VOICE FOR CHANGE PARTNERSHIP (V4CP)

Ghana

COMPREHENSIVE TYPOLOGY FOR FOOD AND NUTRITION SECURITY INTERVENTIONS

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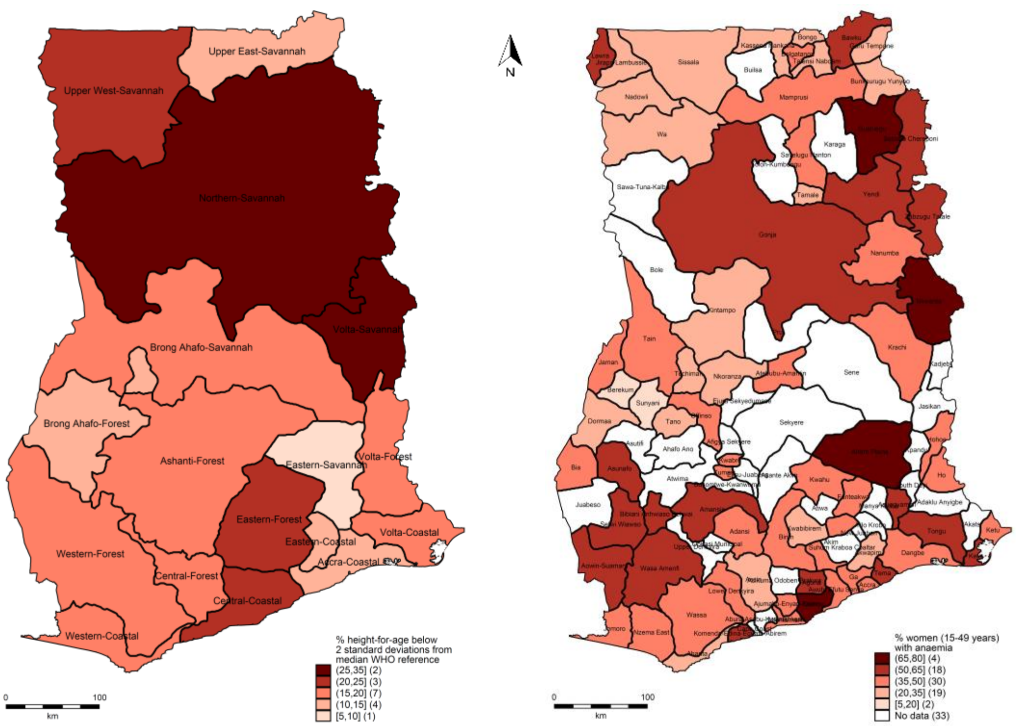
INTRODUCTION

This brief presents a comprehensive typology for food and nutrition security interventions using intervention types and nutrition constraints as a combination of sequential obstacles impeding nutrition security. The typology is applied to Ghana. Based on the typical pillars of food security (availability, access, utilisation and stability) and drawing from previous studies (Torero 2014; Yu et al. 2010), this classification is derived from a demarcation of areas within a four-indicator diagram, each of which represents a core dimension of food and nutrition security (FNS). As such, the typology is conceptually sound, operationally flexible and less data intensive. Obviously, given its simplification of the more complex real-world problems into a fixed set of generic issues, the typology provides only the first layer of information to guide the design and implementation of relevant food and nutrition interventions. Though, if more information is available, both content and localisation of these interventions can be further refined.

Figure 1 presents the spatial distribution of stunting among children below the age of 5 years (panel a) and anaemia among woman of reproductive age (panel b) in Ghana in 2014.

Figure 1. Prevalence of stunting among children (<5 years) and anaemia among women (15-49 years) in Ghana (2014)



Panel (a)

Panel (b)

Source: Authors' with data from DHS (2014).

