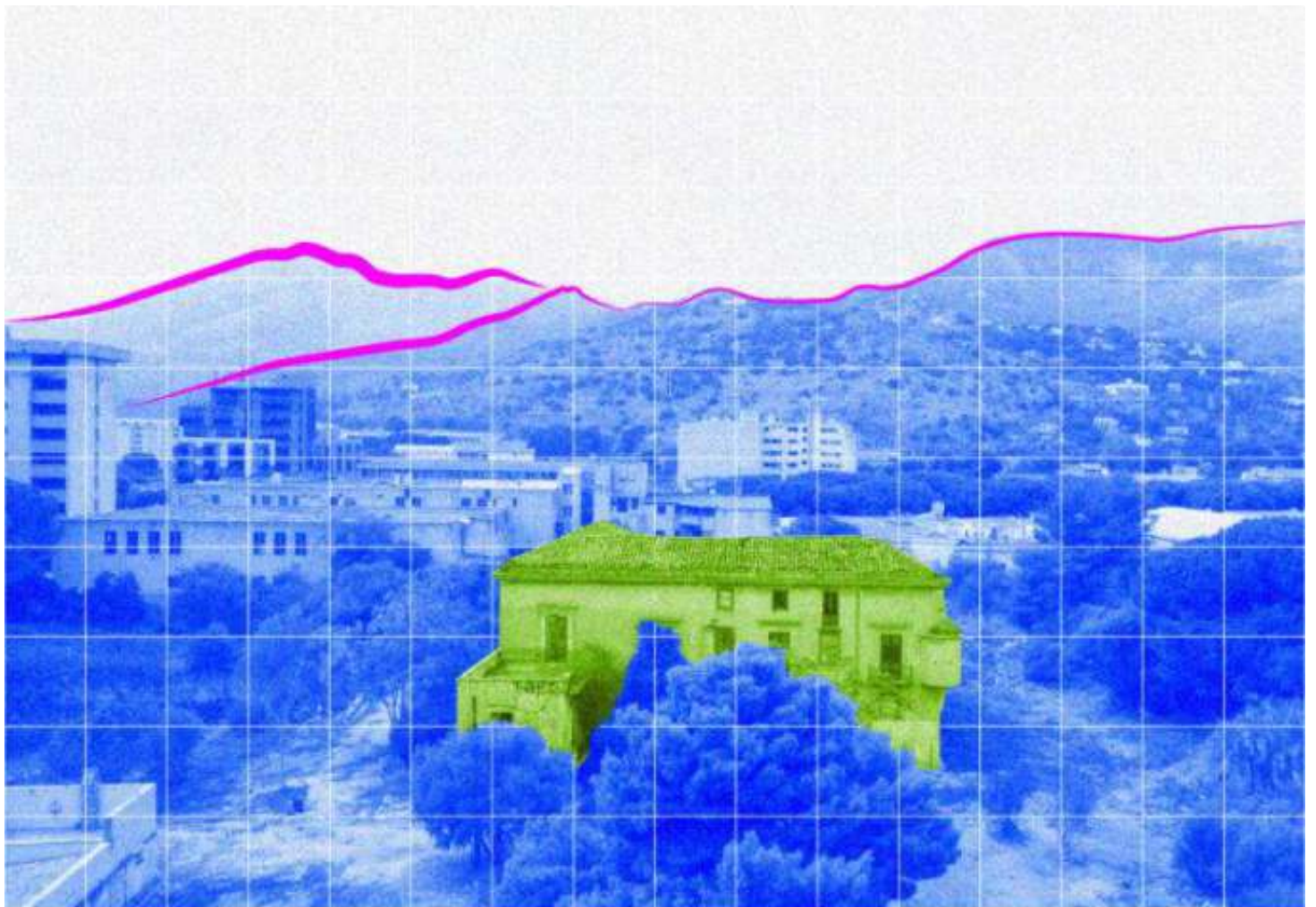


# IN F O U O

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## {Reinventing Marginal Areas heritage, cultures, technology



