Olivestone Retreat: Designing a Connected Rural Living Lab Cluster for Regenerative Agritourism, Heritage, and Ecosystem Monitoring

Authors

Fotios K. Konstantinidis[1,6], Pantelis Pramagkioulis[1] , Ioannis Efthimiadis[2], Georgios Tsimiklis [4,6], Ioannis Kansizoglou [5] and Tina Katika [6]

[1] Olivestone Retreat, Kentrika Tzoumerka, Epirus, Greece, 470 45

[2] G2lab, Poutetsi 21, Ioannina, Epirus, Greece, 45 332

[3] Department of Occupational Therapy, School of Physical Education, Sport Science and Occupational Therapy, Democritus University of Thrace (DUTH), Komotini, Greece, 691 00

[4] Cognisensus, 2nd km Paianias – Markopoulou Avenue, GR- 19400 Koropi, Greece

[5] School of Physical Education, Sport Science and Occupational Therapy, Democritus University of Thrace (DUTH), Komotini, Greece, 691 00

[6] Institute of Communication and Computer Systems, National Technical University of Athens, 9 Iroon Polytechniou Str., Athens, Greece, 157 73

Abstract

Living Labs (LLs) provide a practical way to co-create, trial, and evaluate innovations in real-life settings, but most guidance is tailored to urban, project-driven contexts. Small rural hospitality sites must integrate experimentation with daily operations while caring for heritage assets and managing environmental risks. This paper presents a design blueprint for Olivestone Retreat (Kentrika Tzoumerka, Greece) as a connected rural living lab cluster comprising seven interlinked micro-labs: agritourism, stone buildings, olive grove, river corridor, heritage landscape, walking paths, and forest. Grounded in living lab theory, place-based innovation, and design science and action research, the blueprint translates the concept into an actionable operating model: a "7+1" architecture (seven micro-labs plus a shared governance–data–learning backbone), clear roles and decision rights, lightweight monitoring protocols, and a staged evaluation framework suitable for multi-season learning. The empirical status is deliberately bounded: this paper reports implementation-ready design artefacts derived from site documentation, the project concept, and a literature synthesis; it does not report completed pilots, stakeholder co-design data, sensor datasets, or measured impacts. Its contribution is therefore a design proposition for rural SMEs whose usefulness and transferability must be tested through the planned implementation and longitudinal evaluation.

Key words

living labs; rural innovation; agritourism; citizen science; monitoring and evaluation; heritage

Subtitle

A seven-lab architecture and evaluation framework for applied innovation in a mountainous rural context

Introduction

Living Labs (LLs) have become a widely used approach for addressing complex societal challenges through experimentation, co-creation, and iterative learning in real-life contexts. Across domains—from health and wellbeing to mobility and climate action, LLs are positioned as participatory infrastructures that connect diverse actors (citizens, businesses, public authorities, and research organisations) to develop and test solutions that matter in practice [1-3].

At the same time, the living lab field continues to wrestle with two persistent frictions. First, many LL initiatives are organised as time-bound projects rather than as long-term infrastructures, which can limit continuity, cumulative learning, and evidence building across seasons and years. Second, much of the published LL guidance is shaped by urban contexts, where density, data infrastructure, and institutional capacity are comparatively high. Rural contexts, especially mountainous or remote areas, often combine small-scale enterprises, seasonal visitor flows, fragile ecosystems, and strong cultural heritage, while operating with limited staff, budget, and technical support. This creates a paradox: rural areas arguably need real-world experimentation and locally grounded innovation the most, but they often have the fewest resources to sustain it. Tourism and hospitality illustrate this challenge acutely. Rural hospitality sites frequently depend on local ecosystems (water availability, forest condition, microclimate), built heritage (traditional stone structures), and landscape access (walking paths, river crossings). They also sit at the intersection of multiple value chains (food, energy, mobility, safety, learning) where interventions in one area (e.g., retrofitting buildings) may influence others (e.g., visitor comfort, energy demand, local narratives). A living lab approach can offer an organising logic to integrate these concerns into coherent cycles of "implement–test–learn–improve", but only if it is translated into a manageable operating model for small rural sites.

This paper addresses that translation challenge through the case of Olivestone Retreat, a rural hospitality site in Kentrika Tzoumerka (Epirus, Greece). The concept articulates a set of seven connected living labs for applied innovation, monitoring, and visitor-focused learning: (1) agritourism, (2) stone buildings, (3) olive grove, (4) river corridor, (5) heritage landscape, (6) walking paths, and (7) forest. The ambition is not to "add a project" on top of hospitality operations, but to embed experimentation and evidence collection into everyday practices, such as hosting guests, maintaining buildings, supporting harvesting, monitoring seasonal changes, and ensuring safe access in rugged terrain.

