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An Integrated SWOT-Based Framework for a Sustainable Ecotourism Masterplan in Subak Saih, Bali, Indonesia

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ABSTRACT : Ecotourism is proposed to sustain irrigated farmland near Balinese towns, yet masterplans for such land seldom show how strategies, technical, economic, legal and sustainability considerations, and spatial decisions are connected. This paper presents an integrated, SWOT-based framework for preparing an ecotourism masterplan and demonstrates it on Subak Saih, a small irrigated landscape in Dalung, Badung Regency, Bali, where nearby farmland has been widely converted. The framework has six stages, namely analysis of existing conditions, SWOT analysis, formulation of strategies, evaluation of the strategies on technical, economic, legal and sustainability aspects, compilation of the masterplan and evaluation of the masterplan. At Subak Saih, twenty evidence-based SWOT factors gave eight strategies, each traced to a spatial directive. The masterplan has five zones and ten activity nodes along existing bund paths, reuses existing buildings, proposes no new enclosed building and limits new construction by a cumulative cap. In the desk-based evaluation, two of ten criteria are met by design, three are conditional on surveys or permits and five remain open. No areas, lengths or costs are reported, and neither financial feasibility nor optimality is claimed.

KEYWORDS - Ecotourism, Integrated planning, Masterplan, Subak, SWOT analysis

I. INTRODUCTION

Peri-urban farmland performs several functions at once, producing food, keeping land open, helping to regulate floods and groundwater, carrying cultural identity and, increasingly, hosting recreation [1]. Tourism is often proposed as a means of financing these functions, but it also brings buildings, access roads and paving, which can reduce the cultivated area, interrupt irrigation and drainage, and gradually convert a working landscape into a visitor setting. The planning question is therefore how much construction a working irrigated landscape can absorb, and where.Bali illustrates this problem. The subak is both an irrigation system and a social institution governed by customary rules [2]. The subak system was inscribed on the UNESCO World Heritage List in 2012 [3], provincial regulation recognises the subak [4] and national law allows food-crop land to be designated for protection [5]. Nevertheless, studies in Badung, Gianyar and Denpasar report a continuing loss of subak rice fields, with consequences for food security, farmer welfare and irrigation channels [6]–[8]. Reported figures include 700 to 1,000 ha of rice field converted each year in Bali [9], a decline in the rice-field area of Badung from 9,072 ha in 2019 to about 8,024 ha in 2022 [7] and about 87 ha of subak land lost in five years in South Denpasar [8].

Ecotourism, which aims to conserve the environment, sustain local well-being and provide interpretation, with low-impact facilities among its principles [10], has been proposed as one means of keeping the subak viable. Studies in Denpasar argue that it can slow conversion and give farmers additional benefits, provided that facilities do not reduce paddy productivity and subak members take part in management [11], [12], although operational, structural and cultural barriers often limit participation in practice [13]. Visitor impacts can be managed against explicit thresholds, as in the Limits of Acceptable Change (LAC) framework, which pairs indicators with thresholds and actions [14], [15]. Preparing an ecotourism masterplan for irrigated farmland is therefore a technical, economic, legal and sustainability problem at the same time. It is technical because paths, facilities and drainage must fit the irrigation network, terrain and access; economic because facilities should help farmers to keep farming and share the benefits fairly; legal because what may be built on paddy land depends on national and provincial law, the spatial plan, irrigation and building rules and the customary rules of the subak [4], [5], [16], [17]; and a matter of sustainability because the aim is a landscape that retains its water, farming and culture. SWOT analysis is widely used to structure such problems, including in subak tourism studies [11],

[18], but it is criticised when it ends as an unweighted list of factors without a route to decisions [19]. Three gaps remain. First, local studies of subak tourism are mostly strategic, institutional or concept-level [11], [18], [20], [21], and in the sources reviewed they rarely convert strategies into spatial directives that state where facilities may be placed, in what form and how much new construction is acceptable. Second, planning systems elsewhere limit tourism buildings on farmland by explicit rules, for example in New South Wales and Ontario [22], [23], but these apply to individual holdings, not to the shared water system of a subak. Third, studies of agricultural heritage sites, such as the Ifugao and Honghe Hani rice terraces and Jatiluwih, document the consequences of poorly managed development and tourism [24]–[26] but give little guidance for a small peri-urban command area without heritage status.

Subak Saih, in Dalung Village, North Kuta District, Badung Regency, is such a place and was chosen as the case because the pressure described above is already evident there. Conversion is documented in Badung and specifically in North Kuta District, where Subak Saih lies [6], [7]. Imagery interpreted in this study shows that open farmland around Subak Saih was converted to a government complex, mixed buildings and housing between 2006 and 2026, so that the remaining irrigated paddy is becoming an open space enclosed by urban development. An ecotourism masterplan is therefore needed to help protect Subak Saih from conversion, by giving the paddy a use that supports farming while limiting new construction. An earlier facility programme for the site included an interpretive centre, a lookout tower, pedestrian bridges, a market building and guest units, which together would place considerable new construction in working paddy. This paper therefore asks how an ecotourism masterplan for such a landscape can be prepared so that each spatial decision is traceable to evidence, a strategy and explicit technical, economic, legal and sustainability criteria. Its contribution is an integrated framework that converts SWOT results into strategies, evaluates each strategy on the four aspects and compiles the outcome into a zoned masterplan, which is then evaluated against the same criteria.

II. STUDY AREA AND METHODS

A. Study area: Subak Saih lies in Dalung Village, North Kuta District, Badung Regency, Bali, at about 8.60° S, 115.17° E (Fig. 1). Housing lies to the west and south, and institutional buildings, including the Badung Regency government complex, lie to the north and east. The site retains an irrigated paddy core served by channels and by earthen bunds that also serve as paths, with tree-lined edges and a few existing buildings in the south-central part and at the western street frontage. Subak Saih is not part of the inscribed Bali subak landscape, so planning has to rest on land-use, hydraulic and community grounds, not on heritage designation.