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**DOTTORATO DI RICERCA  
IN ARCHITETTURA,  
ARTI E PIANIFICAZIONE**  
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DI ARCHITETTURA DI PALERMO

## La Rivista

**In folio** è la rivista scientifica di Architettura, Design, Urbanistica, Storia e Tecnologia che dal 1994 viene pubblicata grazie all'impegno dei dottori e dei dottorandi di ricerca del Dipartimento di Architettura (D'ARCH) dell'Università di Palermo (UNIPA). La rivista, che si propone come spazio di dialogo e di incontro rivolto soprattutto ai giovani ricercatori, è stata inserita dall'ANVUR all'interno dell'elenco delle riviste scientifiche dell'Area 08 con il codice ISSN 1828-2482. Ogni numero della rivista è organizzato in cinque sezioni di cui la prima è dedicata al tema selezionato dalla redazione della rivista, mentre le altre sezioni sono dedicate all'attività di ricerca in senso più ampio. Tutti i contributi della sezione tematica sono sottoposti a un processo di *double-blind peer review*. Con questo numero si riprende la serie delle *Special Issue* – come già per i numeri 35, 37 e 40 – dedicate a eventi organizzati dal corso di Dottorato di ricerca e che hanno prodotto, anche grazie al carattere spesso internazionale degli eventi, interessanti esiti di ricerca collettiva. Nel caso di questo numero di Infolio, il riferimento è al Seminario del Dottorato di ricerca in Architettura, Arti e Pianificazione dal titolo *Reinventing Marginal Areas: Heritage, Cultures, Technology. General thoughts on marginality in the built environment and proposals for the Villa Maltese area in Palermo* che si è svolto il 3 e 4 ottobre 2024, attività finanziata da Bando CoRi Unipa 2023 Azione B, Linee di finanziamento 4.

Per questo numero il tema selezionato è:

***Reinventing Marginal Areas: heritage, cultures, technology***

Il tema della marginalità nell'ambiente costruito è riconosciuta come condizione diffusa in qualunque forma di insediamento, che non dipende soltanto dall'ubicazione poco raggiungibile o dalla mancanza di servizi, ma piuttosto dall'abbandono e da fenomeni di esclusione sociale, economica e culturale. La consapevolezza della complessità e della fragilità delle aree marginali viene affiancata dalla possibilità di valorizzare le loro potenzialità, facendo leva su patrimonio, cultura, tecnologia, applicando una visione olistica, interdisciplinare e integrata. A partire da queste riflessioni, il 3 e 4 ottobre 2024 si è svolto il Seminario internazionale *Reinventing marginal areas: heritage, cultures, technology*, che ha offerto l'occasione per proporre prospettive multidisciplinari per l'analisi e l'ipotesi di soluzioni alla marginalità, attraverso le quali suggerire strategie metodologiche utili a proporre un diverso destino alle aree marginali, valorizzandone l'identità e reintegrandole nella contemporaneità. Le ricerche e il confronto con le istituzioni e la comunità hanno preso spunto da un caso studio emblematico, che si estende alla sfera culturale, economica e sociale: l'area di Villa Maltese a Palermo, confiscata alla criminalità organizzata ed adesso assegnata alla Città Metropolitana di Palermo. Da questa esperienza nasce lo *Special Issue* della Rivista In Folio dedicato al tema *Reinventing Marginal Areas*, allo scopo di raccogliere contributi sul significato della marginalità alle varie scale dell'ambiente costruito, le sue conseguenze materiali e immateriali, sulle strategie e soluzioni che possono risolverla.

