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Tamarind Harvesting, Processing, and Marketing: A Case Study of Tribal Livelihoods in Bastar Forest Area, Chhattisgarh, India

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ABSTRACT

This case study documents tamarind harvesting, primary processing, storage, and marketing among tribal households in Dabpal and Belar villages of Lohandiguda block, Bastar, Chhattisgarh. A household-level survey of 100 families, comprising 50 households from each village, was used to describe patterns of participation, processing practices, value addition, and marketing. Particular attention was given to the roles of household members, local processing methods, storage and by-product use, and the channels through which tamarind was sold. The study uses descriptive analysis to summarize household responses and to examine the reported contribution of tamarind-related income to household livelihoods. The findings are interpreted as evidence from the surveyed households rather than as a region-wide estimate. The case study highlights the seasonal importance of tamarind as a forest-based livelihood resource and identifies value addition and improved market access as areas with potential for further livelihood development, while recognizing the need for larger and more systematic studies to quantify household-level economic outcomes.

Introduction

Tamarind-focused livelihoods in the tribal forest belt of Bastar, Chhattisgarh, hinge on a seasonal bioeconomy where entire households engage in harvesting, primary processing, and marketing, with this case study centering on Dabpal and Belar villages of the Lohandiguda block to examine how community participation, value addition, and market linkages shape incomes and social organization across the January–April collection window when agricultural work is minimal. Bastar's landscape

dry tropical forests interspersed with rainfed farm plots, supports dense stands of *Tamarindus indica* L., a hardy, long-lived legume valued for pulp, seed, and gum; systematic reviews and agronomic studies consistently describe tamarind's adaptability to marginal soils and drought, making it a keystone non-timber forest product (NTFP) for smallholders and tribal communities across peninsular India. Within this regional system, Jagdalpur functions as a pivotal wholesale hub; assessments from Bastar report Asia's largest tamarind auction center there, with annual production estimates above 21,000 metric

tonnes and tens of thousands of seasonal person-days generated figures that frame the economic canvas for village-level enterprise in Lohandiguda. NTFP literature further shows that forest products regularly contribute double-digit shares of rural household income in India and comparable countries, particularly when collectors can move beyond raw produce into processing and organized group marketing; this aligns with emerging self-help group models that channel women's labour into standardized products, branding, and better margins in tamarind value chains. Against this backdrop, the case study's selection of Dabpal and Belar is purposive: both villages are road-connected to weekly markets and Jagdalpur mandi, host active tribal self-help groups, and exhibit widespread household participation in collection, de-seeding, drying, and packaging features repeatedly identified as preconditions for livelihood upgrading in empirical studies of Bastar's tamarind collectors [1, 2]. The research pursues four objectives tailored to these contextual realities. First, it documents intra-household division of labour and time-use across harvesting, drying, deseeding, and storage to quantify women's and children's contributions and identify task bottlenecks where simple tools or collective norms could raise throughput and quality, reflecting recommendations from sustainability and processing reviews that stress labour-saving innovations at the household level. Second, it evaluates the income effects of low-cost value addition, such as hygienic brick formation, candy, and pulp standardization, drawing on intervention evidence from Bastar and adjacent districts where training and group production lifted net returns per kilogram relative to selling unprocessed pods.

Third, it analyses market access pathways that range from Minimum Support Price procurement to auction sales and trader networks, using cost-benefit profiles reported for Bastar collectors to test whether transport distance, grading, and seasonality jointly explain the spread in realized prices within Lohandiguda. Fourth, it situates Dabpal and Belar within the broader NTFP livelihood scholarship by estimating the share of tamarind earnings in annual household income and benchmarking those shares against multi-country syntheses that report NTFP contributions frequently between one-tenth and two-fifths of rural income when market's function and tenure is secure. Collectively, the study aims to generate actionable evidence on how tribal communities convert an ecologically resilient tree resource into stable cash flows by aligning seasonal labour, basic processing, and group marketing with

known quality parameters, a strategy repeatedly shown to move households up the value ladder in India's tamarind sector [3, 4].

Materials and Methods

The study used a household-level field survey to document tamarind harvesting, processing, storage, and marketing practices in Dabpal and Belar villages of Lohandiguda block, Bastar, Chhattisgarh. Fifty households were interviewed in each village, giving a total sample of 100 households.

The two villages were selected purposively because tamarind collection and associated post-harvest activities are locally practiced and the villages are connected with nearby markets. The household was considered the primary unit of analysis.

