



Strengthening Fortification Markets to Reduce Iron Deficiency Anemia

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Keywords

Fortification markets · Fortification incentives
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Introduction

Food fortification holds strong potential for making a major contribution to the prevention of iron deficiency anemia. As a broad, population-based intervention requiring no change in consumption and adding little cost to staple foods that consumers are already purchasing, it is no surprise that over 90 countries globally have included iron in their wheat, rice, maize, and/or salt fortification standards [1].

Building on this legislative base, governments, donors, and NGOs focus their resources on the development and refinement of programs, including assessments of consumption patterns to

ensure standards are adjusted appropriately over time [2], impact studies on effectiveness of fortified foods [3], regulatory and industry capacity-building, and program evaluations [4]. Yet, despite the progress since the 1990s when salt iodization was first expanded into low- and middle-income countries (LMICs), fortification has not reached its potential, particularly for cereal staples.

This is due, in part, to the fact that food fortification is one of the few public health interventions that is largely delivered by private sector actors, from micronutrient manufacturers to pre-mix suppliers, millers, wholesalers, and retailers. Accordingly, a market lens is needed for improving its effectiveness.

Why Have Fortification Markets Largely Failed Us?

In general, markets tend to work best when strong demand meets a robust capacity to supply with appropriate government oversight. For fortified foods, these fundamental pillars often break down. Demand for added micronutrients tends to be missing, as consumers make their purchasing decisions largely based on taste, brand (as a proxy for quality), and/or cost. Therefore, supply chains lack a business incentive to comply with government mandates. Additionally, as low-margin commodities, there is little incentive to

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develop value-added products. Further, while all food processors are concerned about food safety because it creates an immediate liability, the same cannot be said for sub-standard fortification quality. Finally, in many countries, government leadership does not send a strong enough signal on the importance of fortification for the private sector to invest in the necessary equipment and raw materials. An aggregation of coverage data from 16 fortification assessment coverage toolkit (FACT) surveys revealed that while 41% of households had access to fortifiable wheat flour, only 15% consumed fortified wheat flour, highlighting non-adherence to legislation [5].

Beyond weak incentives, fortification programs tend to over-rely on constrained governments systems for enforcement. A review by Osendarp et al. (2018) [6] found that often government regulatory oversight was inadequate. Combined with the lack of transparency around fortification quality, particularly of their competitors, there is a perception held by industry that the playing field is not level and their actions to be good stewards of the government's fortification programs could result in a loss of market share or simply added costs without consequent improvement in market positioning. In a semi-quantitative survey with industry representatives from 13 countries on key barriers for fortification compliance, 75% cited premix prices and 60% competition with non-fortifying producers as two top barriers [7]. We posit that concerns over premix prices may recede if the latter issue—the lack of a level playing field—were effectively addressed. Studies demonstrate a price premium that varies between 0.5% and 4% above the cost of the non-fortified commodity [8–10] and is generally passed on to the consumer. Some studies have found that even higher premiums are tolerated [11].

How Do we Make Fortification Markets more Functional?

Ensuring better functioning markets for fortified foods requires an understanding of the industry structures and dynamics. For iron, those tend to

be the cereal staples, mainly rice, wheat, and maize due to their daily consumption, nominal sensory impact from low inclusion of iron relative to quantities consumed, and minimal incremental costs. However, these industries in some cases are dominated by small- and medium-sized enterprises (SMEs) without the capacity for fortification. Other iron-carrying vehicles are also emerging, such as double fortified salt (DFS), multiple fortified salt (MFS), bouillon cube, seasoning powders, and fish and soy sauces. Although these markets are not as fragmented, several technical and programmatic bottlenecks need addressing, including micronutrients interactions and sensory changes from the enhanced concentrations needed for the smaller quantities consumed, as well as higher incremental costs for inclusion of iron relative to cereals [12, 13]. In addition, these vehicles often face political obstacles, as governments are simultaneously implementing sugar and salt reduction strategies to reduce the risk of diseases such as diabetes and hypertension.

Public–private partnerships (PPP) with a few dominant players has come to serve as the primary means by which to address dysfunctional global health markets. However, in staple cereal markets, these traditional structures tend to be used less regularly, as there is often an absence of dominant players to engage, and many nutritionally vulnerable consumers tend to purchase from lower cost regional brands and local mills. Furthermore, partnerships with leading players may not create a demonstration effect for the SMEs. This is because SME investments in fortification may not be rewarded through an improvement in market position, as consumers tend to lack understanding and interest in fortification, even when promoted through social marketing campaigns [14, 15]. Additionally, SMEs face different barriers from the larger players, such as access to premix and dosifers. Thus, mandatory legislation rather than PPPs tends to be a key mechanism for influencing the full range of players in commodity industries, particularly in LMICs where there are few examples of successful fortification programs without mandated standards.

