

Drivers and barriers to the commercialization of an agroecological millet-based bread in a territorialized food system in Senegal: a multi-criteria analysis using the Garrett method



Demand-driven: Niakhar Lighthouse for the Development of Agroecological

Modou Gueye Fall, El Hadji Kabe Gaye, Samba Sy, Marc Piraux, Astou Diao Camara

January 2026

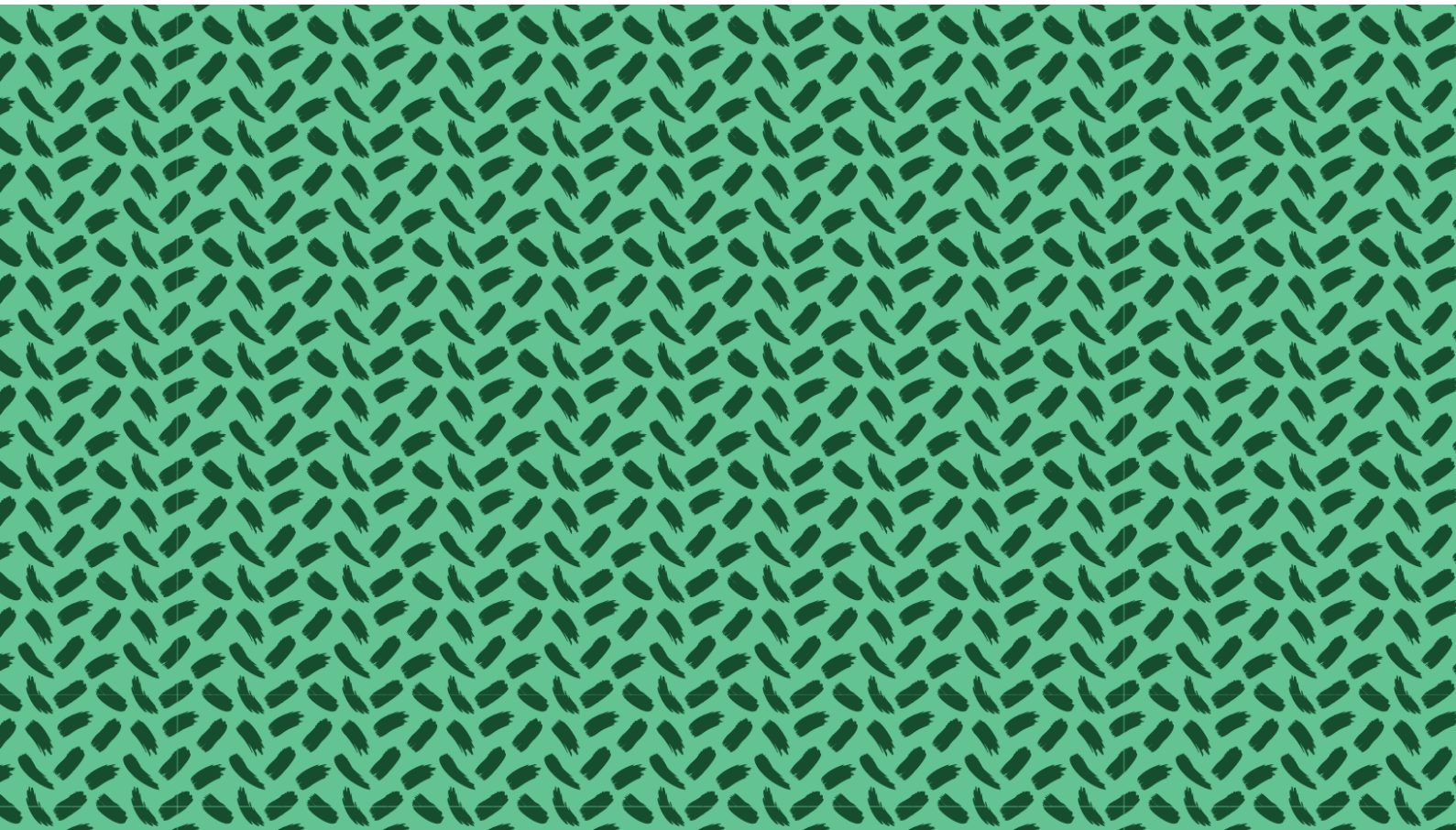
Table of Contents

1. Introduction	3
2. Agroecological transition and performance of the composite bread value chain	3
3. Presentation of agroecological bread	4
4. Methodology	5
4.1. Conceptual framework, study area and surveyed population	5
4.2. Survey and data collection system	6
4.3. Data processing and Garrett's method	7
5. Results	7
5.1. Characteristics of the respondents' profiles	7
5.2. Levers for marketing	8
5.3. Barriers to commercialization	9
6. Discussion	10
7. Conclusion	11
8. Références Bibliographiques	12
Figure 1 : Level of agroecological transition in the bread value chain	4
Figure 2 : Mapping of the study area	6
Figure 3 : Levers for commercialization	9
Figure 4 : Barriers to commercialization	10
Table 1 : Characteristics of the respondents' profiles	8

Summary

The agroecological transition promotes the territorialization of food systems and the valorization of local cereals to reduce dependence on imports. In Senegal, white bread (made from 100% imported wheat) dominates, despite the nutritional and agroecological potential of millet. This study aims to identify and prioritize the determinants of adoption of bread enriched with 30% millet in the commune of Niakhar, Senegal. A qualitative and participatory approach was employed, combining taste tests with households, street food vendors, and their customers, followed by semi-structured interviews and forced ranking of criteria. Data were analyzed using Garrett's method, with interpretation based on relative thresholds. The strongest drivers are nutritional and health-related (nutrient richness, health benefits), followed by sensory attributes (taste, crispness). The main obstacles stem from structural constraints: irregular availability, unsuitable format and price, and perceived incompatibility with street food stall practices (sandwiches, sauces). Perceptions differ significantly between households, street food stalls, and customers. Millet bread enjoys high acceptance, but its wider distribution requires adjustments to the regularity of supply, format, and targeted communication. The study highlights the need for differentiated marketing strategies to support localized value chains based on local grains.

Keywords: Agroecology; Millet; Bread; Marketing; Garrett method; Territorialized food systems; Senegal; Consumer acceptance.



1. Introduction