The research gap we target is methodological: How can a connected set of micro-labs be designed so that (a) each lab is actionable at small scale, (b) the cluster is coherent as an innovation-and-learning system, and (c) the initiative can generate trustworthy evidence without overburdening local operations? While LL literature offers frameworks for stakeholder engagement, co-creation, and experimentation, less attention has been paid to intra-site architectures that intentionally connect multiple micro-contexts (buildings, grove, river, trails, forest) within a single rural hospitality ecosystem. Similarly, impact discussions often highlight the importance of long-term evaluation, but do not specify indicator sets and data routines that fit small rural enterprises [4-5].

Positioning and novelty. Relative to living lab work that commonly addresses city-scale platforms, project networks, or individual thematic domains [2,3,7-9], the novelty claimed here is not the rural setting alone. It lies in the intra-site orchestration of heterogeneous micro-contexts—hospitality operations, buildings, agriculture, water, heritage, trails, and forest—through one lightweight governance, data, and learning backbone designed for the capacity constraints of a rural SME. This is a design contribution rather than evidence of superior impact.

Accordingly, the aim of this paper is to develop and document a reusable design blueprint and evaluation framework for Olivestone Retreat as a connected rural living lab cluster. The initiative is at a design-and-construction stage; the paper therefore addresses the coherence and implementation-readiness of the artefact rather than the effectiveness of implemented interventions.

Throughout the manuscript, "design outputs" refers to the architecture, governance routines, monitoring protocols, and indicator framework developed here; "expected outcomes" refers to hypotheses to be tested; and "measured impacts" is reserved for future empirical evidence from pilots and longitudinal evaluation.

- RQ1: How can a rural hospitality site be structured as a connected cluster of living labs that integrates agritourism operations with environmental monitoring, heritage stewardship, and visitor learning?
- RQ2: What governance, data stewardship, and ethical principles enable such a rural living lab cluster to produce both local value (for visitors, residents, and local SMEs) and transferable knowledge?
- RQ3: Which evaluation framework and indicators are feasible and meaningful for assessing environmental, socio-cultural, economic, and learning outcomes of a rural living lab cluster over multiple seasons?

Our contributions are as follows:

- We propose a connected micro-labs pattern that decomposes a heterogeneous rural hospitality ecosystem into manageable experimentation units while preserving cross-lab coherence through a shared backbone.
- We operationalise a monitoring-and-learning approach that couples lightweight sensing and structured observation with visitor-facing interpretation, enabling both evidence generation and educational value without creating a separate R&D function.
- We provide a staged evaluation framework, including a logic model and indicator set, together with an explicit implementation and validation pathway that other rural SMEs can adapt rather than copy unchanged.

The remainder of the paper presents the conceptual framing, the case context and methods, the connected living lab blueprint with a planned evaluation framework, and finally a discussion of implications, limitations, and future work.

Conceptual and theoretical framework

Living labs as real-life innovation platforms

A widely shared definition positions a living lab as an innovation platform where stakeholders collaboratively create, test, and evaluate solutions in real-life contexts. Core components recur across definitions: a real-world setting, active user and stakeholder involvement, multi-method experimentation, and iterative learning that bridges research and practice [2,6-9]. In contrast to controlled laboratory research, LLs treat context not as "noise" but as a critical part of what is being learned, particularly relevant when the context includes seasonal ecologies, heritage assets, and operational constraints. For small-scale rural sites, two aspects of this definition are especially consequential. First, the "platform" metaphor implies a stable infrastructure (governance routines, stakeholder relations, data practices) rather than a one-off pilot. Second, the real-life setting implies that experimentation must fit within everyday operations; otherwise, it risks becoming extractive (research that burdens hosts or residents) or performative (innovation theatre without evidence).

Participation and soci(et)al engagement

Living labs often claim an inclusive ethos, but participation is not automatically meaningful. Participation can range from consultation to shared decision-making; classic critiques remind us to examine who has power, whose knowledge counts, and who benefits [10]. In living lab research, co-creation is also treated as a dynamic process shaped by purpose, ownership, motivation, and place [11]. Co-creation literatures more broadly emphasise creating “spaces” and “tools” that allow participants to express needs, envision futures, and collaboratively shape solutions [12]. In a rural hospitality context, participation is multi-layered: residents and local producers may be long-term stakeholders; visitors are transient but can contribute observations and feedback; public actors influence infrastructure and risk management; and research/technology partners can provide methods and tools. This configuration makes governance and ethics central: participation should be designed for reciprocity (e.g., open learning resources) rather than only for data extraction.