A structured questionnaire was used to collect information from household members involved in tamarind-related activities. The questionnaire covered the nature of household participation, division of labour among family members, harvesting and processing methods, quantity handled, storage practices, utilization of by-products, value-added products, marketing channels, tree-rental practices, selling period, price realization, and the use of tamarind income for household needs. Discussions with respondents were used to clarify local practices and terminology. Information was recorded at household level and summarized separately for the two villages where appropriate.

The analysis was primarily descriptive. Categorical responses were summarized using frequency and percentage, while numerical variables were summarized using mean and range (or standard deviation where sufficient individual observations were available). The contribution of tamarind to household income was expressed as the percentage share of reported annual tamarind income in reported annual household income. Market access was described using the observed marketing route, timing of sale, buyer type, and other variables recorded during the survey. Because the study is a case study with a modest purposive sample, the results are interpreted as characteristics of the surveyed households and are not generalized to all households in Bastar. No causal claim is made that a particular marketing practice independently increases household income unless supported by the recorded data and an appropriate statistical analysis.

Community Participation in Tamarind Harvesting

Community participation in tamarind harvesting within the tribal-dominated regions of Chhattisgarh, especially in Bastar district's villages like Dabpal and Belar, is characterized by a deeply ingrained division of labour among men, women, and children, reflecting both tradition and economic necessity. The organization of labour is distinctly seasonal, with harvesting concentrated from January to April, coinciding with dry months when agricultural employment is limited and households turn to forest produce for supplementary income. This seasonal rhythm is not unique to tamarind but typifies non-timber forest product (NTFP) economies across Central India, where collection, preliminary processing, and trading activities can generate tens of thousands of employment days in a single season. Within each family, men typically undertake the physically demanding tasks of climbing tamarind trees and shaking or knocking down the ripe pods, a role supported by studies showing that NTFPs requiring climbing tend to have higher male and youth participation, while women and children, who may not climb due to social or practical reasons, collect fallen fruits, carry loads, and clean the produce [5]. Women's contributions to tamarind harvesting are especially significant, comprising not only collection from the forest floor but also critical post-harvest activities such as de-shelling, deseeding, sorting, sun-drying, and packing, all of which demand many hours of labour and skill. Empirical research in Chhattisgarh and cross-regional NTFP reviews concur that these often "invisible" post-harvest stages provide essential household income and food security, positioning women as key decision-makers and stewards of both the resource and the cash flows it generates. Children, particularly during school holidays, actively assist in collection and cleaning, their involvement reflecting the longstanding reality that NTFP economies draw on the flexible time and labour of all available household members, especially when the magnitude of the harvest determines total earnings [6, 7, 8]. Socio-economically, tamarind collection offers a vital cash buffer for tribal communities during months of low agricultural income; even modest quantities (e.g., 300–500 kg annually per household) can yield meaningful revenue, as shown by case studies in Bastar where the average net seasonal earnings from tamarind ranged from ₹3,000 to over ₹9,000 depending on harvest size and market access. Nonetheless, these advancements are not uniformly allocated: the distribution of labour frequently

reflects wider trends of gender and age roles in rural India, where men typically enjoy a higher relative access to market opportunities, whereas women and children disproportionately undertake labour with significantly reduced authority over the proceeds from sales [3, 9]. At the community level, collective engagement, the exchange of traditional knowledge, and collaborative market initiatives such as those promoted by women's self-help groups contribute to reducing certain inequalities, facilitate capacity development, and support sustainable harvesting practices. Institutional frameworks, including the Chhattisgarh Minor Forest Produce Federation and government initiatives for Minimum Support Price procurement, have bolstered these seasonal livelihoods. However, enduring challenges related to market structure, labour recognition, and equitable income distribution underscore the necessity for continued policy focus and research into interventions that are sensitive to gender and age considerations. Consequently, the tamarind value chain in tribal Bastar exemplifies a significant instance of community-led natural resource management and resilience amidst challenging socio-economic circumstances. It also highlights the intricate relationships among gender, age, and labour that form the foundation of rural livelihoods in the forested regions of India.

