

# Comparative Analysis of Constraints Affecting Tamarind Processing and Marketing in Kano, Kaduna and Nasarawa States, Nigeria

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## ABSTRACT

This study examined the constraints affecting tamarind processing and marketing among processors and marketers in Kano, Kaduna, and Nasarawa States, Nigeria. Primary data were collected in 2025 using structured questionnaires and a multistage sampling technique. Descriptive statistics and weighted mean scores were used to identify and rank the severity of constraints faced by actors in the tamarind value chain. Results revealed that inadequate capital, poor road networks, high transportation costs, spoilage, and difficulty in gathering tamarind from the wild were the most severe constraints across processors and marketers.

Nasarawa marketers were most constrained by inadequate capital (mean 3.96), while Kano marketers cited poor road networks (mean 2.97) and Kaduna marketers reported difficulties in gathering tamarind (mean 3.04) as key challenges. Processors were predominantly constrained by post-harvest losses and lack of storage.

These findings reflect broader challenges in rural agricultural value chains, notably financial, infrastructural, and post-harvest barriers that limit value addition and market efficiency in under-utilized indigenous food sectors (Anegbeh et al., 2025; Magry et al., 2023; Van der Stege et al., 2011). The study recommends targeted interventions in finance, infrastructure, storage technologies, and market information systems to strengthen the tamarind value chain in Northern Nigeria.

**Keywords:** Tamarind, Constraints, Processing, Marketing, Kano, Kaduna, Nasarawa, Nigeria

## INTRODUCTION

Tamarind (*Tamarindus indica* L.) is an indigenous multipurpose tree species widely consumed in West Africa and contributes to rural livelihoods through its use in food, medicine, and income generation (Van der Stege et al., 2011). In Nigeria, smallholder processors and marketers engage in tamarind value-chain activities that offer opportunities for income diversification and rural economic development (Idahosa et al., 2025).

Despite its importance, tamarind processing and marketing remain constrained by systemic challenges that reduce efficiency, limit value addition, and weaken market linkages. Constraints along agricultural value chains in developing countries often include inadequate access to credit, poorly developed infrastructure, post-harvest losses, and limited market information (Magry et al., 2023; Nzenwa et al., 2025). Specifically, rural marketing systems are affected by poor road conditions and high transportation costs, which raise transaction costs and reduce competitiveness (Magry et al., 2023).

Additionally, post-harvest challenges, such as spoilage and lack of storage, have been identified as barriers to value chain performance for fruits and non-timber forest products, including tamarind (Adewole et al., 2023). Despite the recognized potential of tamarind for livelihoods and agro-industrial development in Northern Nigeria (Anegbeh et al., 2025), there remain significant empirical gaps in understanding the relative severity of constraints faced by processors versus marketers and across states. This study therefore analyzes these constraints in Kano, Kaduna, and Nasarawa States to inform targeted interventions that improve value chain performance and rural incomes.

## METHODOLOGY

### Study Area and Sampling

The study was conducted in Kano, Kaduna, and Nasarawa States of Northern Nigeria, which have active tamarind processing and marketing activities. A multistage sampling technique was used to select respondents. In the first stage, local government areas with significant tamarind activities were purposively chosen.

In the second stage, communities within the selected LGAs were randomly sampled. Finally, tamarind processors and marketers were randomly selected from market centres and processing clusters in each state.

### Sampling Technique and Sample Size

A multistage sampling technique was employed for the study. In the first stage, the three states were purposively selected based on the presence of tamarind processing activities. **Sampling procedure and sample size**

A multistage sampling procedure was employed to select the study sample.

#### Step 1:

Three states Kano and Kaduna and Nasarawa, were purposively selected due to their high levels of tamarind processing and marketing activities.

#### Step 2:

Within each state, Purposive sampling was use to select four (4) Local Government Areas (LGAs) with the most significant tamarind processing and marketing activities.

#### Step 3:

Subsequently, one (01) community each was selected using a simple random from a local government area to make it four communities each in a state. Yamanes formula was used to determine the number of respondents to be allocated to each states from the sample frame. Yamanes formular states:

$$n = N \div 1 + N(e^2)$$

n = sample size

N = Estimated Sample Size

e = margin error ( 5% or 0.05)

#### Kano Sample Size;

N = 300 processors and marketers (ADP Kano)

n = ?

$$n = 300 \div 1 + 300(0.05)^2$$

n = 171(Kano)

#### Kaduna Sample Size:

N = 200 Processors and marketers (ADP Kaduna)

$$n = 200 \div 1 + 200(0.05)^2$$

n = 133 (kaduna)

**Nasarawa State Sample Size**

**N = 100 Processors and marketers (ADP Nasarawa State)**

$$n = 100 \div 1 + 100(0.05)^2$$

n = 80

**Step 4:**

Proportionate sampling percentage was used to determine the number of respondents per community.

