Assessing Agricultural Production Availability for Food Security in Gianyar Regency, Bali

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Abstrak

Tujuan: Kajian ini bertujuan untuk menganalisis kondisi ketahanan pangan di Kabupaten Gianyar berdasarkan empat dimensi FAO (ketersediaan, aksesibilitas, pemanfaatan, dan stabilitas), mengidentifikasi wilayah yang rentan beserta faktor-faktor yang memengaruhinya, serta merumuskan strategi penguatan ketahanan pangan yang berkelanjutan. **Desain/metodologi/pendekatan:** Penelitian menggunakan pendekatan kuantitatif deskriptif yang didukung analisis kualitatif, dengan teknik sensus jenuh terhadap 70 desa/kelurahan di tujuh kecamatan dan 140 responden pemangku kepentingan desa serta kelembagaan Subak, diolah menjadi Indeks Persepsi Deskriptif dan dipadukan dengan data sekunder BPS, Kementerian Pertanian, dan SSGI Kemenkes. **Temuan:** Ketahanan pangan Kabupaten Gianyar berada pada klasifikasi Stabil untuk seluruh delapan komoditas pokok (indeks tertinggi beras 78,89%, terendah perikanan 64,25%), dengan capaian dimensi tertinggi pada pemanfaatan (73,86%) dan terendah pada stabilitas (66,80%); Kecamatan Ubud, Gianyar, dan Sukawati merupakan wilayah paling rentan akibat tekanan pariwisata dan alih fungsi lahan (diidentifikasi oleh 47,1% responden), di tengah penyusutan lahan baku sawah sebesar 33,65% (2015–2024). **Implikasi:** Diperlukan strategi berlapis yang memprioritaskan penguatan stabilitas pangan melalui sistem informasi harga, penegakan regulasi lahan pertanian pangan berkelanjutan (LP2B), serta penguatan kelembagaan Subak untuk menjaga keberlanjutan ketahanan pangan di daerah berbasis pariwisata.

Kata Kunci: ketahanan pangan, ketersediaan pangan, alih fungsi lahan, indeks persepsi, Gianyar

Abstract

Purpose: This study analyzes the condition of food security in Gianyar Regency based on the FAO's four dimensions (availability, accessibility, utilization, and stability), identifies vulnerable areas and their determining factors, and formulates strategies for sustainable food security strengthening. **Design/methodology/approach:** A quantitative descriptive approach supported by qualitative analysis was used, employing total sampling (census) of 70 villages/kelurahan across seven sub-districts and 140 village- and Subak-institution stakeholder respondents, processed into a Descriptive Perception Index and triangulated with secondary data from BPS, the Ministry of Agriculture, and the Ministry of Health's SSGI. **Findings:** Gianyar's food security falls into the Stable category for all eight staple commodities (highest index: rice, 78.89%; lowest: fisheries, 64.25%), with the highest dimension score for utilization (73.86%) and the lowest for stability (66.80%); Ubud, Gianyar, and Sukawati sub-districts are the most vulnerable due to tourism pressure and land-use conversion (cited by 47.1% of respondents), amid a 33.65% decline in wet-rice (sawah) land area between 2015 and 2024. **Implications:** A layered strategy that prioritizes food-price information systems, enforcement of Sustainable Agricultural Land (LP2B) regulations, and strengthening of Subak institutions is needed to sustain food security in a tourism-dependent region.

Keywords: food security, food availability, land-use conversion, perception index, Gianyar

INTRODUCTION

Food security remains one of the most persistent challenges of sustainable development, encompassing not merely the physical presence of food but the interlocking conditions of availability, accessibility, utilization, and stability that the Food and Agriculture Organization (FAO) identifies as its four constitutive dimensions (Barrett, 2021; Calicioglu et al., 2019). Achieving food security in times of compounding crises—climate variability, land-use competition, and demographic change—requires continuous empirical monitoring rather than one-off assessment, since the interaction of these dimensions varies markedly across regions and over time (Galanakis et al., 2025; Swaminathan, 2010). In Indonesia, this challenge is intensified by rapid land conversion, which several recent studies identify as one of the principal structural threats to national food self-sufficiency (Rondhi et al., 2026; Amelia et al., 2026; Tiftazani et al., 2025).

