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Fueling growth: unlocking local production of fortified complementary foods in West Africa

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Introduction: Malnutrition among young children remains high in West Africa, with stunting (34.5%), wasting (6.7%), and micronutrient deficiencies (62%). Fortified, locally and Commercially Produced Complementary Foods (CPCFs) can help fill nutrient gaps, yet local production faces systemic challenges.

Objective: To assess the opportunities and constraints facing CPCF producers in Ghana, Niger, and Nigeria, and identify strategies to strengthen local production.

Methods: A literature review screening over 120 mixed sources mapped evidence on demand, production capacity, supply chains, costs, and regulation. Findings informed qualitative research. Five focus group discussions and 46 in-depth interviews were conducted with CPCF producers, regulators, financial institutions, and institutional buyers. Data were coded thematically using QDA Miner Lite.

Results: Producers reported operating below capacity and facing aflatoxin contamination. In Ghana, underutilization was linked to irregular demand and costly packaging. Nigerien producers highlighted obsolete machinery, high input prices such as premix and reliance on savings groups. Nigerian firms had invested in modern systems but faced volatile input prices, high energy costs, and frequent inspections. Regulatory compliances were hindered by limited awareness, high compliance costs, widespread illiteracy, and informal businesses. Consumer demand was shaped by affordability and trust, with imported brands often preferred. Adaptive strategies included single-serving sachet packaging, WhatsApp marketing, NGO-supported machine rehabilitation, bulk raw material purchasing, and producers and suppliers' contract for quality.

Conclusion: CPCF producers demonstrate resilience but face systemic barriers. Coordinated action through targeted Small and Medium Enterprises (SME) financing, aflatoxin control, streamlined certification process, and demand creation is essential to unlock the potential of CPCFs in West Africa.

KEYWORDS

complementary feeding, food systems, fortified foods, infant nutrition, Small and Medium Enterprises (SME), West Africa, local food production

1 Introduction

Infants and young children in West Africa face significant nutritional challenges with persistently high rates of undernutrition and poor diet quality across the region. An estimated 62% of pre-school-aged children live with a micronutrient deficiency (Stevens et al., 2022). Dietary quality remains suboptimal, with only one in four children consuming an adequately diverse diet (UNICEF, 2020), rate that is even lower in Sahelian countries, where persistent food insecurity and seasonal changes heavily shape feeding pattern. As a result, stunting continues to affect nearly one in three children, and one in 15 suffered from wasting, with the highest prevalences recorded in countries such as Niger, Burkina Faso, Nigeria (FAO et al., 2024).

Appropriately formulated, fortified, Commercially Produced Complementary Foods (CPCFs) can help bridge nutrient gaps, as emphasized in WHO's 2023 complementary feeding guidelines (World Health Organization, 2023). However, pronounced disparities exist across the region in terms of production, distribution, and consumption of fortified foods remain limited, especially in rural areas (Feeley et al., 2016; Bruyeron et al., 2010). For example, actual production in Sahelian countries is often much lower than what the units claim they can produce due to diverse reasons including supply chain disruption, unreliable electricity supply, and elevated input costs undermining continuous operations. Consumption patterns also vary widely. For example, only 12 and 31% of infants 6–8 months in Cameroon and Ghana, respectively, consumed fortified “baby foods,” while in Senegal, 49% of 6–23-month-olds in Dakar consumed any type of CPCFs (Khosravi et al., 2023). Market assessments further show a quality gap. Most CPCFs on the market fail to meet WHO or Codex nutrition standards in terms of nutrient composition requirements, with only 16% were nutritionally suitable across five West African countries (Khosravi et al., 2023).

In many countries across the region, porridges, whether traditional or prepared from local or imported flours, remain the main complementary food from 6 months of age. Caregivers' food choices are guided by the child's needs and preferences, as well as by perceived nutritional and sanitary quality, which they assess primarily through advice from relatives and the reputation of the products (Khosravi et al., 2023). The overall market remains limited, as use of infant-specific foods typically declines after 1 year of age when children transition to the family diet. Although demand for young child foods is rising due to urbanization, higher income levels, and Infant and Young Child Feeding (IYCF) promotion, this growth in demand disproportionately benefits imported products, which are often marketed aggressively and not always in alignment with the International Code of Marketing of Breast-milk Substitutes, limiting the competitiveness of locally produced infant flours (Khosravi et al., 2023). Given the region's high burden of micronutrient deficiencies and limited dietary diversity among infants and young children, this study examines how local businesses in West Africa can help expand sustainable access to CPCFs. This study integrates field interviews with a regional desk review to identify constraints, opportunities, and pathways to scale production of CPCFs in West Africa.

2 Methods

2.1 Literature review

We conducted a desk review between May and July 2024 to map existing evidence on the supply and demand for CPCFs in West Africa.