The agroecological transition is now widely recognized as a key driver for transforming food systems towards greater sustainability, resilience, and equity (HLPE, 2019; Wezel et al., 2020). This paradigm emphasizes the territorialization of food systems, understood as a process of reconnecting production and consumption basins, relocalizing value chains, and leveraging local resources and knowledge (Gliessman, 2018; Torres et al., 2023). Within this framework, substituting imported cereals, such as wheat, with adapted local cereals like millet appears as a promising strategy for strengthening food and nutritional sovereignty in West Africa (Sourisseau et al., 2016; Bricas et al., 2016).

In Senegal, despite the strong agri-food, agronomic, and cultural potential of millet, bread consumption remains largely dependent on imported wheat, with significant economic, social, and environmental implications (ANSD, 2022). Several initiatives aim to develop composite breads incorporating local flours (Mishra et al., 2012; AwadElkareem & Taylor, 2023), but their large-scale dissemination remains limited by technological and organizational constraints, and, above all, by market acceptability (Muhammad et al., 2020).

This study is part of the Multifunctional Landscape (MFL) program, a holistic research and development initiative based on a partnership between civil society and local stakeholders (DyTAEL of Fatick), national research institutions (ISRA), and international research institutions (CIRAD and CGIAR). It focuses on the co-constructed experience of the Jamm Bugum bakery in Niakhar, which has achieved technical mastery of producing an agroecological bread incorporating 30% agroecological millet. However, while the technical offering is now operational, the conditions for its commercial viability and the sustainability of the economic model remain to be clarified.

From this perspective, the analysis of the preferences, perceptions and constraints expressed by the different links in the value chain, from producers to end consumers, appears essential for designing inclusive and sustainable economic models (Meynard et al., 2017).

The objective of this research is to identify and prioritize, through a participatory process, the drivers and barriers to the marketing of agroecological bread in the commune of Niakhar. By employing Garrett's method, the study aims to generate actionable evidence to guide marketing strategies and contribute to the scientific debate on the development of localized agroecological markets in Senegal and, more broadly, in Sahelian contexts.

2. Agroecological transition and performance of the composite bread value chain

The value chain for millet-enriched bread, supported by Jamm Bugum, is part of an agroecological transition process at two complementary levels: millet production and breadmaking.

