Decision-Making CIA Process (DeMaCIA) to Support SNAI Strategies: The Case of Castelluccio Inferiore in Basilicata, Italy

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Abstract. The debate on Inner Areas has produced the SNAI strategy (since 2014). It involves public and private actors, aiming to reverse the dynamics of small towns' depopulation and the citizenry's inaccessibility to primary services. We configured an intervention project for the Lucanian territory with an interdisciplinary approach and evaluated it through scenario simulation (DeMaCIA). The study is realized within an Agreement between the Municipality of Castelluccio Inferiore (PZ) and the Polytechnic University of Turin (2020–2025). Analyzing the use of resources deployed over the past 10 years (SNAI and PNRR) reveals a lack of population involvement. While identifying possible strategies to trigger active resident participation, we hypothesized the configuration of a Renewable Energy Community (REC) embedded in the site of the Old Mills, as a way to enable the collective sharing of the environmental and cultural resources of their area. The paper focuses on the methodology adopted by building a process to be applied in other fragile contexts.

Keywords: SNAI · Community Impact Analysis (CIA) · REC · Basilicata Region

1 Introduction

As is well known, areas referred to as "Inner Areas" (IA) in the Italian context cover 60% of the peninsula's land area and are home to 22% of the population. IAs are closely related to the morphological characteristics of mostly mountainous terrains, where poor accessibility comes with an absence of economic development. Most of these areas are organized into smaller centers, which fail to provide residents with adequate essential services, such as health, education, and mobility. The activation in 2014 of the National Strategy of Inner Areas (SNAI) [1] has triggered policies for territorial development to improve these services and the economic system in territories at risk of marginalization, especially as they are affected by depopulation [2]. The SNAI mainly uses European Funds to implement this process: after the first round of funding (2014–2020), a second

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one (2021–2027) has started. The policies of the Basilicata Region have been examined to check SNAI's effects on the national territory. The case study of the community of Castelluccio Inferiore (PZ) has been chosen to reflect on a methodological proposal to support Public Administrations' (PAs) planning process and the community's effective participation as an inclusive action embodying SNAI in its principles and effectiveness. The manufacturing sector can play a new role in achieving the goals proposed by the SNAI for IAs and in consciously developing practices for adapting to contemporary needs while working in parallel on countering the climate crisis and reconstituting fragile communities. In Castelluccio Inferiore the sequence of events has distorted its identity.

1.1 Background: The SNAI for the Basilicata Region

The SNAI 2014–2020 cycle for the Basilicata Region involved 4 IAs: Alto Bradano, Montagna Materana, Marmo Platano, and Mercure-Alto Sinni-Val Sarmento, formed by the aggregation of 42 Municipalities. The Partnership Agreement (PA) 2014–2020 [3] indicates two priorities: the first concerns "the adjustment of the quality/quantity of the supply of essential services," such as education, health and mobility, as well as the network of services required to ensure their maximum accessibility; the second is directed toward the activation of "Local Development Projects" [4]. The financial resources are distributed to the zones through the programs of the European Regional Development Fund (FESR), European Social Fund (FSE), European Agricultural Fund for Rural Development (FEASR), and Complementary Operational Program (POC). These are compounded by other funding, such as the contributions of the Stability Law (147/2013), for a total of about 138 M€ (DR Basilicata 53/2017).

In the distribution of funds, most interest is placed on roads (44.4% of investments), followed by Energy, Social Inclusion, and Tourism (11–15% of funds), and finally, Education and Business Aid (8%).

From 2019 to 2022, the subscriptions to the Framework Programme Agreement (FPA) by the 4 areas occurred at different times, especially hindered by the years of the pandemic. This delay did not allow for achieving effective results by the end of the period and carrying out ex post evaluations useful for planning the new cycle.