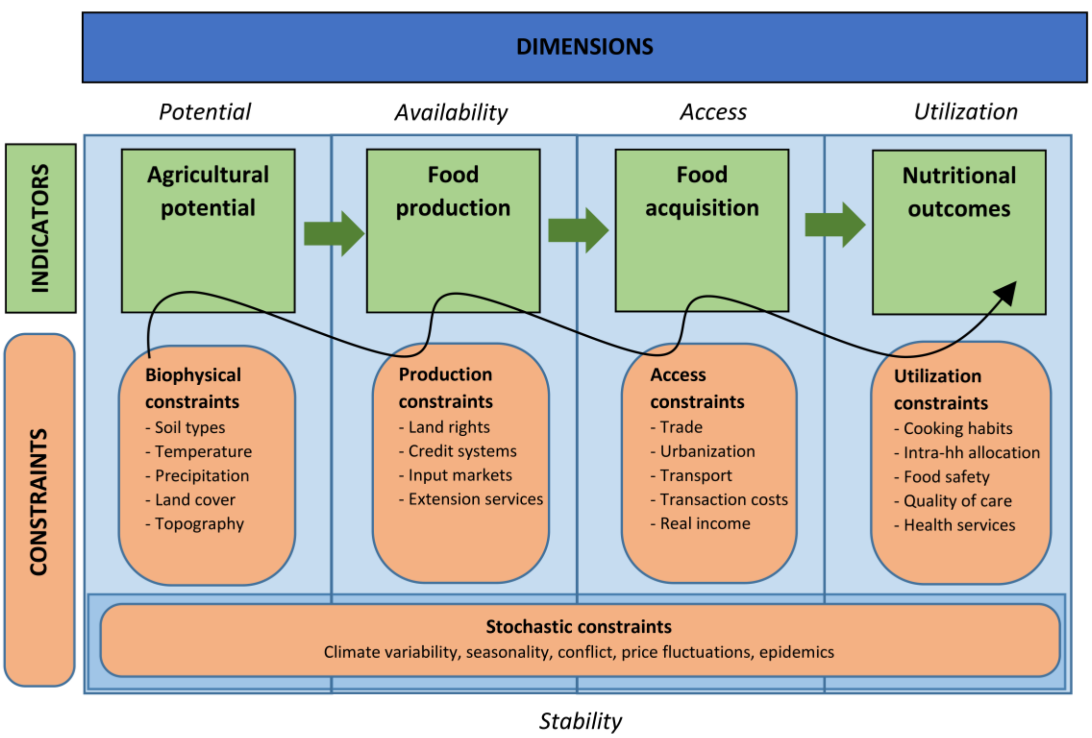
With an average national stunting level below 19%, Ghana is performing relatively well compared to many other African countries (DHS 2014). However, as shown in panel (a) of Figure 1, important spatial variations exist: whereas chronic malnutrition affects more than 25% of all children in the Northern and the Volta-Savannah regions, the Eastern-Savannah region is doing markedly better with a prevalence rate below 10%. This being said, and except for increased obesity, currently, the real challenge of malnutrition in Ghana is related to micronutrient deficiencies, particularly iron deficiency. Indeed, more than 42% of women at reproductive age suffer from some form of anaemia, which results from inadequate intake of iron, malaria and intestinal worm infestation, leading to increased health risks for mother and fetus. In addition to higher prevalence rates, anaemia among women varies considerably across districts, as shown in panel (b) of Figure 1. Scattered from north to south, the most affected districts are Gushiegu, Nkwanta, Afram Plains and Gomoa, with anaemia rates well above 65%. Somewhat less affected but still very problematic are two clusters of districts located in the Northern and Western regions, with a prevalence of anaemia between 50% and 65%. On the other hand, the districts of Sunyani and Berekum in the Brong Ahafo-forest region perform much better as less than one fifth of all women at reproductive age seems to suffer from anaemia.