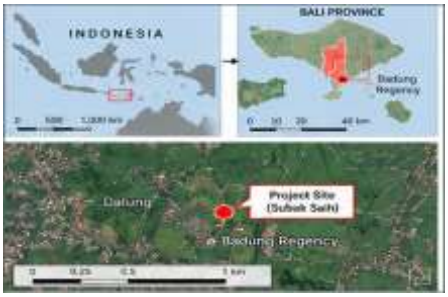


Fig. 1. Location of Subak Saih in Dalung Village, Badung Regency, Bali.

Research design : This study takes a design-oriented, single-case approach in which the framework is demonstrated on Subak Saih. The framework has six stages (Fig. 2). The first is analysis of existing conditions, the second SWOT analysis, the third formulation of strategies by TOWS pairing, the fourth evaluation of the strategies on technical, economic, legal and sustainability aspects, the fifth compilation of the masterplan and the sixth evaluation of the masterplan. The SWOT result is the basis of the strategies, and the four aspects are the basis for assessing them and translating them into spatial directives, so that the masterplan is the end product of the analysis and not a drawing added after the SWOT table. All analyses are desk-based. No field survey, hydrological modelling, stakeholder survey or measurement of areas, lengths or costs was carried out, and site knowledge shared by the subak head and farmer members informed the description of the site but is not treated as validation. Results are grouped as findings, which the imagery, the drawing and the sources show, design proposals, which the strategies, directives and masterplan put forward, and management recommendations, which are the checks and arrangements needed to keep the design within its limits. Only findings are evidence.

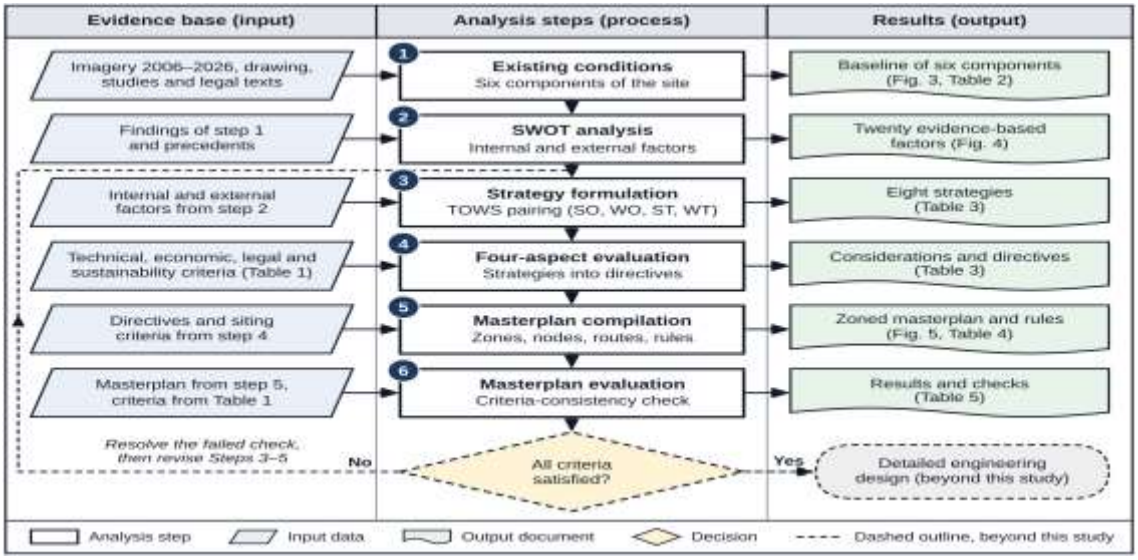


Fig. 2. Six-stage research framework.

B. Analysis of existing conditions : Six components were examined, namely agricultural land and the irrigation network; accessibility and existing paths; existing buildings and facilities; tourism potential; the socio-economic condition of farmers and the community; and spatial policy and regulations. Land-cover change was described by visual interpretation of historical high-resolution imagery in Google Earth, viewed from a fixed camera position for five reference years (2006, 2013/2014, 2018, 2022 and 2026), and places where open farmland had become buildings or paving were outlined as change zones A–D (Fig. 3). Because acquisition dates and sensors differ, apparent change can partly reflect crop stage or image quality, so the zones are described, not counted; area-based classification of satellite imagery would be the proper quantitative step [27]. The masterplan drawing was read for the paddy, vegetation, buildings, channels, bund paths, tree and green buffers, the proposed visitor path and ten numbered activity nodes. The drawing is schematic, its boundary is not surveyed, its three scale references disagree and its coordinate labels could not be reconciled with the site, so no areas or lengths were taken from it.

C. SWOT analysis and formulation of strategies *:* Internal factors (strengths and weaknesses) were drawn from the site features and the existing-condition analysis, and external factors (opportunities and threats) from the land-use interpretation, legislation, published studies and precedents. Following Weihrich [28], each factor was stated with its evidence, and TOWS pairing generated four types of strategy, namely SO (use strengths to take up opportunities), WO (use opportunities to reduce weaknesses), ST (use strengths to counter threats) and WT (reduce weaknesses and avoid threats). The factors rest on evidence but are unweighted, a common criticism of SWOT [19], and no stakeholder scoring was done, so every strategy was carried forward to the evaluation stage and the SWOT result was not treated as an end in itself.