For this study, CPCFs were defined as packaged foods marketed for children 6–36 months of age, with or without fortification. The review covered cereals and porridges, purees, dairy products, snacks/finger foods, and beverages; home fortification products (e.g., micronutrient powders, small-quantity lipid-based nutrients supplements) were excluded.

A tailored search strategy combined keywords related to complementary feeding, fortification, commercial food markets, and West Africa. Due to the limited example of studies in West Africa, experiences in similar environments in other parts of Sub-Saharan Africa, South Asia and Southeast Asia were also considered. Peer-reviewed literature was searched in PubMed, Scopus, and Web of Science, while Global Health and OpenAIRE were used for gray literature. Reports from World Food Program (WFP), United Nations Children's Fund (UNICEF), Food and Agriculture Organization (FAO), Global Alliance for Improved Nutrition (GAIN), and Economic Community of West African States (ECOWAS) were also sourced directly. All documents identified through database searches and gray-literature sourcing were screened in two steps: first by title and abstract to remove studies not meeting inclusion criteria (West Africa focus, 2010 onward, English/French, directly related to production, regulation, marketing, and consumption of fortified complementary foods), followed by a full-text review of remaining documents. Reference lists were also scanned to capture additional relevant sources. For all included documents, data was extracted using a standardized form capturing publication details including information on author(s), year of publication, study objectives, methodology, key findings, and relevant conclusion. Extracted information was then organized in a structured matrix to ensure consistency and comparability across sources. In total, over 120 documents were screened, and data were extracted on consumer demand, production capacity, supply chains, costs, regulations, investment needs, and export potential.

Importantly, the literature review was not only a source of background evidence but also directly shaped the qualitative study protocol. Findings were used to identify key knowledge gaps and to guide the purposive selection of respondents, in close collaboration between HKI and WFP. Five priority domains were identified: (1) production capacity and workforce, (2) supply chain and raw material sourcing, (3) regulatory environment and compliance, (4) financial barriers and investment needs, and (5) sustainability of CPCF business models.

These gaps were explicitly translated into focus areas for the qualitative study. For example:

- Production capacity: Underutilized machinery and outdated equipment prompted targeted questions on scaling and equipment needs.
- Supply chain: Seasonal variability and aflatoxin risks informed probes on raw and packaging material sourcing, farmer linkages, and traceability.
- Regulation: Weak compliance and enforcement guided the inclusion of national regulators, standards agencies, and regional bodies [ECOWAS/West African Health Organization (WAHO)].
- Finance: Limited access to affordable credit informed the inclusion of financial institutions as interviewees.
- Sustainability: Concerns around profitability and affordability shaped questions on consumer demand, pricing strategies, packaging innovations, and business viability.

Thus, the review provided the scaffolding for the qualitative protocol, ensuring that the study addressed regionally relevant and

TABLE 1 Qualitative data collection summary (FGDs and IDIs).

Method	Respondent group	Country/scope	n	Producers
FGD	Producer groups	Nigeria	2	FGD1 (04 participants including small and medium size); FGD2 (05 participants including small and medium size)
FGD	Producer groups	Niger	2	FGD1 (07 participants including small and medium size); FGD2 (04 participants including small and medium size)
FGD	Producer groups	Ghana	1	03 participants including only small size
FGD subtotal			5	
IDI	Producers	All countries	24	
IDI	Regulators	All countries	11	
IDI	Financial-institution representatives	All countries	5	
IDI	Institutional buyers (e.g., NGOs, UN agencies)	All countries	6	
IDI subtotal			46	
Grand total (sessions + interviews)			51	

FGD, focus group discussion; IDI, in-depth interview. FGD counts are shown by country; IDI counts are pooled across Ghana, Niger, and Nigeria. Totals combine FGD sessions and IDI interviews.

policy-actionable gaps while avoiding duplication of existing evidence. While the review also examined consumer demand, the qualitative work focused primarily on production-side perspectives. This focus allowed more in-depth exploration of CPCF supply-side dynamics within the study's time and resource constraints and also aligns closely with broader efforts to strengthen local production and market systems that ensure young children have access to nutritious, safe, and affordable foods. By examining production-side perspectives, qualitative work provides critical insights into producer capabilities, constraints, and opportunities that inform policy and partnership aimed at building resilient and inclusive food systems.

2.2 Focus group discussions and in-depth interviews

Following the literature review, qualitative data were collected in Ghana, Niger, and Nigeria between October 2024 and January 2025. These three countries were selected because they reflect varied market and policy environments and insights from these countries can inform broader regional strategies to enhance access to fortified complementary foods. Participants included CPCF producers, regulators, representatives of financial institutions, and institutional buyers. The sample size was designed to capture diverse perspectives across three countries Ghana, Niger, and Nigeria selected for their contrasting market and policy environments relevant to fortified complementary foods. Producers were purposively sampled to ensure representation of small (<50 tons/month), medium (50–100 tons/month), and large (>100 tons/month) enterprises, while regulators, financial institutions, and institutional buyers were purposively sampled to reflect the full ecosystem shaping production and access to CPCFs.