At the production level, approximately 200 millet-producing members have an overall agroecological score of 64%, reflecting an ongoing transition. However, this progress remains



Downstream, the Jamm Bugum bakery , which develops an innovative bread incorporating 30% of this local millet , boasts a higher agroecological score (73%), positioning it as a potential driving force in the transition within the region. This performance is primarily based on strengthened social and resilience dimensions , notably the inclusion of small-scale producers and the local integration of the business. Nevertheless, further efforts are needed to diversify the range of products made from local grains and to strengthen agroecological requirements for suppliers, particularly upstream in the millet supply chain.

From an economic perspective, this agroecological approach does not come at the expense of profitability. Technical and economic performance analyses show positive benefit/cost ratios, estimated at 1.94 for millet production and 1.33 for bread processing, suggesting the economic viability of the chain in an agroecological transition context (Fall et al., 2024) .



Figure 1: Level of agroecological transition in the bread value chain

3. Presentation of agroecological bread

In Senegal, the approved standard bread is produced according to a reference format of 200 g, for a length between 55 and 65 cm, and sold at a unit price of 175 FCFA ¹. This format is widely adapted to local consumption practices , as it facilitates fragmentation and sharing within households, while responding to the customs of cheap eateries .



In Niakhar , agroecological bread is offered in a different format , with a weight weighing between 200 and 225 g, but with a reduced length approximately half the price of standard bread. It is sold at a price of 200 FCFA (source: nos. surveys , 2025).

¹ <https://lequotidien.sn/la-baguette-augmente-de-25-francs-plus-de-ble-pour-le-pain-le-poids-passe-de-190-a-200-gr/>

4. Methodology

4.1. Conceptual framework, study area and surveyed population

The study adopts the framework of territorialized food systems (Chiffolleau and Prevost, 2012) and socio-technical innovation (Geels, 2002), considering that the diffusion of a new agroecological food is a multidimensional process.

The study was conducted in the area of influence of the Jamm Bugum bakery , located in the commune of Niakhar in the Fatick Department, as well as in the surrounding villages (Figure 2), in order to account for the urban-rural gradient and the socioeconomic contrasts associated with consumption practices. The Jamm Bugum bakery is a key player in the local food supply, with a daily production and distribution of approximately 3,000 loaves of white bread (primarily 100% wheat). Its marketing network served as a reference framework for defining the study area and identifying the surveyed populations.

The study population was structured into three categories of actors to reflect the diversity of uses, perceptions, and consumption practices related to bread, particularly according to the types of accompaniments (butter, chocolate, sandwiches) and socioeconomic profiles. These categories include: (i) households, (ii) street food vendors (bread and sandwich sellers), and (iii) street food vendor customers, including students and individual consumers.

The targeting of respondents was carried out using the sales lists of the Jamm Bugum bakery , in close collaboration with its managers. For the household category, the bakery's subscriber list was used to create a sample of 25 households residing in the commune of Niakhar . Regarding street food vendors, resellers of white bread produced by Jamm Bugum were identified from the bakery's database, allowing for the identification of 15 such vendors located in the town of Niakhar and four surrounding villages (Mbafaye , Sangai, Ndoss , and Sagne Folo). These vendors include outlets located in neighborhoods, schools (primary and secondary), and in the targeted villages.

Finally, to access the customers of the street food stalls (34 people), a relay approach was adopted. Each identified street food stall served as an entry point to voluntarily contact between three and four customers, allowing the collection of direct consumer perceptions in various consumption contexts .