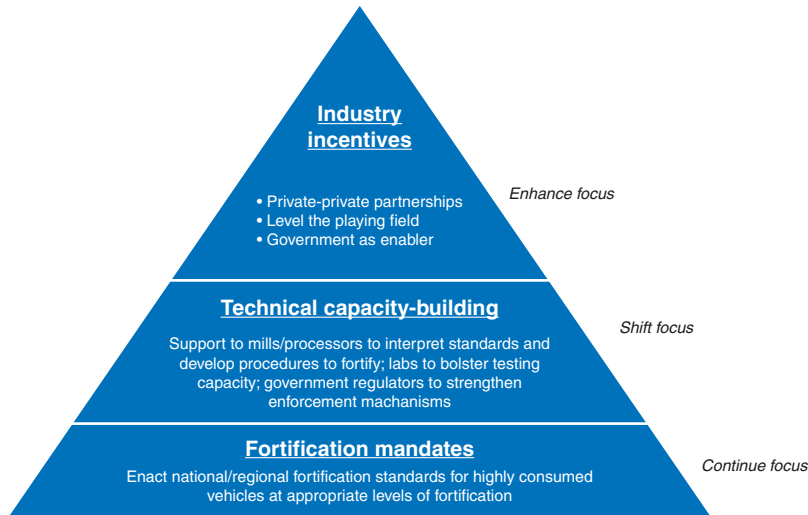


Fig. 24.1 Layered system capabilities for the development of fortified food markets

However, the use of mandatory legislation is insufficient for achieving fortification goals of coverage and quality. It follows that governments and development partners tend to focus on technical approaches to achieving compliance with mandates, but underneath these capacity-building efforts is a fundamentally failed incentive structure that undermines the goals. There are weak incentives on both the supply and demand sides of the market for fortified foods, requiring a fundamental rethinking about how development partners might support the cultivation of industry incentives to both augment and shift the current approach.

As depicted in Fig. 24.1, all three elements, fortification mandates, technical capacity-building, and industry incentives have the potential to result in more functional markets. Mandates will continue as the bedrock of fortification programs, as they create a market pull that is difficult to replicate through alternative means in commodity markets. Technical capacity building is also still needed but could be provided more effectively by fortification input suppliers than governments and development partners. Finally, industry incentives could be directly cultivated through several emerging approaches: (1) broadening fortification to additional private sector players along the value chain and encouraging

more partnerships between them (private–private partnerships); (2) leveling the playing field through automated collection of quality data, transparency that engenders industry self-regulation, and new business innovations to remove barriers to fortification; and (3) repositioning government as an enabler, beyond their regulatory function.

Strengthening Market Forces for Industry Engagement in Fortification

Private–Private Partnerships to Broaden Business Opportunities

There is a growing interest in *private–private* partnerships as a mechanism for driving sustainable development goals, particularly when other constructs, such as traditional public–private partnerships, are not as well suited for the particular development challenge [16]. This concept applies well to fragmented commodity markets and may be one key to leveraging competitive dynamics along the value chain to enhance the coverage of fortified foods.

Table 24.1 below depicts various business incentives that could be exploited through pri-

Table 24.1 Exploiting industry incentives to fortify through private–private partnerships

Current technical approach	Expanded industry-oriented approach	Incentive exploited
Focus on industrial mills, where fortification takes place	Broadening fortification opportunities to others in the value chain: Premix suppliers, wholesale buyers, and retailers	Other value chain players can claim higher quality products and/or fortification-related services as an integral part of their business propositions
Capacity-building of millers is largely supported by NGOs and their donors	Creative partnership structures to enable premix or other input suppliers to offer capacity-building services to millers	New service offering can enhance the input suppliers' value proposition to millers to help expand business
Access to fortified foods is limited to the production and distribution footprint of millers who fortify	Intentional expansion of fortified products into rural markets through retail partnerships	Urban retailers expand revenue opportunities to additional markets. Rural retailers increase foot traffic through enhanced quality of offerings to consumers