Five focus group discussions (FGDs) were conducted with producer groups (two in Nigeria, two in Niger, and one in Ghana).

Each country was expected to include one urban and one rural producer groups; however, in Ghana, the discussion was held only in an urban area due to the limited number of producers available to form a rural group. For individual interviews, producers of different sizes were purposively selected, with 6–7 individual interviews conducted in each country. Other stakeholders (regional representatives and national government officials from relevant regulatory bodies, representatives from financing institutions and investment bodies, and institutional buyers) at both the country and regional levels were identified in coordination with the World Food Program country offices and Helen Keller Intl, following the principle of selecting one key stakeholder per country when feasible. In total, 46 in-depth interviews (IDIs) were carried out: 24 with producers, 11 with regulators, 5 with representatives of financial institutions, and 6 with institutional buyers (e.g., NGOs, UN agencies; Table 1).

Discussion guides were developed in English and French, pre-tested, and adapted to local contexts. All FGDs and IDIs were audio-recorded with consent, transcribed verbatim using Stream Apps in Microsoft Teams, and manually formatted into Microsoft Word. Transcripts were coded thematically in QDA Miner Lite. A structured yet flexible coding approach was used to ensure analytic rigor. A preliminary codebook was developed based on deductive coding derived from the literature review and study objectives. This list was further refined through inductive coding as new themes emerge from the field data.

To ensure systematic data management, a standardized labeling system was applied across all transcripts. Labels captured the type of interview (FGD or IDI), respondent category (producer, regulator, financial institution, or institutional buyer), country, city, interviewer's name, and interview date. To maintain confidentiality, all personal identifiers were removed during transcription and replaced with codes prior to analysis.

2.3 Ethics approval and consent to participate

This activity was undertaken as programmatic monitoring/quality-improvement to inform complementary food supply and demand and was not designed as human-subjects research; therefore, submission to national research ethics committees in Ghana, Niger, and Nigeria was not sought. Prior to fieldwork, administrative authorization was obtained from the relevant administrative and health authorities as well as from participating stakeholders. All participants were adult professionals (CPCF producers, regulators, representatives of financial institutions, and institutional buyers) and provided written informed consent for participation, audio-recording image rights and the potential use of the results to advise policy makers, companies and international institutions on how to improve public health and nutrition programming for children aged 6–23 months. Participation was voluntary; individuals could decline or withdraw without consequence. Personal identifiers were not collected or were removed during transcription; transcripts were assigned study IDs and analyzed in de-identified form.

3 Results

3.1 Insights from the literature review

The literature review underscored wide disparities in CPCF consumption across West Africa. In Dakar, Senegal, nearly half of children 6–23 months consumed CPCFs in the previous 24 h (Feeley et al., 2016), compared to only 12% in Cameroon and 31% in Ghana (Khosravi et al., 2023; Ghana Statistical Service (GSS) et al., 2015). Consumption was consistently higher in urban areas than rural, where awareness, affordability, and availability remain limited. Caregivers' decisions to purchase CPCF were strongly shaped by children's preferences ("bliss factor"), convenience for busy mothers (in preparation, feeding and purchasing practices), and perceptions of health benefits. Affordability, perception of CPCF as unhealthy and lack of trust in local brands were key barriers, while the influence of family members was both a barrier and enabler (Hystra, 2014).

Production capacity among local enterprises was found to be low and underutilized (Olive et al., 2020; Dimaria et al., 2018; GAIN, 2014; IRD, GRET, and UNICEF, 2020). Although some firms had significant capacity, outdated equipment, weak infrastructure, and high costs for fortification premixes and packaging constrained their operations. Supply chain fragility emerged as a recurrent theme, with challenges in securing quality raw material such cereals, groundnuts, and premixes, compounded by aflatoxin contamination. High-quality packaging shortages and reliance on imports of packaging material drove up costs, while limited in-country laboratory capacity undermined consistent quality assurance.

Regulatory systems varied widely across countries, complicating both compliance and regional trade. Differences in standards, coupled with weak enforcement, led to market distortions and quality inconsistencies. Many SMEs lacked access to affordable local laboratory services, forcing them to seek costly international certification if targeting institutional buyers (Dimaria et al., 2018; Sanogo et al., 2024; Masters et al., 2011).

The review also flagged high production and distribution costs, limited access to finance, and weak investment climates as structural barriers. Opportunities for regional export exist but remain hampered by non-harmonized standards and regulatory fragmentation, although the ECOWAS Standards Harmonization Model (ECOSHAM) and the West African Accreditation System (WAAS) efforts hold promise for alignment (ECOWAS Commission, 2022).

3.2 Findings from focus group discussions and in-depth-interviews

3.2.1 Production capacity and workforce capabilities

Across all three countries, producers reported operating below potential, with the smallest enterprises most constrained. In Ghana, some firms were running at only a third of capacity due to irregular demand. As one explained, "Our machines can produce one ton a day, but the orders do not come regularly, so we operate at only 30% of capacity." For some, registration hurdles were equally daunting: "It took me more than eight years before I was able to register with the FDA."

