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Analysis of Market Structure, Pricing Systems, and Consumer Preferences for Breadfruit (*Artocarpus altilis*) in Ife East LGA, Osun State, Nigeria

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ABSTRACT

This study examined the market structure, pricing systems, and consumer preferences for breadfruit (*Artocarpus altilis*) in Ife East LGA, Osun State, Nigeria. Using a purposive sampling technique, three primary markets (Oja-Ife, Adedoyin, and Ajifowobaje) were selected, followed by the selection of 100 respondents, comprising 50 active traders and 50 consumers. Data were analyzed using descriptive statistics, Likert-scale rankings, and marketing margin (MM) analysis to evaluate economic efficiency. Findings indicate that the breadfruit trade is a female-dominated enterprise, with 46% of traders and 32% of consumers within the 41–50 age bracket. Sourcing is primarily from farmlands (72%), with supply peaking during the rainy season (July–August). The marketing channel is characterized by a short distribution chain consisting of producers, village merchants, retailers, and consumers. Transactional analysis shows that bulk procurement occurs in basket units (20–24 fruits) at a mean price of N1,600, while retail trade is standardized into sets of four fruits at N400. Marketing margin analysis revealed a retail markup of approximately N80–N130 per set, which offsets transportation and spoilage risks. Consumer demand is driven by long-standing cultural background and seasonal availability rather than household income, highlighting breadfruit as a socially inclusive staple. However, sustainability is hindered by seasonal scarcity and inadequate storage facilities. The study suggests that improving traditional drying systems and formalizing farm-gate trade units are essential for enhancing market performance, while continued research into varietal improvements and off-season cultivation remains critical for moderating extreme seasonal supply patterns and ensuring a more consistent year-round market.

INTRODUCTION

Breadfruit (*Artocarpus altilis* (Parkinson) Fosberg), a high-yielding perennial tree species of the Moraceae family, constitutes a significant biological resource within the category of non-timber forest products (NTFPs), functioning as a vital component of provisioning services in tropical forest ecosystems (Houngbo *et al.*, 2024). Within this broader category, NTFPs are widely recognized for their contributions to rural livelihoods through income generation, food security, and sustainable utilization of forest resources (Emire *et al.*, 2024). Breadfruit, locally referred to as “Gbere” in the study area, is particularly valued for its exceptional productivity, often exceeding 200 fruits per tree, and its biannual fruiting cycle, making it an important source of energy and micronutrients for rural and peri-urban populations (Omobuwajo, 2007; Mehta *et al.*, 2023). Beyond its biological importance, it contributes to household welfare as both a subsistence food and a marketable commodity within local economies (Ogunlade *et al.*, 2015; Abrajano *et al.*, 2021). The economic performance of NTFPs such as breadfruit is largely shaped by the structure of the markets through which they are traded. Market structure refers to the organizational characteristics that define relationships between buyers and sellers, including the level of trader concentration and ease of entry into local trade systems (Meinhold & Darr, 2019). These characteristics influence how value

is distributed along the supply chain and determine the efficiency of market transactions. Closely linked to this is the pricing system, which in many forest product markets remains informal and is shaped by seasonal availability, bargaining processes, and non-standardized units of exchange (Mugido & Shackleton, 2018; Frey *et al.*, 2019). Together, market structure and pricing systems play a central role in shaping the performance and sustainability of NTFP value chains (John *et al.*, 2013; Magry *et al.*, 2023). Furthermore, consumer preference serves as the primary demand-side driver that determines the commercial viability of indigenous forest species. These preferences are influenced by cultural familiarity, sensory attributes, and perceived nutritional or functional benefits (Maluleke *et al.*, 2024; Soumya *et al.*, 2025). In the case of underutilized forest crops, understanding these preference patterns is essential for identifying the factors that sustain market demand even under changing economic conditions (Shackleton, 2011). When combined with market structure, consumer preference provides a more complete understanding of how NTFP markets function and evolve. Despite their importance, NTFPs remain insufficiently integrated into formal development planning and policy frameworks in many developing regions. This limited attention has implications for their governance and sustainability, often resulting in weak regulation and increased exposure to unsustainable

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harvesting and trade practices (Sakyi & Ameko, 2025). As a result, while these economic and behavioral frameworks provide a general understanding of NTFP trade, there remains a critical dearth of empirical data regarding their practical application to the breadfruit value chain in southwestern Nigeria. Existing literature has focused heavily on biological production and processing techniques, leaving the specific interplay between structural market organization and consumer preference drivers largely unexplored. This study therefore provides a comprehensive evaluation of the breadfruit market environment in Ife East Local Government Area, Osun State. By integrating an analysis of socio-economic profiles, supply sources, and marketing channels with an examination of pricing mechanisms and consumer behavior, the research aims to identify the primary factors limiting the efficiency and sustainability of the breadfruit trade.