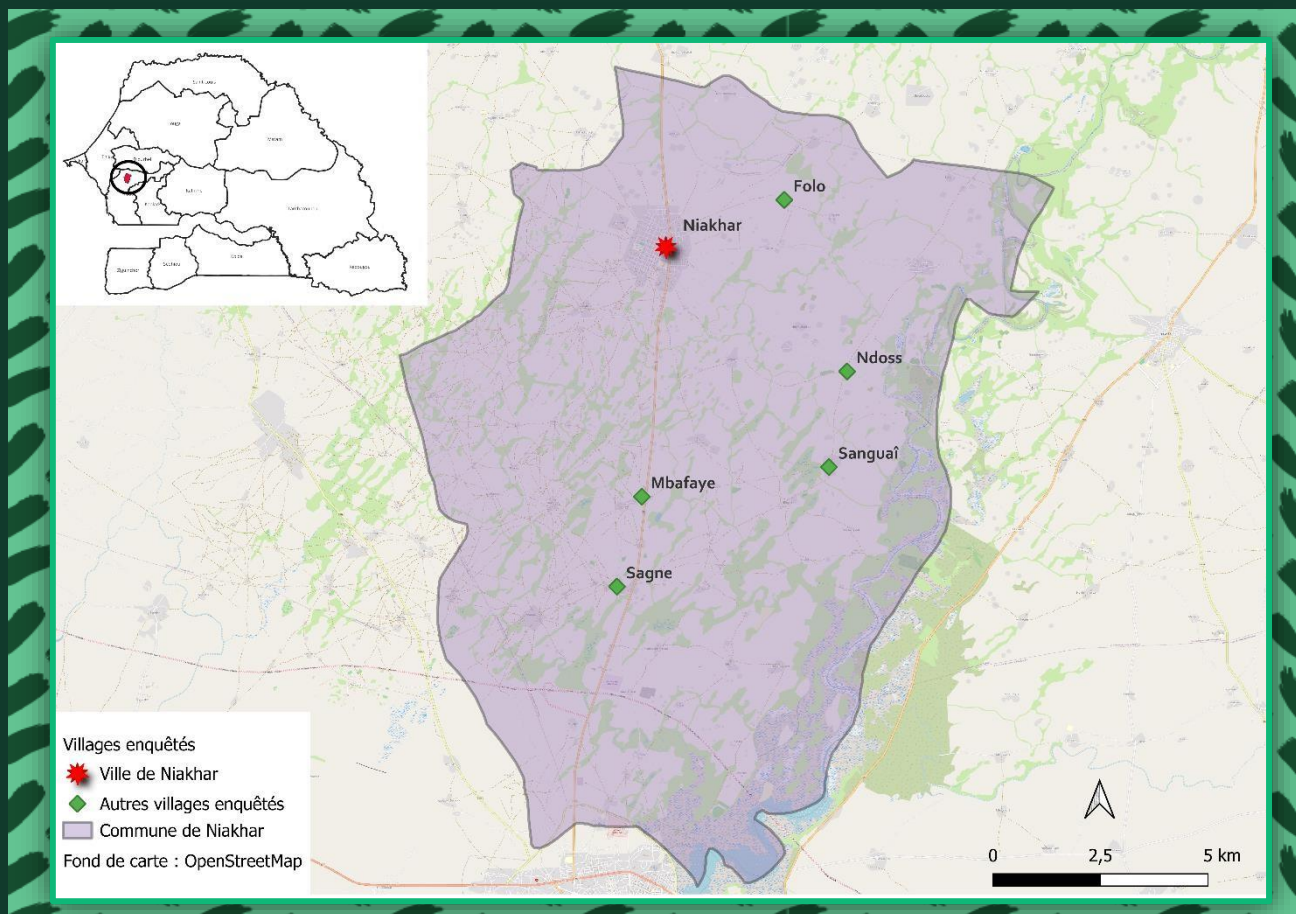


Figure 2: Mapping of the study area

4.2. Survey and data collection system

Following the targeting of participants, a prospecting and contact phase was conducted to present the study's objectives, explain the participation procedures, and obtain the consent of the identified individuals. This preliminary step aimed to ensure understanding of the survey protocol and the voluntary participation of the individuals.

Prior to collecting perceptions, tasting tests of the agroecological bread were organized through the usual distribution channels of the Jamm Bugum bakery . This approach aimed to ensure that subsequent evaluations were based on an actual and shared sensory experience of the product, thus limiting biases related to preconceived notions. The tasting sessions were immediately followed by individual interviews.

In this regard, following the tasting, each participant was asked to individually identify up to seven criteria that would encourage the purchase, consumption, or marketing of the compound bread , and then up to seven criteria that would discourage it. The identified criteria were then ranked in ascending order of importance, using a forced ranking system to prioritize the expressed preferences.

Data collection was based on a semi-structured qualitative interview guide, structured around four main components: (i) the socio-demographic profile of the respondents, (ii) their level of prior knowledge of agroecological bread, (iii) their current practices of consuming or selling bread, and (iv) the identification and prioritization of the levers and barriers to the adoption of the product.

4.3. Data processing and Garrett's method

The individual rankings obtained were analyzed using Garrett's method, which transforms ordinal ranks into weighted scores comparable between individuals and groups of actors. This method is based on the assumption of a decreasing utility function, according to which criteria ranked higher reflect substantially greater importance than those ranked lower.