To address food and nutrition insecurity across the country, it is therefore important that the design of policy interventions accounts for spatial heterogeneity. Unfortunately, the country's decentralization process has not yet produced adequate measures to reform its statistical system (Quiñones et al. 2011); indeed, many household surveys are still organized to provide estimates only representative of the regional level, whereas the country currently counts 216 districts. To provide more spatial disaggregation while keeping sufficient observations to derive reliable statistics, the country's 10 regions were crossed with the three prevailing ecological zones (coastal, forest and savannah) to arrive at the 17 geographical units used in panel (a). For panel (b), a subdivision of 106 districts has been used, which aligns well with the more aggregate and early stages of decentralization initiated at the end of the 1980s. Given its more alarming character combined with the possibility to use more disaggregated data, this brief will rely on the prevalence of anaemia among women as the main indicator of nutrition.

CONCEPTUAL FRAMEWORK

To guide public policies on malnutrition, Pangaribowo et al. (2013) state that it is crucial to go beyond the mere collection and profiling of different food security and nutrition indicators. Each of these indicators certainly point to several important aspects, but knowledge about their interrelation is key to grasp the complete picture and understand the causal chain that determines nutritional status. To do so, we make use of the conceptual framework laid out in Figure 2 which includes all typical dimensions of FNS.

Figure 2. Conceptual pathway from agricultural potential to nutrition



Source: Adapted from Pangaribowo et al. (2013).

Apart from 'stability', which is cross-cutting and points to the absence of shocks, all other dimensions follow a chronological sequence from agricultural potential to final consumption. This chronology is captured by the black wavy line in Figure 2, which also considers the constraining factors affecting the conversion at each step. Regarding food production, farmers should have sustained access to, for example, credit, seeds, fertilizer and knowledge to be able to tap into the agricultural potential of their land. Further, even if food is sufficiently produced, access by families might still be constrained due to all sort of transaction costs, such as trade barriers, poor transport infrastructure and high prices. And finally, even when families have secured access to food, nutrition might still be jeopardised because of various utilisation constraints preventing a correct absorption of nutrients by individuals. These constraints might relate to cooking habits, intra-household allocations, food safety, and health and sanitation conditions.

Making use of one indicator for each of the four sequential FNS dimensions and applying it to the country's 106 "older" districts, the typology helps point out where and which type of intervention would be most effective in improving the nutritional status of the Ghanaian population.

DATA ON FOOD AND NUTRITION SECURITY

For each sequential FNS dimension, we construct a summary indicator based on available data at district level. Table 1 summarises the key steps for their construction while providing some basic descriptive statistics for each.

For potential, we rely on two remote sensing data sources at 30m spatial resolution. The first measures current crop land extent in 2015 (Xiong et al. 2017), and the second points to the amount of cleared forests between 2000 and 2015 (Hansen et al. 2013), for which we assume that it has recently been or will soon be used for agriculture (Codjoe and Dzanku 2009). Each of these "arable pixels"[1] are then cultivated with maize, rice, cassava, yam, cocoyam, plantain, soya beans and cowpeas following the national food consumption pattern, as obtained from the Ghana Socioeconomic Panel Survey conducted in 2009-2010 (ISSER/EGC 2015), and by applying potential yield factors as earmarked by the Ministry of Food and Agriculture (MoFA 2016). The resulting output is then converted into daily potential kilocalorie production (Stadlmayr et al. 2012), summed up by district and divided by the corresponding population estimate.

Table 1. Descriptive statistics of key FNS indicators for Ghana (2008-2015)

Dimension	Indicator	Obs.	Mean	Min	Max
Potential	Immediately arable land (km^2)	106	478.4	2.2	3793.4
	Daily potential kilocalorie production per person	105	12304.0	3.2	126799.7
	3rd-root transformation of daily potential kilocalorie production per person	105	19.1	1.5	50.2
Production	Daily kilocalorie production per person	105	6268.4	0.0	64241.1
	3rd-root transformation of daily kilocalorie production per person	105	15.8	0.0	40.1
Acquisition	% of households with FCS below 52.5	80	16.2	0.0	56.7
	% of households with FCS above 52.5	80	83.8	43.3	100.0
Nutrition	% of women (15-49 years) with anaemia	73	43.3	11.7	77.3
	% of women (15-49 years) without anaemia	73	56.7	22.7	88.3

Source: Authors' with data from Brown de Colstoun et al. (2017); CFSVA (2008); DHS (2014); Hansen et al. (2013); ISSER/EGC (2015); MoFA (2015, 2016); Pekel et al. (2016); Stadlmayr et al. (2012); UNEP-WCMC (2018); Xiong et al. (2017).