Multi-actor collaboration through a quadruple-/quintuple-helix lens

To make the multi-stakeholder logic operational, the blueprint uses a quadruple-helix collaboration structure extended by the environmental dimension of the quintuple helix [15]. The business helix comprises the host–operator, local producers, cooperatives, and tourism SMEs; the knowledge helix includes universities and research or technology partners; the public helix includes municipal, environmental, infrastructure, and civil-protection actors; and the civil-society helix includes residents, cultural associations, and visitors. The fifth helix is the natural environment itself—the olive grove, river, heritage landscape, paths, and forest—whose condition constrains and informs decisions. The model does not assume equal participation in every pilot; each micro-lab identifies the actors required for legitimacy, technical quality, operational feasibility, reciprocity, and safety.

Rural living labs as social-ecological experimentation

Rural contexts are often characterised by strong coupling between social activities and ecological processes (e.g., water availability, forest health, biodiversity). The social-ecological systems (SES) lens highlights that outcomes depend not only on individual interventions but also on interactions among actors, resources, and rules across scales [13-14]. This is relevant for Olivestone Retreat because the “lab objects” include both built assets (accommodation buildings and stone structures) and living systems (olive grove, river corridor, forest). As a consequence, experimentation must address (i) temporal dynamics (seasonality, drought periods, fire risk), (ii) spatial heterogeneity (microclimates across grove, river, trails), and (iii) governance arrangements (access rules, maintenance responsibilities, safety protocols). A second rural-specific consideration concerns value chains. Agritourism can be understood as a nexus connecting production (e.g., olive cultivation), processing, distribution, and visitor experience. Designing a connected living lab cluster allows interventions to be situated along that nexus: for example, a precision irrigation pilot is not only an agronomic intervention but can also become a visitor learning experience and a contribution to local producer workshops. In this sense, “regenerative futures” for rural places require living labs that can couple operational improvements with stewardship and learning, rather than treating tourism, agriculture, and conservation as separate silos.

Evidence, impact, and learning

A recurring challenge in living lab research is demonstrating impact beyond immediate outputs. Studies note that living labs produce diverse value types, economic and business value (e.g., improved services, revenue opportunities) as well as public value (e.g., inclusion, policy learning, environmental benefits), while public value is often the hardest to measure [15-16]. Impact evidence is also complicated by context specificity, long time horizons, and the fact that living labs deliberately work with uncertainty. Empirical studies have started to operationalise and measure living lab impacts in specific domains (e.g., [17]), while systematic reviews emphasise that robust evaluation requires clear theories of change, mixed methods, and longitudinal perspectives [4-5]. For this paper, two implications follow. First, we treat evaluation as an integral part of the design: the blueprint includes data routines and indicators from the outset, rather than as an afterthought. Second, given that empirical impact data are not yet available, we explicitly frame "expected outcomes" as hypotheses to be tested through planned evaluation cycles, avoiding retrospective impact claims.

Design science and action research alignment

Designing and studying a living lab cluster simultaneously is well aligned with design science research (DSR) and action research. DSR provides a structured logic for creating and communicating artefacts (e.g., models, methods, architectures) that address a practical problem while generating knowledge [18]. Action research emphasises iterative cycles of planning, acting, observing, and reflecting with stakeholders, aiming at both change and learning [19]. In living lab settings, these traditions converge: artefacts are developed and refined through real-world cycles, and the evaluation focus is on how the artefact performs in context. This provides the methodological backbone for the blueprint in Sections 4–5.

Case and context: Olivestone Retreat and the seven living labs

Palaiokatouno and the wider Athamania landscape combine long settlement continuity with episodes of disruption and adaptation. The local record includes ancient and Ottoman-era references, the incorporation of the property into the family estate in 1884, its development as a residence and farming base, wartime destruction in 1943, post-war reconstruction, later agricultural modernisation, and rural-to-urban migration. These layers of heritage, self-reliance, disruption, and demographic change provide the place-based rationale for the Olivestone Retreat living lab concept.

Figure 1: Living Lab map of Olivestone Retreat and its surroundings, highlighting seven real-world testbeds from agritourism and stone-building retrofit to river, walking paths, and forest resilience.

Established as a living lab concept in 2022, Olivestone Retreat is conceived as an infrastructure for applied innovation, monitoring, and visitor-focused learning in Kentrika Tzoumerka (Epirus, Greece). The physical setting combines accommodation within an approximately four-acre olive grove, old stone outbuildings, a river corridor, a stone bridge and other historic landscape elements, walking paths, and surrounding forest. The broader cluster extends across approximately 60 acres in nearby locations (Figure 1). The site can host real visitors and operate as a functioning hospitality enterprise, but experimentation must remain lightweight, safe, and maintainable. The blueprint therefore decomposes the setting into seven connected micro-labs, each with a defined focus and a set of plausible experimentation and monitoring activities.

Seven micro-labs

1) Agritourism living lab for experiential rural tourism. This lab targets the farm–food–visitor value chain. It will pilot and iterate low-impact rural tourism offerings, producer workshops, and partnerships with local cooperatives and retailers while strengthening resident–visitor engagement and local economic linkages.