ate–private constructs. The key principle is to broaden active participation to other players, including upstream micronutrient and premix suppliers and downstream wholesalers and retailers. Partnerships anchored in concrete business opportunities which can pull fortification along as an added benefit have a strong opportunity for success. For instance, to enhance their competitive positioning, premix suppliers could offer capacity-building services to millers. In this emerging model, premix suppliers sign long-term contracts with their miller clients, which enables them to secure lower prices from their global micronutrient suppliers. They then leverage these savings to provide value-added services at no additional charge to millers. Beyond gener-

ating business value, these private–private partnerships may help transform the role of donors and development partners from capacity-builders of industry to catalyzers of within-industry partnerships, thereby increasing the chances of sustainability once development partners exit.

As another opportunity, private–private partnerships between urban and rural retailers with non-overlapping markets, hold strong potential, as they exploit the incentive of both partners to cultivate new markets. For example, in India, many of the cereal staple commodities that are fortified in industrialized facilities are sold in urban markets, and therefore do not reach rural populations. This is because most wheat and rice commodities sold through fair price shops in rural areas under the country's Public Distribution System tend to be those supplied by the peri-urban and rural millers, where it is more difficult to fortify. In 2015, the Government of Rajasthan introduced *Anapurna Bhandar* [17], an innovative program that brokered partnerships between urban and rural retailers to support the pull of branded and healthy products, including fortified foods, into rural markets [18]. In the state of Rajasthan, there are over 26,000 fair price shops, from where approximately 85% of the population obtain their basic staples. In the pilot phase, they turned 5000 of these otherwise dilapidated shops into modern retail stores. The scheme involved shipping goods from urban retailers to rural fair price shops, where products were sold on consignment, with rebates associated with each sale. This enabled urban retailers to add branded, vitamin A-fortified edible oil in their basket of goods at the same cost as unfortified oil. As a result, unfortified oil was eventually phased out, placing additional pressure on non-conforming producers to fortify [19–21]. This model worked because it was anchored in business fundamentals: urban retailers expanded into rural markets, rural retailers generated additional income from increased foot traffic, and rural consumers were provided a more aspirational shopping experience without the added cost or travel time to urban centers.

Leveling the Playing Field through Process Data, Transparency, and New Business Innovations

Industry’s overriding concern is that weak government enforcement of mandatory standards may enable competitors to get away with low-quality or no fortification at all, since fortification is designed to confer no change in sensory attributes to the underlying staple food and is therefore difficult to detect without specialized tests. This places those who comply at a perceived disadvantage in highly competitive markets. Therefore, the importance of a level playing field, where all entities are held to the same quality standards (i.e., rules) and have access to the same fortification inputs (i.e., opportunities) cannot be overemphasized.

Table 24.2 depicts three broad approaches towards a level playing field. The first is a change in emphasis from *where* and by *whom* the quality data is captured. At present, government regulators are responsible for quality monitoring and focus primarily on *end-product* testing at production sites and/or through products sampled in markets. Both are costly and time consuming and therefore not frequently assessed. A paradigm-shift towards *process* data that can be captured through automated, digital systems within *industry settings* and transmitted directly to government may not only simplify government oversight and reduce budget pressures, but also ensure more immediate feedback to millers to control their internal quality.

Secondly, if fortification quality data were also made transparent to downstream buyers, millers may be further incentivized to fortify. Wholesale buyers, re-packagers, and retailers may select for products of higher fortification quality, creating a market pull for fortification and ultimately a self-regulating supply chain. Transparency would also support private–private partnerships around a quality advantage, as described in earlier. Finally, a level playing field requires that all players have equitable access to needed fortification inputs. Developing new business innovations can serve this need, particularly for SMEs, who are at a significant disadvantage

Table 24.2 Exploiting industry incentives to fortify by leveling the playing field

Current technical approach	Expanded industry-oriented approach	Incentive exploited
Focuses on end-product data (in production sites and markets)	Generate automated quality data within milling environments and transmit directly to government to enable effective oversight over all industry players	Real-time feedback and course corrections reduce the miller’s cost of re-fortifying commodities to meet standards
Fortification quality data is known only to the industry partner and government regulator	Stronger self-regulation made possible by sharing quality data with downstream buyers	Millers incentivized to fortify to enhance their competitive positioning with downstream buyers
Inequitable access to fortification inputs across industry not explicitly addressed	New business innovations that enable local access to high-quality, affordable premix and dosifiers	Enables SMEs to more effectively compete with larger players. Unleashes the competitive dynamics for quality products in regional markets that did not have prior access to fortification inputs

compared to the larger players due to their lack of access to capital.