MATERIALS AND METHODS

Study area

The study was conducted in Ife East Local Government Area (LGA), one of the 30 LGAs in Osun State, southwestern Nigeria. Osun State is bounded by Kwara State to the north, Ekiti and Ondo States to the east, Ogun State to the south, and Oyo State to the west. The state lies approximately between latitude 7°30'N and longitude 4°30'E, covering about 14,875 km², with an

estimated population of 4,435,800 (National Population Commission [NPC], 2020). Osun State experiences a tropical climate characterized by two distinct seasons: a rainy season from April to October and a dry season from November to March. The vegetation is predominantly rainforest and derived savannah mosaic, with secondary forests occurring along river valleys and stream channels. Mean annual rainfall falls within the humid tropical range, supporting diverse plant species and agricultural activities suitable for tree crops such as breadfruit (*Artocarpus altilis*) (Akinsorotan *et al.*, 2024). Ife East LGA, where the study was specifically conducted, has an estimated population of 188,614 people (National Bureau of Statistics [NBS], 2010). The area is predominantly inhabited by the Yoruba ethnic group and shares the general climatic and vegetation characteristics of Osun State, which provide favorable ecological conditions for the growth, harvesting, and trade of forest-associated food species.

Source: Author's fieldwork and GIS compilation, 2023. Sampling Procedure, Data Collection and Analysis

A purposive sampling technique was employed to select three major markets within Ife East Local Government Area.

characterized by prominent breadfruit trading activities. The selected sites included Oja-Ife (Ife Central Market),