D. *Evaluation of the strategies on four aspects :* Each strategy was evaluated on four aspects (Table 1). The economic aspect does not test financial feasibility, because no data on investment cost, income or operating cost were available; it identifies mechanisms and the distribution of benefits. The legal aspect used the instruments that bear on food agricultural land, irrigation, tourism, buildings, the subak and the spatial plan, namely national law and regulation [5], [16], [17], [29], [30], the provincial subak regulation [4] and the strategy part of the current Badung spatial plan [31]. Their status was checked in October 2026, and the spatial plan and the tourism law have been replaced or amended since the earlier texts, so the current versions were used. The pattern map and zoning rules of the spatial plan, the amendments to the food agricultural land law and the customary rules of Subak Saih were not examined. The sustainability aspect used the environmental, economic and socio-cultural dimensions [32], with the spiritual, human and natural realms of the traditional Balinese philosophy of harmony as an additional cultural reading. Each strategy received a short statement under each aspect, which was converted into a spatial directive. All evaluations are qualitative and were not tested with officials, experts or the subak.

E. ***Compilation and evaluation of the masterplan :*** The masterplan was compiled from the directives as eight components, namely zoning and zone functions; locations of ecotourism facilities; visitor circulation; integration with existing paths; areas retained for farming and irrigation; rules for new facilities; a community economic strategy; and management and sustainability directives. The schematic layout drawn for the site is the spatial expression of this compilation, and each of its elements was traced to a directive. For each node, the siting context, the relation to existing paths and channels, the highest of four intervention levels needed (from L0, no physical intervention, to L3, a new lightweight open structure) and the type of any new element were recorded. Built footprint is defined as the ground area of all new structures, roofed or not; this is stricter than the building coverage ratio in Indonesian building regulation, the ground-floor building area divided by the plot area [17], because it also counts unroofed decks and temporary stalls. The masterplan controls footprint by rules, not by a calculated figure. Finally, it was evaluated by a criteria-consistency check, in which the criteria of Table 1 were applied to the zones and nodes and each result was recorded as met by design, conditional on a stated check, or open. Expert and stakeholder validation was not carried out.

Table 1. Aspects and criteria used in the evaluation.

Aspect	Criteria examined	Evidence used	Masterplan decisions informed
Technical	Site suitability, accessibility, topography, irrigation condition and infrastructure	Imagery and masterplan drawing; no hydraulic or structural data	Zoning, facility locations, visitor routes and limits of development
Economic	Income potential, local business, benefits to farmers, financing and maintenance	Precedents and regional studies [8], [11], [12]; no cost or revenue data	Facility priorities, business opportunities and benefit-sharing mechanisms
Legal	Spatial-plan conformity, protection of farmland, irrigation provisions, permits and the subak as an institution	Texts of the instruments listed above [4], [5], [16], [17], [29]–[31]	Permitted locations and activities, and limits of development
Sustainability	Environmental protection, irrigation function, continuity of farming, cultural conservation and community involvement	Environmental, economic and socio-cultural dimensions [32]; precedents [24], [25]	Intensity of activities, protected areas, visitor management and principles of sustainable development

III. RESULTS

Existing conditions of Subak Saih : The imagery shows four zones of conversion around the site between 2006 and 2026 (Fig. 3). Zone A, now occupied by the Badung Regency government complex, was open rice field in 2006 and had been developed into a multi-storey complex by about 2013–2014. Mixed buildings began to appear around the fuel station in Zone B from 2018, land in Zone C had been subdivided for housing by 2022–2026, and the cultural hall in Zone D expanded its built footprint and paved areas. Over the same period the core irrigated area retained its agricultural character, so the remaining paddy is becoming an open space enclosed by urban development, as regional studies also describe [6]–[8]. Its value as open, permeable ground that stores water and recharges groundwater increases [33], and so does its exposure to infill, which makes the footprint of any new facility a central design variable.



Fig. 3. Land-cover change around Subak Saih, 2006–2026, from Google Earth historical imagery.

Table 2 summarises the six components. The paddy core, the bund-and-channel network and a few existing buildings are the physical assets on which visitor use can be built; the main information gaps are channel capacity, building condition, farm income and land tenure, which a desk study could not settle.

Table 2. Existing-condition analysis of Subak Saih.

Component	Evidence	Main findings and information gaps
Agricultural land and irrigation network	Historical imagery (Fig. 3); masterplan drawing	An irrigated paddy core served by channels and bunds kept its agricultural character from 2006 to 2026 while farmland around it was converted. Channel capacity, water quality and cropping calendar not surveyed.
Accessibility and existing paths	Masterplan drawing	Earthen bunds form a path network that links most of the site, with street access at the western frontage. Path width and bearing capacity not measured; access across private plots not confirmed.
Existing buildings and facilities	Masterplan drawing; description of the site	A few buildings and compounds at the western frontage and in the south-central part. Condition, ownership and capacity not surveyed; parking, sanitation and signage not shown.
Tourism potential	Drawing; studies of subak tourism [2], [11], [12]	Working paddy, water sharing and farm work offer nature, agricultural and cultural experiences, and nearby institutions and housing supply potential visitors. Demand not estimated.
Socio-economic condition of farmers and community	Regional studies [7], [8]	Regional studies report farmland loss, lower welfare and low farm income. Membership, income and land tenure at Subak Saih not surveyed.
Spatial policy and regulations	Legal texts [4], [5], [16], [17], [29]–[31]	The instruments protect subak and food agricultural land, control the conversion of irrigated land, set channel setbacks and plot coverage ratios and, in the current spatial plan, promote agrotourism and ecotourism while protecting agricultural areas. Pattern map, zoning rules and customary rules not examined.

SWOT analysis :

Fig. 4 shows twenty factors, five in each category. S1, S2, S5, W1 and O3 come from the masterplan drawing and the description of the site, W3 from the scale of the site and the earlier programme, W4 from the schematic drawing and W5 from land tenure, which was not surveyed. The other factors rest on published sources, with S3 resting on [2], [12]; S4 on [2], [4]; W2 on [3]; O1 on [4], [5]; O2 on [34]; O4 on [11], [12]; O5 on [10], [14], [15]; T1 on [6]–[8], [35] and Fig. 3; T2 on [24], [26]; T3 on [8], [24]; T4 on [8]; and T5 on [13], [25]. Two interactions matter most. S2 with T2 shows that the reuse of existing buildings is an advantage only while the build-up of new facilities is controlled. W1 with T3 shows that narrow bunds and a shrinking farming workforce leave little tolerance for disruption of farm work.