Traditional Tools and Methods for Tamarind Processing

The conventional instruments and techniques employed by tribal communities for the processing of tamarind in areas such as Bastar, Chhattisgarh, serve as a prime illustration of indigenous knowledge systems that effectively convert raw tamarind pods into products suitable for the market and consumption. A fundamental traditional implement is a wooden mallet or club, typically made from locally sourced hardwood. This tool is utilized by harvesters to fracture tamarind pods, facilitating the separation of the pulp from the shell and seeds. This method, extensively recorded in rural India, entails striking the pods against a hard surface or utilizing a wooden mallet to detach the pulp. This technique effectively balances the intensity of labour with the preservation of pulp quality while minimizing potential damage to seeds intended for subsequent processing or planting. Mallets, in conjunction with stone or hammering tools, play a crucial role in the post-harvest process of seed expulsion. Approximately fifty percent of tamarind farmers utilize this beating technique as their main method for dehulling pods [3]. The

traditional method of extracting tamarind pulp from seeds and fiber utilizes skilled manual techniques in conjunction with basic implements such as sieves and trays. After the beating process, the pulp is carefully hand-sorted to remove seeds, which can then be boiled or dried for use in medicinal or culinary applications. The traditional approach to seed extraction involves submerging pods in water to increase their flexibility, which facilitates the manual removal of seeds and fibrous materials. The stages involved necessitate considerable time and effort, yet they are crucial for reducing pulp loss and preserving quality. This is especially significant given the small scale and subsistence nature of tribal enterprises. Conversations surrounding various tribal economies highlight the significance of immersing materials in water at either ambient or elevated temperatures as a crucial preparatory phase for the pulping process. The process facilitates the softening of tamarind pods, which in turn improves the efficacy of fiber extraction. These practices align with sustainable water utilization and are guided by the local resource availability [10]. Modern advancements bolster and reinforce these established practices. The use of fundamental wooden or bamboo structures for sun-drying tamarind pulp exemplifies the modifications made in response to the hot and humid conditions prevalent in Bastar. This approach reduces microbial hazards and extends shelf life, all while decreasing energy requirements. Certain communities have altered the design of the wooden mallet to enhance force distribution, thereby minimizing the physical strain associated with processing. Furthermore, the collaborative efforts of women's groups frequently involve a division of labour, with certain members focusing on deseeding while others dedicate their efforts to drying and packaging. This approach enhances production efficiency and upholds hygiene standards, ultimately contributing to improved market prices [1].

Although mechanical deseeding machines have been engineered and implemented in certain regions, their utilization in tribal contexts is still constrained, primarily owing to elevated costs and insufficient access to electricity. Manual deseeding remains prevalent, facilitated by straightforward tools such as oscillating wooden sectors or rollers utilized in artisanal tamarind de-seeders; however, their application is generally limited to commercial or cooperative environments. The indigenous techniques highlight an efficiency that harmonizes production scale, economic viability, and cultural relevance within tribal economies.

Storage, Utilization, and Value Addition

The storage, utilization, and value enhancement of tamarind represent critical factors that enable tribal communities in regions like Bastar, Chhattisgarh, to extend the shelf life of their products while maximizing the economic and functional advantages of both the fruit and its by-products. The appropriate storage of tamarind is essential to avert rotting, fungal infection, and deterioration of quality, which can occur due to its sticky pulp and inherent moisture content. Traditional methods of storage encompass the sun-drying of tamarind pods or pulp, followed by their preservation in airtight containers made from locally available materials, which effectively minimizes their exposure to moisture and pests. Research indicates that the use of glass jars or aluminium foil packaging in cool environments (below 20°C) can significantly extend the shelf life of tamarind for up to two years, especially when paired with natural preservatives such as salt, which helps absorb moisture and prevent the growth of fungi. The utilization of tamarind waste products for secondary purposes plays a crucial role in promoting economic and ecological sustainability within tribal communities. Seeds extracted during processing are not discarded; rather, they are repurposed as organic fertilizer, employed in natural wastewater treatment, charcoal adsorbents, or used as cleaning agents for domestic utensils. The ash from tamarind bark has historically been utilized to clean brass and copper utensils, demonstrating a cohesive waste utilization ethic throughout tribal cultures. Tamarind seeds have been studied for their potential in environmental remediation owing to their adsorption capabilities, highlighting their value as agricultural waste beyond culinary applications. The cyclical utilization of waste improves resource efficiency and mitigates environmental damage, a crucial element in tribal livelihood strategies intimately connected to forest ecology [11]. The utilization of tamarind spans a wide range of applications in both domestic and commercial settings. Tamarind pulp serves as a crucial souring agent in a variety of regional recipes across India, appreciated for its distinctive sweet-sour flavour profile. Tamarind undergoes commercial processing to produce a variety of value-added products, such as concentrated paste, candies, sauces, and chutneys. These products cater to broader regional and national markets, thereby increasing revenue for the families involved in their collection. Tamarind finds applications in both the pharmaceutical and textile sectors. The tamarind kernel powder serves as a sizing agent in fabric production, whereas pulp extracts