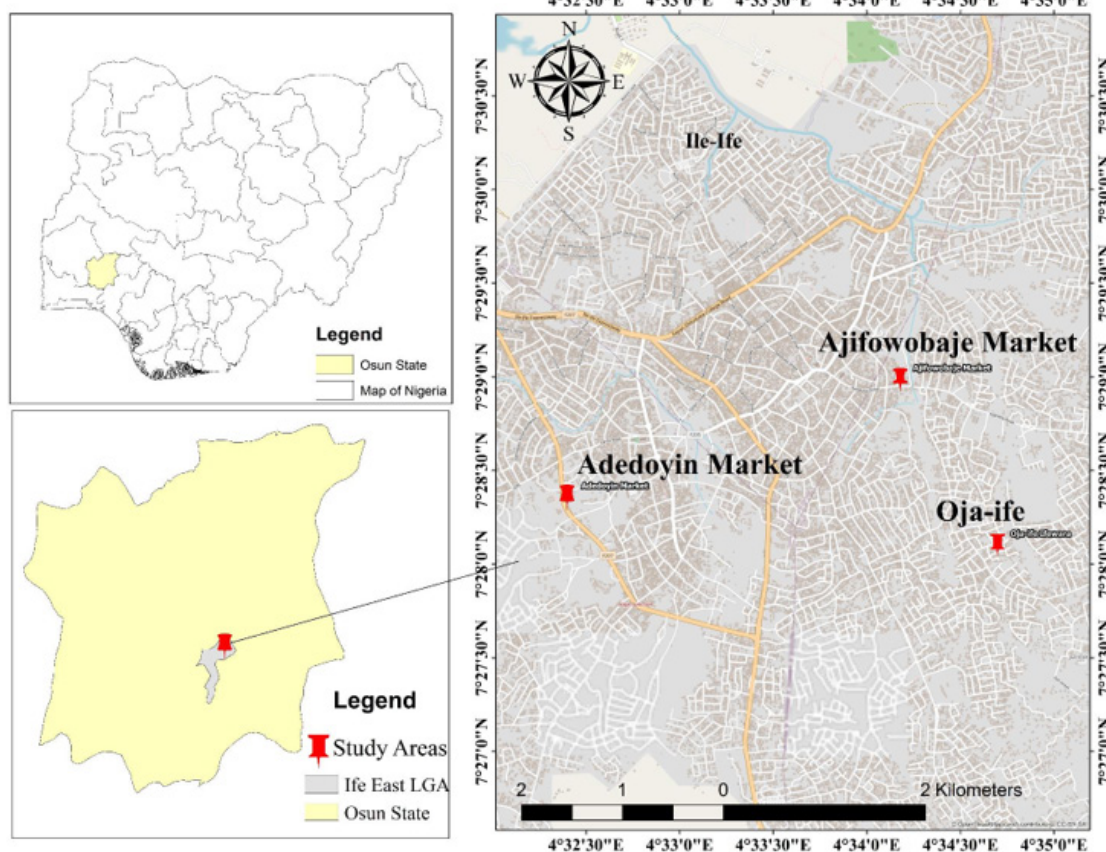


Figure 1: Map showing the location of selected breadfruit markets in Ife East Local Government Area, Osun State, Nigeria.

Adedoyin Market, and Ajifowobaje Market (Figure 1). Following market selection, purposive sampling was further used to select breadfruit traders and consumers within each market location. A total of 100 respondents were sampled for the study, comprising 50 active

breadfruit traders and 50 consumers. The distribution of respondents across the selected markets is presented in Table 1.

Primary data were collected using 100 semi-structured questionnaires administered through face-to-face

Table 1: Distribution of Breadfruit Respondents across Selected Markets

Local Government Area	Market	Number of Respondents		Total
		Traders	Consumers	
Ife East	Oja-Ife	26	26	52
Adedoyin	15	15	30	30
Ajifowobaje	9	9	18	18
Total		50	50	100

Source: Field survey, 2023

interviews. These were supplemented with oral interviews and direct field observations to obtain information on supply sources, marketing channels, pricing mechanisms, and consumer utilization and preference patterns. Digital weighing instruments were used to determine the average weights of both retail sets and bulk basket units observed during market visits. Data analysis was performed using descriptive statistics, including frequencies, percentages, and mode, to summarize socio-economic profiles, utilization patterns, and consumer preferences. Constraints affecting the breadfruit trade were evaluated using a four-point Likert scale. Marketing channels were characterized using observational evidence supported by schematic flowcharts. To evaluate the economic efficiency of the trade, a marketing margin analysis was performed. The unit cost per fruit at the bulk level (Cu) and the absolute marketing margin (MM) per retail set were determined using the following equations:

$$Cu = Pb / Qb$$

$$MM = Pr - (Cu \times Qr)$$

Where Pb is the mean price of the bulk unit (basket), Qb is the average quantity of fruits per basket, Pr is the retail price per set, and Qr is the quantity per retail set (4 fruits). These calculations allowed for the determination of the price markup and the economic returns associated with retail-level trade.

RESULTS AND DISCUSSION

The socio-economic characteristics of both traders and consumers are presented in Table 2. The results reveal that the breadfruit trade in the study area is an exclusively

female-dominated enterprise (100%), while purchase patterns also show a strong female inclination (76%). This gender distribution suggests that women play a central role in both the commercial and household utilization of breadfruit. Similar gender-specific patterns are common in the trade of non-timber forest products (NTFPs) across southwestern Nigeria, where women often dominate retail activities and household food management (Odeyale *et al.*, 2023). Age distribution followed a consistent pattern for both groups, with the 41–50 age bracket being the most represented among traders (46%) and consumers (32%). This indicates that breadfruit-related activities are primarily undertaken by middle-aged, economically active adults with significant household responsibilities. The predominance of married respondents, which stood at 70% for both groups, further supports the finding that engagement in the breadfruit trade and its consumption are closely linked to family livelihood needs and food security. Educational attainment varied between the two groups. While a majority of traders (42%) possessed only primary education or no formal schooling (30%), the consumer group showed a higher level of literacy, with 46% having attained secondary education and 6% possessing tertiary qualifications. This variation suggests that formal education is not a prerequisite for participation in the breadfruit trade, as the fruit remains a staple among individuals across diverse educational backgrounds. This aligns with the observations of Babatunde *et al.* (2022), who noted that formal education is often not a limiting factor for participation in traditional forest product markets. Ethnically, the market is characterized

Table 2: Socio-economic characteristics of breadfruit traders and consumers in the study area (n=100)

Variable	Category	Traders (n=50)	%	Consumers (n=50)	%
Gender	Female	50	100.0	38	76.0
	Male	0	0.0	12	24.0
Age	21-30	3	6.0	7	14.0
	31-40	10	20.0	9	18.0
	41-50	23	46.0	16	32.0
	51-60	9	18.0	13	26.0
	61 and above	5	10.0	5	10.0