The weights assigned to the ranks were calculated according to Garrett's formulation and then aggregated to obtain, for each criterion, an average score reflecting its relative importance within each category of actors. The scores thus obtained are not absolute measures, but comparative indicators of perceived priority.

It is important to clarify that a criterion not mentioned by a participant is interpreted as a low priority in their preference system, and not as an explicit rejection of the criterion. The analysis is therefore based exclusively on the criteria actually used by the participants during the ranking process, which is consistent with the exploratory and participatory approach of the study.

To facilitate the reading and interpretation of the results, Garrett's scores were grouped into three levels of importance, based on thresholds relative to the maximum score observed for each set analyzed (levers or brakes):



strong levers or brakes : Score $\geq 2/3$ of the maximum score observed;

average levers or brakes : Score between $1/3$ and $2/3$ of the maximum score;

Weak levers or brakes : Score $< 1/3$ of the maximum score.

This approach, although conventional, allows for a clear and comparative ranking (Kumar et al., 2013).

5. Results

5.1. Characteristics of the respondents' profiles

Table 1 presents the main socio-economic characteristics of the respondents, divided into three categories mentioned in the methodology section, namely households, customers of the eateries and eateries.

The average age of households is around 46, and they are predominantly female (60%). 65% live in villages, while 35% live in towns. Their main occupations are agriculture (40%), commerce (25%), or teaching/civil service (25%). More than half have a monthly income below 60,000 FCFA (55%). Average consumption is about four loaves of bread per day, and 45% report having a good understanding of agroecological breadmaking.

Customers of these small eateries, with an average age of around 43, are also predominantly women (63%) and reside in both rural (56%) and urban (44%) areas. Their professional profiles are diverse, including farmers (30%), traders (33%), and students (24%). Incomes are generally low, with 70% earning less than 60,000 FCFA per month. Average consumption is at least one loaf of bread per day, and 37% report having a good knowledge of millet bread.

The street food stalls are characterized by a high proportion of female employees (92%) and a predominantly urban location (62%). The average age is approximately 46, and the business is exclusively commercial. Incomes are mainly in the 60,000-120,000 FCFA range (54%). Knowledge of millet bread is reported by 62% of the stall owners, with an average sales volume estimated at at least 48 loaves per day.

Table 1: Characteristics of the respondents' profiles

Characteristic	Households	Customers of roadside eateries	Gargotes
Average age (years)	46.2	42.6	46.2
Gender	60% women; 40% men	63% women; 37% men	92% women; 8% men
Place	65% village; 35% town	56% village; 44% town	38% village; 62% town
Main professions	40% farmers; 25% shopkeepers; 25% teachers/civil servants; 10% other	30% farmers; 33% shopkeepers; 24% pupils/students; 13% other	100% retailers
Monthly income (FCFA)	55% < 60,000; 30% 60,000 - 120,000; 15% 120,000 - 40,000	70% < 60,000; 26% 60,000-120,000; 4% 120,000-240,000	31% < 60,000; 54% 60,000-120,000; 15% 120,000-240,000
Knowledge of millet bread	45% good knowledge	37% good knowledge	62% good knowledge
Consumption	3.9 loaves of bread/day	2.4 loaves of bread/day	48.1 loaves/day

7.2. Levers for marketing

The analysis of the levers for marketing agroecological bread, based on the rankings made by the actors and weighted using Garrett scores, highlights a clear hierarchy of criteria favorable to the adoption of the product.

Overall, criteria related to nutrition (nutrient content) and health (with diabetes as a key consideration) are the most heavily used levers by all stakeholders. Nutrient richness, perceived health benefits, particularly for the elderly, and the product's hygienic quality are predominantly among the strongest levers.

Sensory criteria, particularly taste, crispness, and visual appearance, occupy an intermediate to strong position depending on the category of stakeholders. They play a key role in product acceptability, especially among customers of street food stalls and households.

Other levers, such as buying local, diversifying the product range, or contributing to local development, appear to be used less frequently. Their importance varies depending on the profile, but they remain secondary to nutritional and sensory considerations. These criteria are

more related to social and territorial considerations, which can strengthen product loyalty in specific contexts.