are used in medicinal formulations and skincare products. The expansion into commercial products strengthens rural entrepreneurship, particularly for women's self-help groups engaged in collective processing and marketing, thereby promoting socio-economic empowerment. The conventional therapeutic use of tamarind is deeply embedded in indigenous knowledge systems. Various parts of the tree, including fruit pulp, leaves, bark, and seeds, are employed in Ayurvedic and traditional medicinal practices. The pulp serves as a mild laxative and digestive support, while infusions of the bark and roots are employed to treat ailments including fever, ulcers, and menstrual disorders. The seeds are utilized topically for dermatological issues, including boils, while the powdered bark possesses antipyretic qualities. This information is transmitted between generations and is foundational to health practices in isolated groups, safeguarding biocultural legacy [12]. Finally, tamarind pickles represent a popular traditional value-added culinary item. To prepare, soak the tamarind pulp in warm water before cooking it with a spice mixture that includes mustard seeds, fenugreek, turmeric, and red chili powder. This results in a peppery, spicy condiment with a long shelf life that can be marketed or consumed locally, increasing economic value and nutritional diversity. The technique demonstrates how indigenous culinary traditions elevate tamarind's importance as a critical forest product while creating long-term revenue through culturally meaningful value addition.

Marketing Strategies and Economic Impact

Local marketing and tree rental systems are essential components of the tamarind economy in tribal regions such as Bastar. During the harvest season, communities frequently lease mature tamarind trees to traders or middlemen, thereby generating a consistent income stream without the necessity of land ownership or significant investment. The integration of this practice with direct sales of fresh or dried tamarind pods from households markedly improves household income, particularly during the peak season spanning from January to April. Seasonal selling involves the gathering, processing, and distribution of tamarind pulp, seeds, or value-added goods such as pickles and pastes. This activity generally transpires at local marketplaces or via middlemen, with prices fluctuating based on quality, timing, and market demand. Premium tamarind typically fetches elevated rates, anywhere from several hundred to over a thousand rupees per quintal, substantially impacting household income. Marketing initiatives

bolster local economies by generating employment possibilities and promoting income diversity, especially for women engaged in processing and packaging roles. Furthermore, the direct sale of tamarind and seeds is vital for improving community welfare, as it sustains rural livelihoods amid agricultural shortages and promotes the establishment of cooperative enterprises. The income generated by tamarind-related activities supports household expenses, such as education, healthcare, and agricultural inputs, thus reducing vulnerability to seasonal income fluctuations. Community-oriented marketing and tree rental schemes bolster resilience by empowering indigenous women and small-scale farmers. These programs enhance market access, price realization, and value chain integration, ultimately converting local natural resources into sustainable lives. In conclusion, these methods improve socio-economic stability and promote inclusive growth within indigenous communities [3].

In conclusion, the survey of 100 households in Dabpal and Belar shows that tamarind harvesting and associated processing and marketing activities form an important part of the seasonal livelihood system of the participating tribal households. Family members contribute at different stages, including harvesting, collection, deseeding, drying, storage, processing, and sale. Traditional methods remain important at household level, while value-added products and collective marketing represent possible avenues for improving product handling and market opportunities. The present study is descriptive and based on a purposive household sample; therefore, its findings should not be generalized to all tamarind-producing households in Bastar. Overall, tamarind remains an important seasonal forest resource for the households studied in Dabpal and Belar. Its importance lies not only in the income obtained from selling the produce, but also in the traditional knowledge, family labour, processing practices, and local marketing networks associated with it. Strengthening these existing practices through better processing facilities, improved market access, and locally appropriate training may help households obtain greater value from tamarind while maintaining its sustainable use. Future studies using larger samples and household-level economic records could provide stronger estimates of income contribution, profitability, gendered returns, and the effects of different marketing channels. Within these limitations, the case study indicates that tamarind remains a locally important forest resource whose livelihood value depends on both community practices and access to fair and reliable markets.