After the abolition of the Agency for Territorial Cohesion (DPCM of Nov. 10, 2023), the SNAI has been reappointed by the Department for Cohesion Policies and the South also in the 2021–2027 period, as established by the Partnership Agreement (PA) 2021–2027 [3, 5]. The new configuration introduces some changes for the new cycle, in addition to the identification of new areas and the redefinition of the perimeters of some of them: among them, the adoption of sectoral measures to support shared projects between Municipalities is deemed relevant [6]. The implementations follow the drafting of Cohesion Agreements, indicating the objectives and the coordinating entity of the funding. The interest in enhancing IAs originates from their geomorphologically defined and recognizable geomorphologically "compact" system, representing "an identifiable socio-historical unity that has been consolidated over time through socio-economic relationships" [7]. While recognizing the need to find a common denominator for defining territorial areas, it is clear that the SNAI has limitations in taking into account territorial complexity and specificities. For Basilicata, the same objective compactness represented

by both a "physical-geomorphological" unity and a "historical-social identity" unity has been left aside, choosing instead the municipal administrative borders as a reference.

Within the AP, Basilicata proposes new IAs for the SNAI program: a new re-mapping of the IAs 2014–2020 is planned, with the inclusion of 3 areas in particular: Medio Agri; Basento; Vulture with 23 municipalities and 2 Urban Areas that circumscribe the cities of Potenza and Matera with 12 municipalities, thus doubling the total number of municipalities involved by the SNAI. At the same time, a new classification of IAs is applied by changing the allocation of some municipalities from Peripheral to Ultra-peripheral.

This territorial layout is aimed at fulfilling the goals of the regional FESR and FSE-PLUS program, Basilicata 2021–2027. It follows the principle of the configuration of a "network of integrated territories", avoiding too many fragmentations, urging actions and objectives that solidify complementarity between municipalities in the provision of services (DR Basilicata 581/2023). The amount for the new cycle decreases by 6%; this is made more onerous by the increase of the involved area, penalizing the municipalities included in the first cycle of IAs in favor of newly established ones. The new SNAI program is concurrent with the National Recovery and Resilience Plan (PNRR) 2021–2026, which also directs its resources to the policy of strengthening IAs. The common goals involve balanced and sustainable spatial development through the redistribution of new economic opportunities to strengthen local communities, supported by extensive infrastructure (transportation and technology). PNRR funds thus integrate with FESR and FSE funds. The PNRR allocates 1.8 B€ to the Basilicata Region, funding a total of 3528 projects. The data for the 1st half of 2024 show that, in the distribution of investments by mission, there is a prevailing 50.8% budget for Mission 3 "Infrastructures for Sustainable Mobility" (M3) and a 20% for Mission 2 "Green Revolution and Ecological Transition" (M2) [8]. PNRR funds mostly benefit the SNAI regarding the improvement of essential services (health, education, and mobility), while little is directed to supporting economic development and job creation, without materializing the SNAI's ultimate goal of providing these areas with new growth opportunities that enable people to stay, work, and invest in their home areas.

In examining how ongoing projects have considered the possibility of triggering development based on local specificities, generating economic activity and involving communities in a participatory manner [2], a varied presence of small, non-institutionalized initiatives emerges. Unfortunately, these are neither cataloged nor easily comparable in terms of size and outcomes.

The involvement of residents mainly concerns the sectors of sustainable tourism (nature-based or agritourism), agriculture (enhancing local products), culture (historical heritage), and education (outdoor education), as is also the case in other IA in Italy [9].

1.2 Background: The MASV IA

The Mercure-Alto Sinni-Val Sarmento (MASV) area is characterized by more inhabitants and a higher extension than the other areas identified for the Basilicata Region, in addition to the presence of the Pollino National Park.