Bali Province exemplifies this tension in an acute form. Decades of tourism-led economic growth have generated a land-rent differential in which the economic return from converting agricultural land to hotels, villas, and tourism infrastructure substantially exceeds the return from continued rice or horticultural production, creating a persistent structural incentive for landowners to convert productive sawah into non-agricultural uses (Mahaendrayasa et al., 2024; Suganda & Setyono, 2026). Sumadi (2024) frames this dynamic explicitly as a competition between the right to land, the right to food, and the right to tourism, arguing that Bali's traditional subak irrigation institution—a cooperative, temple-centered water-management system recognized by UNESCO as part of the Cultural Landscape of Bali—can serve as an institutional anchor for reconciling agricultural sustainability with tourism growth. Empirical work on subak-managed landscapes elsewhere in Bali similarly shows that the durability of local irrigation institutions is a strong predictor of continued agricultural sustainability even under external economic pressure (Suasih et al., 2024), while modernization of Indonesia's rice-irrigation infrastructure more broadly is repeatedly identified as a precondition for maintaining productivity as arable land shrinks (Tirtalistyani et al., 2022).

Gianyar Regency occupies a particularly instructive position within this dynamic. It is simultaneously home to Ubud—one of Bali's most intensively developed international tourism destinations—and to some of the island's most productive rice-growing landscapes and subak networks, spread across seven sub-districts (Ubud, Gianyar, Sukawati, Blahbatuh, Tampaksiring, Tegallalang, and Payangan) comprising 70 villages and kelurahan. This dual identity makes Gianyar a compact natural laboratory for observing how tourism-driven land-use change interacts with the four FAO food-security dimensions at a sub-regional scale. The regency's local government has responded with a series of protective policy instruments, most notably Gianyar Regency Regulation (Perda) Number 1 of 2020 on Sustainable Agricultural Land (Lahan Pertanian Pangan Berkelanjutan, LP2B), which is intended to fix a minimum protected area of productive wet-rice land, and which now operates alongside the more recently enacted Bali Provincial Regulation Number 4 of 2026 on Food Self-Reliance and Sovereignty (Kemandirian dan Kedaulatan Pangan Bali).

Despite this policy architecture, systematic village-level evidence on how the four FAO dimensions of food security actually behave across an entire tourism-exposed regency in Bali remains limited. Prior Indonesian studies on agricultural land conversion and food security have generally been conducted at the household or farmer level in Java (Rondhi et al., 2026; Suganda & Setyono, 2026), while Bali-focused studies have tended to foreground the legal, economic, or institutional dimensions of land conversion rather than a comprehensive, census-based measurement of food security perception across all villages of a regency (Sumadi, 2024; Mahaendrayasa et al., 2024). At the same time, nutrition-outcome research demonstrates a robust association between household food security and child stunting in the Indonesian context (Dewi et al., 2024), underscoring the practical stakes of monitoring food security not only as an agricultural-production question but as a determinant of public health outcomes. Recent national-scale modeling further confirms that Indonesia's food-security index exhibits significant spatial dependence across neighboring administrative units (Amelia et al., 2026) and that the FAO four-pillar framework remains an unstable, unevenly recovering system nationally as of 2023–2025 (Tiftazani et al., 2025)—both findings that motivate disaggregated, sub-regional assessment rather than reliance on provincial or national averages alone.