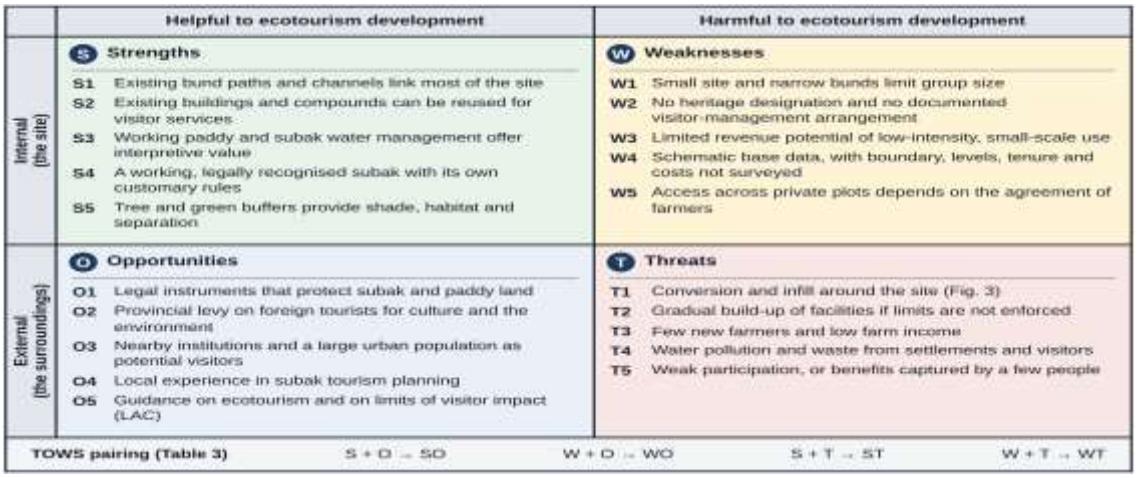


Fig. 4. SWOT diagram for ecotourism development at Subak Saih.

Strategies and their evaluation on four aspects : Pairing the factors in Fig. 4 gave eight strategies, two for each TOWS type (Table 3). Each strategy was evaluated on the four aspects and converted into a masterplan directive. Two strategies keep new construction small (ST1 and WT1), two safeguard the interests of farmers (SO2 and WT2), and the other four address learning visits, management and monitoring, local products and public awareness (SO1, WO1, WO2 and ST2). The evaluation shows four patterns. Technically, the strategies rely on existing bunds, channels and buildings, so that no new route is needed, but bund strength, channel capacity and building condition are unknown, and nodes beside channels are sensitive to setback requirements. Economically, a small footprint lowers capital and upkeep but also revenue, so benefits must come from many small sources and reach farmers directly (SO2, WO2 and WT2); because no costs or revenues were estimated, no conclusion on financial feasibility is drawn. Legally, the instruments examined protect farmland, regulate channels and fix a building coverage ratio per plot (Table 2), but none sets a cumulative cap on new footprint for a whole subak, so the cap must be built from permit conditions and customary rules agreed with the permitting authority. For sustainability, the strategies serve the environmental dimension by protecting paddy and permeable ground, the economic dimension through benefit-sharing and the socio-cultural dimension by giving priority to farm work; the spiritual realm is addressed only indirectly, and temples and shrines were not identified.

Table 3. Traceability from SWOT factors to masterplan directives.

ID	Strategy (SWOT factors used)	Considerations on the four aspects	Masterplan directive
SO1	Offer guided learning visits on the existing circuit, hosted in existing buildings (S1, S2, O3)	**Technical.** Circuit and buildings exist; bund capacity and building condition unknown. **Economic.** Guide fees; no new construction. **Legal.** Change of building use needs a permit. **Sustainability.** No new footprint.	Orientation, exhibition and service functions in existing buildings (Nodes 1, 5, 6); guided visits on bunds (Node 2).
SO2	Pay a fixed share of visitor income, and any eligible levy-funded grants, into the subak maintenance fund (S4, O1, O2)	**Technical.** Funds channel and bund upkeep. **Economic.** Benefit mechanism independent of an outside operator; amount not estimated. **Legal.** A subak may form a business body and make rules on its income [4]; levy eligibility unchecked. **Sustainability.** Keeps irrigation and farming viable.	Facilities and activities run by the subak and local groups under a written sharing rule.
WO 1	Establish a management body with LAC-type monitoring, and set group-size and visitor limits from the results (W1, W2, O4, O5)	**Technical.** Narrow bunds limit group size. **Economic.** Management funded from the income share. **Legal.** Limits written into subak rules and permit conditions. **Sustainability.** Protects farm work and water quality.	Group-size limits on bund paths; paths closed or rerouted during farm work; indicators and thresholds for every zone.
WO 2	Build income from local produce, workshops and learning programmes in existing buildings, with no new built area (W3, O2, O3)	**Technical.** Demountable stalls on existing hardstanding. **Economic.** Diversified local income; not estimated. **Legal.** Activities must fit the business fields open to a subak. **Sustainability.** Supports livelihoods and culture.	Culture and community zone confined to existing buildings and hardstanding (Nodes 5, 6); demountable stalls only.
ST1	Write the development rules (cumulative cap, size limit, no new enclosed building) into subak rules and permit conditions, with an annual audit (S2, S4, T2)	**Technical.** Cap and size limit set from a surveyed base map. **Economic.** Limits capital cost and revenue alike. **Legal.** No instrument examined sets a cumulative cap, so it must be built from permit conditions and customary rules. **Sustainability.** Prevents gradual build-up; keeps permeable ground.	Rules for new facilities, namely lowest workable level first, a cumulative cap, a size limit, excluded types and services in existing buildings.

