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Synopsis: Implications of urbanization, consumer awareness, and income trends on future food supplies in Senegal

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Summary

Our food systems (FS) are unable to provide healthy diets in a just and sustainable way, an observation which prompted the United Nations Food Systems Summit to establish a consensus on the need to transform FS. This study examines potential entry points—and resulting implications—to improve Senegal's FS following expected trends in population growth and urbanization, consumer awareness, and income growth. The study finds that total food supplies need to triple by 2040, with animal-source foods (ASF), fruits, and vegetables requiring increases of a factor of four or more. The study identifies potential strategies to increase the production of these food products while also considering their environmental impact. The study underscores the importance of socially inclusive and equitable outcomes and highlights the need for significant investments to reduce food waste in targeted subsectors.

Background

There is general agreement that our FS are failing us, reflected in their inability to provide populations with healthy diets in a just and sustainable way. At the same time, FS are undergoing rapid structural changes. Whereas traditional FS were characterized by local and short value chains, modern FS have long value chains—extending to global markets—and include considerable food processing and modern marketing. This evolution is driven by sociodemographic, economic, climate, and technological changes, which in turn are affected by the current and future functioning of FS (Ericksen 2008; Global Panel on

Agriculture and Food Systems for Nutrition 2016; Béné et al. 2019a; Béné et al. 2019b; von Braun et al. 2021). Confronted with current FS limitations and predicted changes, a broad coalition of stakeholders at the United Nations Food Systems Summit (UNFSS) established a consensus on the need to transform today's FS and shift corresponding paradigms, including making changes to frameworks and revisiting definitions and related concepts (von Braun et al. 2021; Ruben et al. 2021; Clapp et al. 2022). Despite the enthusiasm following the UNFSS, empirical FS-related studies remain limited, which stems not only from imperfect analytical tools but also from the lack of high-quality data on several FS nodes, especially in low- and middle-income countries.

This study examines potential entry points and resulting implications for improving FS in Senegal, which is currently struggling to provide healthy diets in an inclusive and sustainable manner to its people. Indeed, 46 percent of the population was unable to afford healthy diets, and 49 percent was food insecure in 2020. Senegal also performs poorly on nutrition outcomes for infants, children, and women. The study estimates the volume and composition of food supplies that can accommodate current and expected trends in population growth and urbanization, consumer awareness, and income growth, all of which will influence future food demand in Senegal.

Data and Methods

We use data from the 2017/18 Agricultural Policy Support Project (PAPA) survey,[1] which includes consumption data on more than 100 food items and is spatially representative of households in urban and rural areas of the country's 14 regions. The estimates of food quantities consumed are used to develop diet profiles for urban and rural residents, as well as associated energy and nutrient adequacy profiles. While the former is displayed in terms of eight aggregate food groups (cereals, legumes and nuts, vegetables and tubers/roots, fruits, meat and fish, dairy, oil, and sugar products), the latter results from the computation of adult male equivalence scales for each food component.

Scenarios are built to study the impact of three socioeconomic drivers of food demand: population growth and urbanization, increased consumer awareness, and increased household incomes. For the first factor, the simulation computes the volume and composition of food demanded by the estimated population of 2040. The food demand simulation for increased consumer awareness assumes that people are fully aware of the need to consume healthy diets. For this purpose, the study relies on Beal et al.'s hypothetical micronutrient-adequate (BHMA) diet developed by Beal, Ortenzi, and Fanzo (2023). The simulation of increased incomes assumes that all people are financially able to access the BHMA diet.

Table 1 presents three compounding scenarios based on the simulation for each driver. The study focuses greatest attention on Scenario 3, which combines all three socioeconomic drivers. Accordingly, food demand profiles are derived for this scenario and compared with the baseline to guide future investments in transport, storage, cooling, and processing capacity, while also pointing to import substitution opportunities and environmental concerns.

[1] The dataset and corresponding metadata are available for public use from papagriculture@agriculture.gouv.sn.

Table 1: Drivers, simulations, and scenarios

	Driver 1: Population growth	Driver 2: Increased consumer awareness	Driver 3: Income growth
Simulation	Volume/composition of food demanded by 2040 population	Volume/composition of food demanded by nutrition-aware consumers	Volume/composition of food demanded by income-secure consumers
Description	Based on extrapolation of spatially specific intercensus growth rates to 2040	Based on scaling of current food preferences to reflect the weight proportions of the BHMA diet	Based on implicit income growth to guarantee a daily food budget to access the BHMA diet
Scenario 1	Included	Excluded	Excluded
Scenario 2	Included	Included	Excluded
Scenario 3	Included	Included	Included

Source: Author.

Note: BHMA diet stands for Beal et al.'s hypothetical micronutrient-adequate diet (2023).