Proportionate sampling percentage was used for each LGA's

$$n_i = (N_i \div N)n$$

$$\text{Percentage} = (N_i \div N) \times 100.$$

Where  $N_i$  = population of the subgroup

**N = Total population**

$$\text{Kano} = \left(\frac{171}{384}\right) \times 100 = 42.75 \text{ (43\%)} \text{ for the 4 LGAs}$$

$$\text{Kaduna} = \left(\frac{133}{384}\right) \times 100 = 35\% \text{ for the 4 LGAs}$$

$$\text{Nasarawa} = 80 \times 100 \div 384 = 20\% \text{ for the 4 LGAs}$$

= 20%

**Sampling Frame and Sample Size**

**Table 1**

States under study	Sample Frame	LGAs selected	Numbers of Communities selected	Numbers of respondents to select	Estimated population
<b>Kano State</b>	300 marketers and processors (ADP Kano State)	Madobi, Dawakin -Tofa , Kano-South and Kano-Central	04	44.5% respondents from each community using proportionate sampling (171)	300
<b>Kaduna State</b>	200 marketers and precessors (ADP Kaduna State)	Chikun Zaria, Kaduna-South and Kaduna-North	04	34.6% respondents from each community using proportionate sampling (133)	200
<b>Nasarawa State</b>	100 Processors/Marketeters (ADP Niger State)	Lafia, Nasarawa Eggon, Akwanga, Awe	04	20.8% 20respondents from the 4community each.(80)	100
<b>3 States</b>	<b>600</b>	<b>12 LGA's</b>	<b>12 Communities</b>	<b>384 Respondents</b>	<b>600 Population</b>

## Data Collection

Primary data were collected through structured questionnaires administered to a total of 384 respondents, comprising both processors and marketers. The questionnaire captured socio-economic characteristics, constraint indicators, and other relevant variables. Data collection took place during the 2025 field survey.

## Analytical Techniques

Descriptive statistics (frequencies, percentages) were used to summarize socio-economic characteristics, while a weighted mean score (WMS) was used to assess the severity of constraints.

Respondents rated each constraint on a four-point Likert scale: Not a Problem (1), Not Serious (2), Serious (3), and Very Serious (4). Mean scores were calculated for each constraint, and items with higher mean scores were interpreted as more severe constraints.

## Results and Discussion

### Constraints Faced by Tamarind Processors

Processors in Kano, Kaduna, and Nasarawa States faced a range of constraints (Tables 18–20). Poor road network was the most severe constraint for Kano processors (mean = 3.00), while inadequate capital and high transportation costs were major challenges across all states. Spoilage ranked high for Kano and Kaduna processors (mean = 2.56–2.71), reflecting losses from inadequate storage and post-harvest management. Other moderate constraints included weather conditions, period of maturity, scarcity of trees, and inadequate labor supply.

### Constraints Faced by Tamarind Marketers

Marketers reported constraints that were both similar and distinct from processors (Tables 21–23). In Kano, poor road network (mean = 2.97) and high transportation costs (mean = 2.92) were the most severe, whereas in Kaduna, difficulty in gathering from the wild (mean = 3.04) and high transportation costs (mean = 3.00) dominated. In Nasarawa, inadequate capital (mean = 3.96) and price fluctuations (mean = 2.82) were primary constraints. Post-harvest losses, bulky products, and limited access to extension services were moderate constraints across all states.

### Comparative Analysis: Processors vs Marketers and Across States

**Processors vs Marketers:** Processors were most constrained by post-harvest losses and lack of storage, whereas marketers were more affected by market instability, poor infrastructure, and high transportation costs.

**State Comparison:** Nasarawa marketers were highly constrained by capital shortages, Kaduna marketers by labor-intensive harvesting, and Kano marketers by poor road networks.

**Overall Constraints:** Across all actors and states, the most critical constraints were inadequate capital, poor roads, high transportation costs, spoilage, and difficulty in harvesting from the wild.