ID	Strategy (SWOT factors used)	Considerations on the four aspects	Masterplan directive
ST2	Use viewpoint and reflection points to make land-use pressure visible, and support formal protection of the paddy (S3, S5, T1)	**Technical.** Low unroofed decks in tree buffers. **Economic.** Cost not estimated. **Legal.** Designation as food agricultural land to be checked. **Sustainability.** Raises awareness; no paddy lost.	Viewpoint and reflection nodes in the northern buffer and green area (Nodes 9, 10); the lookout tower is replaced by low decks.
WT1	Phase delivery, beginning with points that need no new structure and adding lightweight structures only when monitoring shows that paths and farm work can accommodate visitors (W1, W4, T2, T3)	**Technical.** Survey channels, bunds and levels before any structure. **Economic.** Defers capital cost until demand is observed. **Legal.** Permits sought phase by phase. **Sustainability.** Steps are reversible and protect farm work.	In phase 1, nodes needing no new structure (Nodes 2, 5, 6, 7, 10); in phase 2, lightweight open structures (Nodes 1, 3, 4, 8, 9) after review of monitoring.
WT2	Compensate farmers for hosting visitors and crop damage, monitor water quality and flow, and manage visitor waste (W5, T3, T4, T5)	**Technical.** Monitoring points at channels; waste handled in existing buildings. **Economic.** Direct payments to farmers; amounts not estimated. **Legal.** Access across private plots by written agreement. **Sustainability.** Protects water quality and farmer participation.	Written access agreements for bund sections on private plots; monitoring at channel nodes (Nodes 3, 8); waste handling in arrival and culture zones.

LAC, Limits of Acceptable Change. Node numbers refer to Fig. 5 and Table 4.

Masterplan : Compiled from the directives in Table 3, the masterplan (Fig. 5, Table 4) is a design proposal with five zones and ten activity nodes. Zoning and facility locations. The arrival and orientation zone holds Node 1 at the western street frontage; the water and farming learning zone (Nodes 2–4), the culture and community zone (Nodes 5 and 6, in the south-central buildings) and the nature and landscape zone (Nodes 7–10, at the green edges) hold the other nodes; and the protected paddy and irrigation core holds none. Siting followed four criteria in this order of priority. These were (a) reuse before building, so that indoor and service functions go into existing buildings; (b) edge before interior, so that seating, viewpoints and learning points go into tree or green buffers and non-productive edges; (c) path and channel first, so that nodes lie on or beside existing paths and nothing narrows a channel or blocks maintenance access; and (d) never in a cultivated plot, so that interior bund points serve only activities tied to farm work, with no more than an open-sided shelter. Accordingly, three nodes use existing buildings or compounds (Nodes 1, 5 and 6), six lie in the tree and green buffer near the edge (Nodes 2, 3, 7, 8, 9 and 10) and one is on an interior bund (Node 4); no node is in the middle of a cultivated plot, and five nodes (Nodes 2, 5, 6, 7 and 10) need no new permanent structure. The siting of Nodes 1, 5 and 6 assumes that the existing buildings shown in the drawing are available.Circulation and retained areas. The existing bund paths, left unpaved, form the visitor path, so no new route, crossing or bridge is built. Nine nodes lie on or beside a drawn path; Node 10 lies a short distance from the nearest one, so its access remains to be resolved at detailed design. The paths also give access for the inspection and maintenance of channels, so visitor use yields to that function and paths are closed or rerouted when farm work or maintenance requires. All cultivated plots, channels and channel banks are retained for farming and irrigation, and no plot is withdrawn for visitor facilities.



Fig. 5. Schematic masterplan concept for Subak Saih, not to scale.

Table 4. Masterplan zones and activity nodes.

Node and experience	Siting and existing assets	Level	New element (type only)
Arrival and orientation zone. Arrival, orientation and interpretation, with the existing compound reused and no parking or road in the paddy.			
1. Entrance and Interpretation Point. Arrival, orientation, history	Western street frontage; existing compound reused	L3	Open information pavilion or gate
Water and farming learning zone. Learning about water sharing and farm work, using existing bunds and buffers only, with no crossing and at most an unroofed step or an open-sided shelter.			
2. Subak Heritage Walk. Bund walk; water sharing, local stories	North-western tree buffer; existing bund paths	L0	None
3. Irrigation and Water Learning Point. How water is shared	Western buffer, at an existing channel	L3	Unroofed viewing step or platform
4. Rice Cultivation Demonstration. Seasonal farm work with farmers	Interior bund; paddy stays in production	L3	Open-sided farm shelter
Culture and community zone. Exhibitions, local produce and workshops, using existing buildings and hardstanding only, with demountable stalls and no new building.			
5. Subak Cultural Learning Pavilion. Exhibitions, tools, rituals	South-central existing buildings	L2	None new; removable displays
6. Local Produce and Community Workshop. Rice products, food, crafts	South-central existing buildings and hardstanding	L2	Demountable stalls (L1)
Nature and landscape zone. Viewing, biodiversity and reflection, using green edges only; low unroofed decks count against the cap and nothing is built on channel banks.			
7. Balinese Plants Learning Garden. Plants of daily life and ceremony	South-eastern green area	L1	Planting and plant labels only

Node and experience	Siting and existing assets	Level	New element (type only)
8. Biodiversity and Water Observation Point. Aquatic life, birds, insects	Eastern green and water edge, along a channel	L3	Low unroofed deck, where appropriate
9. Urban Rice Landscape Viewpoint. Panoramic views	Northern tree buffer	L3	Low viewing deck
10. Conservation and Reflection Point. A quiet place to reflect	Northern green area, a short distance from the nearest drawn path	L1	Seating and one interpretive panel
Protected paddy and irrigation core. No activity node; food production and water management, with no visitor building and no plot withdrawn, bund paths unpaved and visits yielding to farm work.			