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*San Mauro Castelverde, drone photo (photo Zipline Sicilia <https://www.ziplinesicilia.it/>).*

# Enhancing to Avoid Marginalization.

## Strategies and actions for Smart Villages in inner areas.

Luisa Lombardo

*Inner areas of the Madonie Park represent an invaluable heritage yet face persistent challenges of depopulation and marginalization. Enhancing to Avoid Marginalization applies the Smart Village framework to integrate cultural and natural heritage rehabilitation, sustainable development, and innovation. Using SWOT analysis and comparative case studies, this research identifies actionable strategies to empower local communities, foster new economic activities, and improve quality of life, positioning the territory as a laboratory for resilient and inclusive growth—both by analogy and contrast with other contexts.*

**Keywords** Marginal Areas, Smart Rehabilitation, Territorial Resilience, Inclusive Sustainable Growth, Smart Villages

### From the margin to the centre: New territorial perspectives

Sicily, traditionally regarded as a 'land of cities' [Leone, 2004], exhibits a spatial distribution of settlements that generates complex urban forms, where interactions between consolidated and emerging settlements vary considerably. In this framework, inner areas and smaller centres assume the role of true territorial peripheries, located far from metropolitan and intermediate cities, yet connected to them through both material and immaterial networks. Despite their substantial territorial capital, these centres often suffer from limited administrative and entrepreneurial capacity and face territorial constraints that hinder the creation of new opportunities, particularly in service provision. Depopulation, low tourist appeal, and fragile infrastructure exacerbate this situation, especially in rural districts where the absence of primary economic activities renders communities dependent on nearby urban centres. The debate on inner, marginal, and peripheral areas has evolved through various cycles of academic and political attention, frequently followed by periods of neglect. Over time, these territories have been central to development strategies aimed at counteracting decline and enhancing potential. However, despite numerous interventions and theoretical

reflections, challenges persist, significantly affecting the quality of life of local communities and their socio-economic development.

Opportunities for revitalizing Italy's inner areas, particularly the Madonie region, have been provided by the National Recovery and Resilience Plan (PNRR) [Ivona et al., 2025] and the National Strategy for Inner Areas (SNAI) [Barca et al., 2012], which allocate resources to reduce territorial inequalities and strengthen social and economic cohesion. Mission 5, Component 3 of the PNRR, dedicated to "Special Interventions for Territorial Cohesion," aims to bridge disparities by enhancing social infrastructure, community services, and local healthcare networks. This involves reinforcing community services with a focus on social inclusion and active citizen participation, fostering cooperatives and circular economy models to generate employment; improving access to education, welfare, and healthcare through better transport networks and advanced digital connections; and activating local healthcare services via decentralized facilities, telemedicine, and innovative care pathways.

However, these policies have often favoured already advanced municipalities, rather than promoting collaboration across territories. Consequently, the vision of a collective, networked territory capable of smart development has

been limited, unlike in other contexts where cooperative approaches prevail. This gap in European literature is noticeable, as most policies are recent [Fernández et al., 2023] whereas other global regions have developed long-standing cooperative networks.

The COVID-19 pandemic reinforced these reflections [Bozzato et al., 2020], highlighting inner areas as refuges from urban pressures and environments conducive to lifestyle and cultural continuity. These dynamics have affected not only main settlements but also hamlets and rural districts, which remain marginalized due to low population density and geographic isolation, limiting their inclusion in development strategies. Administrative tendencies to focus interventions on historic centres rather than considering the entire territory further exacerbate marginalization.

The Madonie territory [Fig. 1] is emblematic, featuring a valuable natural heritage within the UNESCO Madonie Geopark and a medieval settlement system historically linked to defence and territorial control, evidenced by towers and castles. The 26 municipalities, combined with widespread traditional and vernacular architecture, offer significant opportunities for shared preservation and enhancement. The rural landscape is enriched by archaeological sites, villas, farmhouses, mills, churches, and hermitages, all interconnected by historical routes documented in Bourbon cadastral maps. Smaller settlements intensify the dense

network of habitation and services [Barca et al., 2020], creating “villages within villages” of extraordinary cultural and environmental value, often overlooked in policy.

Although contemporary dynamics provide planning opportunities, infrastructural strategies integrating the Madonie into regional networks date back to the late 19th century, exemplified by the unfinished 1889 railway project connecting inner areas to main hubs. The failure to complete such infrastructure has contributed to ongoing isolation and vulnerability.