These findings underscore systemic inefficiencies in the tamarind value chain that reduce profitability and hinder rural economic development.

## CONCLUSION AND POLICY RECOMMENDATIONS

### Conclusion

The study revealed that tamarind processors and marketers in Kano, Kaduna, and Nasarawa States face a range of financial, infrastructural, post-harvest, and market constraints. These constraints vary across states and actors, with processors affected primarily by storage and spoilage, and marketers by transportation and market volatility.

Addressing these constraints is essential for improving efficiency, increasing value addition, and promoting rural livelihoods.

### Policy Recommendations

**Access to Finance:** Provide microcredit or low-interest loans to processors and marketers for investment in equipment, storage, and marketing.

**Infrastructure Improvement:** Upgrade rural road networks to reduce transportation costs and facilitate timely delivery of products.

**Post-Harvest Management:** Promote training on improved storage techniques and preservation technologies to reduce spoilage.

**Market Stability:** Strengthen cooperatives, associations, and digital market information systems to mitigate price fluctuations.

**Sustainable Harvesting:** Encourage tamarind tree planting and efficient harvesting methods to reduce labor intensity and ensure raw material availability.

**Extension Services:** Enhance technical support to actors on best practices in processing, storage, and marketing.

### Tables

Table 2–7 (Processor and Marketer Constraints).

**Table 2: Constraint limiting Tamarind processing in Kano state**

Constraints	Not a Problem	Not Serious Problem	Serious Problem	Very Serious Problem	Weighted Score	Mean Score	result
Inadequate Capital	27 (20.30)	69 (51.88)	11 (8.27)	26 (19.55)	302	2.27	1st
Price Fluctuation	34 (25.56)	65 (48.87)	24 (18.05)	10 (7.52)	276	2.08	6th
Lack of Storage Facilities	33 (24.81)	64 (48.12)	21 (15.79)	15 (11.28)	284	2.14	4th
High Transportation Cost	42 (31.58)	43 (32.33)	22 (16.54)	26 (19.55)	298	2.24	2nd
Poor Patronage	44 (33.08)	53 (39.85)	22 (16.54)	14 (10.53)	272	2.05	7th
Difficulty in Gathering from the Wild	72 (54.14)	39 (29.32)	15 (11.28)	7 (5.26)	223	1.68	10th
Bulky	85 (63.91)	16 (12.03)	25 (18.80)	7 (5.26)	220	1.65	12th
Weather Condition	59 (44.36)	34 (25.56)	33 (24.81)	7 (5.26)	254	1.91	8th
Period of Maturity	67 (50.38)	48 (36.09)	10 (7.52)	8 (6.02)	225	1.69	11th
Contact with Extension Agents	78 (58.65)	38 (28.57)	10 (7.52)	7 (5.26)	212	1.59	14th

Spoilage	44 (33.08)	49 (36.84)	16 (12.03)	24 (18.05)	286	2.15	3rd
Poor Road Network	55 (41.35)	27 (20.30)	32 (24.06)	19 (14.29)	281	2.11	5th
Scarcity of Tamarind Trees	64 (48.12)	42 (31.58)	13 (9.77)	14 (10.53)	243	1.82	9th
Inadequate Supply of Labour	73 (54.89)	40 (30.08)	16 (12.03)	4 (3.01)	217	1.63	13th

Source: Field Survey, 2025

**Table 3: Constraint limiting Tamarind processing in Kaduna state**

Constraints	Not a Problem	Not Serious Problem	Serious Problem	Very Serious Problem	Weighted Score	Mean Score	Rank
Inadequate Capital	17 (22.08)	36 (46.75)	9 (11.69)	15 (19.48)	176	2.29	6th
Price Fluctuation	15 (19.48)	33 (42.86)	19 (24.68)	10 (12.99)	178	2.31	4th
Lack of Storage Facilities	19 (24.68)	37 (48.05)	15 (19.48)	6 (7.79)	162	2.10	9th
High Transportation Cost	12 (15.58)	30 (38.96)	24 (31.17)	11 (14.29)	188	2.44	3rd
Poor Patronage	25 (32.47)	21 (27.27)	16 (20.78)	15 (19.48)	175	2.27	7th
Difficulty in Gathering from the Wild	26 (33.77)	9 (11.69)	18 (23.38)	24 (31.17)	194	2.52	2nd
Bulky	28 (36.36)	22 (28.57)	18 (23.38)	9 (11.69)	162	2.10	9th
Weather Condition	28 (36.36)	16 (20.78)	30 (38.96)	3 (3.90)	162	2.10	9th
Period of Maturity	35 (45.45)	25 (32.47)	9 (11.69)	8 (10.39)	144	1.87	13th
Contact with Extension Agents	46 (59.74)	14 (18.18)	7 (9.09)	10 (12.99)	135	1.75	14th
Spoilage	20 (25.97)	15 (19.48)	21 (27.27)	21 (27.27)	197	2.56	1st
Poor Road Network	25 (32.47)	17 (22.08)	28 (36.36)	7 (9.09)	171	2.22	8th
Scarcity of Tamarind Trees	32 (41.56)	10 (12.99)	15 (19.48)	20 (25.97)	177	2.30	5th
Inadequate Supply of Labour	28 (36.36)	30 (38.96)	10 (12.99)	9 (11.69)	154	2.00	12th