In the 2014–2020 SNAI, it consisted of 19 municipalities, 14 of which were included in the Ultra-peripheral category: with the new 2021–2027 cycle, the MASV area has been

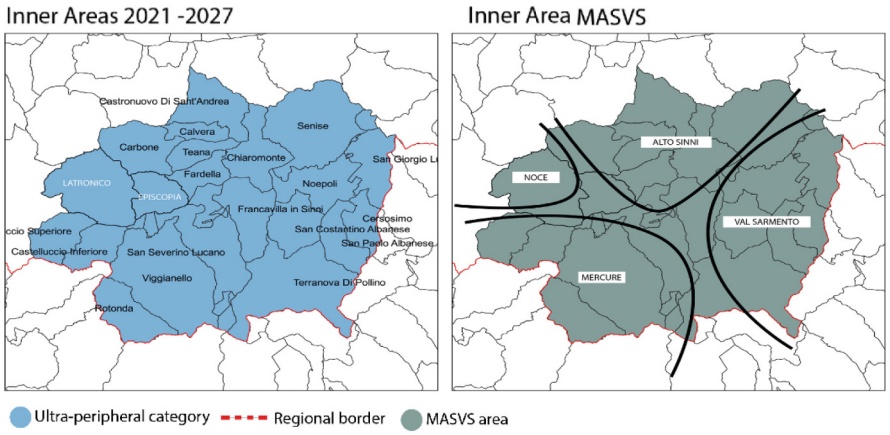

Fig. 1. Left side: MASVS perimeter, classification, 2021–2027 cycles. Right side: Mercure's valley. (Source: Authors' elaboration)

re-perimetered by including two new municipalities (Episconia and Latronico). Moreover, it is fully considered Ultra-peripheral (Fig. 1). The development of the Apennine ridge is closely linked to the dynamics of the IAs in this area. Moreover, the territory is characterized by an impervious orography, which prevents agile connections between even close territories. A notable element is the presence of the A2 Salerno-Reggio Calabria highway section, which allows for faster travel, in contrast with the total absence of the railway system. In the 2014–2020 cycle, MASV signed the Framework Agreement on November 11, 2020, managing funds amounting to 59 M€ to implement 136 projects. This consists of 34 M€ from the FESR, 21 M€ from the Basilicata COP, and 4 M€ from the SNAI for Basilicata. In the 2021–2027 cycle, the MASV IA has acquired 15 M€ for Priority 11 0S 5.2 and 3 M€ for Priority 5 OS 3.2, compounded by 300,000 € from CIPESS 41/2022, for a total of 18.4 M€ [10]. Fund distribution is coordinated by the lead municipality, Francavilla in Sinni. Each project often turns out to be a stand-alone entity. The use of funds reveals that the greatest critical issues arise from the absence of synergic territorial programs involving multiple centers in building a network defined by local identities that do not always correspond to administrative boundaries.

2 Strategies and Research Questions

The complex framework depicted in §1 clearly shows the need to outline a *problem-solving* approach and identify a methodological proposal to support operational intervention methods through a control room, synergistically cooperating with citizens according to participatory, consultative, and co-design methods. The methodological approach outlined in §3 starts with the following research questions:

Is it possible to configure processes that are strongly anchored with territorial identities? Can PAs be supported in identifying innovation-triggering processes, able to produce new opportunities for land preservation? In Basilicata, and in particular in the

MASV IA, which themes and resources could build a relationship between population, institutions, and territory?

3 Research Methodology: The Decision-Making CIA Process (DeMaCIA) Method

The goal of the research is to design new forms of IA development that enhance the specificity of places and encourage the involvement of all stakeholders within an area. This paper fine-tunes the methodological framework for Castelluccio Inferiore to evaluate whether it can be extended to other contexts. Starting from the analysis of the specific phenomena of MASV (and energy production for the Castelluccio case study), we intend to highlight the research methodology to support the *decision-making* of PAs, which has focused on three pillars: 1. The SNAI, 2. Renewable Energy Communities (RECs) model, 3. Generative Economy principles. These three elements, when considered together, represent an integrated and innovative response to territorial challenges for revitalizing local communities and fostering sustainable and participatory development. Specifically, RECs are groups of private individuals, Small and Medium Enterprises, territorial entities, or local authorities that decide to establish a legal form to produce and share energy collectively, deriving collective benefits of social, environmental, and economic nature. These decentralized energy production and management models contribute to fostering energy autonomy through a social innovation process that can overcome the concept of the citizen as a mere consumer, transforming him or her into a co-producer and fostering a culture of participatory and sustainable management of territorial energy resources.