For production, the district statistics of the agricultural year 2015, as estimated by MoFA (2015), were converted to kilocalories using Stadlmayr et al. (2012), aggregated to the 106 districts and similarly expressed per person and day. Due to data limitations (Sumberg et al. 2016) this measure does not cover agricultural production from animal sources, such as meat, fish, milk and eggs. As a measure of food acquisition, we use the WFP's Food Consumption Score (FCS) from the Comprehensive Food Security and Vulnerability Analysis (CFSVA) of 2008, which is a food access indicator based on recall data of food group consumption frequencies in the past 7 days (WFP 2008). For each district, we compute the prevalence of households with an FCS above the (higher) threshold being suggested by the WFP in Ghana to distinguish between acceptable low and acceptable high food consumption (i.e. 52.5). Finally, for nutrition, we rely on blood sample data from the Demographic and Health Survey (DHS) of 2014, and define an inverse measure of anaemia prevalence among women aged between 15 and 49 years old with a haemoglobin level above the common cut-offs set for pregnant and non pregnant women.

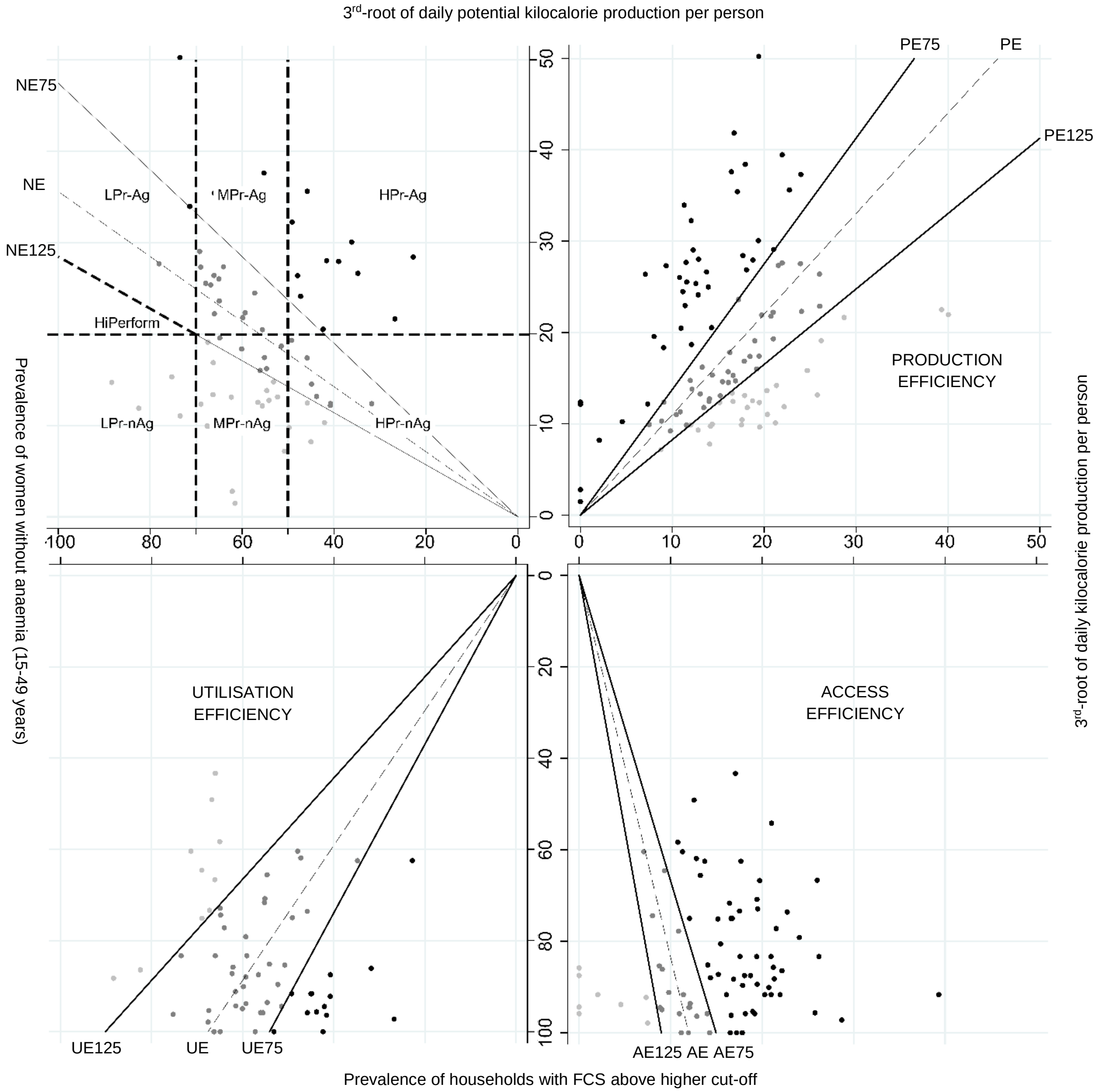
[1] Given our aim to construct a conservative and short-term measure for agricultural potential, these pixels represent land which is immediately arable, either because currently or recently used for cultivation, or where trees have been logged to start cultivation (the latter which is the assumed reason for logging).