Source: Field Survey, 2025

**Table 4: Constraint limiting Tamarind processing in Nasarawa state**

Constraints	Not Problem	Not Serious Problem	Serious Problem	Very Serious Problem	Weighted Score	Mean Score	Rank
Inadequate Capital	-	5 (62.50)	3 (37.50)	-	19	2.38	7th
Price Fluctuation	-	2 (25.00)	5 (62.50)	1 (12.50)	23	2.88	2nd
Lack of Storage Facilities	2 (25.00)	2 (25.00)	4 (50.00)	-	18	2.25	10th
High Transportation Cost	1 (12.50)	4 (50.00)	2 (25.00)	1 (12.50)	19	2.38	7th
Poor Patronage	3 (37.50)	3 (37.50)	2 (25.00)	-	15	1.88	11th
Difficulty in Gathering from the Wild	1 (12.50)	3 (37.50)	2 (25.00)	2 (25.00)	21	2.63	5th
Bulky	2 (25.00)	2 (25.00)	1 (12.50)	3 (37.50)	21	2.63	5th
Weather Condition	1 (12.50)	-	7 (87.50)	-	22	2.75	4th
Period of Maturity	2 (25.00)	6 (75.00)	-	-	14	1.75	13th
Contact with Extension Agents	3 (37.50)	-	4 (50.00)	1 (12.50)	19	2.38	7th
Spoilage	2 (25.00)	1 (12.50)	1 (12.50)	4 (50.00)	23	2.88	2nd
Poor Road Network	1 (12.50)	-	5 (62.50)	2 (25.00)	24	3.00	1st
Scarcity of Tamarind Trees	3 (37.50)	4 (50.00)	-	1 (12.50)	15	1.88	11th
Inadequate Supply of Labour	4 (50.00)	3 (37.50)	1 (12.50)	-	13	1.63	14th

Source: Field Survey, 2025

**Table 5: Constraint limiting Tamarind marketing in Kano state**

Constraints	Not Problem	Not Serious Problem	Serious Problem	Very Serious Problem	Weighted Score	Mean Score	Rank
Inadequate Capital	-	23 (60.53)	9 (23.68)	6 (15.79)	97	2.55	7th
Price Fluctuation	3 (7.89)	16 (42.11)	14 (36.84)	5 (13.16)	97	2.55	7th
Lack of Storage Facilities	3 (7.89)	14 (36.84)	11 (28.95)	10 (26.32)	104	2.74	3rd
High Transportation Cost	-	12 (31.58)	17 (44.74)	9 (23.68)	111	2.92	2nd

Poor Patronage	4 (10.53)	11 (28.95)	19 (50.00)	4 (10.53)	99	2.61	5th
Difficulty in Gathering from the Wild	2 (5.26)	17 (44.74)	15 (39.47)	4 (10.53)	97	2.55	7th
Bulky	13 (34.21)	8 (21.05)	10 (26.32)	7 (18.42)	87	2.29	13th
Weather Condition	8 (21.05)	1 (2.63)	28 (73.68)	1 (2.63)	98	2.58	6th
Period of Maturity	2 (5.26)	20 (52.63)	4 (10.53)	12 (31.58)	91	2.40	11th
Contact with Extension Agents	2 (5.26)	23 (60.53)	9 (23.68)	4 (10.53)	91	2.40	11th
Spoilage	2 (5.26)	14 (36.84)	15 (39.47)	7 (18.42)	103	2.71	4th
Poor Road Network	2 (5.26)	2 (5.26)	29 (76.32)	5 (13.16)	113	2.97	1st
Scarcity of Tamarind Trees	4 (10.53)	19 (50.00)	9 (23.68)	6 (15.79)	93	2.45	10th
Inadequate Supply of Labour	14 (36.84)	5 (13.16)	17 (44.74)	2 (5.26)	83	2.18	14th