The following sections describes each of these three levers in more detail and provides case studies of progress along these lines.

Leveling the Playing Field through Process Data Captured within Industry Settings

Evolution from manual records to “smart dosifiers or microfeeders”: Fortified foods processors use “micro-feeders” or “dosifiers” for dosing the premix into their products such as flour. To date, most equipment does not automatically collect or store fortification data on premix volume used during food processing. Food producers rely on a “systems-based approach” [22] to compliance, which in part involves premix reconciliation cal-

culations that are undertaken to provide an indication on whether the fortification *process* is adequately dosing the targeted levels of micronutrients to the volume of fortified food produced, in line with the country's fortification standards. Errors cannot be discounted as the system depends on production personnel manually recording information correctly. Smart dosifiers, which automatically collect and transmit this data to the internet, are not in widespread use in fortification programs, but have been effectively leveraged by some development partners in limited settings. For example, in Tanzania, Sanku have deployed smart dosifiers in 300 small-scale mills and are able to monitor their usage remotely through a *cellular link*. Based on the information transmitted, they can arrange visits to mills if the premix to food commodity ratio is off, dosifiers are not in use/require repairs, or premix supply needs re-stocking. A similar concept can be extended to larger, industrialized mills in urban areas, enabling data to be written to a centralized database, accessible to both the individual company and government regulator that could lead to timely corrective action. Given regulatory resource constraints in LMICs and the criticality of credible oversight to a level playing field, such an approach could be one of the linchpins to more effective fortification programs. The cost of upgrading dosifiers in larger mills with smart functions may vary by capacity, brand and type of milling equipment, and other factors. At present, a Sanku dosifier is approximately US\$2500 [23].

Future opportunities also exist for real time, in-line monitoring through Process Analytical Technologies (PAT). For instance, various spectroscopic and computer image analysis technologies can now measure various parameters in foods, such as total ash, moisture, protein, starch, fiber, and particle size in flour. Based on real-time data, production operators can take corrective action to achieve the targeted quality, reducing production variation, and overall costs of production [24]. Building on current parameters analyzed, future R&D could advance solutions for in-process micronutrient analysis.

Leveling the Playing Field Through Transparency and Self-Policing

The concept of self-policing has been used effectively, albeit in limited settings, to drive an incentive to fortify. For example, to address low compliance with mandatory salt iodization legislation in Kyrgyzstan in 2002, the Swiss Agency for Development and Cooperation (SDC) supported a program to empower retailers with rapid test kits (RTKs) to test for iodine in the salt they purchased from wholesale markets. After 18 months, non-iodized salt was largely driven out and continued demand for iodized salt incentivized retailers to sustain the program [11]. As an added benefit, the increased demand for potassium iodate by salt producers catalyzed its local availability through a national premix model (see Decentralized Premix Facilities section below), further enabling access to iodized salt and creating a virtuous flywheel effect of self-perpetuation [25].

Food manufacturers could also create market pull by checking the fortification quality of their incoming raw material ingredients, such as salt, wheat, maize, and oil. Some nudging by third parties may be required to make such practices the norm. One such organization, Changing Markets Foundation (CMF) started their food fortification advocacy work in Mexico, which mandated wheat and maize fortification with iron, zinc, folic acid, and other B vitamins in 1999. CMF independently purchased 61 different wheat and maize flour brands from the market and tested them through accredited labs. Results showed only 7% of the wheat flour while none of the maize samples were adequately fortified. Another key finding was that food processors were using not using recommended iron compounds [26]. The work catalyzed government regulatory action. Such findings have the potential to also be shared with food manufacturers and food service businesses to encourage demand for fortified ingredients from their suppliers. In turn, this has the potential to shift focus away from the miller's compliance with fortification standards towards their incentive to comply with customer requirements.