In this context, the Smart Village concept [Bokun et al., 2023] emerges as a multidimensional development model combining tradition and innovation to overcome inner area vulnerabilities. Smart Villages should not be understood merely as technologically advanced settlements; rather, they represent interconnected communities that integrate strategic actions aimed at enhancing both tangible and intangible heritage, thereby revitalizing places, architecture, and people. International experiences documented in the literature [Lombardo, 2025] demonstrate a wide range of approaches adopted across America, Asia, Africa, and Europe. These experiences have been systematically analysed in a doctoral study comprising 70 case studies [Lombardo, 2025]; comparative analysis between extra-European and European Smart Villages highlights significant differences in terms of technological solutions, funding opportunities, regulatory frameworks, institutional



*Fig. 1. Back of the shop houses close to the agricultural fields: a space at the intersection of production and rural practices, march 2024 (photo by the author).*

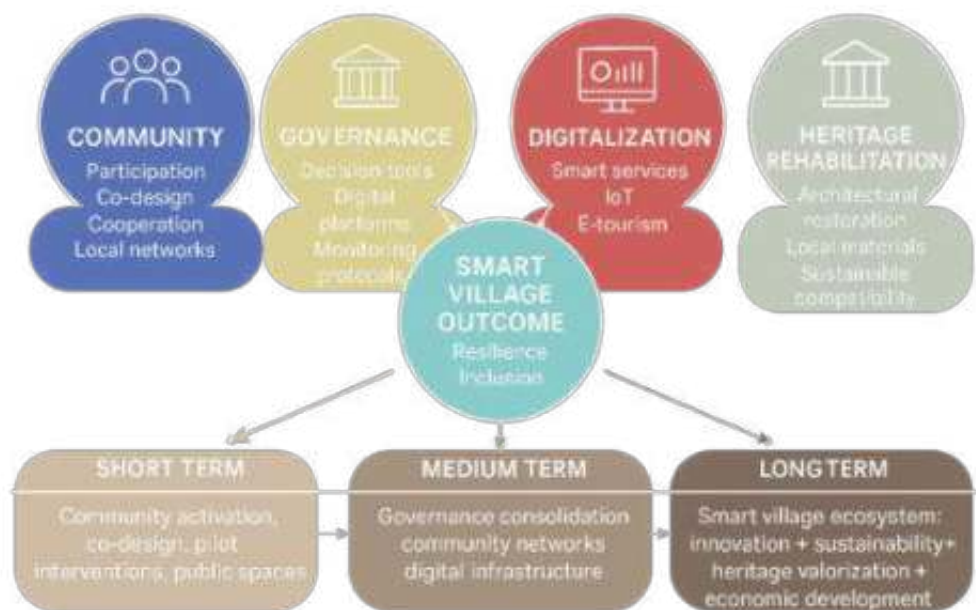


Fig. 2. Methodological framework for Smart Village outcome (elaborated by the author).

support, and implementation challenges. Extra-European initiatives often adopt more advanced and experimental technological solutions, frequently operating within less restrictive regulatory contexts; however, they commonly face limitations related to unstable funding sources and weaker institutional structures. Conversely, European Smart Villages benefit from consolidated regulatory frameworks and strong institutional support mechanisms, particularly through European and national funding programmes. At the same time, they must address stricter regulatory constraints and place greater emphasis on environmental sustainability, social inclusivity, and participatory governance. This underlines how differing policy environments and resource availability influence both the adoption of technologies and the overall development of Smart Village initiatives. These insights are crucial for identifying transferable best practices and for adapting strategies to specific territorial contexts. Through the integration of digital infrastructure, participatory governance models, and sustainable solutions, Smart Villages contribute to bridging the gap between urban centres and peripheral or inner areas. They enhance access to services, strengthen local economies, preserve territorial identity, and foster social inclusion, tourism development, and cooperative economic models. Building on this framework, the present study investigates the potential of Smart Villages within the Madonie Park, focusing on their capacity to revitalise inner and marginal areas by analysing key characteristics, implementation strategies, and positive impacts on accessibility, sustainability, and territorial resilience.