In Niger, outdated equipment was the main bottleneck, with breakdowns halting production for weeks. "We use old machines and when they fail, production stops. We do not have technicians here who know how to fix them," lamented one producer. Manual sorting of raw material such as maize or peanuts was common: "Sorting is still done by hand, and it is very slow because we do it manually." While some cooperatives had received external support—"Fédération des Unions de la Filières Oignons (FUFO) supported us with 9 million West African CFA (XOF) for electrification and machine rehabilitation"—most lacked trained staff or technical support.

Nigeria presented a more mixed picture. Larger firms had invested in extrusion and Enterprise Resource Planning (ERP) systems, but workforce retention was a persistent challenge. "We have the equipment and the systems, but the hardest part is finding and keeping skilled people—they leave as soon as they are trained," noted one respondent. SMEs in Kano emphasized seasonal production: "We're more of a small company, seasonal. We focus on the areas where demand is high."

Comparative insight: Capacity constraints were most acute in Niger due to obsolete equipment and weak technical skills; Ghanaian firms struggled with demand shortfalls and long certification delays; Nigerian companies were better equipped but hampered by workforce turnover and seasonal operations (Table 2).

3.2.2 Supply chain and raw material sourcing

Supply chain challenges were universal but varied in nature. In Niger, aflatoxin contamination and quality inconsistencies were widespread. "Sometimes half of the groundnuts we buy cannot be used—they are spoiled or contaminated, but we have no choice but to pay," said one processor. Another complained, "The quality of the millet was poor, mixed with sorghum." Limited storage capacity forced SMEs to buy frequently at higher prices, often transporting raw materials on carts or tricycles.

Ghanaian producers described more stable access to cereals and legumes but highlighted problems with packaging costs. "We can get maize and soy, but packaging is always a problem—you wait months for delivery and pay double what you budgeted." Some also struggled with aflatoxin and inconsistent supplies of fresh ingredients, leading to

TABLE 2 Country comparison of CPCF production challenges and opportunities.

Theme	Ghana	Niger	Nigeria
Production capacity & workforce	Medium-to-large producers supported by donors; many SMEs operate at ~30% of installed capacity due to irregular orders (“Our machines can produce one ton a day, but the orders do not come regularly”). Skilled labor turnover is a problem.	Small producers most constrained; outdated machines frequently break down (“We use old machines and when they fail, production stops”). Manual sorting; weak technical skills; some NGO-supported electrification/machine rehab.	Diverse sector (micro to large). Large firms invest in extrusion & ERP but face retention issues (“The hardest part is finding and keeping skilled people”). SMEs often seasonal and underutilized.
Supply chain & raw materials	Relatively stable cereals/legumes; severe issues with costly imported packaging (“You wait months for delivery and pay double”). Aflatoxin risk persists. High premix cost because it’s imported	Highly fragile; aflatoxin widespread; quality inconsistencies (“The millet was mixed with sorghum”). Seasonal shortages drive price spikes. Transport with carts/tricycles; inability to source in bulk disrupt flows. High premix cost because it’s imported	Volatile prices for maize/millet (“By the time maize reaches us, it has changed price three times”). Farmers hoard grain; aflatoxin contamination common. Larger firms invest in testing and R&D for quality blends.
Regulatory environment & compliance	FDA oversight but unaffordable, slow and unclear processes (“It took me more than eight years before I was able to register”). Limited labs outside Accra.	Awareness of standards but compliance costly and slow (“Analysis can take 1–2 months”). Weak enforcement. Exports rare, usually NGO-facilitated. Limited lab capacity (“No lab capacity to enforce the standards effectively”)	Central role of NAFDAC/SON, but audits frequent and costly (“Inspections come four times a year, every time you have to pay”). Relationship described as punitive (“Like the police and the thief”). Inconsistent enforcement. Lack of internationally accredited lab
Finance & investment	High interest rates (>20%), collateral demands limit SME access. Producers often save incrementally for equipment.	Limited access to credit; strong cultural resistance to interest-based loans (“We rely on family, savings groups, or small grants”). High transport costs further squeeze margins.	Credit constrained; high collateral; energy tariffs up 300% (“The cost of electricity has increased by more than 300%”). Most rely on savings or retained earnings.
Demand & pricing/packaging & marketing strategies	Urban demand growing but price-sensitive (“Mothers like the product but cannot buy it every week”). Consumers often prefer traditional porridge. Awareness-building still needed.	Weak demand; low awareness (“Families know porridge, but do not see why they should pay more for something in a package”). Varying demand from institutional buyers (e.g., WFP) due to heavy dependance on aid funding.	Stronger urban demand but imported brands dominate (“Parents will buy the imported brand because they trust them more”). SMEs innovate with sachet packaging and WhatsApp marketing.
Adaptive strategies	Foil packaging to protect nutrients; direct outreach to mothers; calls for government support in farmer training.	Bulk purchases to cut costs; NGO/association support for electrification/machines; demonstrations at baptisms/health centers.	Sachet packaging; digital marketing (WhatsApp groups); blending local crops with fortified premix; investment in R&D for consumer trust.

reliance on imports: “We tried to use local carrots, but the varieties were inconsistent, and we had to rely on imports.”

