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Diversification of Beneng Taro (Birak) Processing to Support Food Security Policy in Central Lombok Regency

Lalu Ahmad Murdhani *, Mujahidin, Erfan Wahyudi, and Marzuki
Institut Pemerintahan Dalam Negeri, Sumedang Regency, West Java Province, 45363, Indonesia
* Corresponding Author: murdhani.md@gmail.com

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ABSTRACT

Food security remains a persistent challenge in Central Lombok Regency due to climate vulnerability, land-use change, and overreliance on rice as the dominant staple crop. This study investigates the overlooked potential of Beneng taro (Xanthosoma undipes), locally known as birak, as a climate-resilient and nutritionally valuable alternative. Using a qualitative approach, the research draws on field observations, interviews with farmers and local officials, and a review of empirical and policy literature to examine the crop's role in local food systems. Findings reveal that Beneng taro is ecologically suited to marginal lands, yet its cultivation and utilization remain marginalized in formal development agendas. The plant's nutritional benefits, particularly its high fiber content and low glycemic index, are undermined by fragmented knowledge on detoxification techniques, mostly transmitted orally and lacking standardization. Product diversification efforts are emerging but remain isolated, constrained by limited access to technical training, micro-enterprise licenses, and market linkages. Symbolic perceptions of Beneng taro as a wild or inferior crop further inhibit its economic potential and inclusion in mainstream food discourse. The absence of institutional support, including in the Regional Medium-Term Development Plan (RPJMD) and agricultural extension services, exacerbates these challenges. Nonetheless, the plant offers significant prospects for value-added innovations such as gluten-free flour, herbal tobacco alternatives, and biodegradable textile inputs. The study concludes that unlocking the potential of Beneng taro requires coordinated interventions in policy integration, food safety education, capacity building, and branding strategies to reposition the crop as a viable contributor

to sustainable food systems and rural livelihoods in Central Lombok.

Keywords: *Beneng Taro; Central Lombok; FAO; Food Diversification; Food Security*

1. Introduction

Food security has become a pressing national concern in Indonesia in recent years. Although the country can produce staple crops, food availability has declined in several regions. This situation has made it increasingly difficult for specific communities to access sufficient and nutritious food, particularly in West Nusa Tenggara (NTB), East Nusa Tenggara (NTT), Papua, and parts of Java. As a result, rising levels of food insecurity, malnutrition, and even localized starvation have been reported. A similar crisis unfolded in 1999 following the 1997–1998 Asian financial crisis, which triggered a sharp increase in poverty, a marked deterioration in child nutrition, and a significant drop in household food and health expenditures (Suryahadi et al., 2010; Waters, 2003).

Food insecurity in Indonesia underscores systemic weaknesses in national food resilience, particularly at the household and individual levels. Although the country has made significant progress toward macro-level self-sufficiency in staple food production, disparities in distribution and access continue to prevent vulnerable populations from fully benefiting. Recent studies show that approximately 18.6% of Indonesian households experience some degree of food insecurity, with undernutrition and child stunting remaining critical issues (Dewi et al., 2024). Regions such as West Nusa Tenggara (NTB), despite their agricultural potential, remain particularly at risk due to uneven infrastructure and access to markets (Sayuti et al., 2022). These findings highlight the need for targeted, locally grounded strategies to strengthen food security and ensure equitable access, especially in regions with high agronomic capacity.

West Nusa Tenggara (NTB) has extensive agricultural land and cultivates many staple crops, including rice, maize, sweet potatoes, cassava, taro, and peanuts. A study conducted in North Lombok reported the existence of 16 local staple food varieties in addition to rice, highlighting the region's rich agroecological diversity (Yusuf & Usman, 2022). NTB also produces a significant volume of fruits and vegetables, supported by its fertile wetlands and highland zones (World Food Programme, 2015). However, this agricultural potential remains underutilized due to limited post-harvest infrastructure. Post-harvest technologies such as cold storage, effective drying systems, and modern packaging are essential to reducing spoilage, extending shelf life, and transforming raw harvests into high-value food products for broader markets (Food and Agriculture Organization of the United Nations, 2019a; World Food Programme, 2015).

According to the Komando Strategis Areal (KSA) Survey results, the peak rice harvesting season in West Nusa Tenggara (NTB) shifted in 2024 compared to previous years, occurring in April with a harvested area of 71.28 thousand hectares. In contrast, the peak harvest in 2023 took place in March. The April 2024 harvest marked a decline of approximately 2.49 thousand hectares (3.37%) compared to March 2023 (see **Figure 1**) (Badan Pusat Statistik Provinsi Nusa Tenggara Barat, 2024).

From January to September 2024, the total harvested area amounted to 251.44 thousand hectares, reflecting a decrease of around 11.89 thousand hectares (4.51%) relative to the 263.33 thousand hectares recorded during the same period in 2023. The projected harvested area for October to December 2024 is estimated at 28.58 thousand hectares. Consequently, the total

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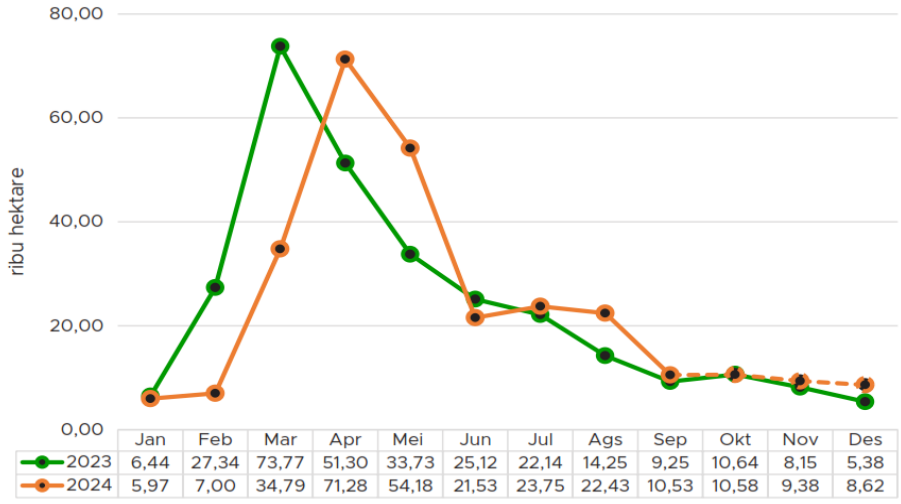
harvested area for 2024 is projected to reach 280.03 thousand hectares, representing a decline of approximately 7.49 thousand hectares (2.60%) compared to the 2023 total of 287.51 thousand hectares (Badan Pusat Statistik Provinsi Nusa Tenggara Barat, 2024).



	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Ags	Sep	Okt	Nov	Des
2023	6,44	27,34	73,77	51,30	33,73	25,12	22,14	14,25	9,25	10,64	8,15	5,38
2024	5,97	7,00	34,79	71,28	54,18	21,53	23,75	22,43	10,53	10,58	9,38	8,62

Keterangan: * Luas panen Oktober–Desember 2024 adalah angka potensi
Perbedaan angka di belakang koma disebabkan oleh pembulatan angka

Figure 1. Trends in Rice Harvested Area in West Nusa Tenggara Province (thousand hectares), 2023–2024
Source: (Badan Pusat Statistik Provinsi Nusa Tenggara Barat, 2024)

Rice production in West Nusa Tenggara Province from January to September 2024 is estimated at 1.30 million tons of unmilled rice (*Gabah Kering Giling*, GKG), marking a decline of approximately 108.31 thousand tons (7.67%) compared to the same period in 2023, which reached 1.41 million tons. Based on phenological observations from the September 2024 Strategic Area Command (Komando Strategis Areal, KSA) Survey, rice production for the October–December 2024 is projected at 149.67 thousand tons of GKG (see **Figure 2**) (Badan Pusat Statistik Provinsi Nusa Tenggara Barat, 2024).