TYPOLOGY

All estimated FNS indicators for each district are combined in one scatterplot (see Figure 3). The North-West (NW) panel of Figure 3 connects both ends of the food system by opposing the measures of agricultural potential and nutrition. Within this panel, we identify three levels of priority based on two cut-offs for nutritional status, set at 50% and 70%. In addition, the level of agricultural potential which corresponds to 125% of the average efficiency observed between potential and nutrition is used in combination with the upper bound nutritional cut-off to differentiate between districts with higher and lower agricultural opportunities. This means that districts with an agricultural potential below this threshold will not reach a nutritional status above 70%, unless they perform better than 125% of what is on average observed in the country. In the latter type of districts, focusing on agriculture alone might therefore be a less optimal strategy. Based on these benchmarks, and largely in line with Torero (2014), seven generic intervention types can be identified by crossing the three priority levels (High Priority (HPr), Medium Priority (MPr) and Low Priority (LPr)) with higher (Ag) or lower (nAg) agricultural potential. Within the category of "low priority with higher agricultural potential (LPr-Ag)", one can further classify districts as "high-performance (HiPerform)", when their overall efficiency level is higher than 125% of the country's average.

In addition to these broad intervention types, the other three panels of the combined scatterplot provide more detail regarding the relative importance of various sets of constraints along the sequential pathway from agricultural potential to nutrition. Reading clock-wise, the North-East (NE), South-East (SE) and South-West (SW) panels respectively focus on production, access and utilisation constraints. For each set of constraints and based on fitted lines through the origin, we define three levels of inefficiency (high-medium-low) depending on whether a district's performance falls below, between or above 75% and 125% of the average estimated efficiency level of the country.