In Nigeria, volatility in raw material pricing was the main challenge. “By the time maize reaches us, it has changed price three times—we cannot plan,” one SME observed. Producers in Kano described farmers hoarding millet, which drove up prices. Others stressed the need for strict testing: “With ginger, we make sure we get the American standard, and with millets, we constantly test them for moisture before we purchase them.” Another explained that “we have started to import groundnut because of the aflatoxin found in the local groundnut.”

Comparative insight: While all three countries faced challenges related to contamination, Niger struggled with fragile logistics, Ghana with costly packaging constraints, and Nigeria with supply chains affected by currency and price volatility (Table 2).

3.2.3 Regulatory environment and compliance

Awareness of national standards was high, but certification and compliance remained burdensome everywhere. In Ghana, SMEs found certification unaffordable and slow: “We want to sell to WFP and NGOs, but without the certification, they will not touch our products.”

Another lamented, “There is no standard lab in Northern Ghana, and people cannot afford to travel to Accra for testing” (Allen et al., 2011).

In Niger, the problem was not awareness but enforcement. “We have the standards, but not the laboratory capacity to enforce them effectively,” one official admitted. Certification delays could stretch for months: “The results of product analysis at LANSPEX can take from 1 to 2 months.”

Nigeria’s regulatory system was perceived as both costly and punitive. One producer explained, “If they come for periodic inspections, they are coming four times a year, and every time you have to pay for them to come.” Another described the relationship with regulators as “like the police and the thief... they wait till they catch you in something wrong and then penalize.” Large firms seeking to sell to WFP noted that WFP’s testing requirements may necessitate WFP to send samples to laboratories outside the country, due to lack of in-country testing capacities, which adds time to the process. According to regulators, SMEs across the three countries struggle to meet CPCF regulatory requirements due to limited awareness, high compliance costs, widespread illiteracy, and the informal nature of many businesses, which hinders communication and enforcement. A regulator explained “Small-scale producers do not know much about standards and regulations, but maybe the medium producers understand a bit more than the

first.” *These challenges are sometimes compounded by corruption with “some producers trying to pay bribes to regulatory body agents to prevent strict enforcement actions.”*

Comparative insight: Ghana’s bottleneck was slow and centralized certification, Niger’s was weak enforcement and laboratory shortages, and Nigeria’s was the high cost and punitive nature of inspections and laboratory testing (Table 2).

3.2.4 Financial barriers and investment needs

Access to finance was consistently cited as one of the most serious barriers. Ghanaian SMEs reported exclusion from bank loans due to collateral requirements and often resorted to saving incrementally for equipment purchases.

In Niger, the range of available financial products is poorly known, and the conditions for obtaining them—such as requirements for a business plan, certified financial statements, and personal contribution—are often unsuitable for SMEs. In addition, cultural and religious restrictions on interest-based loans further limited access. *“Our community will not take interest-based loans—we rely on family, savings groups, or small grants,”* explained one cooperative. Rising transport costs added to the financial burden, with some firms fragmenting shipments to reduce fees.

In Nigeria, financial constraints were compounded by rising electricity tariffs. *“The cost of electricity has increased by more than 300%, threatening the survival of small industries,”* one respondent reported. Banks were seen as inaccessible: *“Most financial institutions require tangible assets as collateral, which small producers often lack.”*

Financial institutions hesitate to relax lending requirements for CPCF producers because of the sector’s vulnerability to climate, market, and security risks, combined with SMEs’ lack of collateral and poor financial literacy. *“The main challenge we face when providing financial support to the producers is the uncertainty of these producers to repay the loan to microfinance institutions or banks, we connect them with,”* explained one financial institution.

Comparative insight: All three countries faced high interest rates and collateral barriers, but Niger was further constrained by cultural resistance to conventional loans, Ghana by rigid collateral demands, and Nigeria by soaring operational costs linked to electricity usage (Table 2).

3.2.5 Market viability and consumer demand

Consumer demand varied widely. In Ghana, urban demand was growing but price-sensitive. *“Mothers like the product, but many say they cannot buy it every week—it is too expensive compared to regular porridge.”* Producers also noted the need for greater consumer education on the benefits of fortified foods.

In Niger, demand was weakest. Awareness of fortified foods was limited, and households often preferred traditional porridges. *“Families here know porridge, but they do not see why they should pay more for something in a package,”* said one producer. Some tried to boost awareness through demonstrations at baptisms or health centers. Institutional buyers such as WFP provided important markets though these come with specific product compliance requirements.