### A methodological approach to the rehabilitation and enhancement of marginal areas: The case of San Mauro Castelverde

The rehabilitation and enhancement of marginal territories require a multidimensional and interdisciplinary approach, combining innovative strategies, advanced technologies, and sustainable practices over short, medium, and long-term planning horizons. The approach is based on four fundamental pillars of social organization: community, governance, digitalization, and the rehabilitation of tangible and intangible cultural heritage. Synergy among these components is essential to ensure integrated and measurable development; the absence of any would compromise the transformation process toward a Smart Village. To understand which dynamics are most effective, a case study from the Madonie municipalities, analysed during doctoral research [Lombardo, 2025], is examined to apply the proposed methodology and define a concrete path. The methodology [Fig. 2] integrates these elements into a participatory local development strategy, leveraging territorial peculiarities and available resources while ensuring inclusivity and sustainability in rehabilitation processes. The Madonie territory preserves a dense network of historical routes capable of enhancing connectivity between marginal areas. Notable examples include the Via del Grano, famously described by Cicero and connecting to the Port of Alesa (Tusa, in Sicily), the Via Francigena, the Via dei Frati, and the Via di Biagio Conte [Anselmo et al., 2021]. These routes represent a potential infrastructure to link scattered settlements, integrating tangible and intan-



Fig. 3. Casale Botindari (A), Borgo Malia (B) e Karsa (C) in San Mauro Castelverde (photos by the author).

gible heritage within a framework of sustainable development [Lucatelli et al., 2022].

A key example is the municipality of San Mauro Castelverde, with about 1,200 inhabitants, comprising small rural districts and scattered settlements along routes connecting the town centre to neighboring municipalities, such as Borgo Malia (featured on the cover). Historically home to about twenty families, today only three residents remain. Agricultural activities, olive cultivation, and wood extraction formed the local economy, supplemented by a water mill serving the community. Similar patterns exist in Casale Botindari, Borgata Borrello, Karsa, Xinni, and Kalavri [Fig. 3], highlighting varying trajectories: some are nearly abandoned, others had schools, and some, rich in ancient olive groves and orange orchards, have become focal points for hospitality.

A virtuous example of rehabilitation is Borgo Buonotte [Fig. 4], transformed into a mid-to-high-level resort by a visionary owner. This intervention strengthened the hospitality sector and supported San Mauro's main urban centre. The restoration, compatible with historical and environmental contexts, activated a virtuous hospitality-based system—critical in the Madonie, where facilities for groups larger than ten are limited. Entrepreneurial scarcity and constrained growth opportunities further underscore the importance of such initiatives.

Limited access to education and employment reinforces abandonment and heritage loss, undermining social and economic fabric. The lack of gathering spaces and weak territorial policies intensifies marginalization, highlighting the need for interventions that combine heritage preservation with innovation to revitalize inner areas.

The proposed path begins with a SWOT analysis to identify territorial vocation and define guidelines for creating an intelligent, inclusive, and resilient territory. Subsequently, strategies inspired by international case studies are developed, particularly from European and Italian experiences, identifying analogies and best practices for territories with similar or contrasting characteristics.

Research in the Madonie Park, part of a doctoral thesis, led to identifying concrete actions aligned with the 2030 Agenda objectives. Beyond best practices, both a busi-

ness plan (ensuring economic sustainability) and a management protocol (monitoring, evaluation, and coordination of human, technological, and digital resources) are essential to define a Smart Village framework. Advanced technologies and sustainable practices ensure intervention effectiveness, while comparisons with successful national and international models confirm that integration of community, heritage, and innovation is key to activating virtuous development dynamics. Though developed for the Madonie, this methodology can be adapted by analogy or contrast to other contexts worldwide.