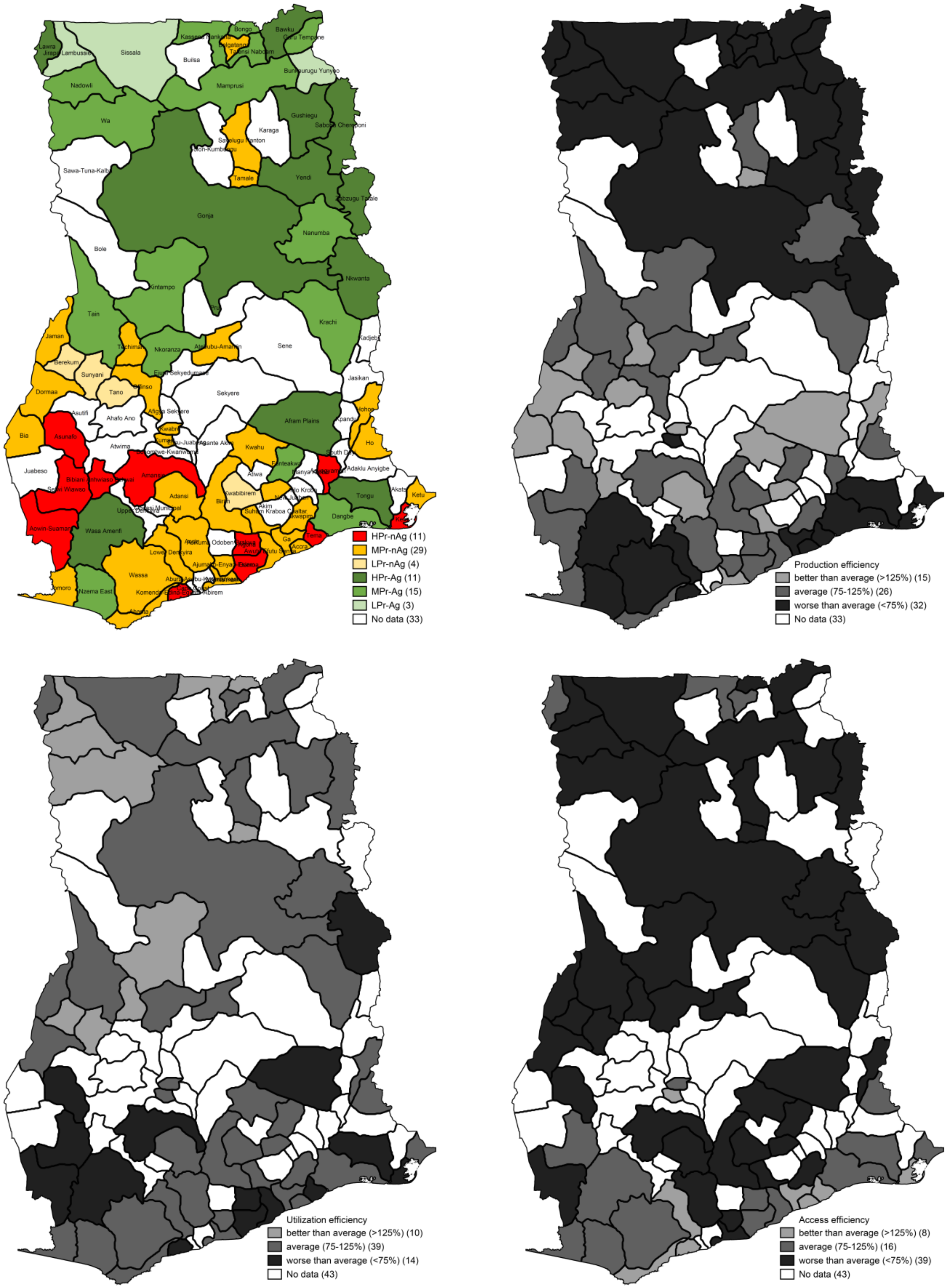
Figure 3. Combined scatterplot with district data, Ghana (2008-2015)



Notes: LPr, MPr, HPr respectively stand for low, medium and high priority districts; Ag and nAg refer to high and low agricultural potential; and HiPerform stands for high-performance districts. PE, AE, UE and NE are estimated lines based on population weighted OLS regressions with intercept through the origin, respectively having a slope of 1.101, 0.120, 1.479 and 2.810. The E75 and E125 lines are derived from the previous lines with slopes being 75% and 125% the size of the estimates slopes.
Source: Authors' with data from Brown de Colstoun et al. (2017); CFSVA (2008); DHS (2014); Hansen et al. (2013); ISSER/EGC (2015); MoFA (2015, 2016); Pekel et al. (2016); Stadlmayr et al. (2012); UNEP-WCMC (2018); Xiong et al. (2017).

Based on the schematic demarcation of areas along each pair of FNS indicators, Figure 4 then adds the spatial dimension by presenting four country maps with colors representing the intervention type and level of production, access and utilisation inefficiency.