Nigeria showed the strongest consumer demand, though imported brands dominated. *“Parents will buy the imported brand, because they trust it more,”* an institutional buyer observed. To compete, SMEs introduced single-serving sachet packaging and digital marketing: *“We use WhatsApp groups to advertise promotions—it helps build trust with young mothers.”*

Comparative insight: Demand was strongest but highly competitive in Nigeria, moderate but price-sensitive in Ghana, and weakest in Niger due to low awareness and entrenched traditional preferences (see Table 2).

4 Discussion

This study provides new evidence on the opportunities and constraints for local production of fortified complementary foods (CPCFs) in Ghana, Niger, and Nigeria. By combining a regional literature review with qualitative data from producers, regulators, financial institutions, and institutional buyers, the study highlights systemic challenges while also documenting adaptive strategies being tested on the ground.

4.1 Linking findings to existing literature

The findings reinforce prior analyses that emphasize the importance of SMEs in African food systems and the barriers they face (Henson and Humphrey, 2015; Clark and Hobbs, 2018; Allen et al., 2011). Our results highlight how these challenges manifest differently across countries, yet follow a common pattern of regulatory hurdles, infrastructural constraints, and market frictions. In Ghana, producers’ accounts of prolonged certification mirror earlier studies on bureaucratic delays in food regulatory systems, underscoring how administrative inefficiencies continue to slow market entry for SMEs. In Niger, descriptions of obsolete equipment and manual sorting (*“Sorting is still done by hand, and it is very slow”*) reflect persistent technological gaps in Sahelian agro-processing sectors (Grace, 2015). In Nigeria, frustrations with regulators were evident, as illustrated by one producer who explained, *“It’s like the police and the thief... they wait till they catch you in something wrong and then penalize you.”* These experiences echo broader concerns about inconsistent and punitive enforcement practices.

Demand-side dynamics also align with prior research. In Ghana, mothers reported liking fortified complementary foods but being unable to purchase them regularly, highlighting affordability barriers. In Niger, entrenched traditions limited demand: *“Families here know porridge, but they do not see why they should pay more for something in a package.”* This reflects a consumer hesitation toward packaged foods, especially when traditional homemade options are considered adequate. In Nigeria, trust in imported brands prevailed: *“Parents will buy the imported brand, because they trust it more.”* These findings confirm earlier evidence that consumer trust, convenience, and perceived health benefits strongly shape complementary food uptake in West Africa (Bruyeron et al., 2010; Khosravi et al., 2023). From our perspective, increasing demand will require more than expanding product availability. It will also require targeted efforts to build consumer trust, improve product visibility, and communicate the value proposition in a manner that aligns with local preferences and cultural norms.

4.2 Policy and practice implications

Our country-specific findings suggest differentiated policy entry points (Table 3):

- 1 Production systems: Niger requires urgent investment in modern equipment, appropriately designed production facilities, workforce training, and maintenance services; Ghana needs stronger links between demand and supply to reduce

TABLE 3 Challenges and solutions by thematic area and country.