Figure 2: Agritourism living lab—on-site olive grove, surrounding rural landscape and villas

Figure 3: Stone buildings living lab—on-site old outbuilding historically used for storage (Location 2).

2) Stone buildings living lab. Existing stone outbuildings, historically used for storage, provide a testbed for low-carbon retrofit, circular renovation (reuse-first, salvage and repair, and local sourcing), and smart-operations monitoring of indoor climate, energy, and maintenance. The lab also uses history-led interpretation through micro-tours, artefacts, and hands-on learning moments.

3) Olive grove living lab for precision cultivation and learning. The olive grove is positioned as a precision-agriculture and visitor-learning testbed. Planned activities include a micro-network of field sensors and a meteorological station, data-informed irrigation experiments, and modular learning content for producers and visitors on olive cultivation, extraction, and Industry 5.0 technologies. A longer-term ambition is an open-science pipeline that publishes well-documented agronomic datasets in trusted repositories.

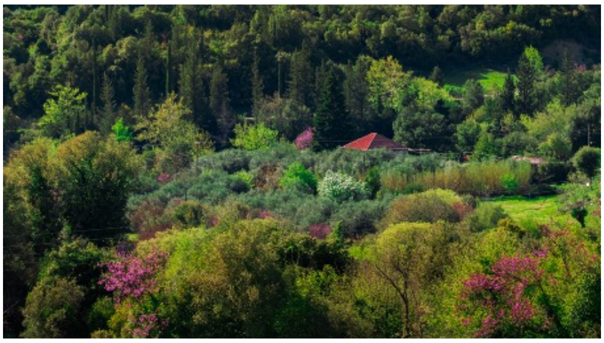

Figure 4: Olive grove living lab—olive-tree health and fruit load.

Figure 5: River living lab—on-site river corridor and riparian vegetation.

4) River living lab for nature monitoring and wellbeing. The on-site river corridor and riparian vegetation are framed as a micro-ecosystem testbed. Planned monitoring includes basic microclimate sensing and water observations combined with lightweight biodiversity protocols such as species sightings, repeat photography, and habitat notes. Visitor-facing elements include quiet observation points and guided nature-learning moments.

5) Heritage living lab for preservation and storytelling. This lab centres on the stone bridge and historic landscape elements. It combines low-impact preservation and safety measures—such as cleaning, vegetation control, drainage protection, and safe access—with nature-based maintenance actions and repeatable condition records. Visitor learning is supported through then-to-now storytelling that connects traditional infrastructure with contemporary rural life.

Figure 6: Heritage living lab—on-site stone bridge and stream corridor.

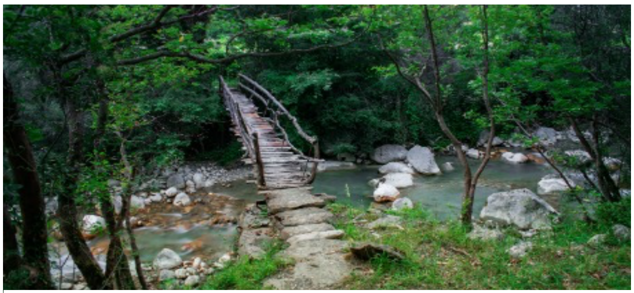

Figure 7: Walking paths living lab—path entering the forest

6) Walking paths living lab for safe access and search readiness. River crossings and mountain path segments provide a testbed for walkability, seasonal risk, and visitor flow in rugged terrain. Planned activities include route-condition checks, warnings and alternatives after rainfall, interpretation micro-stops, and controlled lost-person simulations to define search sectors, rendezvous points, and basic response protocols.

7) Forest living lab for health, regeneration, and fire resilience. The surrounding forest is framed as a testbed for tree vitality, canopy and understory condition, regeneration, invasive-species checks, fuel load, and moisture stress. Repeatable transects, field plots, and photo points will support a geo-tagged baseline and the publication of selected datasets and indicators.

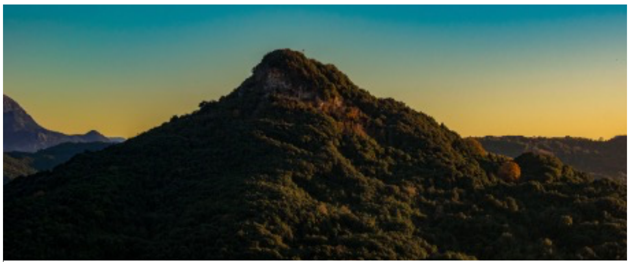

Figure 8: Forest living lab—surrounding forest landscape.

Across the seven labs, two cross-cutting ideas are central: (i) evidence as a shared backbone through monitoring routines, documented decisions, and reusable learning materials; and (ii) visitor-focused learning that turns a stay into an opportunity for place-based understanding without compromising safety, privacy, or the primary hospitality function.