Communities that invest in renewable energy can also access public funding and tax incentives, making this model a real opportunity for local economic development. The PNRR plans to take action by accelerating the development of small-scale energy communities and distributed systems through tariff incentives, grants, and financing for the construction of plants up to a total of 5 GWatts (by 2027). This approach aligns with the SNAI and REC initiatives, where the redistribution of economic benefits from incentives can be a powerful tool for building an economic system that respects local resources and communities' rhythms and vocations. Energy becomes a common good, accessible for all, with care for the most vulnerable citizens and the most marginalized groups, socially and/or geographically.

The synergy between the SNAI, RECs, and generative economy principles can be a paradigm shift for the development of Italian IAs by helping to transform the local development model, making it more sustainable. In light of the three pillars mentioned, the research group of the Polytechnic of Turin[1] has developed a methodological proposal for a multi-phase process to support the *decision-making* of the PAs involved in the SNAI and responsible for financing, which must act and generate multidimensional impacts on the "fragile" areas that are the object of such strategies. The methodological approach is based on the CIA Decision-Making Approach (DeMaCIA) [11], which has

[1] Programma di Riposizionamento Competitivo e Strategico: Convenzione Comune di Castelluccio Inferiore (PZ) e DAD Politecnico di Torino, Torino 16.03.2021.

developed from the original Community Impact Analysis (CIA) Method but includes a step-based parallel process of stakeholder consultation (structured by interest groups in the Lichfield style) (following phases 0, 2, and 3 in Fig. 2) and a collegial assembly presentation of the final scenario. The adopted methodology is proposed with some new activities (Fig. 2, multi-phase process) to assess the role of each stakeholder based on their multi-dimensional impact on the scenario within the development of the SNAI.

Four phases are proposed, aimed at allowing a flexible application of this classical methodology in different study areas through amendments and adaptions to better represent the field of expertise and the role of specific actors.

As it is well-known, in literature the CIA method and its development into the CIE are included among Cost-Benefit Analysis (CBA) techniques [11] but classified as a variant that overcomes some of the limits of the CBA itself [12–14], since it allows the simulation of scenarios, the precise definition of areas of investigation, the identification of subjects, the introduction of the temporal variable for the evaluation of the consequences, and the application of qualitative evaluations on the outcomes. European legislation, particularly the Next Generation Bauhaus [14], emphasizes the importance of community involvement and dictates that processes must include policies to support active citizenship activities. Against this backdrop, DeMaCIA proves to be a robust and effective method in facilitating such processes and in transparently highlighting the positive and/or negative impacts (in both qualitative and quantitative and qualitative-quantitative terms) for each stakeholder group that certain IA development alternatives may generate at specific points in the process. The DeMaCIA facilitates the engagement and co-design community process and supports it in the stages of defining strategic elements within the construction of alternative scenarios, analyzing their temporally (short-medium and long-term) and dimensionally (on-site and off-site) heterogeneous spillovers. DeMaCIA's methodological proposal has 4 steps: it represents an "evolved" version of the CIA method, obtained by strengthening its processual logic, collaborative-consultative mode, and problem-solving capability [15, 16].

The strength of the traditional CIA lies in its robust structuring of strategies to support the identification of intervention scenarios always about community groups: it maintains its investigative nature concerning the subsequent phase of the CIE, in which qualitative assessments are formalized through the most suitable techniques. In DeMaCIAthese elements are maintained, but the "traditional" process is accompanied by specific moments of consultation and interaction with stakeholders that provide aspects of convergence or indicate potential and further critical issues to be taken into account in the final phase of impact assessment: in this sense, they strengthen its nature of aid to the decision-making process, making it more participatory and scalable even to small realities.