Figure 4. Districts by intervention type and nutrition constraint, Ghana (2008-2015)



Notes: LPr, MPr, HPr respectively stand for low, medium and high priority districts; and Ag and nAg refer to high and low agricultural potential.

Source: Authors' with data from Brown de Colstoun et al. (2017); CFSVA (2008); DHS (2014); Hansen et al. (2013); ISSER/EGC (2015); MoFA (2015, 2016); Pekel et al. (2016); Stadlmayr et al. (2012); UNEP-WCMC (2018); Xiong et al. (2017).

With respect to the various intervention types, we observe 22 high priority districts, of which eleven with lower and another eleven with higher agricultural potential. Districts with more agricultural opportunities are found in the northern part of the country, probably due to lower population densities and bigger surface areas, compared to the high priority districts in the south of the country. Exceptions to this north-south divide are the southern districts of Wasa Amenfi, Afram Plains and Tongu, which display higher agricultural potential.

Although these districts all share the same urgency in terms of anaemia prevalence among women, the focus of an optimal intervention will highly depend upon its location. Notwithstanding their spatial diversity, many high priority districts in the north suffer from a combination of production and access constraints, whereby the people of Nkwanta equally faces severe utilisation constraints while Lawra's households seem to have a slightly better access to food. In the south of the country, all high priority districts are confronted with severe utilisation constraints, a situation which is further exacerbated by high production inefficiencies in Keta, Komenda-Edina-Eguafo-Abirem, Tema, Tongu and Wasa Amenfi, and by severe access constraints for the more inland located districts of Afram Plains, Amansie, Aowin-Suaman and Asunafo. Only the coastal districts perform relatively better in terms of market access, which might be explained by the highway running from east to west near the Atlantic Ocean.

POLICY RECOMMENDATIONS

Starting from the generic framework often used to study FNS, this brief applied a comprehensive typology to classify districts according to their intervention types and magnitudes of nutrition constraints. Despite its broad perspective, the typology is useful in identifying various clusters of Ghana districts that suffer mostly from production, access and utilisation inefficiencies. Based on the above classification, any agricultural or nutrition development strategy could be improved with geographical targeting of key investments. For example, investments which aim to improve agricultural productivity should be geared towards various districts in the Northern, Upper West and Upper East regions, and to two clusters in the southwest and southeast of the country. Likewise, investment plans to overcome access constraints should also target many districts in the north of the country, combined with several districts in Eastern and Ashanti region. And finally, to address utilisation constraints, one should focus on a more scattered set of districts mainly in the south of the country. Table 2 presents more detail regarding the exact inefficiency profile observed for each cluster of high priority districts in Ghana.

However, a prerequisite for an increased emphasis on the spatial dimension when designing and formulating policy interventions is the availability of sufficiently disaggregated data. Totalling 216 districts, the country's statistical services should continue to streamline their data collection efforts in order to produce timely and reliable data representative of this local level.

Table 2. Efficiency profile of high priority districts in Ghana (2008-2015)

District	Agricultural potential	Efficiency		
		Production	Access	Utilisation
Lawra	higher	**low**	medium	medium
Bawku, Gonja, Gushiegu, Saboba Chereponi	higher	**low**	**low**	medium
Keta, Komenda-Edina-Eguafo-Abirem, Tema, Tongu, Wasa Amenfi	higher/lower	**low**	high/medium	**low**
Nkwanta	higher	**low**	**low**	**low**
Afram Plains, Amansie, Aowin-Suaman, Asunafo	higher/lower	high/medium	**low**	**low**
Agona, Gomoa, Sefwi Wiawso	lower	medium	medium	**low**
Yendi, Zabzugu Tatale, Bibiani Anhwiaso Bekwai, Asuogyaman	higher/lower	high/ medium/low	.	.