Leveling the Playing Field Through New Business Innovations

A level playing field requires that all entities that are mandated to comply with fortification standards have access to the necessary fortification inputs. New business innovations can help address these critical gaps, particularly for the less industrialized, smaller millers, which respectively represent 70% of maize, 20% of wheat, and 46% of rice processors globally [27]. In line with WHO/FAO guidance, small mills are classified as those producing less than 20MT per day [28]. Often, these entities do not have access to the foreign exchange required to purchase premix and dosifiers from global suppliers, the working capital to cover import lead times (e.g., can be up to 6 weeks or more), nor the leverage to obtain volume pricing discounts on premix. Business incentives to fortify are also weak because none of the local competitors have access to fortification inputs. Developing new business-focused models can remove these barriers while also creating an incentive for SME engagement. The medium and larger mills (>20 MTs/day) also benefit from new business innovations by reducing the cost and complexity of fortification, supporting broader industry participation. Several new innovations are emerging to fill this niche, as described below.

Cost of goods economics: As also referenced in the section above, Sanku is a social enterprise serving the technology and business model needs of SME cereal producers, starting with maize millers in the Morogoro region of Tanzania. Maize consumed in the country is predominantly produced in small-scale mills, making it difficult to fortify [29]. Sanku examined the problem from a business lens. Specifically, they determined that maize flour bags were the most expensive input for the smaller millers, so they aggregated demand and negotiated a lower price point with the bag supplier. Millers are now able to purchase premix plus the bags for the same price they were previously paying for the bags alone. Sanku has also leveraged the bags for strong branding in

bright pink lettering, signaling quality, catalyzing consumer demand, and incentivizing additional millers to engage in the program [30–32]. Since expansion drives economies in their model, this is yet another example of a flywheel effect that can further drive the market [25].

Decentralized premix facilities: Production of premixes is concentrated in a few countries in Asia (mainly India and China), EU, and North America. In Africa, the premix industry is still in infancy, so most countries import premix. For fortified food producers, premix is a recurring and significant cost driver for fortification. Various barriers exist with premix supply chains including quality premix, accessing suppliers and price volatility [33]. Other barriers include, currency volatility, foreign exchange shortages, long lead times, minimum order quantities (MOQs), and access to finance for upfront payments by SMEs [34].

Given these challenges, national availability of premix is critical for sustainable food fortification programs. Various models are in operation or have shown promise in increasing local availability and access to premix. These include: local revolving funds, consignment models, informal pooled mechanisms, commercial/sales agents, government exclusive supplies, and time-limited subsidized supply models.

As an example, in Kyrgyzstan, where salt iodization has been mandatory since 2001, a consignment model for centralized Potassium Iodate (KIO_3) procurement was established by the Kyrgyz Association of Salt Producers (KASP) in 2010. A key barrier to salt producers was consistent availability of KIO_3 but also appropriate packaging configurations for SMEs (i.e., 1 kg, 5 kg). As shown in Fig. 24.2, in partnership with the GAIN Premix facility, KASP aggregates demand and imports KIO_3 for distribution to its members.

Key benefits realized by KASP members include bulk volume discounts, just-in-time local supplies, price stability, access to credit, and procurement in local currency.

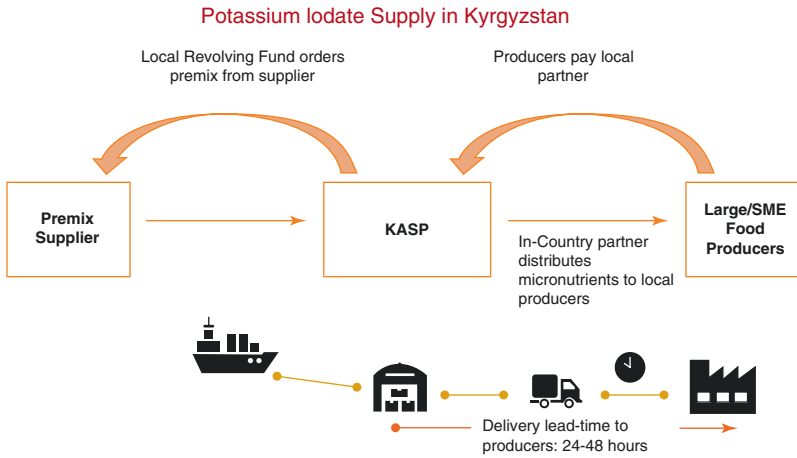


Fig. 24.2 Local premix model in Kyrgyzstan

Government as an Enabler of Fortification Programs

Trust between the regulator and private sector is essential for program scale up and compliance. Regulatory authorities are empowered to apply penalties as outlined in law, and where necessary, they should be leveraged to improve industry compliance. However, leadership at the political, policy and program levels must recognize both the power of a stick and carrot. Beyond the regulatory measures, government has a crucial role as an *enabler* of fortification as a private sector-driven public health intervention.