Religion	Christianity	19	38.0	21	42.0
	Islam	31	62.0	25	50.0
	Others	0	0.0	4	8.0
Marital status	Single	1	2.0	5	10.0
	Married	35	70.0	35	70.0
	Divorced	5	10.0	2	4.0
	Widow	9	18.0	8	16.0
Education	Primary	21	42.0	14	28.0
	Secondary	14	28.0	23	46.0
	Tertiary	0	0.0	3	6.0
	No formal education	15	30.0	10	20.0
Household size	1-5	34	68.0	43	86.0
	6-10	16	32.0	7	14.0
	Total	50	100.0	50	100.0

Source: Field survey, 2023

by a strong local identity. All traders were of Yoruba descent, reflecting the ethnic composition of Ife East Local Government Area. However, the consumer profile showed more diversity, with 16% identifying as Hausa, indicating that breadfruit is accepted as a food source beyond the immediate indigenous population.

Breadfruit Supply Sources and Availability Patterns among Traders

The results presented in Table 3 indicate that breadfruit supply in the study area is largely dependent on cultivated sources, as the majority of traders (72%) obtain the fruit from farmlands rather than from wild stands (28%). This predominance of farm-sourced breadfruit suggests the existence of organized cultivation practices within the study area. This observation aligns with earlier findings that breadfruit production in parts of Osun State is practiced on smallholder farms of varying sizes (Ogunlade *et al.*, 2015). All respondents (100%) indicated that breadfruit is not available throughout the year. Most traders (94%) reported that fruit availability peaks during the rainy season, particularly in July and August, whereas only 6% reported availability during other periods.

Respondents further noted that fruits harvested during the peak period are generally larger than those obtained during the early fruiting phase in April. This seasonal pattern is consistent with previous reports identifying the peak fruiting period of breadfruit within the mid-rainy season (Omobuwajo, 2003). The concentration of supply within this period implies that market participation and income generation from the breadfruit trade are strongly shaped by seasonal production cycles. Variations in fruit size across the production season also suggest that ecological and climatic conditions during the peak rainy months favor optimal fruit development.

Marketing Channel and Pricing Mechanis Marketing Channels of Breadfruit (*Artocarpus altilis*)

The breadfruit marketing channel in the study area involves four primary actors: producers, village merchants, retailers, and final consumers (Figure 2). While the distribution network is categorized into major and minor routes, the most dominant pathway is the direct link from producers to retailers and finally to consumers. This indicates a relatively short and efficient marketing chain with minimal intermediary involvement. Although

Table 3: Distribution of breadfruit supply sources and availability pattern among Traders in the study area

Variables	Frequency (n=50)	Percentage (%)
Sources of breadfruit supply		
- Wild	14	28.0
- Cultivated	36	72.0
Year-round availability		
- Yes	00	00.00
- No	50	100.0
Season of highest availability		
- Rain	47	94.0
- Dry	03	06.0
Total	50	100.0

Source: Field survey, 2023

village merchants exist as assemblers, their role is often bypassed by retailers who procure directly from farms in order to strengthen profit margins and reduce reliance on third-party logistics. The price discovery and control mechanisms are largely driven by retailers (market traders). While producers establish initial bulk prices based on harvest volume, retailers exert the greatest influence over final consumer prices by adjusting retail units to account for transportation costs and desired profit margins. Field observations revealed that retailers typically add a markup of N100 to N200 on retail sets compared to the unit procurement cost. This pricing flexibility allows retailers to manage the economic risks associated with the trade, as they bear the primary burden of spoilage and transportation logistics once the produce leaves the farm gate. A comparison between direct and indirect sales channels highlights significant price differences for the final consumer. Direct sales from producers to consumers (the minor route) represent the most cost-effective transaction, as they bypass additional market-related costs. However, this route remains minimal compared

to formal market trade. Most consumers depend on retailers, where the “standardized retail set” serves as the primary transaction unit. This transition from bulk farm-gate pricing to market-based retail pricing reflects a trade-off between consumer convenience and the added costs associated with transportation and rural market access. Ultimately, the short nature of the marketing chain suggests a relatively high level of market efficiency, as the absence of excessive intermediaries prevents unnecessary inflation of consumer prices.