This study addresses that gap by presenting a comprehensive assessment of agricultural production availability for food security across the whole of Gianyar Regency. Specifically, the study aims to (1) analyze the current condition of food security in Gianyar Regency across the four FAO dimensions; (2) identify the villages and sub-districts most vulnerable to food insecurity; (3) identify the internal and external factors that most influence food security outcomes; and (4) formulate a strategy for strengthening food security on a sustainable basis. The remainder of this article is organized as follows: the next section describes the research method, followed by the results and discussion, and finally the conclusions and policy recommendations.

RESEARCH METHOD

This study used a quantitative descriptive research design supported by qualitative analysis of open-ended survey responses. The quantitative component measured community and stakeholder perceptions of food security using a structured questionnaire, while the qualitative component captured respondents' own descriptions of the greatest challenges to food security in their village and their proposed solutions, which were subsequently coded thematically.

The study population comprised all administrative villages and kelurahan in Gianyar Regency. A total sampling (sensus jenuh/census) technique was applied, covering the entire population of 70 desa/kelurahan spread across the regency's seven sub-districts: Ubud (8 villages), Gianyar (17), Sukawati (12), Blahbatuh (9), Tampaksiring (8), Tegallalang (7), and Payangan (9). A total of 140 respondents were surveyed, comprising village-government and Subak (traditional irrigation institution) stakeholders in each village, on the reasoning that these informants hold the most direct and continuous knowledge of local food production, distribution, and consumption conditions.

Data were collected using a structured questionnaire employing a five-point Likert scale (1 = strongly disagree/very unavailable to 5 = strongly agree/highly available). The instrument measured perceptions across eight staple food commodities—rice, tubers, vegetables, fruits, legumes, chicken meat, chicken eggs, and fisheries products—with each commodity assessed against indicator statements mapped to the four FAO food-security dimensions: availability (production and supply continuity), accessibility (price affordability and ease of obtaining the commodity), utilization (consumption frequency and dietary diversity), and stability (price and supply stability, including resilience to shocks and the buffering role of local institutions such as village granaries, cooperatives, and Subak). Responses were aggregated into a Descriptive Perception Index for each commodity–dimension pair using the formula:

$$\textit{Index Score} = (\Sigma \textit{ Actual Score} / \textit{Maximum Possible Score}) \times 100$$

The resulting index values were classified into four categories following the study's descriptive-index convention: Prime (Prima, 80.01–100%), Stable (Stabil, 60.01–80%), Vulnerable (Rentan, 40.01–60%), and Sectoral Insecurity (Kerawanan Sektoral, 20.01–40%). The same procedure was applied to compute aggregate indices at the commodity level, the FAO-dimension level, the sub-district (kecamatan) level, and the village (desa) level, enabling both a regency-wide overview and fine-grained spatial comparison. Primary survey data were triangulated with secondary statistics from the Central Statistics Agency (BPS) of Gianyar Regency (land area and rice production), the Ministry of Agriculture, and the Ministry of Health's Indonesian Nutritional Status Survey (Survei Status Gizi Indonesia, SSGI) on child stunting prevalence and poverty rates. Open-ended responses on the greatest perceived challenges to food security and respondents' recommended solutions were coded into recurring thematic categories and reported as frequency counts and percentages of the 70 responding villages.

RESULTS AND DISCUSSION

Baseline Secondary Indicators of Food Security

As a baseline for the survey-based analysis, four key secondary indicators were compiled to describe structural change in Gianyar Regency between 2015 and 2024 (Table 1). These indicators frame the empirical starting point against which the perception-based indices discussed in the following sections should be interpreted.