L0, no physical intervention; L1, removable non-structural elements; L2, adaptive reuse of an existing building; L3, new lightweight open structure. The level shown is the highest used at the node.

Rules for new facilities. New construction is controlled by five rules, which can be written into subak rules, permit conditions and design requirements (ST1). The first rule is lowest workable level first, so that a node receives the lowest intervention level that can deliver its experience and moves up only if it cannot, the subak agrees and the cap is re-checked. The second is a cumulative cap on all new footprint for the whole site, counted by the stricter definition above, as an absolute area and not a ratio, set at detailed design. The third is a size limit for any single structure, also set at detailed design. The fourth lists excluded types, namely new enclosed buildings, accommodation, new bridges or crossings, new roads and paving of bund paths. The fifth places services inside existing buildings wherever possible, with any new service element counted against the cap. Setting the cap is a design and governance decision, not a calculation made here; it should draw on the spatial plan, which requires regard for the carrying capacity of land in tourism development [31], and on the agreement of subak members, with any increase justified.

Community economic strategy and management. The economic strategy rests on three mechanisms, namely a fixed share of visitor income paid to the subak maintenance fund (SO2), income from local produce, workshops and learning programmes in existing buildings (WO2) and payments to farmers for hosting visitors and for crop damage (WT2). The management directives comprise a management body with monitoring against thresholds (WO1), phased delivery (WT1), an annual audit of new footprint (ST1) and monitoring of water quality, flow and visitor waste (WT2).Compared with the earlier programme, the masterplan does not claim a measured reduction; it claims that the building types with the largest and most permanent footprint are not carried forward. The interpretive centre is replaced by existing buildings and an open pavilion, the lookout tower by two low unroofed decks, the market building by demountable stalls, and the stage and hall by an existing building. The pedestrian bridges, gazebos, wellness deck and guest units are dropped.

Evaluation of the masterplan : Table 5 applies the criteria of Table 1 to the masterplan. Of ten criteria, two are met by design, three are conditional on a stated check and five remain open, because they need data or agreement that a desk study could not supply. No criterion was found to fail, but none has been verified on site, and the checks in the last column are management recommendations that have not been carried out. If a check fails, the strategies, directives or layout are revised (Fig. 2).

Table 5. Evaluation of the masterplan against the criteria.

Aspect	Criterion and its application to the masterplan	Result	Check required before detailed design
Technical	*Site suitability.* No node lies in the middle of a cultivated plot; three use existing buildings or compounds, six lie in buffers near the edge and one is on an interior bund (Fig. 5).	Met by design	Georeferenced survey; condition of the buildings at Nodes 1, 5 and 6; foundations in saturated soil.
	Accessibility. Nine nodes lie on or beside a drawn path and no new route is built; Node 10 lies a short distance from the nearest path.	Conditional	Resolve access to Node 10; measure bund width and bearing capacity under foot traffic.
	Irrigation condition. No new crossing and no structure on channel banks; Nodes 3 and 8 are sited at channels.	Conditional	Survey channel sections and capacity; compare runoff before and after for a design storm; confirm the setback line.
	Topography and infrastructure. Not shown on the schematic drawing; parking, sanitation and signage are undocumented.	Open	Level survey; access and services study covering parking, sanitation and signage.
Economic	*Benefits to farmers and local business.* A fixed income share, local produce and payments to farmers are specified (SO2, WO2, WT2).	Open	Cost each element from a local unit-price schedule; estimate visitor numbers from comparable sites; test income-sharing scenarios.
Legal	*Spatial-plan conformity and farmland protection.* The plan promotes agrotourism and ecotourism and protects agricultural areas [31]; the status of the paddy and the pattern map were not examined.	Open	Examine the pattern map and zoning rules; confirm whether the paddy is designated food agricultural land [5].
	Irrigation provisions and permits. Building in or across a channel, and use of the setback zone, need permission [16], [29].	Conditional	Confirm the setback line and the permit route for open structures.
	Subak institution. The subak runs the facilities and agrees the cap and the customary rules [4]; no instrument examined sets a cap.	Open	Agree the cap and size limit with the subak and the permitting authority.
Sustainability	*Farming, irrigation and culture.* No plot is withdrawn, no new enclosed building is proposed, bund paths stay unpaved and farm work takes precedence over visits.	Met by design	Survey the cultivated area as a baseline; identify temples and shrines.
	Visitor management and community involvement. Monitoring and phasing are specified; thresholds are not set and participation was not tested.	Open	Set thresholds from monitoring; validate with the subak head, farmers, a water-resources or civil engineer and a local planner.

Met by design, the layout or rule as drawn meets the criterion; conditional, the criterion is met only if the check shown is passed; open, the criterion cannot be judged without further data or agreement.

III. DISCUSSION

The main result is a framework and a worked illustration of it, not a measured outcome. Its contribution lies in traceability, because each spatial directive can be followed back through the considerations on the four aspects and the strategy to the SWOT factors and the evidence behind them (Table 3), a link that earlier subak studies do

not provide. At Subak Saih, the framework shows how a ten-node visitor programme can be organised so that most experiences are delivered by paths, guides, signs and farm work rather than by buildings, as three nodes reuse existing buildings, five need no new permanent structure and the circuit uses bunds that already exist. Whether this lowers impact in practice has not been tested, and the development rules are a control, not a forecast.

Earlier subak studies give strategies for the subak as a whole [11], or zones, routes and roles without limits on construction [20], [21]; here the strategies are tied to directives that can be audited, and the call for facilities that do not reduce productivity [12] becomes a rule. The precedents show why a small footprint alone is insufficient, because the terraces at Ifugao and Honghe Hani degraded where construction was poorly controlled and also where livelihoods, maintenance and governance were neglected [24], [25], and tourism pressure persists at Jatiluwih despite inscription [26]. Half of the strategies (SO2, WO1, WO2 and WT2) therefore address income, management capacity and monitoring. A small footprint lowers capital and upkeep but also revenue, so the economic case rests on a regular income from many small sources and on reuse, and the share received by farmers decides whether the programme helps farming at all; because benefits are often captured by a few people [13], a written sharing rule is proposed.