Figure.1 Community Participation in Tamarind Harvesting



Figure.2 Flow diagram of traditional tamarind processing steps

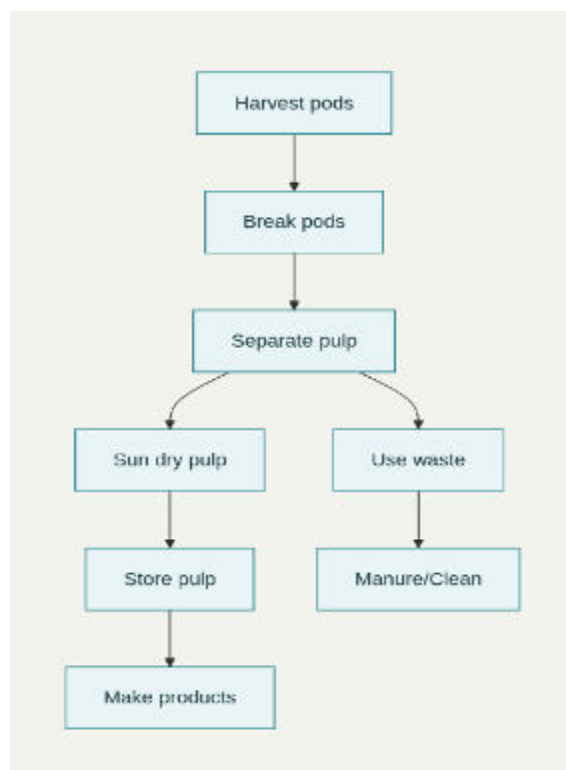


Figure.3 Traditional tool used for Tamarind processing



Figure.4 Storage and processing of Tamarind



Table.1 Household sampling framework

Study village	Households surveyed	Share of total sample
Dabpal	50	50%
Belar	50	50%
Total	100	100%

Table.2 Variables recorded and descriptive treatment

Variable domain	Examples of information recorded	Suggested summary
Household participation	Family members involved in harvesting, processing, and marketing	Frequency and percentage
Harvest and processing	Quantity handled; de-shelling, deseeding, drying, storage methods	Mean/range; frequency and percentage
Marketing	Buyer/channel, timing of sale, market access, tree rental	Frequency and percentage; descriptive comparison
Income	Income received from tamarind-related sales and other household sources	Mean/range and income-share calculation
Value addition	Pickle, pulp, candy or other products actually reported by respondents	Frequency and percentage
By-product use	Use or disposal of seeds and other processing residues	Frequency and percentage

Suggestions for Future Work

- Long-term household studies: Future research could follow the same households over several tamarind harvesting seasons to understand how production, prices, labour use, and income change from year to year.
- Detailed income assessment: More detailed household-level records on the quantity of tamarind collected, processing costs, transportation expenses, selling prices, and net returns would provide a clearer picture of its contribution to family income.
- Improved processing methods: Future studies could examine simple and affordable processing tools that reduce the time and physical effort required for de-shelling, deseeding, drying, and packaging, particularly for women who are closely involved in these activities.
- Women's role in the value chain: Further research should give greater attention to women's decision-making, participation in marketing, access to training, and involvement in self-help groups, as these factors may influence how much benefit households receive from tamarind.
- Market and price analysis: Research involving collectors, traders, self-help groups, cooperatives, and local markets could help identify the major difficulties faced by households in selling tamarind and the possibilities for obtaining better prices.
- Value-added products: Future work could explore the practical potential of products such as tamarind pulp, pickle, candy, paste, and other locally acceptable products, with attention to processing costs, consumer demand, storage, and marketability.
- Sustainable harvesting: Further ecological studies could examine how harvesting practices and the management of tamarind trees affect long-term fruit production, regeneration, and availability of the resource in the study area.
- Village-level comparisons: Comparing more villages in Bastar would help determine whether the harvesting practices, income patterns, processing methods, and marketing problems observed in Dabpal and Belar are common across the wider region.
- Linking livelihood and ecology: Future studies could bring together household economic information and ecological data to identify approaches that can support both the economic needs of tribal families and the long-term sustainable use of tamarind resources.
- Practical interventions: Finally, future research

should focus on small, locally suitable interventions that can be tested in the field and evaluated in terms of their actual effect on household income, labour requirements, product quality, and market access.

Declaration of AI-Assisted Technologies

During the preparation of this manuscript, the author used QuillBot solely to improve the readability and language of the text. No generative AI tools were used to generate data, write sections of the text, or draw scientific conclusions. The author reviewed and edited all suggestions and take full responsibility for the integrity and content of the publication.

Author Contributions

Nishant Ghode: Investigation, formal analysis, writing—original draft.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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