### From knowledge to action: Strategies for transformation into Smart Villages

In the cases of Casale Botindari [Fig. 3A], Borgo Malia [Fig. 3B], and Karsa [Fig. 3C], all within the municipality of San Mauro Castelverde, the application of the proposed methodology aims to develop targeted strategies tailored to the specific characteristics of each settlement, with the overarching goal of transforming them into fully functional Smart Villages. The methodology integrates the four pillars—community, governance, digitalization, and heritage rehabilitation—into a framework of concrete actions that simultaneously enhance quality of life, environmental sustainability, and economic opportunities.

The first step in the process is a comprehensive SWOT analysis for each village, which identifies local resources, constraints, and development potential.

Casale Botindari demonstrates significant potential in rural tourism, sustainable agriculture, and the promotion of local products, including olive oil and citrus fruits. A strategic intervention for this village could include the development of a digital product traceability system, ensuring both the authenticity of the local products and the sustainability of their production. This would allow the village to leverage its agricultural heritage while integrating innovative technologies.

Borgo Malia, with its strong connection to the historic Via del Grano, offers opportunities to develop a tourism model centered on the area's cultural and historical identity.



Fig. 4. Borgo Buonanotte (<https://www.anticoborgobuonanotte.it/>).

Digital tools, such as immersive storytelling, augmented reality tours, and digital platforms for cultural events, could be employed to attract visitors, linking innovation with local tradition. This strategy would not only enhance tourist engagement but also stimulate economic activities linked to hospitality and cultural services.

Karsa, characterized by extensive ancient olive groves, presents the potential for a development model focused on sustainable agriculture combined with smart technologies. Implementation of intelligent irrigation systems, environmental monitoring sensors, and automated management of natural resources would optimize agricultural production, improve efficiency, and ensure the high quality of outputs.

For each settlement, design strategies must prioritize sustainability and innovation while remaining consistent with the local context. In Casale Botindari, rehabilitation of historical buildings could involve the use of local materials and eco-friendly technologies, such as solar panels, biomass heating systems, and energy-efficient insulation, to reduce consumption and environmental impact. In Borgo Malia, creating coworking and co-housing spaces could attract young professionals, fostering economic vitality and social revitalization. The introduction of shared mobility applications and sustainable transport systems would further enhance accessibility for residents and tourists. In Karsa, smart farming systems, combined with technological greenhouses, could address challenges related to climate change and natural resource management while supporting innovation in agricultural practices.

Governance and community involvement are essential

for long-term success. Developing digital participation platforms enables residents to actively contribute to decision-making processes and monitor the progress of local initiatives. Participatory governance strengthens community cohesion and ensures that development aligns with local needs. Additional measures, such as digital neighborhood councils, co-design tools, agricultural support groups, and cooperatives, encourage collaborative management of resources and foster a circular, community-oriented economy.

Digitalization is a key component of the strategy. The deployment of smart services, including energy monitoring, intelligent resource management, and digital public service platforms, enhances liveability and sustainability. For example, in Casale Botindari, applications for energy and public service management can optimize consumption and efficiency. In Borgo Malia, immersive tourism applications and virtual tours enhance accessibility and visitor experience, stimulating the local economy. In Karsa, the use of IoT-based agricultural systems allows real-time monitoring of environmental conditions, improving crop management and product quality [Carrosio, 2019].

The combined application of these strategies across Casale Botindari, Borgo Malia, and Karsa constitutes a transformative pathway that integrates environmental sustainability, digital innovation, community engagement, and heritage rehabilitation. These villages become living examples of Smart Village development, offering transferable models for other marginal territories both in Sicily and internationally, applicable by analogy or contrast.



Fig. 5. Methodology to develop a Smart Village (elaborated by the author).