Accordingly, the total rice production in 2024 is projected to reach 1.45 million tons of GKG, representing a decrease of 85.09 thousand tons (5.53%) from the 2023 total of 1.54 million tons. In 2023, the peak monthly output occurred in March with 410.34 thousand tons of GKG; in 2024, the highest production was recorded at 376.50 thousand tons in April. The lowest production levels were observed in December 2023 (28.76 thousand tons) and January 2024 (33.13 thousand tons) (see **Figure 2**) (Badan Pusat Statistik Provinsi Nusa Tenggara Barat, 2024).

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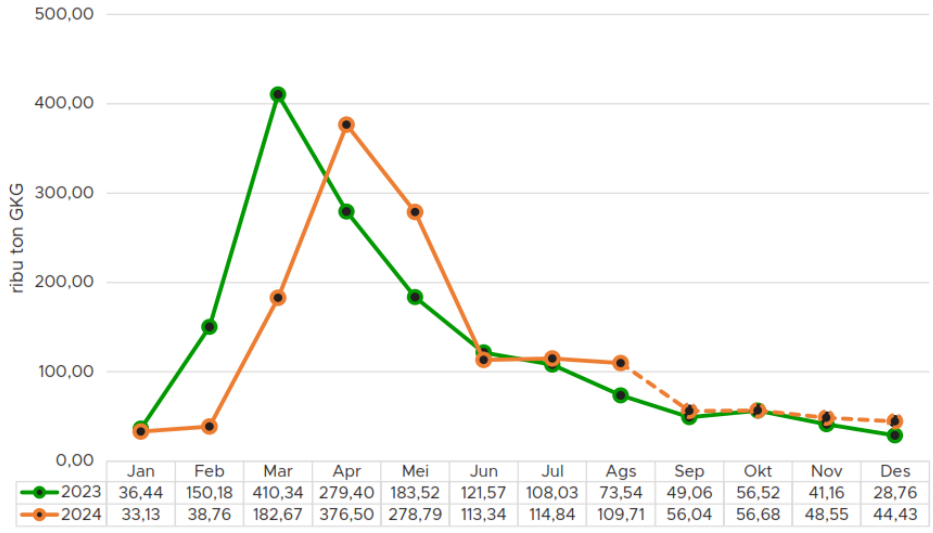

	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Ags	Sep	Okt	Nov	Des
2023	36,44	150,18	410,34	279,40	183,52	121,57	108,03	73,54	49,06	56,52	41,16	28,76
2024	33,13	38,76	182,67	376,50	278,79	113,34	114,84	109,71	56,04	56,68	48,55	44,43

Keterangan: * Produksi padi September–Desember 2024 adalah angka sementara
Perbedaan angka di belakang koma disebabkan oleh pembulatan angka

Figure 2. Rice Production Trends in West Nusa Tenggara (NTB), 2023–2024 (thousand tons, GKG)

Source: (Badan Pusat Statistik Provinsi Nusa Tenggara Barat, 2024)

In 2024, the top three contributors to total rice production were Central Lombok Regency, Sumbawa Regency, and East Lombok Regency. In contrast, the lowest production levels were recorded in North Lombok Regency, Mataram City, and Bima City (see **Figure 3**). A marked decline in rice output was observed in Sumbawa, Central Lombok, and West Sumbawa Regencies. Conversely, production increased in several areas, particularly in Dompu, East Lombok, and North Lombok Regencies (Badan Pusat Statistik Provinsi Nusa Tenggara Barat, 2024).

Keterangan: * Perbedaan angka di belakang koma disebabkan oleh pembulatan angka
Produksi padi September-Desember 2024 adalah angka sementara

Figure 3. Rice Production in West Nusa Tenggara (NTB) in 2023 and 2024 (thousand tons, GKG)

Source: (Badan Pusat Statistik Provinsi Nusa Tenggara Barat, 2024)

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To enhance regional food security, diversifying food sources using locally available crops is increasingly a strategic priority. Beneng taro (*Xanthosoma undipes*), locally known as birak, is an underutilized crop with high potential. This tuber is rich in nutrients and can be processed into various nutritious and economically viable products. Despite these attributes, its cultivation and utilization in Lombok remain limited and underdeveloped.

This study focuses on developing innovative processing strategies for Beneng taro as a policy-driven approach to strengthen food security in NTB. The objective is to identify viable methods for improving production, post-harvest processing, and product diversification, thereby promoting the crop as a sustainable alternative carbohydrate source.

Beneng taro (*Xanthosoma undipes*) is valued for its high dietary fiber content, low glycemic index, and considerable nutritional benefits, including carbohydrates, protein, and essential vitamins. As an underutilized tuber, it has been developed into a range of processed products, such as flour, chips, noodles, and ready-to-eat foods, in various regions across Indonesia (Eris et al., 2023; Nurtiana et al., 2023). One study reported that Beneng taro flour contains approximately 5% soluble fiber and 8.2% insoluble fiber, making it suitable for use in chips, wet noodles, and other functional food products (Eris et al., 2023). Moreover, the substitution of wheat flour with 15–45% Beneng taro flour in baked goods and noodles has been shown to enhance fiber content while maintaining acceptable sensory qualities (Eris et al., 2023).

In Central Lombok, Beneng taro (*Xanthosoma undipes*) remains largely unknown and underutilized among local farmers. However, the region's agroecological conditions, particularly its loose, well-drained soils and sufficient annual rainfall, are well suited to its cultivation (Windarsih et al., 2023). Field trials in similar environments have demonstrated the crop's resilience across varying soil organic carbon levels and rainfall patterns (Alghifari et al., 2023). Beyond its tubers, all parts of the plant hold economic potential. Community studies reveal that the leaves, leaf sheaths, corms, and petioles are used for animal feed, organic fertilizer, and even the production of crafts or bio-packaging (Windarsih et al., 2023). With targeted agronomic development and market support, Beneng taro could significantly improve local food security and create diversified income streams for smallholders, especially within integrated farming systems in West Nusa Tenggara.

Beneng taro (*Xanthosoma undipes*) also offers valuable uses beyond food products. Notably, its leaves have been used as a tobacco alternative in the production of herbal cigarettes, a traditional innovation gaining traction in regions like Banten (Syabana et al., 2024). Moreover, comprehensive field research shows that all plant parts, including leaves, sheaths, corms, and petioles, possess economic value, finding use as animal feed, organic fertilizer, crafts, and even raw materials for herbal cigarettes (Windarsih et al., 2023). Expanding these applications in West Nusa Tenggara could create new entrepreneurial opportunities and strengthen integrated farming systems.

The stalks contain natural fibers suitable for producing eco-friendly textiles, offering possibilities for innovation in sustainable fashion and creative industries. Meanwhile, the tubers can be processed into flour for use in bread, noodles, and other carbohydrate-rich products, making it a nutritious and viable alternative to rice and wheat (Febriyanti & Wijayanti, 2023).