Challenges		Proposed solutions
Production capacity and workforce		
Ghana	<ul style="list-style-type: none"> Underutilized capacity due to irregular demand Lengthy and costly registration process 	<ul style="list-style-type: none"> Develop demand-generation strategies (national social protection program; SBCC campaigns leveraging on community leaders and influencers)
Niger	<ul style="list-style-type: none"> Outdated equipment causing frequent breakdowns Lack of technical expertise for repairs 	<ul style="list-style-type: none"> Establish pooled financing for modern equipment Create regional technical support hubs and mobile repair teams
Nigeria	<ul style="list-style-type: none"> Workforce retention challenges Skills gap despite investment in systems 	<ul style="list-style-type: none"> Implement workforce retention packages (good competitive salaries, housing, bonuses, etc.) Develop vocational training programs for food processing
Regulatory environment and compliance		
Ghana	<ul style="list-style-type: none"> Certification unaffordable and slow process Limited SME awareness of standards 	<ul style="list-style-type: none"> Decentralize FDA labs to Northern regions Introduce mobile testing units Digitalize certification processes to reduce time and cost Launch SME-targeted compliance training
Niger	<ul style="list-style-type: none"> Weak enforcement due to lack of lab capacity Long delays in product analysis (1–2 months) Limited technical capacity for standards 	<ul style="list-style-type: none"> Invest in decentralized labs (e.g., LANSPEX upgrades) Introduce mobile testing units Train SMEs on CPCF standards
Nigeria	<ul style="list-style-type: none"> Redundant inspection by different regulators Perceived punitive regulatory approach Lack of accredited labs for international certification Corruption risks in enforcement 	<ul style="list-style-type: none"> Joint inspections or mutual recognition agreements among regulators and standardize fees Develop internationally accredited labs in-country Introduce transparent digital payment systems to curb bribery
Supply chain and raw materials		
Ghana	<ul style="list-style-type: none"> High packaging costs and delays Aflatoxin risk in cereals 	<ul style="list-style-type: none"> Invest in regional packaging hubs to reduce import dependency Introduce aflatoxin control programs at farm level
Niger	<ul style="list-style-type: none"> Widespread aflatoxin contamination Limited storage capacity 	<ul style="list-style-type: none"> Introduce aflatoxin control programs at farm level Invest in collective storage facilities
Nigeria	<ul style="list-style-type: none"> Volatile raw material prices Aflatoxin contamination Lack of quality testing infrastructure 	<ul style="list-style-type: none"> Develop grain price stabilization mechanisms (forward contracts) Strengthen farmer–producer linkages through cooperatives Expand accredited testing labs
Finance and investment		
Ghana	<ul style="list-style-type: none"> Exclusion from bank loans due to high collateral 	<ul style="list-style-type: none"> Develop SME-friendly loan products with reduced collateral requirements Create guarantee funds to de-risk lending for SMEs
Niger	<ul style="list-style-type: none"> Limited awareness of financial products Unsuitable conditions (business plans, certified statements) Cultural/religious restrictions on interest-based loans 	<ul style="list-style-type: none"> Launch financial literacy programs for SMEs Pilot revolving funds and cooperative-based credit systems Scale Sharia-compliant financing options
Nigeria	<ul style="list-style-type: none"> High electricity costs increasing operational costs Banks require tangible collateral Poor financial literacy among SMEs 	<ul style="list-style-type: none"> Support energy-efficiency investments to reduce power costs Provide blended finance models combining grants and loans Develop risk-sharing facilities for CPCF producers Launch financial literacy programs for SMEs
Demand and marketing		
Ghana	<ul style="list-style-type: none"> Urban demand growing but highly price-sensitive Limited consumer awareness of fortified food benefits 	<ul style="list-style-type: none"> Introduce affordable packaging formats (e.g., single-serving sachet packaging) Implement SBCC campaigns targeting mothers and other caregivers Support demand via social assistance
Niger	<ul style="list-style-type: none"> Weak consumer demand Low awareness of fortified foods Preference for traditional porridges 	<ul style="list-style-type: none"> Launch community-based demonstrations (health centers, baptisms) Partner with influencers and local leaders for products promotion Expand institutional procurement (e.g., national social protection program) to create stable demand
Nigeria	<ul style="list-style-type: none"> Strong demand but imported brands dominate Trust gap for local products 	<ul style="list-style-type: none"> Promote local brands through digital marketing (WhatsApp, social media) Introduce single-serving sachet packaging for affordability Invest in quality assurance and certification to build consumer trust

underutilization of capacity; and if investments are made without stimulating demand, this could drive prices up, reducing CPCFs affordability; Nigeria must focus on retaining skilled staff and reducing operational costs linked to energy consumption.

- 2 Supply chains: Aflatoxin control through farmer training and storage is a pressing challenge in the three countries while packaging costs remain a more significant challenge in Ghana. Nigeria requires interventions to stabilize prices.
- 3 Regulation: Streamlining and harmonizing certification processes is critical. Ghana must address slow and centralized FDA approvals, Niger and Nigeria need to expand laboratory capacity, including the establishment of internationally accredited facilities to enforce standards. Additionally, Nigeria should simplify inspections procedures to enhance regulatory compliance.
- 4 Financing: Context-sensitive models are essential. Nigerien SMEs rely on savings groups and Sharia-compliant financing, Ghanaian firms struggle with rigid collateral requirements, and Nigerian firms need blended finance and risk-sharing facilities to mitigate energy and currency shocks.
- 5 Demand creation: Strategies must be tailored to local contexts. Ghana requires consumer education to build awareness, Niger could expand community demonstrations through health centers and social events, while also engaging community influencers and religious leaders, and Nigeria’s successful use of sachet packaging and WhatsApp marketing offers lessons for reaching cost-sensitive urban households. National programs, such as social protection, remain a cross-cutting lever to normalize CPCF consumption and reach those most in need of improved diets, including fortified complementary foods.

4.3 Broader significance

By integrating producers’ voices—whether the Ghanaian SME who waited years for FDA approval, the Nigerien cooperative reliant on savings groups, or the Nigerian entrepreneur competing with imports—this study illustrates that scaling CPCFs requires more than technical fixes. It demands coordinated action to address systemic constraints, build consumer trust, and adapt interventions to national contexts. Locally produced CPCFs thus represent a “double-duty” solution: simultaneously addressing nutrient gaps during the complementary feeding period and strengthening SME-led food systems in West Africa.