### Integrated strategy for the enhancement and regeneration of the Madonie: Smart Villages, Architectural Rehabilitation, and Sustainability

The project for the rehabilitation and enhancement of marginal areas in the Madonie region represents a comprehensive and multidimensional strategy that integrates technological innovation, the preservation of tangible and intangible heritage, and the active participation of local communities. Its overarching goal is to counteract territorial marginalization, transforming internal areas—often affected by depopulation and degradation—into dynamic, resilient, and competitive spaces capable of addressing contemporary challenges while becoming models of sustainable and innovative development. The methodology proposed is grounded in a systematic approach that combines SWOT analysis, comparative international case studies, and participatory planning, offering an innovative framework for Smart Village development, specifically adapted to the unique characteristics of the Madonie Park. The strategy unfolds over three temporal phases—short, medium, and long term—each with targeted interventions designed to generate measurable impacts:

In the short term, the focus is on initiating targeted interventions to revitalize public spaces and create essential services for local communities [Sargolini, 2016]. These interventions include co-design workshops, participatory activities, and the implementation of digital tools, all aimed at improving quality of life and reactivating the social dimension of the territories. Direct engagement of residents

fosters a sense of shared responsibility, strengthens social cohesion, and forms the foundation for sustainable development. Additionally, the introduction of innovative technologies for resource management and service provision addresses traditional isolation challenges, facilitating access to new business models, sustainable tourism, and local economic opportunities.

In the medium term, the objective is to consolidate initial actions by establishing a participatory governance model that ensures continuity and long-term sustainability. The integration of digital infrastructure enhances territorial accessibility, enabling new entrepreneurial initiatives. A central component of this phase is the creation of a network among local communities, promoting cooperation and synergy that amplify the social, economic, and cultural effects of the interventions. This network approach strengthens territorial resilience and the competitiveness of marginalized areas by enabling resource sharing, knowledge transfer, and collective problem-solving.

The long-term vision seeks to transform the Madonie into a fully integrated Smart Village ecosystem, balancing heritage preservation, technological innovation, economic development, and social inclusion. A key feature of this phase is the rehabilitation of traditional architecture and the valorisation of the rural and historic landscape through sustainable practices. Interventions employ ecological restoration techniques and local materials, ensuring compliance with modern energy efficiency standards while respecting historical and cultural identity. Such integration of heritage and innovation not only preserves the authenticity of the territories but also enhances their competitiveness within regional and European development contexts.

A central innovation of this work lies in the methodological integration of the four pillars of Smart Villages—community, governance, digitalization, and heritage rehabilitation—into a transferable and adaptable framework. By identifying the specific vocation of each village and engaging local stakeholders in decision-making processes, the model generates virtuous cycles of resilience, sustainability, and social innovation. Moreover, the approach demonstrates replicability, allowing other marginal territories, both within Sicily and internationally, to adopt similar strategies either by analogy or contrast, thus extending the applicability of the proposed methodology [Fig. 5].

In practical terms, the methodology has been applied to settlements such as Casale Botindari, Borgo Malia, and Karsa, where it guided SWOT analysis, identification of local resources and constraints, and the design of targeted interventions. The expected outcomes include enhanced economic opportunities, sustainable tourism, community cohesion, and environmental sustainability, illustrating a concrete pathway from research and planning to actionable Smart Village [Yasuoka, 2025] implementation. By

establishing a framework that links local knowledge, international best practices, and innovative technologies, the strategy represents a significant contribution to the field, offering a model that is both scientifically robust and operationally practical. This integrated approach [Lombardo et al., 2025] transcends mere physical rehabilitation, encompassing social, economic, and cultural regeneration. By combining community engagement, technological innovation, and heritage preservation, the project establishes a replicable and scalable model of Smart Villages capable of addressing depopulation, restoring value to local communities, and promoting inclusive, sustainable, and innovative growth. The transition from isolated interventions to networked strategies positions the Madonie region as a living laboratory for rural resilience [Stanny et al. 2025], demonstrating the potential of Smart Villages to contribute meaningfully to regional, national, and European development agendas.

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DIPARTIMENTO  
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DOTTORATO DI RICERCA  
IN ARCHITETTURA,  
ARTI E PIANIFICAZIONE  
DIPARTIMENTO  
DI ARCHITETTURA DI PALERMO

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