/A	23
South South	92	N/A	26
South West	92	N/A	32

3. **Table 3: Comparison of vitamin A Fortification Levels in Household Vegetable Oil Samples with National Standards (NFCMS 2024)**

Category	**% of Total Samples**	**Mean vitamin A Content (mg/kg)**	**National Standard (mg/kg)**
All Vegetable Oil Samples	100	N/A	6.0
Samples Labelled as Fortified	31	2.6	6.0

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