Pricing Mechanisms and Unit-Based Transactions

Breadfruit transactions are conducted using locally recognized basket and count units (Table 4). At the producer–retailer level, bulk quantities are handled in baskets containing approximately 20–24 fruits, with a mean price of N1,600. Unit cost analysis revealed that retailers procure the fruit at an estimated cost of N66 to N80 per fruit. At the retail stage, traders divide these bulk supplies into standardized sets of four fruits, sold at an average price of N400. This results in a retail price of approximately N100 per fruit, representing a significant

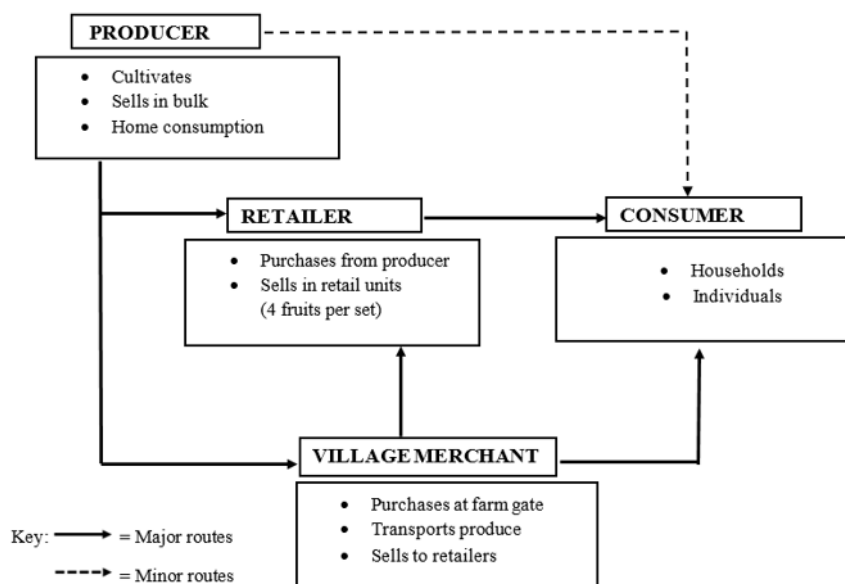


Figure 2: Marketing channels of breadfruit in Ife East Local Government Area

markup from the farm-gate or bulk purchase price. The estimated marketing margin per retail set ranges between N80 and N30, depending on the initial bulk purchase cost. This margin is utilized by traders to cover transportation expenses and manage spoilage risks during periods of low patronage. Field observations further revealed that while retail sets are highly standardized across all three markets, bulk basket units exhibit less uniformity. Although the 20–24 fruit basket is the most common trade unit, the existence of larger, non-standardized baskets indicates that bulk price discovery is often based on visual estimation rather than precise weight measurements. This transition from estimation-based bulk trading to standardized count-based retail units ensures transaction consistency and reflects established rural market trading practices.

Consumer Utilization and Preference Patterns

The utilization patterns and consumption drivers of breadfruit (*Artocarpus altilis*) are presented in Table 5. The study revealed a highly versatile consumption profile, with pounded breadfruit (32%), locally known as Iyan Gbere, and fries (24%) emerging as the primary product forms. This diverse utilization pattern is supported by specific processing methods, as a majority of consumers (52%) preferred boiling the fruit, while 40% utilized frying. These findings align with Ogunlade *et al.* (2015), who noted that while breadfruit is traditionally consumed as a dough-like staple, it is increasingly being integrated into the local snack economy in the form of fries and puff-puff. The preference for breadfruit over traditional staples such as yam is predominantly driven by perceived health benefits (78%). Qualitative field interviews revealed

Table 4: Analysis of trade units, weights, and pricing across breadfruit marketing levels

Market level	Unit of Sale	Average number of fruits	Approx. weight (kg)	Price Range (N)	Average price (N)
Producer → Village Merchant/Retailer	Basket	20-24	22.67	1,200-2,000	1,600
Retailer → Consumer	Set	4	4.85	300-500	400

Note: Retailers are the market traders in the selected markets

USD = N 903.925

Source: Field survey, 2023

that consumers view breadfruit as a “functional food,” particularly due to its perceived ease of digestion and potential benefits in managing common health conditions such as diabetes and hypertension. This medicinal perception is consistent with the findings of Soifoini *et al.* (2018) and Ogunlade *et al.* (2015), who reported that rural populations utilize various breadfruit components in traditional medicine for blood sugar regulation despite limited formal biochemical knowledge. Regarding the drivers of consumption, cultural background (42%) and availability (34%) were identified as the most influential factors. This highlights the cultural integration of the crop within Ife East Local Government Area, a recognized hub for breadfruit production. Notably, income was not identified as a determining factor (0%) by any respondent. This lack of income dependency suggests that breadfruit is a socially inclusive staple that remains affordable and accessible to households regardless of economic status. This finding is historically consistent with Popoola *et*

al. (2003), who observed that breadfruit consumption remains relatively stable across different income groups, further emphasizing its role in local food security and community health.