Beneng taro (*Xanthosoma undipes*) requires careful processing to ensure safety. The plant naturally contains high levels of calcium oxalate, which can cause irritation or harm if consumed raw or improperly prepared. Studies on related species of Xanthosoma demonstrate that methods such as soaking, boiling, steaming, or fermentation significantly reduce oxalate levels, often by 50–80%, making the tubers safe for consumption (Hang et al., 2017; Noviasari et al., 2024; Vela-Gutiérrez et al., 2022). Boiling taro stems for 10–20 minutes lowered soluble oxalates by 63–80%,

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reducing overall crystal content (Hang et al., 2017). Soaking for 18 hours on leaves cut soluble oxalate by about 26%, while boiling sliced leaves achieved a 36% reduction (Vela-Gutiérrez et al., 2022). Consequently, public education on these safe processing techniques is essential. Implementing standardized and accessible methods, such as boiling, fermentation, or soaking protocols, can enhance food safety and boost the commercial potential of Beneng taro (Noviasari et al., 2024).

Further investigation is essential to enhance cultivation methods, improve yield efficiency, and formulate effective marketing strategies that foster greater consumer acceptance. By diversifying the range of products derived from Beneng taro, West Nusa Tenggara (NTB) has the potential to develop high-value commodities suited for both domestic and export markets. These efforts align with Indonesia's broader agenda to strengthen food security through dietary diversification and utilizing locally abundant agricultural resources.

This study contends that advancing the diversification of Beneng taro processing can play a pivotal role in improving food security in Central Lombok. Given its rich nutritional profile and multifaceted economic potential, Beneng taro can be transformed into various food and non-food products, including flour, chips, herbal cigarette components, and natural fibers. However, its limited use in the region stems largely from insufficient public awareness and inadequate knowledge of safe processing techniques to eliminate naturally occurring calcium oxalate compounds. Therefore, addressing these constraints through appropriate education and technology dissemination is critical to unlocking the crop's full value.

2. Literature Review

Recent studies have investigated the potential of root and tuber diversification in enhancing national food security, particularly through using underexploited crops such as Beneng taro (*Xanthosoma undipes*). Aditia et al. formulated analog rice by combining Beneng taro and *Sargassum* seaweed, reporting a fiber content of approximately 23.7% and nutritional adequacy comparable to polished rice (Aditia et al., 2023). Despite these promising results, the widespread adoption of Beneng taro remains constrained by underdeveloped post-harvest processing and limited consumer familiarity. The authors emphasized the importance of improving food processing technologies, community education, and supportive regulatory frameworks.

In another experimental study, Nurtiana et al. examined the substitution of wheat flour with Beneng taro flour in muffins (Nurtiana et al., 2023). While their findings confirmed its high dietary fiber and nutritional value, they also noted that higher substitution ratios negatively affected texture and crust color, highlighting sensory limitations that require further product innovation.

Further development was undertaken by Suherna et al., who explored the optimization and marketing of low-oxalate Beneng taro flour in gluten-free noodles (Suherna et al., 2023). Their study demonstrated that taro-based noodles met moisture standards according to SNI 8217-2015, with favorable sensory ratings in color, aroma, and texture. Two formulas were developed, Formula A, with higher protein and oxalate levels, and Formula B, with better cooking performance and higher fiber content, were generally well-accepted. This study illustrates the product's market potential while underscoring the need for oxalate reduction techniques to ensure consumer safety.

Although systematic research on using Beneng taro (*Xanthosoma undipes*) leaves as a tobacco substitute remains limited, recent studies suggest promising potential. For example, Syabana et al. conducted phytochemical analyses of taro leaves, including fragrance compounds, and discussed their feasibility as a plant-based wrapper in herbal cigarette alternatives (Syabana et

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al., 2024). Meanwhile, community-based initiatives involving farmer groups and MSMEs have begun exploring the cultivation, drying, and processing of taro leaves for such innovations. However, formal validation, encompassing safety assessments, product quality certification, and scalable production protocols, is still needed to support broader commercialization.

Recent advancements in Beneng taro (*Xanthosoma undipes*) product development include its use in baked goods and fermented flour. Replacing up to 45% of wheat flour with Beneng taro flour in sable cookies resulted in favorable sensory qualities, including color, aroma, and taste, alongside a stable shelf life of up to eight hours when stored in PET jars (Eris et al., 2024; Nurhidayati et al., 2024). Meanwhile, fermentation enhances the physicochemical properties of Beneng taro flour, including moisture retention, pH balance, and protein content, thereby increasing its functional value for a range of food applications (Wanita et al., 2023). These findings highlight the crop's promising potential in value-added food innovation, though further optimization in processing and upscaling remains necessary.

Addressing food-safety concerns, multiple studies on taro species from the Araceae family have demonstrated effective oxalate reduction techniques. Savage and Dubois reported that soaking leaves for 18 h, followed by boiling, reduced soluble oxalate content by approximately 60% (26% from soaking plus 36% additional by boiling) (Savage & Dubois, 2006). Hang et al. further confirmed that boiling peeled stems for 10–20 min can eliminate 63–80% of soluble oxalates in cooked tissues (Hang et al., 2017). Complementing these findings, Vela-Gutiérrez et al. demonstrated that heat treatment significantly reduced both oxalate and hydrocyanic acid levels in *Xanthosoma sagittifolium* and *Colocasia esculenta* corms when tested in a murine model, thereby improving safety for human consumption (Vela-Gutiérrez et al., 2022). These studies indicate that combined approaches, such as peeling, soaking, and thermal processing, are essential to detoxify naturally occurring calcium oxalate and related compounds. Implementing such protocols is therefore critical to ensuring Beneng taro is safe for consumption and viable as a carbohydrate alternative.

Building on these prior studies, the present research focuses on the diversification of Beneng taro processing methods within the local context of Central Lombok. It addresses the need for community-oriented food safety protocols, adaptive processing techniques, and stakeholder collaboration. This study contributes to the broader discourse on local food systems and regional food security by proposing context-specific innovations that align with the region's agricultural, economic, and social dynamics.

2.1. The Role of Governance in Food Security

The government plays a strategic role in ensuring national and regional food security through various integrated functions. Its responsibilities extend beyond the quantitative increase in food availability to include qualitative aspects such as equitable access, safe distribution, nutritional value, and food safety for public consumption. At the regional level, local governments are responsible for formulating context-specific policies based on available resources, supporting local food production, and establishing efficient distribution systems that ensure food reaches households effectively.

In addition, the government is vital in fostering a resilient and sustainable agricultural system. This includes providing incentives to farmers, technical assistance, and access to essential agrarian infrastructure. It also involves promoting and disseminating environmentally sustainable farming technologies. In this regard, the processing and development of locally available crops, such as Beneng taro (*Xanthosoma undipes*), offer an innovative strategy that policymakers should actively support. This approach not only enhances food resilience but also

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contributes to improving rural livelihoods. Furthermore, government intervention is critical in strengthening farmer organizations, developing efficient supply chains, and facilitating market access for locally produced agricultural commodities.