Table 24.3 describes three broad mechanisms through which the government’s design of fortification programs and the nature of their involvement can play a strong role in industry’s incentive to engage. Most compliance programs rely on scarce human resources and small budgets. In a future scenario, if industry process data could be collected through smart dosifiers, handheld devices, or other IoT [35] mechanisms, they would be in better control of their quality data. Government could then shift their role to more of an evaluator rather than collector of data. With less government need for periodic market checks of fortification quality, industry then reduces their risk of a potential discrepancy and improves

Table 24.3 Exploiting industry incentives to fortify by transforming government into an enabler

Current technical Approach	Expanded industry-oriented approach	Incentive exploited
Reliance on scarce human resource capacity and small government budgets to enforce compliance	Millers are in control of their quality data; government positioned as more of an evaluator than a collector of data	Reduces industry’s risk of a discrepancy with independent assessments of fortification quality by government or third parties
Fortification advanced as a stand-alone program	Fortification embedded into food quality and safety agenda to strengthen program	Millers incentivized to invest in equipment, raw materials, and processes if fortification is more strongly tied to industry priorities
Compliance with mandatory legislation as the primary means for government to engage industry	Shifting government focus to supporting communications campaigns and engaging more proactively with industry	Value-added services from government can lower investment risk for millers and increase potential for compliance with standards, even if only voluntary

their defense if there is one. Additionally, recognizing that producers and consumers alike value quality over fortification per se, government could better integrate fortification into the food quality and safety agenda, so that quality is defined by both safety and nutrition. In turn, this could incentivize manufacturers to invest in inputs (e.g., premix, dosing, and analysis equipment). Finally, at present, compliance tends to be the center of government and industry interaction. Shifting the focus to supportive government policies, such as communications campaigns (which may elicit a stronger response from industry players along the value chain than consumers per se), and proactive technical assistance, can position government as a value-added supporter of industry. This may further lower their investment risk and increase compliance.

The Food Safety and Standards Office of India (FSSAI), the government's nodal agency for food fortification, is a good example of government that has embraced the enabler role. The FSSAI established the Food Fortification Resource Centre (FFRC) [36] as a multisector platform for scaling-up food fortification. Positioning themselves as a value-added service to industry, FFRC publishes a reference list of premix suppliers and provides a variety of technical resources, such as training modules, analytical methods, and capacity-building services to industry. They also launched the Eat Right India movement, which reinforces the importance of fortification within the context of a healthy diet. In short, FSSAI plays a dual role; as an enabler and regulator for fortification.

Conclusion

Iron deficiency is one of the most pervasive nutritional challenges in the developing world. To date, despite the proven evidence [37], food fortification programs have not made a significant contribution to ameliorating the condition globally, particularly for rural populations whose access to iron-rich foods is most limited. The tra-

ditional components of fortification programs, including legislative mandates, technical capacity-building of industry, and periodic regulatory oversight, are unlikely to yield better results without due attention to industry's incentive to engage. By cultivating the right incentives and structures, we have the potential to leverage the competitive dynamics of the industry to propel us towards better functioning programs.

This approach would leverage more players along the value chain for fortified foods, as well as an expanded set of millers/processors that serve more regional markets. Private-private partnerships and new business innovations may help industry to leverage fortification as an added dimension of quality. In doing so, it could encourage competitors to engage and ultimately broaden responsibility for fortification to an expanded set of parties.

Fundamental shifts are also required for the monitoring of fortification programs. Placing the onus on industry for automatic collection of quality data through internet-connected devices will strengthen the credibility of regulatory monitoring, give industry an opportunity to leverage the data for comparative advantage and may ultimately lead to self-policing along the value chain if the data were made transparent by industry themselves or through third parties. Finally, a stronger government commitment to fortification would reduce investment risk for industry and increase their engagement. In combination with a movement towards the automatic collection of quality data through industry, government could more easily focus on their enabler role.

Fortification programs have been conceived as a seemingly simple intervention—adding inexpensive micronutrients to foods that the population is already regularly consuming to improve micronutrient status and reduce the downstream sequela associated with these deficiencies. However, their implementation is anything but simple, and the proposed constructs are no exception. But they do lay forth a vision to better leverage industry incentives to drive coverage and compliance, and in doing so, create a virtuous

cycle that will ultimately better serve the most vulnerable populations whom fortification programs were designed to most benefit. The development community can play a strong role in catalyzing this vision.

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