4.4 Limitations

This study has some limitations. First, it relied on qualitative interviews in three countries, and interviewer bias may have influenced the way questions were asked and how respondents understood them. To reduce this bias, we trained all the interviewers on neutral probing techniques. Second, while perspectives from multiple stakeholders were included, consumer perceptions were captured only indirectly by asking producers and buyers to share their thoughts regarding consumer perceptions. Future research should directly explore consumer preferences, ability and willingness to pay, and trust in CPCFs. Third, social desirability bias may have shaped responses, particularly among producers when responding to questions related to production challenges, compliance to norms and standards, or market demand. But training interviewers in neutral probing and indirect questioning, emphasizing confidentiality and anonymity during interviews may have contributed to limiting overly favorable reporting.

TABLE 4 Priority recommendations for scaling fortified complementary foods in West Africa.

Stakeholder group	Ghana	Niger	Nigeria	Cross-cutting
Local producers (SMEs)	<ul style="list-style-type: none"> • Strengthen production-demand links • Invest in affordable packaging • Expand consumer education 	<ul style="list-style-type: none"> • Modernize equipment and food safety training • Expand collective storage and aflatoxin management • Leverage NGO support for electrification/machine rehab 	<ul style="list-style-type: none"> • Workforce retention via training & incentives • Expand sachet packaging & digital marketing 	
Policymakers and regulators	<ul style="list-style-type: none"> • Streamline FDA processes • Decentralize certification • Expand regional lab capacity 	<ul style="list-style-type: none"> • Invest in labs (LANSPEX, ANMC) • Simplify SME compliance 	<ul style="list-style-type: none"> • Reduce inspection costs & frequency • Strengthen regulator-industry collaboration • Facilitate affordable certification to international institutional buyers 	<ul style="list-style-type: none"> • Advance ECOSHAM/ECOWAS harmonization
Financial institutions	<ul style="list-style-type: none"> • Adapt loans to SMEs with lower collateral • Support incremental equipment financing 	<ul style="list-style-type: none"> • Scale Sharia-compliant financing • Pilot revolving funds 	<ul style="list-style-type: none"> • Provide blended finance & risk-sharing • Develop seasonal working-capital loans 	
Government, donors and development partners	<ul style="list-style-type: none"> • Support demand generation via SBCC & social assistance 	<ul style="list-style-type: none"> • Invest in cooperatives, equipment, and farmer-processor link in value chain 	<ul style="list-style-type: none"> • Fund energy-efficient investments • Subsidize SME certification for institutional buyers’ procurement 	<ul style="list-style-type: none"> • Co-finance shared infrastructure (labs, packaging hubs) • Strengthen SME capacity-building platforms

4.5 Recommendations

Priority recommendations for scaling fortified complementary foods in West Africa are summarized in [Table 4](#), which highlights actionable steps for four key stakeholder groups. For local producers (SMEs), recommendations focus on strengthening supply–demand linkages, modernizing equipment, improving packaging, and investing in consumer trust-building through education. Policymakers and regulators are urged to streamline certification processes, expand laboratory infrastructure, and advance regional harmonization of standards to enable trade and reduce bottlenecks. Financial institutions are encouraged to adapt loan products, expand community-based and Sharia-compliant financing, and introduce risk-sharing mechanisms that better align with the seasonal and high-risk nature of food processing. Finally, governments, donors and development partners are called to support demand generation, invest in cooperatives and infrastructure, and co-finance shared production units designed for collaborative use by multiple producer groups to reduce costs and strengthen SME capacity. Taken together, these recommendations illustrate the multi-actor, multi-country actions needed to overcome persistent barriers and unlock the potential of fortified complementary foods to improve child nutrition across the region.

5 Conclusion

Despite systemic challenges, SMEs in West Africa are actively engaged in CPCF production and demonstrate capacity to adapt to market constraints with innovative solutions. To further unlock their potential, coordinated action is needed across policy, finance, supply chain (sourcing and production) and demand creation. Strengthening local CPCF production represents not only a nutrition intervention but also a broader opportunity to build resilient food systems that deliver both health and economic benefits.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical approval was not required for the studies involving humans because this activity was undertaken as programmatic monitoring/quality-improvement to inform complementary food supply and demand and was not designed as human-subjects research; therefore, submission to national research ethics committees in Ghana, Niger, and Nigeria was not sought. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

CO: Formal analysis, Investigation, Writing – original draft, Methodology, Data curation, Conceptualization. KG: Methodology, Conceptualization, Writing – original draft, Project administration, Formal analysis, Data curation. JB: Data curation, Writing – review & editing, Conceptualization, Formal analysis. AO: Writing – review & editing, Data curation, Investigation. FI: Writing – review & editing, Formal analysis, Data curation, Investigation. AP: Writing – review & editing, Funding acquisition, Conceptualization. ZT: Writing – review & editing, Investigation, Formal analysis, Data curation. SP: Conceptualization, Writing – review & editing, Supervision. SM: Writing – review & editing. CM: Writing – review & editing. SL: Project administration, Writing – review & editing. RK: Supervision, Data curation, Writing – review & editing, Conceptualization, Funding acquisition, Methodology.

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Conflict of interest

ZT was employed as an Independent Consultant.

The remaining author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that Generative AI was not used in the creation of this manuscript.

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