Equitable food distribution remains one of the most pressing challenges in the broader food security agenda. In many remote or underdeveloped regions, food insecurity often results more from logistical inefficiencies and poor physical access than insufficient production. Inadequate infrastructure, such as poorly maintained rural roads, a lack of storage facilities, and long transportation distances, can significantly increase food loss and reduce market access for smallholder farmers (Erwin et al., 2024; Hadi & Miru, 2024). To address these issues effectively, government investment is essential in upgrading transportation networks, establishing appropriate food logistics systems, and developing rural market infrastructure. Additionally, supporting direct linkages between producers and consumers, through mechanisms like agricultural cooperatives and digital platforms, has proven to enhance efficiency, market penetration, and income for rural communities (Hadi & Miru, 2024)

Moreover, food safety and quality assurance are integral components of governmental responsibility. Inadequate food processing can pose serious health risks, underscoring the need for robust regulatory frameworks and effective quality monitoring systems. Beneng taro contains calcium oxalate, which must be processed appropriately to ensure it is safe for human consumption. The government can play a proactive role by conducting public outreach, offering training on safe food processing practices, and providing product certification to ensure consumer protection and confidence.

Lastly, public awareness campaigns concerning food diversification should be a priority. Overdependence on a single staple crop, such as rice, can increase systemic vulnerability, particularly when production disruptions occur. Promoting food diversification based on local agricultural potential, including utilizing Beneng taro, should be widely encouraged through formal and informal educational initiatives, media outreach, and financial support for micro-entrepreneurs engaged in alternative food production.

2.2. Food Security Challenges and Policy Responses

Food is a fundamental human necessity that cannot be postponed, positioning its availability and accessibility as a core obligation of the state. Despite this imperative, Indonesia's food system faces enduring challenges, including uneven distribution, excessive reliance on imports, and declining domestic production caused by land-use conversion and environmental degradation. Although Indonesia is an agrarian nation endowed with considerable agricultural potential, numerous regions remain food insecure due to inadequate access to sufficient and nutritious food. This situation is exacerbated by rapid population growth, which places increasing pressure on the national food system. While demand escalates, domestic agricultural output has remained relatively stagnant, compelling the country to depend heavily on imports, particularly for staple commodities such as rice, wheat, and soybeans. Such dependency strains the national economy and compromises food sovereignty by exposing the country to global market volatility and disruptions in international supply chains.

Traditional agricultural systems, which once supported national food self-sufficiency, now face significant structural and ecological constraints. These include declining soil fertility, outdated farming technologies, and reduced biodiversity and water availability (Connor et al., 2011). Additionally, younger generations are increasingly reluctant to engage in farming, contributing to labor shortages and reduced knowledge transfer within rural communities (Borda et al., 2023). These systems risk further weakening without updated policy frameworks

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supporting rural agricultural communities. Addressing these complex and interconnected issues requires a transformative approach to food policy that prioritizes increased production, environmental sustainability, rural empowerment, and promoting food diversification rooted in local resources and cultural practices.

2.3. FAO's Food Security Framework and Its Relevance to Beneng Taro

According to the Food and Agriculture Organization of the United Nations, food security exists when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (p. 6) (Food and Agriculture Organization of the United Nations, 2019b). This widely accepted definition underscores that food security is multidimensional, encompassing not only the physical availability of food but also its nutritional quality, equitable distribution, and the sustainability of its production systems.

The FAO outlines four key dimensions of food security: availability, access, utilization, and stability (Food and Agriculture Organization of the United Nations, 2019b). These can be meaningfully addressed through promoting and diversifying local food crops such as Beneng taro (*Xanthosoma undipes*).

First, food availability refers to consistently having sufficient quantities of food. In this context, Beneng taro represents a promising alternative carbohydrate source, particularly in areas with soil and climatic constraints for rice or maize cultivation. It is well-suited to marginal lands and requires relatively low agricultural inputs, making it a viable option for expanding local food production beyond conventional staples.

Second, food access pertains to individuals' ability to obtain food physically and economically. Value-added products derived from Beneng taro, such as gluten-free flour, noodles, and snack items, can be developed relatively cheaply, mainly when supported by local processing initiatives. With appropriate distribution systems and community-level interventions, such products can improve access to nutritious food, particularly in rural or underserved regions.

Third, food utilization relates to the effective biological use of food, which depends on dietary diversity, food safety, and health conditions. Beneng taro is high in dietary fiber and has a low glycemic index linked to digestive health and glycemic control. However, it contains calcium oxalate, which can be toxic if not properly processed. Therefore, public education on safe preparation techniques, such as peeling, soaking, boiling, or fermenting, is critical to unlocking its nutritional benefits (Hang et al., 2017; Savage & Dubois, 2006; Vela-Gutiérrez et al., 2022).

Fourth, food stability emphasizes the reliability of food access and availability over time. Beneng taro can be cultivated year-round as a climate-resilient perennial crop, tolerating environmental stressors such as drought or poor soil fertility. Its adaptability enhances the resilience of local food systems, particularly in the face of climate change and global supply chain disruptions. Promoting underutilized crops supports diversification of food systems and reduces dependency on imported or monoculture staples, strengthening long-term food security.

3. Research Methodology

This study adopts a qualitative research design grounded in an inductive approach. According to Creswell, qualitative research aims to explore and understand the meaning individuals or groups ascribe to social or human problems, emphasizing emerging questions and procedures, data typically collected in the participants' setting, data analysis inductively building from particulars to general themes, and the researcher as the key instrument (Creswell, 2013). As part of the research preparation, preliminary activities, including site identification, stakeholder

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mapping, and contextual review, were conducted in 2024 to establish the empirical and conceptual foundation for fieldwork.

The inductive logic employed in this study follows the process described by Lincoln and Guba, where findings emerge from the data through pattern recognition, category construction, and iterative comparison. Themes are not imposed a priori but are discovered through immersion in empirical material (Lincoln & Guba, 1985). The role of the researcher is central in this process, not merely as a data collector, but as a reflexive and interpretive agent whose engagement with the field influences the production of knowledge (Patton, 2015).

Fieldwork was conducted in Teruwai Village, located in Pujut Subdistrict, Central Lombok Regency, West Nusa Tenggara Province. The area was selected based on the presence of local communities engaged in small-scale cultivation and informal processing of Beneng taro (*Xanthosoma undipes*). Five informants were selected using a combination of purposive and snowball sampling strategies, ensuring the inclusion of directly relevant stakeholders. These included one small-scale food processor, one farmer, two officials from the Central Lombok Food Security Office, and one representative from the Department of Agriculture.

While the number of participants was limited, this was a deliberate methodological decision aligned with qualitative principles emphasizing depth over breadth. Given the study's focus on a neglected crop and the early stage of its development in the region, only a small number of individuals possessed experiential knowledge or institutional involvement. As Patton notes, information-rich cases are particularly valuable in exploratory studies aiming to uncover insights from key actors, rather than to generalize across populations (Patton, 2015).

Data collection involved semi-structured interviews, direct field observations, and documentation review. The researcher acted as the primary instrument, engaging directly with participants and the surrounding environment. Thematic coding was employed to analyze the data, involving a recursive interaction between field material and conceptual categories to identify emerging patterns and relationships.

This qualitative approach was chosen to capture the complexity of local knowledge, institutional framings, and socio-economic practices often overlooked by positivist or quantitative methodologies. It allows for a nuanced understanding of how Beneng taro is embedded in the lifeworlds of local actors, including its agricultural, cultural, and economic dimensions. The study aims to contribute theoretically grounded and empirically rich insights to ongoing debates on food diversification and rural sustainability through this flexible and context-sensitive framework.