Challenges and Constraints to the Breadfruit Trade

Table 6 presents respondents’ perceptions of the major constraints affecting the breadfruit trade in the study area. The results indicate that seasonal scarcity and inadequate storage facilities are the most significant challenges hindering the trade. A substantial majority of respondents (92%) either strongly agreed (70%) or agreed (22%) that seasonal scarcity constitutes a major constraint. This indicates that breadfruit supply is strongly influenced by seasonal production cycles, resulting in fluctuations in product availability and market activity. Such seasonal concentration limits continuous market participation and may reduce income stability among traders. This finding is consistent with studies on

Table 5: Consumer utilization, preference rationale, and consumption drivers (n=50)

Category	Variable	Frequency	Percentage (%)
Utilisation & Product	Pounded breadfruit	16	32.0
	Cooked fruit	11	22.0
	Flour	4	8.0
	Fries	12	24.0
	Puff-Puff	7	14.0
Processing Methods	Boiling	26	52.0
	Drying	4	8.0
	Frying	20	40.0
Preference Rationale	Health Status	39	78.0
	Diverse Utilisation	11	22.0
Consumption Drivers	Background	21	42.0
	Availability	17	34.0
	Nutrition and Medicine	12	24.0
	Income	0	0.0
	Total	50	100.0

Source: Field survey, 2023

non-timber forest product trade, which emphasize that seasonality significantly influences product availability and trade dynamics in many tropical markets (Aiyeloja & Ajewole, 2020). Similarly, the lack of storage facilities

emerged as a critical constraint, with 96% of respondents either strongly agreeing (42%) or agreeing (54%) that it limits the effective trade of breadfruit. In the absence of adequate storage infrastructure, the duration for which

traders can preserve unsold fruits is restricted. Field observations indicated that traders rely mainly on simple air-drying as a preservation method, which provides only short-term protection. This lack of storage capacity becomes particularly problematic during periods of low daily patronage, as unsold fruits are susceptible to spoilage if left on the market floor for extended periods. As a result, traders are often compelled to sell their stock quickly to avoid losses, limiting their ability to store products for sale during periods of higher demand or more favorable prices. In contrast, market infrastructure and transportation constraints were perceived to be less significant. A larger proportion of respondents disagreed that poor market structure (30%) and transportation challenges (64%) constitute major constraints to the breadfruit trade. This suggests that the existing market environment and transport access are generally adequate for the scale at which the breadfruit trade operates within the study area. Furthermore, 82% of respondents

disagreed that low patronage constitutes a constraint, indicating that consumer demand for breadfruit remains relatively stable in local markets. This suggests that trade challenges are driven primarily by supply-related factors, particularly seasonal availability and limited storage capacity, rather than insufficient demand.

CONCLUSION

The breadfruit (*Artocarpus altilis*) trade in the study area is a socio-economically vital, female-dominated enterprise. The market structure is characterized by a short and relatively efficient marketing channel, where the direct link between producers and retailers effectively minimizes intermediary costs. Economic analysis reveals that while bulk pricing at the farm gate relies on visual estimation, retail pricing is highly standardized, providing traders with a consistent Amarketing margin that helps offset transportation costs and spoilage risks. Furthermore, the inclusion of consumer perspectives

Table 6: Traders' perceptions of constraints affecting the breadfruit trade (n=50)

Identified constraints		Strongly Agree	Agree	Disagree	Undecided	Total
Poor market structure	Freq	7	8	15	20	50
	%	14.0	16.0	30.0	40.0	100.0
Lack of Storage facilities	Freq	21	27	2	0	50
	%	42.0	54.0	4.0	0.0	100.0
Seasonal scarcity	Freq	35	11	4	0	50
	%	70.0	22.0	8.0	0.0	100.0
Transportation problem	Freq	6	7	32	5	50
	%	12.0	14.0	64.0	10.0	100.0
Low patronage	Freq	0	3	41	6	50
	%	0.0	6.0	82.0	12.0	100.0
Poor shelf-life	Freq	19	17	14	0	50
	%	38.0	34.0	28.0	0.0	100.0
Low breadfruit production	Freq	1	2	43	4	50
	%	2.0	4.0	86.0	8.0	100.0