Living lab	Primary focus	Example pilots (planned)	Evidence generated (planned)	Visitor learning touchpoints
Agritourism	Visitor–resident value co-creation	Producer workshops; local partnerships	Participation logs; visitor feedback	Guided tastings; maker workshops
Stone buildings	Circular retrofit and smart operations	Reuse-first renovation; indoor-comfort monitoring	Energy and indoor-climate logs; maintenance notes	Micro-tours; retrofit before/after stories
Olive grove	Precision agriculture and open data	Soil-moisture sensing; irrigation-optimisation pilots	Sensor time series; harvest-quality notes	Hands-on harvest; data-informed grove walk
River	Riparian micro-ecosystem monitoring	Microclimate sensing; biodiversity photo points	Species sightings; photo points; rainfall	Quiet observation points; nature prompts
Heritage	Bridge and landscape stewardship	Minimal safety interventions; erosion control	Condition checklists; change photographs	Then-to-now storytelling; heritage trail
Walking paths	Walkability and safety readiness	Route warnings; river-crossing assessment; search simulation	Incident logs; route-condition reports	Interpretive micro-stops; safety briefings
Forest	Health, regeneration, and fire resilience	Repeatable transects; fuel-load proxies; moisture-stress checks	Forest baseline dataset; photo points	Guided forest walk; citizen observations

Table 1: Overview of the seven connected living labs (planned focus and evidence).

Methodology

This study adopts a design-oriented research approach to translate the Olivestone Retreat concept into a living lab blueprint and evaluation plan. The methodology is consistent with living lab, design science, and action-research traditions while explicitly separating completed design work from planned co-design, implementation, and field evaluation.

Research design: We follow a design science research (DSR) logic in which the primary research output is an artefact to create a connected rural living lab architecture and an evaluation framework

[18]. DSR is appropriate because it offers a structured way to (i) identify a practical problem, (ii) derive design objectives from theory and context, (iii) develop an artefact, and (iv) plan for demonstration and evaluation in the field. In parallel, we align the artefact with an action research cycle perspective, anticipating iterative "plan–act–observe–reflect" loops with stakeholders once the living labs are operational [19]. Because the blueprint is rooted in a single setting, we also adopt a case study sensibility, treating context as integral to both design requirements and learning [20].

Evidence status, stakeholder involvement, and completed work

The evidence base for this manuscript is limited to design materials: the Olivestone Retreat concept, site and asset documentation, and the literature synthesis used to derive the architecture, principles, roles, and draft indicators. No primary stakeholder interview, visitor survey, workshop, sensor, biodiversity, incident, or pilot-performance dataset is analysed in this paper. Consequently, the manuscript evaluates the coherence and implementation-readiness of the design artefact, not its realised environmental, social, learning, or economic effects.

Completed outputs at the time of writing are the seven-lab scope, the 7+1 architecture, role and decision-right definitions, data-stewardship principles, safety requirements, and a draft logic model and indicator set. Formal co-design, baseline measurement, pilot implementation, iteration, and impact evaluation remain planned.

Planned stakeholder involvement is role-specific: the host–operator and local SMEs assess operational feasibility; residents and cultural associations shape heritage interpretation and reciprocity; public and safety actors validate access and risk protocols; research and technology partners support methods and data quality; and visitors participate only through opt-in learning activities and feedback.

Phase 1 – Design inputs and artefact derivation. The blueprint was developed from three input streams: (1) the Olivestone Retreat concept and site/asset documentation, which define the seven domains and operational constraints; (2) a focused synthesis of living lab, social-ecological systems, impact-evaluation, design-science, and action-research literature; and (3) a design translation that mapped recurring theoretical requirements—real-life experimentation, participation, iteration, reciprocity, and evidence generation—against site-specific requirements of feasibility, seasonality, heritage care, environmental risk, privacy, and visitor safety. The resulting design principles and architecture are therefore reasoned design propositions rather than inductively derived empirical findings.

Phase 2 – Planned co-design, demonstration, and validation. The implementation pathway has four steps: (1) stakeholder mapping and co-design to refine boundaries, roles, consent procedures, indicators, and the seasonal calendar; (2) baseline data collection and minimum viable pilots in at least three micro-labs; (3) at least one plan–act–observe–reflect iteration per pilot, with decisions documented; and (4) cross-lab and cross-season evaluation, consolidation into operating guidelines and learning materials, and assessment of replication pathways. Validation will combine stakeholder relevance, operational feasibility, data quality, safety, and evidence that monitoring informs decisions. Comparative testing at additional rural sites is required before broader transferability or up-scaling can be claimed.