4. Results

4.1. Absence of Institutional Recognition and Programmatic Support

The findings reveal a consistent pattern of institutional neglect regarding *Beneng taro* (*Xanthosoma undipes*) within the regional food security and agricultural development policy framework in Central Lombok. Interviews with civil servants from the Regional Food Security Agency (*Dinas Ketahanan Pangan*) and the Department of Agriculture indicate that the crop is not included in any official priority list or strategic plan, such as the *Rencana Aksi Daerah Pangan dan Gizi* (RAD-PG) or regional food diversification programs under the Ministry of Agriculture's directives. As confirmed by multiple key informants, no official record or inventory documents the extent of *Beneng taro* cultivation, the state has funded no pilot project, and no government subsidies have been allocated for its development.

This absence of formal institutional recognition has concrete implications. Without integration into the local government's agricultural programs, *Beneng taro* remains excluded from

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the routine extension services, technology dissemination, and farmer capacity-building workshops accessible to more mainstream crops like rice, corn, or chili. Field officers admitted that their technical guidelines (*petunjuk teknis*) and performance targets do not include *Beneng taro*, effectively removing the crop from planning and accountability mechanisms within the bureaucratic apparatus.

This institutional invisibility is mirrored at the grassroots level. Local farmers, including individuals like Suratman, repeatedly described how *Beneng taro* grows "by itself" (*tumbuh sendiri*) and is commonly used to fill unused land patches or serve as emergency food during lean periods. The lack of market certainty and the absence of formal support have led farmers to treat it as a marginal species that is not worth investing labor or capital in. The term "*liar*" (wild) was frequently used to describe the crop, indicating its ecological character and social and economic positioning in the rural knowledge system. Other interviewees called it "*pengisi lahan kosong*" (land filler), a linguistic cue that encapsulates its role as a stopgap rather than a valued agricultural commodity.

Moreover, the absence of institutional attention has broader structural implications. Without government recognition, *Beneng taro* is excluded from data-driven policymaking processes, including agricultural census activities, food security vulnerability maps, and subsidy distribution schemes. This exclusion reinforces a feedback loop in which the crop's marginality justifies its continued neglect. Notably, no regulations, circular letters, or local bylaws (*peraturan daerah*) were identified that explicitly support its development or inclusion in regional food security strategies.

This theme points to a deeper structural issue: the technocratic orientation of food policy in the region, which privileges standardized, high-yield crops backed by national directives, while disregarding locally adapted and culturally embedded species. Such neglect of *Beneng taro*, despite its ecological resilience and cultural familiarity, reflects a gap between policy imaginaries and on-the-ground agrarian realities. The absence of state-driven initiatives limits the crop's development potential. It deprives rural communities of a viable option for food sovereignty and agroecological adaptation in the face of climate and market uncertainties.

4.2. Fragmented Knowledge and Practices in Detoxification and Processing

The research identifies a fragmented landscape of knowledge and practices related to detoxifying and processing *Beneng taro* (*Xanthosoma undipes*) at the community level. Although the crop is locally recognized for its nutritional potential, particularly as an alternative carbohydrate source, its natural content of calcium oxalate, a compound that can cause irritation or toxicity if consumed raw, necessitates proper processing. However, this study finds that knowledge about detoxification remains uneven, primarily informal, and lacks integration into public health or agricultural extension systems.

Interviews with women in household food preparation revealed that traditional detoxification techniques are typically learned through oral transmission from older family members. One informant, Aminah, described how her grandmother taught her to soak sliced *Beneng taro* tubers in salted water overnight and boil them for several minutes before consumption. This method aligns with broader ethnobotanical practices in the region and is consistent with findings from previous research on oxalate-reducing techniques through soaking and thermal processing. Yet, this knowledge is neither universal nor consistently practiced. Several households observed during fieldwork employed shorter soaking durations or skipped boiling altogether, introducing a potential food safety risk.

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This inconsistency is further compounded by the absence of formalized, science-based guidelines disseminated by health or agricultural authorities. Despite the growing public interest in alternative food sources, no posters, leaflets, or community outreach programs provided instructions on safe preparation methods. Some respondents reported learning about detoxification through informal conversations or social media, but few had access to verified or standardized information.

Regarding advanced processing, fermentation is recognized among a small subset of informants but remains marginal. While a few community members know fermentation could enhance shelf life and reduce bitterness, they lack the microbiological understanding and technical infrastructure to implement it safely. None of the visited households possessed fermentation vessels with temperature control, and hygienic standards varied widely; the absence of community-based training or demonstration plots on post-harvest processing further limits experimentation and uptake.

In contrast, drying and milling *Beneng taro* into flour, an essential step in developing value-added food products, is almost absent from local practice. Although women in nearby districts have commercialized taro-based cookies and cakes, no such enterprise or cooperative has yet emerged in the Central Lombok research sites. Flour production involves multiple stages, including slicing, drying, and grinding, that require tools not readily available in rural households. As a result, even those who wish to develop *Beneng taro* beyond basic household consumption are deterred by equipment shortages, lack of technical guidance, and uncertainty about market demand.

This theme highlights the structural marginalization of indigenous processing knowledge, which, while rich in context-specific adaptation, is vulnerable to erosion without institutional support. Without targeted government intervention or NGO facilitation, local practices risk remaining fragmented, unstandardized, and insufficient to support the crop's transition from subsistence to sustainable commodity. Developing comprehensive training programs, integrating traditional knowledge with scientific validation, and investing in community-scale processing infrastructure are critical steps toward realizing *Beneng taro*'s full potential in food diversification and rural development.

4.3. Emerging, Yet Isolated, Innovations in Value Addition

Amid the absence of structured institutional frameworks, this study identified small-scale, community-driven innovations to add value to *Beneng taro* (*Xanthosoma undipes*), although these efforts remain sporadic and unsupported. A few informants, particularly women in peri-urban households, have developed rudimentary methods to process the tubers into flour. Field observations revealed workflows that included manual slicing, open-air sun-drying on woven mats, and grinding using modified household blenders or traditional stone mills. While these methods demonstrate local ingenuity, they are highly labor-intensive and operate without standardization of processing duration, temperature control, or post-processing hygiene protocols.

Participants consistently reported several challenges in attempting to develop *Beneng taro*-based products. First, packaging remains a key constraint, particularly in maintaining shelf life and protecting the flour from humidity and microbial contamination. Many participants lacked access to vacuum sealers or food-grade packaging, relying instead on reused plastic containers or open polyethylene bags. Second, hygiene and food safety standards were inadequately met, as production occurred within domestic spaces without access to clean water, stainless-steel

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surfaces, or proper waste disposal systems. These limitations threaten consumer safety and market competitiveness, especially in regulated environments.

In terms of market access, participants expressed difficulty in registering microenterprises due to bureaucratic hurdles associated with obtaining *izin usaha mikro* (microbusiness permits) and product safety certification (*PIRT* or *Sertifikat Produksi Pangan Industri Rumah Tangga*). These administrative challenges were further exacerbated by limited digital literacy, unfamiliarity with online registration platforms, and a lack of facilitation from local agencies or NGOs. As a result, most products are sold informally, within narrow community circles, or distributed as part of social events rather than commercial outlets. The absence of cooperative support or inclusion in formal supply chains reinforces the marginality of these efforts.