Figure 3: Levers for commercialization

7.3. Barriers to commercialization

The obstacles identified by stakeholders are primarily practical, economic, and organizational constraints, and are more varied than the facilitators, reflecting a heterogeneous perception of the barriers to adopting agroecological bread. Availability, understood here as the regularity of production and the continuous supply of points of sale, appears to be a major obstacle. Indeed, the irregularity of supply and the limited presence of the product in traditional distribution channels restrict access, particularly for households and small eateries. Price and format also constitute structural constraints. Bread is sometimes considered expensive in relation to its uses, especially when the format does not correspond to sharing practices: several respondents indicated that it is "too much for one person but not enough for several," making the price difficult to justify for individual consumption and limiting collective use.

Specific obstacles for street food vendors are also emerging, particularly regarding its use in sandwiches and with sauces. The "not suitable for sandwiches" criterion is especially important because it can necessitate more accompaniments (sauces), increasing costs and reducing profit margins for these establishments. Some respondents also highlighted a lower appreciation of the product with certain sauces, which limits its integration into the most common consumption formats in the area. Finally, communication, understood as a set of marketing dimensions (visibility, information on composition and benefits, consumption methods), remains

insufficient and hinders product adoption. Factors such as aesthetics, perceived hygiene, or texture (bread considered too dry) are mentioned less frequently but can become limiting factors depending on the individual.

Overall, the results show that the development and marketing of agroecological bread depends less on an intrinsic rejection of the product than on targeted adjustments to the regularity of supply, the adaptation of formats, compatibility with the uses of roadside eateries and marketing positioning.

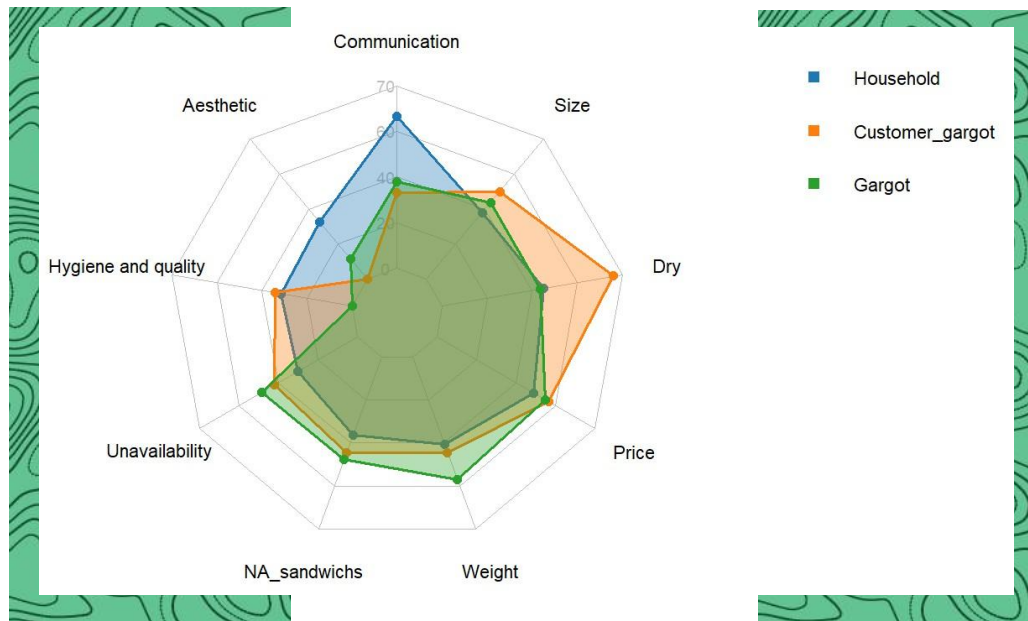


Figure 4: Barriers to commercialization

6. Discussion

Acceptability based on health value, but hampered by structural barriers. The results confirm that perceptions of health and naturalness are powerful drivers for agroecological foods (Kesse-Guyot et al., 2021). However, as observed by Brière et al. in 2022, these criteria encounter practical constraints (availability, price, format) that become decisive in the final choice. The strong sensitivity to format and use (sharing, sandwiching) underscores the importance of a design centered on local culinary and social practices, too often neglected in co-design strategies for new product development (Bricas, 2019).