Table 1: Change in Key Food Security Indicators, Gianyar Regency, 2015–2024

Indicator	2015	2024	Change	Source
Sustainable (sawah) land area (ha)	14,411	9,561	-33.65%	BPS Gianyar
Paddy production (tons GKG)	128,540	94,180	-26.73%*	BPS Gianyar
Stunting prevalence (%)	21.3%	6.1%	-15.2 pts	Kemenkes/SSGI
Poverty rate (%)	4.22%	2.76%	-1.46 pts	BPS

*[Source: BPS Gianyar Regency; Ministry of Health of the Republic of Indonesia (SSGI). *GKG = Gabah Kering Giling (dry milled unhusked rice).]*

Sawah baku (protected wet-rice) land area declined sharply, by 33.65%, from 14,411 hectares in 2015 to 9,561 hectares in 2024, driven principally by conversion to housing, infrastructure, and tourism accommodation. Paddy production fell by a smaller margin (26.73%), a divergence that indicates a real increase in per-hectare productivity, consistent with intensification efforts and the continued effectiveness of Subak-managed irrigation. Over the same period, stunting prevalence fell from 21.3% to 6.1% and the poverty rate fell from 4.22% to 2.76%, suggesting that, at the aggregate level, utilization and accessibility outcomes have continued to improve even as the physical land base for production has contracted—an apparent paradox that the perception-based results below help to explain.

Food Security Index by Commodity

Table 2 presents the Descriptive Perception Index computed for each of the eight staple commodities, disaggregated by the four FAO dimensions and based on the responses of 140 stakeholders across all 70 villages.

Table 2: Food Security Perception Index by Dimension and Commodity (n = 70 villages)

Commodity	Availability	Accessibility	Utilization	Stability	Overall Index	Class
Rice	82.95%	79.57%	85.43%	72.19%	78.89%	Stable
Tubers	63.33%	69.57%	62.00%	66.38%	65.59%	Stable
Vegetables	73.71%	77.86%	80.29%	72.19%	74.86%	Stable
Fruits	66.86%	70.14%	68.86%	62.19%	66.25%	Stable
Legumes	66.86%	70.14%	66.86%	64.29%	66.73%	Stable
Chicken meat	74.29%	75.43%	79.43%	67.05%	72.70%	Stable
Chicken eggs	74.48%	77.43%	79.14%	68.57%	73.68%	Stable
Fisheries	62.95%	68.00%	68.86%	61.52%	64.25%	Stable

[Source: Primary survey data (processed).]

All eight commodities fall within the Stable classification (60.01–80%). Rice records the highest overall index (78.89%), approaching the threshold of the Prime category, reflecting near-uniform availability, affordability, and consumption across villages and consistent with the finding above that paddy production has been maintained despite land loss. Fisheries products record the lowest index (64.25%), which is unsurprising given that Gianyar is a predominantly inland, non-coastal regency with correspondingly limited direct access to marine products. Tubers and fruits cluster around 65–66%, indicating that although these commodities are considered available, their accessibility and consumption remain secondary to rice within prevailing dietary patterns. Vegetables, chicken meat, and chicken eggs cluster higher, around 72–75%, reflecting more stable local production and distribution networks for these commodities. Legumes and fisheries, at the lower end, are most affected by limited local production and consequent dependence on external supply.

Food Security Index by FAO Dimension

Table 3: Average Food Security Index by FAO Dimension Across All Eight Commodities

FAO Dimension	Average Index (All Commodities)
Utilization	73.86%
Accessibility	73.52%
Availability	70.68%
Stability	66.80%

[Source: Primary survey data (processed).]

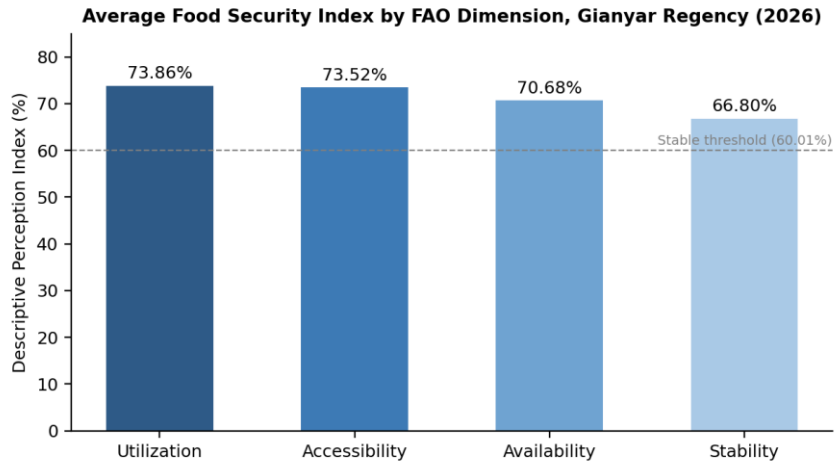


Figure 1. Average food security index by FAO dimension, Gianyar Regency

[Source: Primary survey data (processed).]