Results

The study establishes the following baseline features of the analysis. In 2017/18, Senegal had an estimated population of 15.7 million people, with 47 percent living in urban areas. On average, an urban meal appears to be roughly twice as big as a rural meal and more diversified. Despite differences in portion size and composition, both urban and rural dwellers in Senegal suffer from hidden hunger, which is an inadequate intake of micronutrients. In contrast, caloric and protein adequacy are much better and only slightly lower in rural areas than in urban ones.

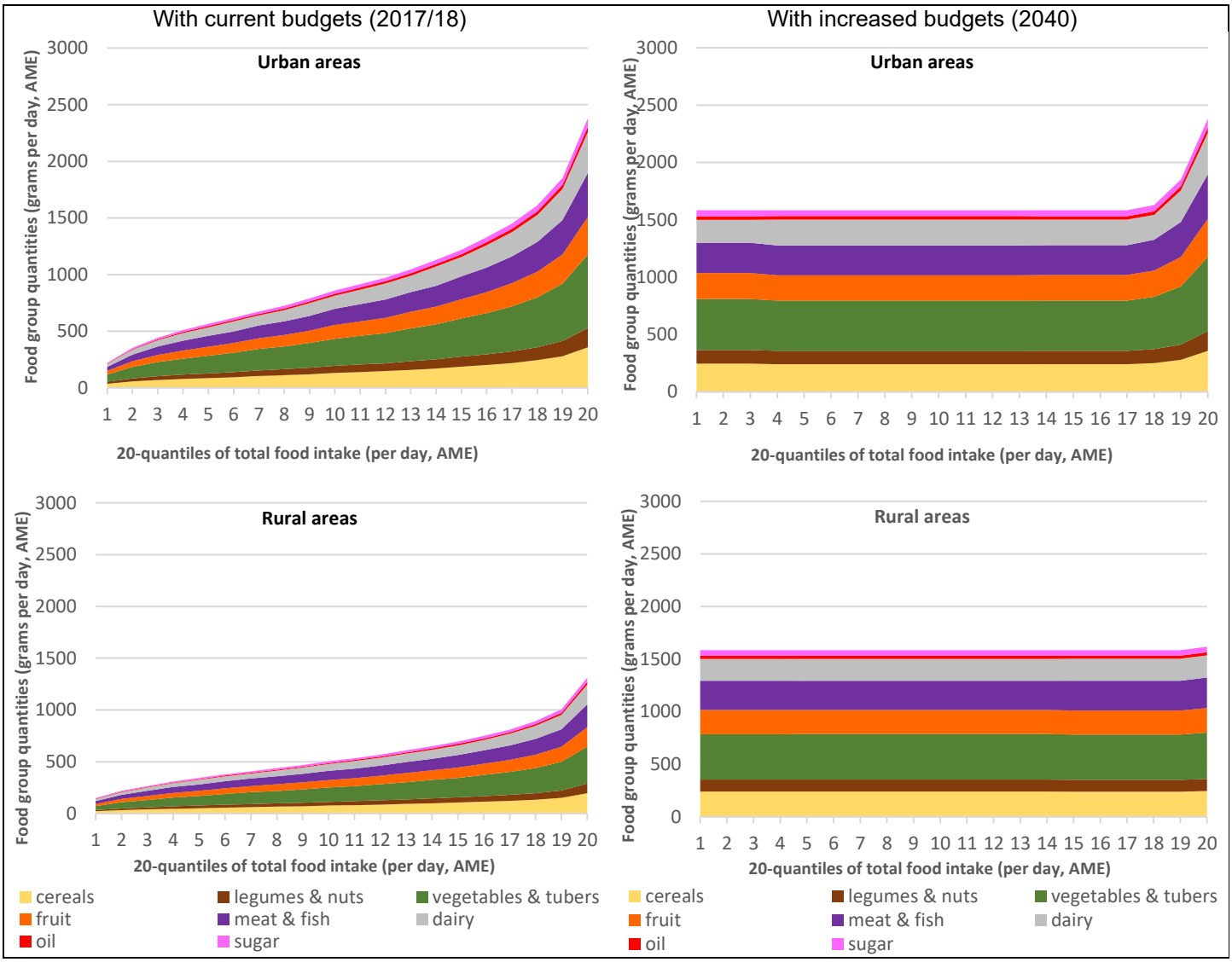
Three compounding scenarios of future food demand

The study first estimates the demographic changes expected, which indicate that Senegal's population will double from 15.7 million in 2017/18 to 32.1 million in 2040 and that the urban population will grow by a factor of 2.5. These demographic changes imply that total food supplies will need to roughly double as well, and increases will be needed in farmers' productivity, specialization, and investments in transport and storage infrastructure.