Beyond food products, the study also documented emerging alternative uses of *Beneng taro* biomass. In several sites, dried leaves were used as a substitute for herbal tobacco in rolled cigarettes or repurposed as supplementary fish feed in household-scale aquaculture systems. However, these uses were experimental, lacking nutritional profiling, phytochemical analysis, or compliance with relevant agricultural or food safety regulations. No informant reported any engagement with agricultural extension officers, research institutions, or product development agencies regarding these innovations.

The continued perception of *Beneng taro* as a "fallback crop", grown passively on unused land or during off-seasons, limits its symbolic and material value within the rural economy. Informants repeatedly described the plant as "*pengisi lahan kosong*" (land filler) or "*makanan darurat*" (emergency food), reinforcing its subordinate status relative to rice, maize, or cassava. This perception is not merely cultural but is structurally embedded, shaped by the absence of formal acknowledgment in policy planning, agricultural extension curricula, or subsidy schemes.

Nevertheless, the existence of localized value-added initiatives, despite structural constraints, indicates a latent potential that could be activated through targeted interventions. These include training programs on food processing and hygiene standards, simplified business registration services, and the creation of marketing cooperatives or digital platforms to aggregate and promote *Beneng taro* products. By linking grassroots experimentation to institutional support structures, *Beneng taro* can evolve from an underutilized crop into a meaningful contributor to local economic development, food system resilience, and agroecological innovation.

5. Discussion

5.1. Strategic Role of Beneng Taro in Food Security

The strategic potential of Beneng taro (*Xanthosoma undipes*) in addressing regional food security in Central Lombok can be examined through the four dimensions defined by the Food and Agriculture Organization of the United Nations: availability, access, utilization, and stability (Food and Agriculture Organization of the United Nations, 2019b). Field data indicate that this underutilized crop exhibits agronomic characteristics highly compatible with sustainable, localized food systems, particularly in resource-constrained environments.

Regarding availability, Beneng taro demonstrates strong adaptability to marginal soils, low rainfall, and minimal input conditions. Its perennial nature and ability to regenerate from tuber segments allow continuous cultivation, even outside formal cropping cycles. These traits make it particularly relevant for increasing food supply in areas unsuitable for rice or maize cultivation. Local observations confirmed that the crop often thrives in neglected plots without requiring external inputs, suggesting its suitability for promoting agroecological food production.

Despite these ecological advantages, Beneng taro remains excluded from formal agricultural planning and food security programming. Interviews with officials from the Regional Food

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Security Agency and the Department of Agriculture confirmed that the crop has not been incorporated into the Regional Medium-Term Development Plan (RPJMD), nor is it included in official databases or technical outreach initiatives. No structured extension services, financial incentives, or pilot programs currently support its cultivation. This institutional absence reflects a governance gap that hinders the formal recognition of the crop and limits its development potential. Consequently, the crop continues to be categorized as "wild" or a "land filler" rather than a strategic food resource.

Concerning access, the lack of policy and programmatic support directly impacts smallholder farmers' ability to cultivate and utilize Beneng taro effectively. Interviews revealed that while the plant is easy to grow and resilient to pests and drought, farmers receive no training, guidance, or market information regarding its optimal use. The crop's low visibility in agricultural policy frameworks contributes to weak adoption incentives, leaving it largely dependent on individual initiative rather than systemic support.

Concerning utilization, traditional knowledge of detoxification techniques, such as soaking and boiling, is widespread but inconsistently practiced. Typically transmitted orally across generations, these methods have not been standardized or incorporated into formal food safety campaigns. As a result, concerns about calcium oxalate toxicity persist among consumers and producers. These findings are consistent with previous research, which emphasizes the need for combined detoxification protocols, such as peeling, soaking, boiling, and fermentation, to ensure the safe consumption of taro species (Hang et al., 2017; Savage & Dubois, 2006; Vela-Gutiérrez et al., 2022). The absence of government-backed processing guidelines and public awareness efforts has further constrained the crop's wider culinary acceptance.

Regarding stability, Beneng taro provides a continuous food source throughout the year, contributing to the resilience of household food systems. Its regenerative properties and drought tolerance position it as a buffer crop in periods of seasonal scarcity or during disruptions to supply chains caused by climate variability. Yet, its stabilizing potential remains underutilized without integration into local climate adaptation plans or food diversification strategies.

Although Beneng taro aligns with the FAO's four pillars of food security and offers tangible benefits to local food systems, it remains institutionally marginalized. The findings of this study highlight a critical disconnect between the crop's agronomic promise and its exclusion from formal governance mechanisms. Addressing this gap will require deliberate policy interventions to incorporate Beneng taro into local development planning, strengthen agricultural extension services, and establish food safety education campaigns that promote its safe and effective use.

5.2. Economic Potential and Diversification Opportunities

Beneng taro (*Xanthosoma undipes*) presents a range of economic opportunities through food and non-food product diversification, yet these remain largely untapped within the local context of Central Lombok. Experimental studies have demonstrated the crop's considerable potential in functional food innovation. Aditia et al. developed analog rice using Beneng taro and Sargassum seaweed, achieving fiber content up to 23.7 percent and a nutritional profile comparable to polished rice (Aditia et al., 2023). Suherna et al. successfully optimized low-oxalate Beneng taro flour in gluten-free noodles that met Indonesian National Standard (SNI 8217-2015) for moisture content and were favorably rated in sensory evaluations (Suherna et al., 2023). Likewise, Eris et al. (2024) formulated cookies with up to 45 percent Beneng taro flour substitution, showing positive consumer acceptance regarding color, aroma, and taste.

However, findings from this study indicate a significant gap between experimental innovations and community-level adoption. Despite the promising scientific research outputs,

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most local households and micro-enterprises have yet to implement these techniques or replicate the tested formulations. Field observations reveal that while some individuals engage in rudimentary processing, such as slicing, drying, and grinding taro into flour, these practices are inconsistent, lack standardization, and are rarely informed by formal research results. This disconnect underscores the limitations of top-down innovation models that fail to embed scientific findings within local economic practices.

Regarding flour production, participants cited challenges related to drying infrastructure, hygiene control, shelf-life maintenance, and packaging materials. These technical barriers are compounded by institutional constraints, such as the absence of training programs, limited access to food safety certification, and the bureaucratic complexity of obtaining micro-enterprise licenses. As a result, grassroots innovations remain fragmented and struggle to reach commercial scale.

Beyond food applications, the crop's non-food economic potential is also emerging, albeit in isolated forms. Several informants mentioned using dried leaves for herbal cigarette production or repurposing tuber waste as fish feed. These alternative uses have not yet undergone formal validation or safety assessments, nor are they supported by regulatory frameworks or entrepreneurial ecosystems. Consequently, such innovations remain informal, experimental, and economically marginal.

The broader market potential of Beneng taro is further constrained by weak value chain integration and limited consumer awareness. Although studies like those by Widyastuti and Rahmawati have highlighted the health benefits of Beneng taro flour, particularly its resistant starch and gluten-free properties, such knowledge is not widely disseminated among producers or consumers in Central Lombok (Widyastuti & Rahmawati, 2022). This knowledge gap hampers demand creation and inhibits entrepreneurial confidence.