The planned evaluation framework uses mixed methods aligned with each micro-lab and with cross-cutting governance and learning outcomes. Qualitative methods will include semi-structured stakeholder interviews, observation and field notes during workshops and pilots, visitor feedback through short surveys and optional diaries, and document analysis of maintenance logs and implementation decisions [21]. Quantitative and semi-quantitative data will include sensor readings, participation counts, and operational or safety metrics such as incident logs and route-use counts where appropriate. Qualitative material will be analysed through thematic coding that combines deductive categories from the logic model with inductive coding for emergent themes [22,23]. Monitoring time series will be analysed descriptively and compared across seasons, focusing on trends and decision relevance. Triangulation across monitoring data, observations, and stakeholder narratives will support credibility.

Ethics, data stewardship, and safety. The procedures described here are prospective because no primary participant data are analysed in this paper. Participation in future interviews, surveys, workshops, and visitor activities will be voluntary and based on informed consent. Environmental and agronomic data may be shared openly in aggregated form with metadata, while personal data will remain protected. Trail activities and search-readiness simulations require explicit risk assessment, communication protocols, and safety oversight.

The methodology therefore distinguishes design evaluation—coherence, traceability, and implementation-readiness, reported here—from field evaluation of pilot performance and longer-term impacts, which remains planned.

Design artefact: Connected living lab blueprint and planned evaluation framework

This section reports the paper's design output, not evaluated implementation results. The artefact comprises (i) design principles, (ii) an interlinked micro-lab architecture, (iii) a governance and operating model, (iv) a data and learning backbone, and (v) a staged evaluation framework. No claim is made that the proposed governance routines, indicators, or interventions have yet produced impact; they are propositions to be demonstrated and evaluated through the phases described in Section 4.

Design principles for connected rural micro-labs

Six design principles translate living lab theory into rural operational requirements:

P1 – Operational embedding. Experimentation is integrated into daily hospitality, farming, and maintenance routines, reducing project overhead.

P2 – Modularity with coherence. Each micro-lab can run lightweight pilots independently, while shared indicators, data practices, and governance routines support cross-lab learning.

P3 – Seasonality-first planning. Protocols and indicators follow seasonal rhythms such as harvest periods, rainfall patterns, and fire risk, enabling year-to-year comparison.

P4 – Reciprocity and local value. Stakeholder engagement should generate tangible value for residents and local SMEs, for example shared learning materials, producer workshops, or safer access.

P5 – Safety and care. Because the site includes rugged terrain and visitor participation, safety protocols are treated as design constraints rather than add-ons.

P6 – Evidence-by-design. Monitoring and documentation are built into pilots from the outset to enable cumulative learning and credible reporting.

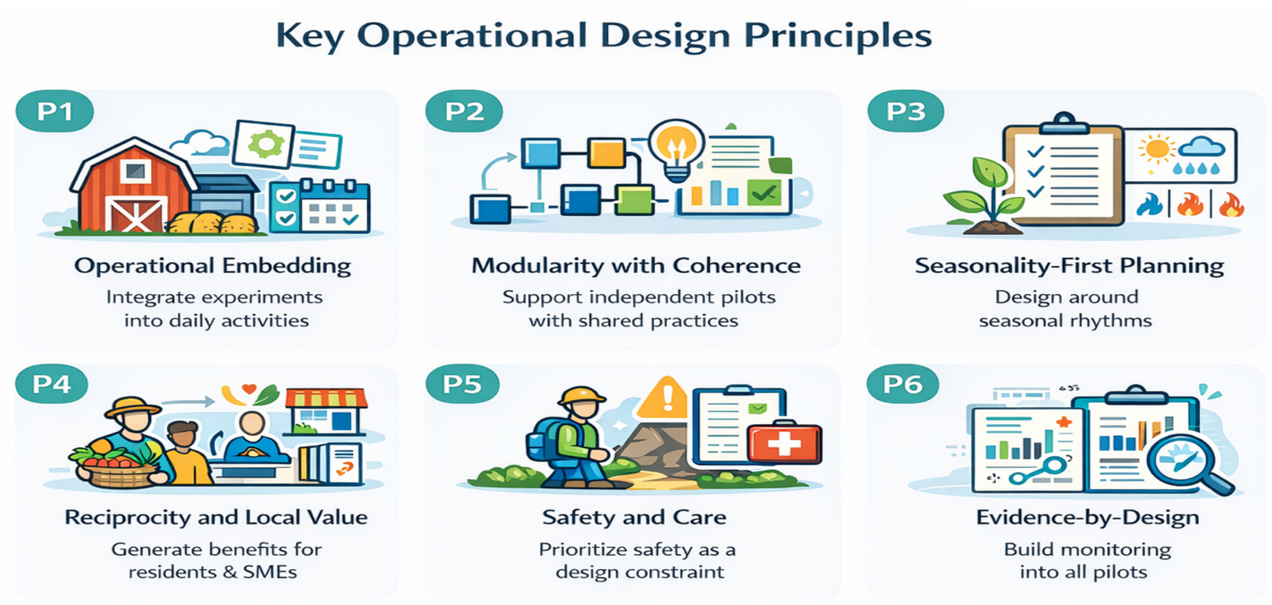

Figure 9: Key operational design principles showing how pilots are embedded, coordinated, seasonally planned, reciprocal, safety-constrained, and monitored.