Utilization records the highest dimension score (73.86%), indicating that households are generally able to translate available food into adequate and reasonably diverse consumption—consistent with the marked decline in stunting prevalence reported in Table 1. Accessibility is a close second (73.52%), suggesting that price affordability and ease of physical access to staple commodities remain broadly satisfactory. Availability, at 70.68%, reflects continued adequacy of physical supply despite the contraction of agricultural land, again consistent with productivity gains offsetting land loss. Stability records the lowest score (66.80%), signaling that the food system's principal vulnerability lies not in the current adequacy of supply, access, or consumption, but in the capacity of the system to maintain these conditions consistently in the face of seasonal, climatic, and market shocks—a finding that directly informs the strategic priority discussed in the concluding section.

Spatial Variation Across Sub-Districts

To identify geographically vulnerable areas, the food security index was also computed at the sub-district (kecamatan) level, combining the four-dimension FAO index with an independently computed overall perception index (Table 4).

Table 4: Food Security Index by Sub-District, Gianyar Regency (Ranked by Perception Index)

Sub-district	Villages	FAO 4-Dimension Index	FAO Class	Perception Index	Perception Class
Ubud	8	66.84%	Stable	45.21%	Strengthening
Gianyar	17	67.75%	Stable	47.55%	Strengthening
Sukawati	12	69.24%	Stable	50.97%	Strengthening
Tampaksiring	8	70.94%	Stable	54.37%	Strengthening
Tegallalang	7	70.75%	Stable	55.48%	Strengthening
Blahbatuh	9	71.11%	Stable	60.19%	Stable
Payangan	9	78.43%	Stable	66.30%	Stable

[Source: Primary survey data (processed).]

The sub-district results reveal a systematic and spatially patterned variation despite every sub-district registering a "Stable" FAO four-dimension index. Ubud (45.21%), Gianyar (47.55%), and Sukawati (50.97%) form a distinct "Strengthening"-category cluster with the lowest perception indices, and these are precisely the three sub-districts that host the highest concentration of tourism activity and urban development pressure in the regency. Tampaksiring and Tegallalang occupy an intermediate position, while Blahbatuh and, especially, Payangan—both located in the regency's more rural, upland north—record the highest scores and fall into the fully Stable category. This spatial pattern points to a functional dichotomy: the northern sub-

districts of Payangan and Tegallalang act as the regency's food-production base, while the southern and central sub-districts, subject to the most intensive tourism and settlement pressure, function as concentrated centers of food demand with comparatively higher perceived vulnerability.

Village-Level Best Practice

At the village level, ten desa/kelurahan recorded the highest overall food-security index, offering concrete reference cases of locally effective food-security practice (Table 5).

Table 5: Ten Villages with the Highest Food Security Index

Rank	Village	Sub-district	Index	Class
1	Melinggih	Payangan	90.00%	Prime
2	Pejeng Kawan	Tampaksiring	89.17%	Prime
3	Samplangan	Gianyar	84.72%	Prime
4	Sebatu	Tegallalang	83.33%	Prime
5	Keliki	Tegallalang	80.28%	Prime
6	Sukawati	Sukawati	78.89%	Stable
7	Kerta	Payangan	74.44%	Stable
8	Batuan Kaler	Sukawati	69.44%	Stable
9	Buruan	Blahbatuh	68.89%	Stable
10	Singapadu	Sukawati	67.22%	Stable

[Source: Primary survey data (processed).]