In Senegal, awareness is growing of the multiple benefits of healthy diets, indicating that consumer preferences are likely to change. Figure 1 displays daily food group amounts for increasing levels of total food intake, which reflect the weight shares of the BHMA diet. The panels to the left depict food intakes based on current food budgets (Scenario 2), whereas the rightmost panels show the diet composition when food budgets increase to allow for a total daily food intake of 1,584 g (Scenario 3). The shift from current (not shown in Figure 1) to healthy diets mainly involves substituting cereals with ASF in urban areas and considerably increasing ASF, fruits, vegetables, and tubers in rural areas.

The levels of food volume and nutrient adequacy under Scenario 3 require a considerable increase in all residents' food budgets, except for those in the highest three 20-quantiles. Without such an increase, it would not only be unrealistic but also potentially harmful to advocate for a fully balanced diet, given that the resulting reductions in total portion size could transform hidden hunger—or micronutrient deficiencies—into actual hunger. To achieve higher real food budgets, household incomes would need to increase and/or food prices to decline, which in turn underscores calls for more efficient and equitable FS.

Figure 1: Diet composition of projected healthy diets with current and increased food budgets in Senegal, 2017/18 and 2040



Source: Author's analysis using PAPA survey data (2017/18) and RGPH census data (2002 and 2013).

Note: AME = adult male equivalence.

Food supply implications and possible entry points

Feeding Senegal's projected population in 2040 with healthy diets would require tripling total food supplies from 4.6 million to 15.3 million tons per year (Table 2). Given that the rural population is relatively shrinking and land extensification is both environmentally unsustainable and unable to achieve total food needs, the required increase in total food supplies would largely require productivity gains realized across the entire Senegalese FS.

For the projected 2040 population, the local production of cereals and legumes and current supply of peanut and vegetable oil do not require any special policy attention, as long as increases to future supplies align with expected demographic growth. As such, current policies are likely to ensure that supplies will be adequate for healthy diets in 2040. However, given the spatial variation in biophysical characteristics across the country, improvements are needed to ensure the functioning of markets, distribution chains, and storage infrastructure.

In contrast, future supplies of ASF, fruits, and vegetables would need to increase significantly to ensure sufficient intake by 2040. The supply of processed dairy and fresh milk needs to increase 19-fold and 9-fold, respectively, compared to current supply (Table 2). To achieve this, the study proposes a generic set of alternative strategies to bridge the gap between the 181,000 tons of milk produced annually through the natural reproduction of dairy cattle and the required dairy supply of 2 million tons per year. The alternatives range from increasing herd size from 0.5 to 9 million dairy cattle in 2040 to raising productivity from current levels of 0.232 tons/year/animal to 2.654 tons/year/animal in 2040, or any combination in between. Yield improvements could be pursued through improved breeding, feeding, veterinary medicine, and other practices.

Supply levels of other ASF (such as meat and fish) and horticultural products should increase by factors of five and four, respectively. These levels need to be increased not only because of currently low consumption but also because micronutrients derived from these products cannot be easily obtained from other foods. However, increasing the supply of ASF and horticulture poses several environmental challenges, especially in the Sahelian context, and, at the same time, additional investments are needed in storage infrastructure, cold chains, processing facilities, and/or transportation and marketing networks. When adapted to the Senegalese context, the following technological areas could be meaningful entry points to combine the objective of increased agricultural productivity with the need to reduce greenhouse gas emissions, improve natural ecosystems, and strengthen smallholder farmers' resilience (Mukherji et al. 2023). First, more attention should be paid to restoring and managing healthy soils to reverse land degradation. Second, agroecological and other sustainable farming approaches should be adopted more widely to help transition to more sustainable FS. Third, more attention should be devoted to reducing food losses throughout the entire FS. Fourth, digital agricultural and climate services should be expanded to help transform the country's FS at all levels.[2]

FS transformations should also aim at more socially inclusive outcomes. Such outcomes are best guaranteed if future FS policies and institutions correct for inequities in access and control over productive resources, such as land, credit, information, and technology, and initiate societal processes to change restrictive social norms and increase people's agency (Njuki et al. 2022). While such interventions can differ depending on the context, they generally share common features. Components of the agroecological approach also aim to create more inclusive and socially just communities,[3] which is reflected by the approach's capacity to provide viable livelihoods for youth, as opposed to more capital-intensive approaches, where resources are concentrated in the hands of a few actors (Prudhomme et al. 2023).

Future FS policies should also target value chains or subsectors that already employ or can attract economically vulnerable groups (such as women and youth); promote technologies that benefit these groups; and consider factors that prevent these groups from participating in key socioeconomic activities (Habanabakize et al. 2022). Pursuing equitable FS not only has intrinsic value but is often also a prerequisite for improving economic livelihoods and increasing nutritional wellbeing. More broadly, FS transformations need to be comprehensive and holistic, based on evidence, and involve broad participation. Through Senegal's institutions and policies, the groundwork to design and implement future agendas on FS transformation is mostly laid and has been reinforced by the 2021 UNFSS. However, the country's current policy aspiration of self-sufficiency, which implies replacing current food imports with local production, is both unrealistic and may harm local consumers.