Notes: The defining set of inefficiencies for each cluster of high priority districts is indicated in bold.
Source: Authors' with data from Brown de Colstoun et al. (2017); CFSVA (2008); DHS (2014); Hansen et al. (2013); ISSER/EGC (2015); MoFA (2015, 2016); Pekel et al. (2016); Stadlmayr et al. (2012); UNEP-WCMC (2018); Xiong et al. (2017).

REFERENCES

Codjoe, S. N. A., & Dzanku, F. M. (2009). Long-term determinants of deforestation in Ghana: The role of structural adjustment policies. *African Development Review*, *21*(3), 558–588. doi:10.1111/j.1467-8268.2009.00223.x

Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A., Tyukavina, A., et al. (2013). High-Resolution Global Maps of 21st-Century Forest Cover Change. *Science*, *342*(November), 850–853. doi:10.1126/science.1244693

ISSER/EGC. (2015). *Ghana Socioeconomic Panel Survey: 2009 -2010*. Accra: Institute of Statistical, Social and Economic Research (ISSER), University of Ghana and Economic Growth Center (EGC), Yale University.

MoFA. (2015). *Multi-Round Annual Crop and Livestock Survey (2015)*. Accra: Ministry of Food and Agriculture.

MoFA. (2016). *Agriculture in Ghana: Facts and Figures (2015)*. Accra: Ministry of Food and Agriculture.

Pangaribowo, E. H., Gerber, N., & Torero, M. (2013). *Food and nutrition security indicators: A review*. *ZEF Working Paper*. Bonn. doi:ISSN 1864-6638

Quiñones, E. J., Muñoz, J., & Ngeleza, G. (2011). *A Strategy for Agricultural Statistics in Ghana*. Washington, DC. http://www.ifpri.org/publication/strategy-agricultural-statistics-ghana

Stadlmayr, B., Charrondiere, R. U., Enujiugha, V. N., Bayili, R. G., Fagbohoun, E. G., Samb, B., et al. (2012). *West African Food Composition Table*. Rome: Food and Agricultural Organization of the United Nations. http://www.fao.org/docrep/015/i2698b/i2698b00.pdf

Sumberg, J., Jatoe, J., Kleih, U., & Flynn, J. (2016). Ghana's evolving protein economy. *Food Security*, *8*(5), 909–920. doi:10.1007/s12571-016-0606-6

Torero, M. (2014). Targeting investments to link farmers to markets: a framework for capturing the heterogeneity of smallholder farmers. In P. B. R. Hazell & A. Rahman (Eds.), *New Directions for Smallholder Agriculture*. Oxford: Oxford University Press. doi:10.1093/acprof

WFP. (2008). *Food Consumption Analysis, Calculation and use of the food consumption score in food security analysis*. Rome: World Food Programme, Vulnerability Analysis and Mapping Branch (ODAV).

Xiong, J., Thenkabail, P. S., Tilton, J. C., Gumma, M. K., Teluguntla, P., Oliphant, A., et al. (2017). Nominal 30-m cropland extent map of continental Africa by integrating pixel-based and object-based algorithms using Sentinel-2 and Landsat-8 data on Google Earth Engine. *Remote Sensing*, *9*(10), 1–27. doi:10.3390/rs9101065

Yu, B., You, L., & Fan, S. (2010). *Toward a typology of food security in developing countries*. *IFPRI - Discussion Papers*. Washington, DC. doi:10.1108/17561371311294810

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Wim Marivoet is Research Fellow and **John Ulimwengu** is Senior Research Fellow in the West and Central Africa Office of the International Food Policy Research Institute (IFPRI). The brief has been prepared in close collaboration with the ReSAKSS eAtlas technical team led by Mohamed Abd Salam El Vilaly and Manson Nwafor (ReSAKSS-WA). More technical and conceptual detail with respect to the typology itself can be found in the following IFPRI Discussion Paper (link). The authors wish to acknowledge the input of many participants who contributed to the discussion during a workshop hosted by SNV (The Netherlands) on April 10-12, 2018 in Cape Coast (Ghana), and thank Fernando Sedano and Samuel Benin for their assistance with data analysis and comments on earlier versions.

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