Desa Melinggih (Payangan) and Desa Pejeng Kawan (Tampaksiring) reach the Prime classification (90.00% and 89.17% respectively), reflecting highly effective local distribution mechanisms, active community participation in managing local food resources, and balanced consumption patterns. Notably, four of the five Prime-classified villages are located in the regency's northern sub-districts (Payangan and Tegallalang), reinforcing the spatial pattern identified at the sub-district level and suggesting that these villages could serve as replicable models—particularly in Subak governance and local grain-reserve management—for lower-scoring villages elsewhere in the regency.

Internal and External Determinants of Food Security

Beyond the quantitative indices, respondents were asked in an open-ended format to identify the single greatest challenge to food security in their village. Responses were coded into six recurring thematic categories (Table 6).

Table 6: Frequency of Reported Food Security Challenge Themes (n = 70 villages)

Challenge Theme	Frequency	% of Villages
Land conversion / land constraints	33	47.1%
Farmer regeneration / human resources	19	27.1%
Climate / weather / pests	16	22.9%
Water / irrigation	8	11.4%
Tourism pressure	6	8.6%
Price / market	4	5.7%

[Source: Coded from open-ended survey responses.]

Agricultural land conversion and land scarcity dominate as the internal factor most frequently cited (47.1% of villages), directly corroborating the 33.65% decline in sawah baku land documented in Table 1. This is consistent with the land-rent differential mechanism described in the literature on Bali's tourism-agriculture interface, in which the economic return from converting land to accommodation, villas, and commercial use far exceeds the return achievable from continued rice or horticultural production, creating a persistent structural incentive to convert productive land even where regulatory protections exist (Mahaendrayasa et al., 2024; Suganda & Setyono, 2026; Sumadi, 2024). The second most frequently cited internal factor, farmer regeneration and human-resource limitations (27.1%), reflects declining interest among younger residents in agricultural livelihoods as tourism and service-sector employment offer more attractive alternatives—a dynamic most pronounced in Ubud and Payangan, the two sub-districts with the highest tourism exposure and the least stable farmer labor pool, respectively.

Among external factors, climate and weather variability, including pest pressure (22.9%), and water/irrigation limitations (11.4%) were the most frequently cited, underscoring the continued centrality of Subak-managed irrigation infrastructure to production stability and reinforcing evidence elsewhere in Indonesia that modernizing rice-irrigation systems is a precondition for maintaining productivity under climatic stress (Tirtalistyani et al., 2022). Tourism pressure was explicitly named by a smaller share of villages (8.6%), concentrated in Ubud and Gianyar Kota, though its indirect effect operates mainly through the land-conversion channel already discussed rather than as an independently perceived challenge. Finally, price and market volatility (5.7%) relates most directly to the structural dependence identified for shallot and garlic supply, which are produced mainly in East Java and West Nusa Tenggara and therefore remain susceptible to external price and logistics disruption regardless of local production conditions.

Strategic Implications

Taken together, these findings point toward a food security profile that is currently adequate on average but structurally exposed to erosion, principally through the stability dimension and through the geographically concentrated pressure of land conversion in tourism-intensive sub-districts. A coherent strengthening strategy should therefore