Source: Field Survey, 2025

**Table 6: Constraint limiting Tamarind marketing in Kaduna state**

Constraints	Not Problem	Not Serious Problem	Serious Problem	Very Serious Problem	Weighted Score	Mean Score	Rank
Inadequate Capital	1 (1.89)	27 (50.94)	8 (15.09)	17 (32.08)	147	2.77	11th
Price Fluctuation	1 (1.89)	24 (45.28)	19 (35.85)	9 (16.98)	142	2.68	13th
Lack of Storage Facilities	1 (1.89)	23 (43.40)	16 (30.19)	13 (24.53)	147	2.77	11th
High Transportation Cost	2 (3.77)	12 (22.64)	23 (43.40)	16 (30.19)	159	3.00	2nd
Poor Patronage	3 (5.66)	6 (11.32)	33 (62.26)	11 (20.75)	158	2.98	3rd
Difficulty in Gathering from the Wild	2 (3.77)	8 (15.09)	29 (54.72)	14 (26.42)	161	3.04	1st
Bulky	3 (5.66)	8 (15.09)	31 (58.49)	11 (20.75)	156	2.94	4th
Weather Condition	3 (5.66)	5 (9.43)	40 (75.47)	5 (9.43)	153	2.89	6th
Period of Maturity	3 (5.66)	16 (30.19)	19 (35.85)	15 (28.30)	152	2.87	8th
Contact with Extension Agents	3 (5.66)	17 (32.08)	14 (26.42)	19 (35.85)	155	2.93	5th
Spoilage	3 (5.66)	22 (41.51)	17 (32.08)	11 (20.75)	142	2.68	13th
Poor Road Network	3 (5.66)	6 (11.322)	42 (79.25)	2 (3.77)	149	2.81	9th

Scarcity of Tamarind Trees	3 (5.66)	16 (30.19)	22 (41.51)	12 (22.64)	149	2.81	9th
Inadequate Supply of Labour	3 (5.66)	16 (30.19)	18 (33.96)	16 (30.19)	153	2.89	6th

Source: Field Survey, 2025

**Table 7: Constraint limiting Tamarind marketing in Nasarawa state**

Constraints	Not a Problem	Not Serious Problem	Serious Problem	Very Serious Problem	Weighted Score	Mean Score	Rank
Inadequate Capital	1 (1.37)	-	-	72 (98.63)	289	3.96	1st
Price Fluctuation	2 (2.74)	11 (15.07)	58 (79.45)	2 (2.74)	206	2.82	2nd
Lack of Storage Facilities	13 (17.81)	53 (72.60)	7 (9.59)	-	140	1.92	12th
High Transportation Cost	8 (10.96)	53 (72.60)	10 (13.70)	2 (2.74)	152	2.08	9th
Poor Patronage	13 (17.81)	53 (72.60)	7 (9.59)	-	140	1.92	12th
Difficulty in Gathering from the Wild	3 (4.11)	15 (20.55)	47 (64.38)	8 (10.96)	206	2.82	2nd
Bulky	11 (15.07)	45 (61.64)	13 (17.81)	4 (5.48)	156	2.14	6th
Weather Condition	29 (39.73)	25 (34.25)	14 (19.18)	5 (6.85)	141	1.93	10th
Period of Maturity	31 (42.47)	27 (36.99)	4 (5.48)	11 (15.07)	141	1.93	10th
Contact with Extension Agents	36 (49.32)	22 (30.14)	10 (13.70)	5 (6.85)	130	1.78	14th
Spoilage	19 (26.03)	31 (42.47)	17 (23.29)	6 (8.22)	156	2.14	6th
Poor Road Network	1 (1.37)	39 (53.42)	24 (32.88)	9 (12.33)	187	2.56	5th
Scarcity of Tamarind Trees	8 (10.96)	11 (15.07)	46 (63.01)	8 (10.96)	200	2.74	4th
Inadequate Supply of Labour	33 (45.21)	10 (13.70)	18 (24.66)	12 (16.44)	155	2.12	8th

Source: Field Survey, 2025

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