The legal analysis has three implications. The first concerns the status of the land. If the paddy is designated as sustainable food agricultural land, national law protects it from conversion [5], and the irrigation regulation permits the conversion of irrigated land only after a change in the spatial plan or a natural disaster [16]. The current spatial plan supports the concept in principle, because it promotes agrotourism and ecotourism, regards the carrying capacity of land and protects agricultural areas [31], but whether open lightweight structures are allowed on this paddy depends on the pattern map and zoning rules, which were not examined. Second, building in, over or across a channel or its setback needs permission [16], [29], which matters for Nodes 3 and 8. Third, the cumulative cap has no ready-made instrument, because the building coverage ratio applies to a single plot [17]; a cap for a whole subak has to be agreed between the subak, which makes its own customary rules [4], and the permitting authority. The tourism law, as amended in 2025, provides for community-based tourism [30], which supports management led by the subak. These are interpretations of texts, not legal opinions, and a planning lawyer should confirm them.

The study has limits. It is desk-based and covers a single case. The layout drawing is schematic and was not redrawn within this study, so the cap and size limit have not been set, and neither the drawing nor the rules have been validated on site or with the subak; a conflict revealed by later checks would send the work back to the strategies and directives (Fig. 2). The land-use interpretation is qualitative, the SWOT is unweighted, no stakeholder survey or analysis of demand, cost or land tenure was made, the review of prior work is not systematic, and the legal analysis covers a few instruments only. A small footprint is also not necessarily a small impact, because the rules control buildings, not visitor flows, which is why monitoring thresholds (WO1) and phasing (WT1) are proposed. Further work should begin with the checks in Table 5, then weight the SWOT factors with the subak head, farmers and other stakeholders, for example by the Analytic Hierarchy Process, as at Jatiluwih [18], calibrate thresholds on the bund paths and monitor the indicators after implementation.

IV. CONCLUSION

This study asked how an ecotourism masterplan for a small peri-urban subak can be prepared so that each spatial decision is traceable to evidence, a strategy and explicit criteria. It proposes a six-stage framework in which SWOT results are converted into strategies, the strategies are evaluated on technical, economic, legal and sustainability aspects, and the outcome is compiled into a zoned masterplan that is evaluated against the same criteria. At Subak Saih, twenty SWOT factors gave eight strategies and a masterplan of five zones and ten activity nodes along existing bund paths, in which three nodes reuse existing buildings, five need no new permanent structure and no new enclosed building is proposed.The masterplan is only as secure as the arrangements around it. The development rules must be enforced, phased and monitored, and farmers must receive a visible share of the benefits, or lightweight structures could still accumulate into pressure on the paddy. None of the instruments reviewed sets a cumulative cap for a whole subak, and the economic side requires costing before the concept can be judged. The framework is a concept. It reports no measured areas, lengths or costs, claims neither financial feasibility nor optimality, and has not been validated on site. It offers planners, subak and local governments a transferable procedure for other small peri-urban subak under pressure, and its

next steps are the checks in Table 5, a surveyed base map and a cap and size limit agreed with the subak and the permitting authority.

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REFERENCES

1. Zasada, Multifunctional peri-urban agriculture: a review of societal demands and the provision of goods and services by farming, Land Use Policy, 28(4), 2011, 639-648.
2. J.S. Lansing, Priests and Programmers: Technologies of Power in the Engineered Landscape of Bali (Princeton, NJ: Princeton University Press, 1991).
3. UNESCO World Heritage Centre, Cultural Landscape of Bali Province: the Subak System as a Manifestation of the Tri Hita Karana Philosophy, World Heritage List No. 1194, inscribed 2012 (Paris: UNESCO World Heritage Centre).
4. Provincial Government of Bali, Bali Provincial Regulation No. 9 of 2012 on Subak [in Indonesian] (Denpasar: Provincial Government of Bali, 2012).
5. Government of the Republic of Indonesia, Law No. 41 of 2009 on the Protection of Sustainable Food Agricultural Land [in Indonesian] (Jakarta: State Secretariat, 2009; amended through the Job Creation legislation: Law No. 11 of 2020, Government Regulation in Lieu of Law No. 2 of 2022 and Law No. 6 of 2023).