operate in four complementary layers. First, availability should be reinforced through strict enforcement of Perda Kabupaten Gianyar Nomor 1 Tahun 2020 on LP2B to lock in the remaining 9,561 hectares of protected sawah, continued production intensification (cropping-index optimization, superior seed varieties, and efficient Subak-managed water allocation), and diversification into alternative protein sources such as integrated rice-fish (mina padi) systems and smallholder poultry. Second, accessibility should be reinforced through regional food reserves, revitalization of village granaries (lumbung desa) and traditional markets (pasar tani), and improved north–south logistics connectivity linking the productive northern sub-districts to demand centers in the south. Third, utilization gains achieved through nutrition-education and local food diversification programs, including the B2SA (Diverse, Nutritious, Balanced, and Safe) movement, should be sustained rather than treated as complete. Fourth—and identified here as the priority dimension given its lowest observed score—stability should be strengthened through a strategic food-price information and early-warning system, expanded crop insurance, climate-adaptive cropping calendars developed jointly with Subak institutions, and diversified sourcing arrangements for commodities structurally dependent on external supply. Spatially, Ubud, Gianyar, and Sukawati warrant priority intervention given their lower perception indices and higher tourism exposure, while Payangan and Tegallalang, and villages such as Melinggih and Pejeng Kawan specifically, offer transferable models of village-level food security governance worth replicating elsewhere in the regency.

CONCLUSION

This study assessed agricultural production availability for food security across all 70 villages of Gianyar Regency using a census-based Descriptive Perception Index spanning the FAO's four food security dimensions. The regency's food security is currently classified as Stable across all eight staple commodities examined, with utilization (73.86%) and accessibility (73.52%) as the strongest dimensions and stability (66.80%) as the weakest. This aggregate stability, however, coexists with a 33.65% decline in protected wet-rice land area between 2015 and 2024 and with pronounced spatial disparity: the tourism-intensive sub-districts of Ubud, Gianyar, and Sukawati register the lowest perception indices and fall into a "Strengthening" category, while the more rural, upland sub-districts of Payangan and Tegallalang—home to nine of the regency's ten highest-scoring villages—demonstrate that locally governed, Subak-anchored food systems can remain robust even as regency-wide agricultural land contracts. Agricultural land conversion, driven by the land-rent differential between tourism and agricultural land use, was identified by 47.1% of villages as the single greatest challenge, ahead of farmer regeneration (27.1%) and climate variability (22.9%).

These findings carry three main implications. First, food security in a tourism-dependent regency such as Gianyar cannot be assumed safe merely because aggregate indices remain in the Stable range; the stability dimension in particular signals latent vulnerability to seasonal, climatic, and market shocks that could rapidly erode current gains if left unaddressed. Second, the spatial concentration of vulnerability in tourism-

intensive sub-districts indicates that food security policy in Bali should be explicitly place-based rather than uniform across a regency, targeting protective land-use enforcement and food-access infrastructure where tourism pressure is highest while replicating the institutional practices—particularly Subak governance and village granary management—found in the regency's highest-performing villages. Third, sustaining the observed improvements in stunting prevalence and poverty reduction will likely depend on maintaining, rather than eroding, the very land base and irrigation institutions currently under the greatest developmental pressure.

Based on these conclusions, this study recommends that the Gianyar Regency Government prioritize strengthening the stability dimension of food security by developing a strategic food-price information and early-warning system and by expanding agricultural insurance coverage; consistently enforce Perda Kabupaten Gianyar Nomor 1 Tahun 2020 on LP2B through strict field oversight, sanctions for zoning violations, and fiscal incentives for farmers who maintain productive sawah; and allocate spatially targeted interventions, prioritizing Ubud, Gianyar, and Sukawati for protective and food-access programs while replicating the practices of high-performing villages such as Melinggih and Pejeng Kawan elsewhere in the regency. Relevant technical agencies—including the food security, agriculture and fisheries, health, trade, public works, and disaster mitigation offices—should implement production-intensification measures (cropping-index optimization, superior seed varieties, mina padi, and smallholder poultry) alongside non-rice food diversification, sustain nutrition-education programs such as B2SA to protect utilization gains, and develop climate-adaptive cropping calendars and early-warning systems in cooperation with Subak institutions and meteorological authorities. Future research should extend this descriptive, cross-sectional assessment with panel monitoring of the food security index at two- to three-year intervals, and should further investigate the causal pathways linking land-rent differentials, Subak institutional strength, and household-level food security outcomes across Bali's other tourism-exposed regencies.

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