In light of these findings, it is evident that the economic promise of Beneng taro remains rhetorical, mainly in the absence of coordinated interventions to bridge research outputs and local practice. While scientific studies have laid a solid foundation for product development, actual uptake at the community level has been minimal. This calls for a reorientation of innovation strategies toward co-production models, where scientists, extension agents, farmer cooperatives, and small-scale processors collaborate to contextualize, adapt, and disseminate processing techniques that are economically viable and socially embedded. Without such integrative approaches, the economic potential of Beneng taro is unlikely to translate into sustainable rural livelihoods or meaningful contributions to regional agri-food systems.

5.3. Institutional Support and Policy Implications

Institutional support transforms underutilized crops such as Beneng taro (*Xanthosoma undipes*) into economically viable and nutritionally significant commodities. However, findings from this study reveal a persistent lack of formal recognition, programmatic backing, and logistical facilitation for the crop within the agricultural governance framework of Central Lombok. Interviews with officials from the Regional Food Security Agency and Department of Agriculture confirmed that Beneng taro is absent from regional development plans, including the *Rencana Pembangunan Jangka Menengah Daerah* (RPJMD), and is excluded from agricultural subsidy schemes, extension programs, or official crop databases.

This institutional vacuum has tangible consequences on the ground. Farmers and household processors reported having no access to technical training in cultivation or post-harvest processing techniques, particularly those related to detoxification and food safety. Many respondents also identified financial and bureaucratic barriers to obtaining *Izin Usaha Mikro dan*

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Kecil (IUMK), which is required to formalize micro-enterprises and access government programs. Without such legal status, local producers are effectively excluded from procurement opportunities, business development services, and public procurement initiatives.

Moreover, the issue of logistical inefficiency remains a structural impediment to market integration. Inadequate transportation networks, lack of storage facilities, and poor access to packaging and distribution infrastructure severely limit the scalability of Beneng taro-based products. As Hadi and Miru emphasized, these constraints are particularly detrimental in rural areas, where high transaction costs and physical inaccessibility discourage production and consumer demand (Hadi & Miru, 2024). In the case of Beneng taro, the absence of cold chain systems, processing hubs, or coordinated supply chains contributes to high post-harvest losses and weakens the economic incentives for commercialization.

The institutional neglect of this crop also reflects a deeper governance issue, the prioritization of major commodities at the expense of indigenous or alternative food resources. This bias has marginalized community-based innovation and impeded inclusive development strategies. Although scattered individual initiatives have emerged, such as small-scale flour production or alternative uses of taro leaves, these remain unsupported by any form of cooperative structure, extension service, or marketing platform. Without proactive state intervention, such grassroots efforts risk stagnation or failure.

A recalibration of agricultural policy and food security strategy is needed to address these issues. First, Beneng taro should be formally included in local and regional development agendas, supported by dedicated funding, technical guidelines, and data collection initiatives. Second, training modules on safe processing, value addition, and business management should be developed in collaboration with agricultural extension workers, vocational institutions, and local universities. These efforts must prioritize participatory methods sensitive to local knowledge systems and cultural practices.

Third, regulatory simplification and facilitation of IUMK issuance would enable small producers to access microfinance, formal markets, and capacity-building programs. Fourth, infrastructural investments in rural logistics, such as farm-to-market roads, storage units, and processing centers, are essential for reducing transaction costs and improving market connectivity. These initiatives would enhance the economic viability of Beneng taro but also contribute to broader goals of rural development, food diversification, and climate resilience.

In sum, the absence of institutional infrastructure has marginalized Beneng taro and undermined its potential contribution to food security, rural livelihoods, and sustainable agriculture. Institutional reform, logistical development, and policy innovation are urgently required to support the transition of Beneng taro from a marginal "land filler" crop to a recognized and valuable element of local agri-food systems.

5.4. Local Knowledge and Transfer Gaps

The viability of Beneng taro (*Xanthosoma undipes*) as a sustainable food source is not solely dependent on institutional or infrastructural support but also on the continuity and effectiveness of local knowledge systems. This study found that knowledge related to the detoxification and processing of Beneng taro is predominantly oral, fragmented, and inconsistently applied across communities. While specific households have preserved traditional techniques, such as soaking, boiling, or sun-drying to reduce calcium oxalate content, these practices vary widely in execution and efficacy, with no standardized guidance or community-wide protocols.

These findings mirror prior studies on taro species within the *Araceae* family. Savage and Dubois emphasized the importance of soaking and thermal treatment in oxalate reduction

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(Savage & Dubois, 2006), while Vela-Gutiérrez et al. demonstrated that combined preparation methods significantly improve food safety outcomes (Vela-Gutiérrez et al., 2022). However, such scientific evidence has not been meaningfully translated into community practice in Central Lombok. The absence of outreach mechanisms or participatory education models has hindered the integration of empirical findings with lived practices.

Moreover, intergenerational knowledge transfer appears to be weakening. As noted by Borda et al., the erosion of agricultural interest among younger generations has disrupted the continuity of ecological and food-related skills in many rural settings (Borda et al., 2023). In the case of Beneng taro, a similar pattern is evident. Few young people possess or are interested in acquiring the experiential knowledge of detoxification and post-harvest processing, resulting in an overreliance on elderly family members. In several households, the loss or absence of key individuals has already led to the abandonment of taro use due to fears of toxicity or uncertainty regarding preparation techniques.

The fragmentation of oral knowledge also presents tangible public health risks. Observations revealed that some families employed incomplete or shortened detoxification processes, such as minimal soaking or insufficient boiling, raising concerns about potential oxalate exposure. Without formal food safety regulation or accessible public information, community members often rely on trial-and-error or anecdotal instructions, which vary in accuracy and safety.

The lack of interface between traditional practices and formal extension services exacerbates this knowledge gap. Agricultural officers interviewed in this study admitted that Beneng taro is rarely, if ever, addressed in training modules or food safety campaigns. This disconnect marginalizes the crop further and disincentivizes experimentation and learning at the household level. Local practices may become obsolete without targeted support, and the community's capacity to process the crop safely and effectively will diminish over time.

Integrated strategies are needed to preserve and enhance community knowledge of Beneng taro. First, participatory documentation of existing practices should be initiated to map out diverse methods of processing and detoxification. Second, scientific validation of these traditional techniques can build local confidence and support knowledge retention. Third, intergenerational learning should be actively fostered through school programs, village workshops, and youth engagement initiatives that bridge empirical knowledge and local experience.

Ultimately, safeguarding and revitalizing local knowledge is critical to ensuring the long-term integration of Beneng taro into the food system. The preservation of oral heritage, when aligned with evidence-based standards, not only addresses food safety concerns but also reinforces cultural resilience and adaptive capacity in the face of environmental and nutritional challenges.

5.5. Symbolic Marginality and Product Perception

Beyond agronomic constraints and infrastructural limitations, the marginal status of Beneng taro (*Xanthosoma undipes*) in Central Lombok is reinforced through social perception and symbolic food hierarchies. Despite its ecological suitability and nutritional potential, local communities predominantly regard the crop as *tanaman liar* (wild plant) or *pengisi lahan kosong* (land filler), reflecting its low cultural capital and peripheral status in the regional food imagination. This symbolic marginality profoundly influences local production choices, household consumption patterns, and entrepreneurial engagement.