The divergence in perceptions between street food vendors (major obstacle: sandwich use) and households (major obstacles: format, price) calls for a more inclusive production range that is sensitive to demand concerns, with a commitment to fairness. For street food vendors, key players in distribution, it would be beneficial to work on the product's technical and economic compatibility (improved texture, adapted recipes). For households, the challenge is economic and practical accessibility (family/individual format, reliable points of sale). This aligns with Moustier's (2017) work on the importance of adapting the governance of short value chains to the needs of each link.

7. Conclusion

This study demonstrates that the commercial potential of agroecological bread enriched with local millet in Niakhar is real, driven by a very positive perception of its nutritional and health benefits. However, scaling up will only be possible by directly addressing the identified structural and behavioral constraints, namely the irregularity of supply, the inadequacy of the format and price, and the difficulties of integrating it into dominant food practices, particularly in street food.

The participatory approach and Garrett's method enabled a rigorous and contextualized prioritization of action for stakeholders in the value chain. The Niakhar "lighthouse" site now provides a framework for testing and refining these solutions, with the aim of producing a replicable model for the commercial valorization of local cereals for the agroecological transition in Senegal and West Africa.

Regarding limitations and future research, this study, focused on acceptance, would benefit from being supplemented by longitudinal sales monitoring after the implementation of the recommendations, in order to model the agroecological market for agroecological bread. Similar studies in other territorial contexts would further strengthen the generalizability of the results.

8. Références Bibliographiques

- AwadElkareem, A. M., & Taylor, J. R. N. (2023). African cereal grains for bread and other fermented foods: A review. *International Journal of Food Science & Technology*.
- Bricas, N. (2019). *Urbanization issues affecting food system sustainability*. In C. J. K. Henry (Ed.), *Food systems and health* (Vol. 18, pp. 123-138). Elsevier.
- Bricas, N., Tchamda, C., & Thirion, M.-C. (2016). *Africa conquering its domestic food market*. AFD.
- Brière, L., Dury, S., & Alpha, A. (2022). Consumer perceptions and willingness to pay for agroecological fruits and vegetables in Senegal. *Agricultural and Food Economics*.
- Chiffolleau, Y., & Prevost, B. (2012). Short food supply chains: between market and social innovation. *Rural Economics*.
- Garrett, H. E., & Woodworth, R. S. (1969). *Statistics in psychology and education*. Vakils, Feffer and Simons Ltd.
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research policy*.
- Gliessman, S. (2018). *Agroecology: The ecology of sustainable food systems* (3rd ed.). CRC Press.
- HLPE. (2019). *Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition*. High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security.
- Kesse-Guyot, E., Rebouillat, P., Payrastra, L., Allès, B., Fezeu, L. K., Druesne-Pecollo, N., ... & Touvier, M. (2021). Prospective association between organic food consumption and the risk of type 2 diabetes: findings from the NutriNet-Santé cohort study. *International Journal of Behavioral Nutrition and Physical Activity*.
- Kumar, S., Prasad, R., & Mishra, V. N. (2013). Application of Garrett ranking technique for prioritization of problems of vegetable growers. *Indian Research Journal of Extension Education*.
- Meynard, J. M., Jeuffroy, M. H., Le Bail, M., Lefèvre, A., Magrini, M. B., & Michon, C. (2017). Designing coupled innovations for the sustainability transition of agrifood systems. *Agricultural Systems*.
- Mishra, G., Joshi, D.C., & Panda, B.K. (2012). Popping and puffing of cereal grains: has review. *Journal of Grain Processing and Storage*.
- Moustier, P. (2017). *Urban markets and food supply in cities*. In J.-M. Codron, V. Diaz Pedregal, & S. Dury (Eds.), *Short food supply chains: between market and social innovation* (pp. 45-60). Quae.
- Muhammad, L., Muta'ali, M., & Ismono, H. (2020). Consumer preferences and willingness to pay for sorghum-based bread in Indonesia. *Cogent Food & Agriculture*.
- Sourisseau, J. M., Bosc, P. M., Fréguin-Gresh, S., & Bélières, J. F. (2016). *Diversité des agricultures familiales*. Quae.
- Torres, J., Valencia, C., & Chia, E. (2023). Territorial food systems: A critical review of the literature. *Global Food Security*.
- Wezel, A., Herren, B. G., Kerr, R. B., Barrios, E., Gonçalves, A. L. R., & Sinclair, F. (2020). Agroecological principles and elements and their implications for transitioning to sustainable food systems. A review. *Agronomy for Sustainable Development*.