Connected living lab architecture

The blueprint uses a "7+1" architecture: seven domain-specific micro-labs connected through one shared backbone (governance, data, learning, and evaluation). Each lab runs lightweight pilots and produces observations; the backbone consolidates these into decision support, visitor interpretation, and potentially transferable guidance.

Operating model: roles, routines, and decision rights

Small rural sites require explicit role definitions so that living lab work does not overburden a single actor. The operating model assigns five core functions:

Host–operator. Maintains hospitality operations, authorises feasible pilots, and retains final authority for operational decisions.

Living lab facilitator. Coordinates co-creation, documents decisions and iteration cycles, and connects the micro-labs.

Technical steward. Supports sensing, metadata, data quality, maintenance of the open-data pipeline, and proportionate technical choices.

Community and stakeholder advisory circle. Contributes local knowledge and legitimacy and reviews reciprocity, heritage interpretation, and community value.

Safety liaison. Connects walking-path, river-crossing, and search-readiness activities with risk assessment and relevant public or volunteer safety actors.

These functions operationalise the quadruple-/quintuple-helix framing: business actors lead feasibility, knowledge partners support methods, public actors support infrastructure and safety, civil society contributes place-based knowledge and legitimacy, and environmental conditions shape the scope of action. Operational and safety decisions rest with the host–operator and safety liaison; experimental design and evaluation decisions are co-created and documented through the facilitator.

Engagement follows seasonal rhythms already present in rural life: a spring co-design kickoff, autumn harvest workshops, and a winter evidence review. Visitors join opt-in activities such as guided observation walks and micro-tours, while residents and local SMEs participate through workshops and open days. Repeated touchpoints are intended to make participation cumulative rather than one-off.

Shared governance, data, learning, and safety backbone				
Host–operator	Living lab facilitator	Technical steward	Advisory circle	Safety liaison
Feasibility and operations	Co-creation, coordination, and documentation	Sensing, metadata, and data quality	Local knowledge, legitimacy, and reciprocity	Risk assessment and emergency coordination

Table 2: Governance and operational roles for the Living Lab.

Data and learning backbone

The backbone combines lightweight sensing and structured observation protocols, documentation of decisions and changes, and visitor-facing interpretation. This aligns with experiential learning: guests can engage with real place-based observations and reflect on how stewardship decisions are made [24]. To balance openness and privacy, the blueprint separates open environmental and agronomic datasets (aggregated with metadata) from protected personal data.

Staged evaluation framework and indicator set

The proposed evaluation framework links inputs → activities → outputs → outcomes → impacts and is designed to remain feasible for a small rural site. It covers five dimensions: environmental stewardship; heritage and socio-cultural value; economic and operational value; learning and engagement; and living lab process quality. Indicators prioritise baseline creation, trend monitoring, and decision relevance over large-sample statistical claims. All indicators are proposed and remain to be validated through implementation and seasonal reflection cycles; none is reported here as a measured outcome.

Dimension	Example indicators (planned)	Data sources (planned)	Timing
Environmental stewardship	Baseline datasets; trend signals used in decisions	Sensors; structured observations	Monthly/seasonal
Heritage and cultural value	Preservation actions logged; perceived authenticity and respect	Checklists; interviews; visitor survey	Seasonal
Economic and operational value	Feasibility of pilots; uptake of offerings; partner outcomes	Booking and service logs; partner feedback	Seasonal
Learning and engagement	Participation diversity; learning-module use; knowledge change	Sign-ups; short surveys; diaries	Per visit/seasonal
Process quality and governance	Iteration loops completed; transparency; reciprocity satisfaction	Meeting notes; reflection sessions	Quarterly/seasonal

Table 3: : Proposed evaluation dimensions and example indicators (to be validated in implementation)

Discussion

This paper addresses a practical and methodological gap: how a small rural hospitality site can be organised as a coherent living lab infrastructure without assuming urban-scale capacity or presenting design intentions as realised impact. The 7+1 artefact answers this gap through intra-site coordination of seven heterogeneous micro-labs and one shared governance-and-evidence backbone.