Source: Field survey, 2023

highlights that breadfruit is a socially inclusive staple, with demand driven by long-standing cultural backgrounds and seasonal availability rather than household income levels. Despite this potential, the sustainability of the trade is hindered by pronounced seasonal scarcity and inadequate storage facilities, which shorten the marketing period and limit the ability of traders to manage surpluses beyond the peak harvest. To enhance the performance and sustainability of the trade, there is a clear need for targeted interventions that strengthen local preservation practices through the improvement of traditional drying systems and simple storage structures. Furthermore, the formalization of trade units at the farm-gate level would improve price transparency and ensure fairer returns for all market actors. Finally, continued research into varietal improvements and off-season cultivation remains essential to moderate extreme seasonal supply patterns

and ensure a more consistent year-round market.

REFERENCES

- Abrajano, M., Casillano, M. G. P., Padel, J., Ranido, J., Ronquillo, M., & Trinchera, A. J. D. (2021). *Sensory evaluation of breadfruit (Artocarpus altilis) polvoron*. SSRN. <https://doi.org/10.2139/ssrn.3856829>
- Aiyelaja, A. A., & Ajewole, O. I. (2020). Non-timber forest products' marketing in Nigeria: A case study of Osun State. *African Journal of Agricultural Marketing*, 8(2), 1–7.
- Ajani, A. O., & Adegoke, G. O. (2018). Nutritional quality and sensory acceptability of fermented breadfruit – pigeon pea based custard. *Annals. Food Science and Technology*, 19(2), 265–272.
- Akinsorotan, O. A., Aremo, A. E., & Sanusi, A. (2024). Quantifying charcoal consumption in Osun State:

- Implications on climate change. *Nigerian Journal of Agriculture and Agricultural Technology*, 4(4B), 298–308. <https://doi.org/10.59331/njaat.v4i4B.924>
- Awolola, G. V., Oluwaniyi, O. O., Aremu, T. A., & Oladapo, B. O. (2017). Comparative proximate composition and functional properties of flour and composites from breadfruit (*Artocarpus altilis*) (Parkinson) Fosberg. *Ilorin Journal of Science*, 4(2), 239–249. <https://doi.org/10.54908/iljs.2017.04.02.004>
- Babatunde, T. O., Olawuyi, B. E., Babatunde, O. O., Odeyale, O. C., Babatunde, K. O., & Akinbosoye, T. S. (2022). Marketing of non-timber forest products as a means of income generation in Oja-Oba market, Iseyin local government area, Oyo State. *AROC in Agriculture*, 1(1), 33–40. <https://doi.org/10.53858/arocagr01013340>
- Emire, A., Demise, S., & Giri, T. (2024). Effect of provenance variation on growth performance of indigenous highland bamboo species (*Arundinaria alpina*), in Bore district, Southern Ethiopia. *American Journal of Agricultural Science, Engineering, and Technology (AJASET)*, 8(3), 60–66. <https://doi.org/10.54536/ajaset.v8i3.2439>
- Frey, G. E., Alexander, S. J., Chamberlain, J. L., Blatner, K. A., Coffin, A. W., & Barlow, R. J. (2019). Markets and market values of nontimber forest products in the United States: A review, synthesis, and identification of future research needs. *Journal of Forestry*, 117(6), 613–631. <https://doi.org/10.1093/jofore/fvz051>
- Houngbo, A. S., Medoatinsa, S. E., Koudoro, Y. A., Olaye, T., Bogninou, G. S. R., & Dossa, C. P. A. (2024). Status of production and use of *Artocarpus altilis* and *Artocarpus camansi* in Benin Republic. *GSC Biological and Pharmaceutical Sciences*, 29(1), 277–289. <https://doi.org/10.30574/gscbps.2024.29.1.0382>
- John, J. I., Nnamdi, M. S., & Aduralere, I. I. (2013). Economics of non-timber forest products (NTFPs) in Oyo-state, Nigeria. *IOSR Journal of Humanities and Social Science*, 18(4), 1–18.
- Magry, M. A., Cahill, D., Rookes, J., & Narula, S. A. (2023). Marketing constraints of non-timber forest products: Evidence from Jharkhand, India. In S. A. Narula & S. P. Raj (Eds.), *Sustainable Food Value Chain Development* (pp. 221–237). Springer. https://doi.org/10.1007/978-981-19-6454-1_11
- Maluleke, M. K., Mathibe, N., & Mthombeni, D. L. (2024). Consumers' perceptions on indigenous fruit value-added products in Bushbuckridge, Mpumalanga, South Africa. *Discover Sustainability*, 5(1), Article 224. <https://doi.org/10.1007/s43621-024-00454-5>
- Mehta, K. A., Quek, Y. C. R., & Henry, C. J. (2023). Breadfruit (*Artocarpus altilis*): Processing, nutritional quality, and food applications. *Frontiers in Nutrition*, 10, Article 1156155. <https://doi.org/10.3389/fnut.2023.1156155>
- Meinhold, K., & Darr, D. (2019). The processing of non-timber forest products through small and medium enterprises—A review of enabling and constraining factors. *Forests*, 10(11), Article 1026. <https://doi.org/10.3390/f10111026>
- Mugido, W., & Shackleton, C. M. (2018). Price determination of non-timber forest products in different areas of South Africa. *Ecological Economics*, 146, 597–606. <https://doi.org/10.1016/j.ecolecon.2017.12.010>
- National Bureau of Statistics. (2010). *Annual abstract of statistics*. Federal Republic of Nigeria. <https://www.nigerianstat.gov.ng>
- National Population Commission. (2020). *Nigeria population projections and demographic indicators*. <http://nationalpopulation.gov.ng/publications>
- Odeyale, O. O., Babatunde, T. O., Babatunde, O. O., Olawuyi, B. E., Babatunde, K. O., & Falana, A. R. (2023). Survey of non-timber forest products (NTFPs) and their socio-economic contribution to rural household livelihood in adjoining communities in Ago-Owu forest reserve of Osun State, Nigeria. *AROC in Agriculture*, 2(1), 6–12. <https://doi.org/10.53858/arocagr02010612>
- Ogunlade, I., Bakare, A. K., Adebayo, A. S., & Olorunfemi, D. O. (2015). Determination of constraints in production and utilization among breadfruit farmers in two selected local government areas, Osun State, Nigeria. *Equity Journal of Science and Technology*, 3(2), 84–90.
- Omobuwajo, T. O. (2003). Compositional characteristics and sensory quality of biscuits, prawn crackers and fried chips produced from breadfruit. *Innovative Food Science & Emerging Technologies*, 4(2), 219–225. [https://doi.org/10.1016/S1466-8564\(03\)00006-7](https://doi.org/10.1016/S1466-8564(03)00006-7)
- Omobuwajo, T. O. (2007). Breadfruit as a key component of sustainable livelihoods in Nigeria: Prospects, opportunities and challenges. *Acta Horticulturae*, 757, 121–124. <https://doi.org/10.17660/ActaHortic.2007.757.15>
- Popoola, L., Agbeja, B. O., & Nyenka, J. (2003). Marketing and utilization of *Artocarpus altilis* (Parkinson) Forsberg in the rainforest area of Osun State, Nigeria. *ASSET Series A*, 3(3), 149–158.
- Sakyi, E. K., & Ameko, S. K. (2025). Adverse effects of human activities on forest reserves in Ghana: Lessons of experience from the Yenku Forest Reserve in the Central Region. *American Journal of Environment and Climate*, 4(1), 52–63. <https://doi.org/10.54536/ajec.v4i1.3727>
- Shackleton, S., Paumgarten, F., Kassa, H., Husselman, M., & Zida, M. (2011). Opportunities for enhancing poor women's socio-economic empowerment in the value chains of three African non-timber forest products (NTFPs). *International Forestry Review*, 13(2), 136–152.
- Soifoini, T., Donno, D., Jeannoda, V., Rakotoniaina, E., Hamidou, S., Achmet, S. M., Solo, N. R., Afraitane, K., Giacomini, C., & Beccaro, G. L. (2018). Bioactive compounds, nutritional traits, and antioxidant properties of *Artocarpus altilis* (Parkinson) fruits: Exploiting a potential functional food for

- food security on the Comoros Islands. *Journal of Food Quality*, 2018, Article 5697928. <https://doi.org/10.1155/2018/5697928>
- Soumya, K. V., Shackleton, C. M., & Setty, S. R. (2025). Consumer preferences and markets for a cultural non-timber forest product (*Boswellia serrata* Roxb.) around Hindu temples in southwestern India. *Forests*, 16(6), 911. <https://doi.org/10.3390/f16060911>