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[2] See also: https://aiccra.cgiar.org/regions/senegal

[3] See, for example: https://www.fao.org/agroecology

Table 2: Required food supply changes between baseline and scenario 3, Senegal (2017/18 and 2040)

Food type	Baseline (tons/year)			Scenario 3 (tons/year)			Growth factor (Scenario 3/ baseline)
	Urban	Rural	Total	Urban	Rural	Total	Total
BELOW EXPECTED POPULATION GROWTH							
Cereals/legumes: import & processed	258,217	403,786	662,003	468,627	397,747	866,374	1.31
Maize: unprocessed	20,986	87,935	108,921	33,924	69,858	103,782	0.95
Maize: processed	34,228	45,174	79,402	63,652	38,086	101,738	1.28
Sugar	114,356	86,539	200,896	169,647	123,106	292,753	1.46
SUBTOTAL	427,788	623,435	1,051,222	735,850	628,798	1,364,648	1.30
AROUND EXPECTED POPULATION GROWTH							
Cereals/legumes: local & unprocessed	71,989	371,096	443,085	424,640	513,779	938,418	2.12
Cereals/legumes: local & processed	423,996	299,901	723,897	1,004,451	416,291	1,420,742	1.96
Peanut oil	18,585	49,458	68,043	37,538	101,308	138,846	2.04
Vegetable oil	99,346	37,964	137,310	199,862	76,111	275,972	2.01
SUBTOTAL	613,916	758,418	1,372,335	1,666,490	1,107,489	2,773,979	2.02
ABOVE EXPECTED POPULATION GROWTH							
Horticulture: local & unprocessed	913,548	337,037	1,250,585	3,153,118	2,442,976	5,596,094	4.47
Horticulture: local & processed	28,671	11,206	39,877	96,280	80,648	176,927	4.44
Horticulture: import & unprocessed	146,348	22,463	168,811	423,400	166,520	589,921	3.49
Horticulture: import & processed	2,819	0	2,819	9,581	0	9,581	3.40
Ruminants and pork	45,014	18,792	63,806	205,324	128,962	334,285	5.24
Poultry and eggs	61,856	12,800	74,657	249,020	111,946	360,965	4.84
Fish: unprocessed	200,162	111,292	311,454	690,278	676,707	1,366,986	4.39
Fish: processed	72,371	32,951	105,322	306,056	213,708	519,764	4.94
Dairy: unprocessed	7,631	14,286	21,917	59,730	131,315	191,045	8.72
Dairy: processed	76,713	21,646	98,360	1,163,719	717,914	1,881,634	19.13
Palm oil	16,769	12,521	29,291	50,723	31,857	82,579	2.82
SUBTOTAL	1,571,903	594,993	2,166,897	6,407,229	4,702,553	11,109,781	5.13
Other/undefined	0	5,509	5,509	0	8,178	8,178	1.48
TOTAL	2,613,607	1,982,355	4,595,962	8,809,569	6,447,017	15,256,586	3.32

Note: Given that the predefined food list for the consumption module in the PAPA survey allows for distinguishing between processed and unprocessed forms of maize, the latter cereal is excluded from the more general categories of cereals/legumes.

Source: Author's analyses using PAPA survey data (2017/18).

Conclusion

Based on the three compounding simulations of population growth and urbanization, increased consumer awareness of healthy diets, and income growth, this study estimates the volume and composition of future food supplies required in Senegal by 2040 to satisfy the associated demand. The following main potential entry points and resulting implications emerge for an efficient, nutritious, sustainable, and equitable transformation of Senegal's FS.

First, to provide the entire Senegalese population with a healthier diet in 2040, total food supplies need to triple, from around 5 million to 15 million tons of food per year.

Second, future supplies of ASF, fruits, and vegetables need to increase dramatically, whereas maize and other imported cereals and legumes do not require significant policy attention. To develop these subsectors, future policies need to consider the overall impact on the environment and related use of natural resources.

Third, given that ASF and horticultural products are highly perishable, considerable investments are needed in terms of storage, cooling, and processing capacity.

Fourth, given that women and young people are already engaged in or could be attracted to livestock, fishing, and horticulture, the upgrading or further development of these subsectors presents an excellent opportunity to create more equitable FS. This would not only require that public policies and investments focus on the immediate needs of vulnerable groups by ensuring better access and control over productive resources, but also that restrictive social norms be altered to improve effective agency.

Fifth, although the current policy landscape in Senegal provides a solid foundation to stimulate the agenda of FS transformation, some policies, such as those on food self-sufficiency, are unrealistic in the short run and could potentially harm the population's nutritional outcomes.

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