Field observations revealed that Beneng taro remains a fallback crop, utilized sporadically, often only during economic hardship or food scarcity. It is rarely cultivated with intention, managed for quality, or processed with the same care afforded to more commercially respected

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crops such as cassava, banana, or sweet potato. The absence of visual or linguistic markers of prestige, such as standardized packaging, public promotion, or state endorsement, further reinforces its invisibility within formal and informal markets. As Bourdieu suggests, food hierarchies are socially constructed and mediated by taste, class, and power (Bourdieu, 2018). In this case, Beneng taro has been relegated to the margins of culinary practice and economic value.

The absence of product identity or local branding further compounds this symbolic relegation. While some households have begun experimenting with flour production or leaf-based innovations, these efforts are highly individualized, lacking collective visibility or market recognition. No cooperative or producer group has yet emerged to standardize quality, articulate shared narratives, or build consumer trust through certification and design. As a result, Beneng taro products remain anonymous in local markets, often sold in unmarked packaging without nutritional information or brand story, making them less competitive and easily dismissed by urban consumers.

The absence of strategic branding limits market reach and undermines the crop's symbolic repositioning. Widyastuti and Rahmawati noted that alternative flours such as Beneng taro hold strong potential in the health food segment due to their high fiber and resistant starch content (Widyastuti & Rahmawati, 2022). Yet, this potential remains unrealized in Central Lombok due to a lack of consumer-oriented marketing, weak narrative framing, and limited visual identity that could position the crop as nutritious, local, and culturally meaningful.

Furthermore, the symbolic framing of Beneng taro is shaped by generational attitudes. The crop is often associated with poverty or backwardness among youth and younger adults, further stigmatizing its usage and impeding innovation. This negative perception will likely persist and deepen without efforts to revalorize traditional crops through school programs, culinary festivals, or media storytelling. As emphasized by recent studies on alternative foods (Eris et al., 2024; Suherna et al., 2023), product image and cultural narrative are crucial in determining consumer acceptance, especially in post-harvest innovation and food system diversification.

Multi-scalar interventions are required to shift these entrenched perceptions. First, local government and NGOs could collaborate to develop place-based branding that frames Beneng taro as a resilient, healthy, and climate-adaptive food. Second, training in packaging design, labeling standards, and market positioning must be extended to local producers. Third, digital and culinary media storytelling could help reconstruct public narratives around Beneng taro, not as a marginal plant, but as a source of innovation, health, and identity rooted in local agroecological traditions.

The marginality of Beneng taro is not merely a function of biological or economic constraints but a symbolic condition reproduced through language, social valuation, and policy omission. Addressing this condition requires more than technical fixes; it demands cultural recognition, representational strategies, and systemic support for vernacular food futures.

6. Conclusion

This study has examined the socio-agronomic potential and institutional neglect of Beneng taro (*Xanthosoma undipes*) within local food security in Central Lombok, Indonesia. The research reveals four critical dimensions based on field interviews, household observations, and thematic analysis.

First, although Beneng taro demonstrates ecological resilience and high nutritional value, it remains excluded from formal development planning. It is absent from the Regional Medium-Term Development Plan (RPJMD), receives no support through agricultural extension services, and is not included in government food security databases or subsidy programs. Second, local

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knowledge about detoxification and processing, particularly to reduce calcium oxalate levels, persists through oral tradition, but remains fragmented and inconsistent. This raises public health concerns and highlights the lack of technical standardization or institutional support in safe food preparation.

Third, grassroots innovations in product development, including flour-making and leaf utilization, indicate an emerging entrepreneurial interest. However, these efforts remain isolated due to financial constraints, lack of market access, inadequate technical training, and the absence of micro-enterprise licensing. Lastly, the symbolic framing of Beneng taro as a wild, secondary, or fallback crop has marginalized its cultural and economic status, impeding wider adoption and commercialization. Without strategic branding or collective representation, the crop remains peripheral in the marketplace and the local food imagination.

Several limitations of this study must be acknowledged. The research was conducted in a single regency (Central Lombok). It may not reflect the diversity of practices, perceptions, and institutional responses in other regions where Beneng taro is grown. The study also focused on qualitative field data. It did not include a biochemical or nutritional analysis of locally processed Beneng taro products, which could have further validated their food safety and commercial viability. Additionally, the perspectives of policymakers beyond the district level, such as provincial or national agricultural authorities, were not systematically included.

Future studies should consider expanding the geographic scope to include comparative insights from other Beneng taro-growing regions in Indonesia. Interdisciplinary research involving food scientists, agricultural economists, and policy analysts is needed to evaluate the full value chain of Beneng taro, from cultivation and processing to distribution and consumption. Moreover, experimental studies could explore the efficacy of different detoxification and fermentation techniques in community-based settings to establish scalable safety protocols. Investigations into branding strategies, consumer behavior, and symbolic food hierarchies would deepen our understanding of repositioning marginalized crops within contemporary food systems.

Ultimately, advancing the role of Beneng taro in sustainable agriculture and food security requires not only agronomic and technical innovations but also structural support, cultural recognition, and policy reform. This study contributes to that conversation by situating local practices and knowledge at the center of food system transformation in Indonesia.

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The authors have declared no potential conflicts of interest regarding this article's research, authorship, and/or publication.

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About the Authors

1. **Lalu Ahmad Murdhani** is an Assistant Professor at Institut Pemerintahan Dalam Negeri (IPDN), Indonesia, in the Public Safety and Security Management Study Program. He earned his Master of Management degree from Universitas Mataram in 2009. His teaching includes courses on disaster management, national resilience, and character development. He has been involved in research and community service initiatives related to disaster risk, village governance, and environmental awareness, with publications in national and international journals.
   E-Mail: murdhani.md@gmail.com

2. **Mujahidin** is an Assistant Professor at Institut Pemerintahan Dalam Negeri (IPDN), Indonesia, in the Public Safety and Security Management Study Program. He earned his Doctoral degree from Universitas 17 Agustus 1945 Surabaya in 2024, after completing his Master of Management at Universitas Mataram and his Bachelor's degree in Social Sciences at Universitas Brawijaya. His academic interests include disaster resilience, public sector management, and digital learning. He has actively participated in research and community engagement initiatives related to disaster mitigation, village governance, and environmental awareness.
   E-Mail: mujahidin@ipdn.ac.id

3. **Erfan Wahyudi** is an Assistant Professor at Institut Pemerintahan Dalam Negeri (IPDN), Indonesia, in the Public Safety and Security Management Study Program. He earned his Master of Computer Science from Universitas Islam Indonesia in 2018, after completing his Bachelor's degree at STMIK Amikom in 2016. He teaches courses on digital governance and applied research methodology. His academic interests include digital forensics, cybersecurity, and community empowerment in disaster-affected areas, and he has been actively involved in various research and community service programs in West Nusa Tenggara.
   E-Mail: erfan.wahyudie@gmail.com

https://doi.org/10.33019/society.v13i1.769

4. **Marzuki** is an Assistant Professor at Institut Pemerintahan Dalam Negeri (IPDN), Indonesia, in the Public Safety and Security Management Study Program. He earned his Master of Science degree from Universitas Mataram in 2012, after completing his undergraduate studies in Agricultural Science at Universitas Islam Al-Azhar in 1996. He teaches courses on national resilience, public administration, and government communication. His research focuses on disaster resilience, digital governance, and public service innovation, and he has been actively involved in community engagement programs, particularly in areas related to village governance and administrative capacity building.
E-Mail: marzukipacu64@gmail.com

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