1. ***"Agritourism Living Lab"*** for experienced rural tourism
2. ***"Stone buildings living lab"*** for retrofit and storytelling
3. ***"Olive grove living lab"*** for precision grow and learning
4. ***"River living lab"*** for nature monitoring and wellbeing
5. ***"Heritage living lab"*** for preservation and storytelling
6. ***"Walking paths lab"*** for safe access and search readiness
7. ***"Forest living lab"*** for health, regeneration, and fire resilience

Figure 11: Living Lab landscape map of the Olivestone Retreat area (Palaiokatouno, Tzoumerka), showing seven geolocated activity zones.

In relation to RQ1, the architecture shows how agritourism, built heritage, agriculture, river ecology, trails, and forest can be treated as distinct experimentation contexts while remaining part of one coherent system. The explicit coupling of monitoring and visitor learning is a notable feature: it positions education and interpretation not as an "add-on activity" but as an integral mechanism for making evidence meaningful in a hospitality setting. **Regarding RQ2,** the governance model emphasises role clarity, reciprocity, and safety as core design constraints. This is consistent with living lab critiques that warn against participation being reduced to data collection without shared benefits. The proposed advisory circle and seasonal engagement routines aim to support continuity and legitimacy, two recurrent challenges in project-based living labs. The dual data pipeline addresses a further governance tension: open data ambitions can support transparency and reuse, but must be balanced against privacy and the commercial realities of a small enterprise. **For RQ3**, the staged evaluation framework responds to common living lab evaluation shortcomings by embedding indicators and data routines into the design from the outset. Importantly, the indicator set is pragmatic: it prioritises decision relevance and trend tracking over large-sample statistical claims, which are often unrealistic in rural pilot contexts. By explicitly labelling outcomes as expected and to be tested, the framework encourages disciplined learning rather than impact overclaiming. This framing is aligned with calls in the living lab literature for clearer theories of change and more transparent evidence practices.

For rural SMEs, the blueprint offers a way to structure innovation without a separate R&D department. Adoption can be incremental: a site may begin with one building-retrofit or visitor-learning pilot and add ecological or safety-oriented micro-labs only as partnerships and routines mature. Implementation nevertheless faces four risks: seasonal variability can complicate baselines; sensing and data pipelines require sustained technical capacity; visitor participation must remain voluntary, safe, and compatible with hospitality quality; and an overextended multi-lab scope can create coordination overhead. Minimum viable monitoring and staged adoption are therefore essential.

Exploitation, replication, and up-scaling

At Olivestone Retreat, exploitation means embedding selected micro-lab routines in hospitality, maintenance, farming, and visitor-learning operations and converting evidence into practical outputs such as maintenance protocols, learning modules, producer workshops, and reusable datasets. Replication elsewhere should preserve the logic—modular micro-labs plus a shared backbone—rather than the exact seven domains. Adaptation requires at least a host–operator with decision authority, a mapped set of local assets and risks, anchor partners from the community/public/knowledge spheres, minimum data-stewardship and safety capacity, and a seasonal workload that permits repeated observation and reflection. Sites with fewer resources should begin with one or two micro-labs and expand only after the routines prove feasible.

Up-scaling is more plausibly pursued through a federated network of rural nodes than by enlarging a single site. Shared metadata, indicator definitions, training materials, and cross-site learning events could support comparison and cumulative knowledge while leaving protocols and priorities locally governed. These are proposed pathways, not demonstrated outcomes; longitudinal implementation at Olivestone Retreat and comparative validation at other sites are prerequisites for stronger transferability claims.

Limitations and validation priorities

The main limitations are the single-case setting, the absence of primary stakeholder and monitoring data in the present manuscript, and the fact that the artefact has not yet been tested across seasons. The design cannot therefore establish effectiveness, causal impact, or generalisability. Priority validation tasks are stakeholder review of relevance and reciprocity, pilot-level assessment of feasibility and safety, data-quality checks, evidence that observations influence decisions, and cross-site comparison of which elements remain stable under adaptation.

Conclusion and future work

This paper presents, rather than empirically validates, a design blueprint for Olivestone Retreat as a connected rural living lab cluster. The 7+1 architecture combines seven micro-labs—agritourism, stone buildings, olive grove, river corridor, heritage landscape, walking paths, and forest—with a shared governance, data, learning, safety, and evaluation backbone. Its principal design contribution is the intra-site coordination of heterogeneous social-ecological and operational contexts in a form intended to remain manageable for a rural SME. The manuscript also provides role definitions, data-stewardship principles, and a staged indicator framework that makes the distinction between design outputs, expected outcomes, and measured impacts explicit.

The next stage is empirical: stakeholder mapping and quadruple-/quintuple-helix co-design; baseline data collection; minimum viable pilots in at least three micro-labs; documented plan–act–observe–reflect cycles; and cross-season evaluation. Exploitation at the host site should precede replication. Replication should adapt the micro-lab domains, governance, indicators, and safety protocols to local assets and capacity, while up-scaling should be explored through a federated network of rural sites. Until those steps are completed, claims about effectiveness and transferability remain provisional.

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