   I. Lanya, N.N. Subadiyasa, and G.P. Ratna Adi, Impact of spatial plan on the conversion of Subak rice fields and food security, in Badung and Gianyar Regencies, Bali Province, IOP Conference Series: Earth and Environmental Science, 149(1), 2018, 012003.
6. I.G.A.E. Suwintari and P.W. Prasetya, The impact of subak rice field conversion on socio-economic welfare and environmental sustainability in North Kuta District, Badung Regency, Journey: Journal of Tourismpreneurship, Culinary, Hospitality, Convention and Event Management, 8(2), 2025, 353-364, doi:10.46837/journey.v8i2.351.
7. L.A.D. Ambarini, E. Frimawaty, and H. Herdiansyah, Sustainable management strategies for degraded subak rice fields in South Denpasar, Bali, Journal of Degraded and Mining Lands Management, 13(1), 2026, 9199-9209, doi:10.15243/jdmlm.2026.131.9199.
8. Widhianthini, H. Tarigan, I.A.N. Saskara, and P.P.K. Wiguna, Bali provincial regional planning design based on sustainable food security, International Journal of Sustainable Development and Planning, 20(7), 2025, 3145-3153, doi:10.18280/ijsdp.200739.
9. The International Ecotourism Society, What Is Ecotourism? (TIES, 2015).
10. I.K.S. Diarta and I.M. Sarjana, Subak Padanggalak development strategy as tourism attraction in Denpasar City, Bali, Media Konservasi, 23(3), 2018, 281-292, doi:10.29244/medkon.23.3.281-292.
11. N.W.P. Rusadi, I.G. Pitana, I.N. Sunarta, and I.N.S. Arida, Development of Subak Lestari as a sustainable tourism attraction in Denpasar city, International Journal of Green Tourism Research and Applications, 5(2), 2023, 114-128, doi:10.31940/ijogtra.v5i2.114-128.
12. C. Tosun, Limits to community participation in the tourism development process in developing countries, Tourism Management, 21(6), 2000, 613-633, doi:10.1016/S0261-5177(00)00009-1.
13. G.H. Stankey, D.N. Cole, R.C. Lucas, M.E. Petersen, and S.S. Frissell, The Limits of Acceptable Change (LAC) System for Wilderness Planning, General Technical Report INT-176 (Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station, 1985).
14. P.F.J. Eagles, S.F. McCool, and C.D. Haynes, Sustainable Tourism in Protected Areas: Guidelines for Planning and Management (Gland, Switzerland and Cambridge, UK: IUCN, 2002).
15. Government of the Republic of Indonesia, Government Regulation No. 20 of 2006 on Irrigation [in Indonesian] (Jakarta: State Secretariat, 2006).
16. Government of the Republic of Indonesia, Government Regulation No. 16 of 2021 on the Implementing Regulation of Law No. 28 of 2002 on Buildings [in Indonesian] (Jakarta: State Secretariat, 2021).
17. N.U. Vipriyanti, N.W. Rustiarini, M.E.A. Citra, and G. Sedana, The cultural landscape heritage sustainable strategy: integration of agriculture and tourism in Bali, Discover Sustainability, 6, 2025, 1201, doi:10.1007/s43621-025-00789-7.

18. T. Hill and R. Westbrook, SWOT analysis: it's time for a product recall, Long Range Planning, 30(1), 1997, 46-52.
19. L.S. Yusiana and N.N.A. Mayadewi, Concept of a subak landscape development plan as a sustainable agrotourism area [in Indonesian], Jurnal Arsitektur Lansekap, 3(1), 2017, 97-107, doi:10.24843/JAL.2017.v03.i01.p11.
20. I.K. Suamba, Sumiyati, A.A.K. Krisnandika, I.W. Tika, N.N. Sulastri, and G.M.K. Arisena, The subak-based agro-tourism management model in the world cultural heritage area of Catur Angga Batukaru, Tabanan Regency, Bali Province, Indonesia, African Journal of Food, Agriculture, Nutrition and Development, 23(2), 2023, 22534-22547, doi:10.18697/ajfand.117.21970.
21. NSW Department of Planning and Environment, Agritourism changes: case studies (Sydney: NSW Government, page updated 4 May 2023), planning.nsw.gov.au, accessed October 2026.
22. Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), Guidelines on Permitted Uses in Ontario's Prime Agricultural Areas, Publication 851, 2016 (Ontario: OMAFRA).
23. UNESCO World Heritage Centre, Rice Terraces of the Philippine Cordilleras (Philippines), World Heritage List No. 722, and State of Conservation record, whc.unesco.org/en/soc/149 (Paris: UNESCO World Heritage Centre).
24. H. Hua, Y. Wang, Z. Ding, H. Liu, S. Zhou, and Y. Liu, Relationship, discourse and construction: the power process and environmental impact of the Honghe Hani Rice Terraces as a World Heritage Site, International Journal of Environmental Research and Public Health, 19(24), 2022, 17100, doi:10.3390/ijerph192417100.
25. D.H. Rahmi and B. Setiawan, Pressures on the Balinese world cultural landscape heritage: the case of Jatiluwih Subak Village, IOP Conference Series: Earth and Environmental Science, 501(1), 2020, 012032, doi:10.1088/1755-1315/501/1/012032.
26. P. Olofsson, G.M. Foody, M. Herold, S.V. Stehman, C.E. Woodcock, and M.A. Wulder, Good practices for estimating area and assessing accuracy of land change, Remote Sensing of Environment, 148, 2014, 42-57.
27. H. Weihrich, The TOWS matrix: a tool for situational analysis, Long Range Planning, 15(2), 1982, 54-66.
28. Ministry of Public Works, Ministerial Regulation No. 17/PRT/M/2011 on Guidelines for Determining the Setback Line of Irrigation Networks [in Indonesian] (Jakarta: Ministry of Public Works, 2011).
29. Government of the Republic of Indonesia, Law No. 10 of 2009 on Tourism [in Indonesian] (Jakarta: State Secretariat, 2009; amended through the Job Creation legislation and, most recently, by Law No. 18 of 2025, the third amendment).
30. Badung Regency Government, Badung Regency Regulation No. 4 of 2025 on the Badung Regency Spatial Plan 2025-2045 [in Indonesian] (Mangupura: Badung Regency Government, 2025; replaces the 2013-2033 plan, Regency Regulation No. 26 of 2013).
31. United Nations Environment Programme and World Tourism Organization (UNWTO), Making tourism more sustainable: a guide for policy makers (Paris and Madrid: UNEP and UNWTO, 2005).
32. Y. Matsuno, K. Nakamura, T. Masumoto, et al., Prospects for multifunctionality of paddy rice cultivation in Japan and other countries in monsoon Asia, Paddy and Water Environment, 4, 2006, 189-197, doi:10.1007/s10333-006-0048-4.
33. Bali Provincial Government, Official release: utilization of the foreign tourist levy for the preservation of Balinese culture and natural environment, LoveBali portal, lovebali.baliprov.go.id, 2025 (levy established by Bali Provincial Regulation No. 6 of 2023).
34. I.P. Sriartha and S.R. Giyarsih, Spatial zonation model of local irrigation system sustainability (a case of subak system in Bali), Indonesian Journal of Geography, 47(2), 2015, 142-150, doi:10.22146/ijg.9253.