It is essential to set research objectives (Phase 0) aligned with the PAs that create development levers concerning the critical issues highlighted in §2 and impacts for the stakeholders involved. This serves as a prerequisite for outlining both the geographical boundaries and possible thematic or methodological constraints. The analysis of the competitive framework in the territorial context (Phase 1) is based on data collection and knowledge construction activities to understand the characteristics and peculiarities of the area (cultural heritage, natural resources, territorial planning, and "intangible"

heritage). The outputs of this phase consist of: 1. Understanding the territory's vocation, evaluating its strengths and weaknesses (competitive framework model and SWOT Analysis); 2. Identifying a user base interested in undertaking this type of experience and choosing alternative ways of enjoying the cultural heritage of the sample area.

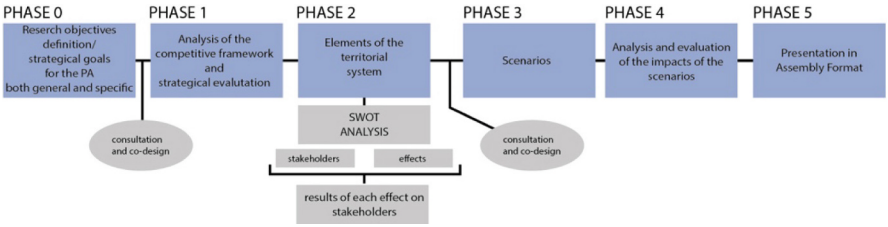

Fig. 2. The methodological approach: the Decision-Making CIA process (Source: Authors' elaboration)

The synergy between the SNAI, RECs, and generative economy principles can be a paradigm shift for the development of Italy's mountainous areas. The combination of these strategies can help transform the local development model, making it more sustainable, inclusive, and resilient **(Phase 2).** Thus, local communities no longer serve as merely passive beneficiaries of economic policies but become active participants in the transformation of their local areas and can proactively contribute to the improvement of the proposed scenarios. In this vision, the future of IAs will shift from isolation and depopulation to rebirth, based on a participatory and regenerative approach, capable of enhancing the natural, social, and economic resources present on site according to a development model centered on people's well-being and environmental protection. In this phase, DeMaCIA was tested in the technical steps (inherited from the traditional CIA model) of structuring the elements of the System, individuating the effects (to be successively translated into impacts), and identifying and classifying the Community interest groups to be consulted. **Phase 2** and **Phase 3** represent the decisional design to support the identification of alternative development scenarios compared to the current state (zero option). Finally, support is provided to PAs in **Phase 4** through the analysis and evaluation of the preferable scenario resulting from the analysis of impacts, which can be illustrated in an assembly to the interest groups, structured according to the CIA.

4 Focus Area (FA): Castelluccio Inferiore (PZ)

The municipality of Castelluccio Inferiore (population 1911 in 2024) is one of the 21 municipalities that constitute the MASV IA (Mercure area) established in 2014. With the new classification – 2021–2027 – Castelluccio is considered Ultra-peripheral due to the continuous population decline estimated at −10.28% in the decade 2011–2020 (see ISTAT data). The territory is located within the Mercure plain, in Valle del Mercure-Lao, a valley that develops between the Basilicata and Calabria Regions and constitutes a system of close relations between the municipalities of the two regions (see Fig. 1). The pivotal elements around which the anthropogenic development of the valley revolves

are hydrography and orography. Hydrography drives the development of routes, connections, and residential, manufacturing, and production settlements. The orography provides an interesting demarcation between the Lucanian territory, characterized by the soft reliefs of the Mercure plain, and the Calabrian territory of the Lao gorges, the valley floor, and the coast.

An initial observation of the centers shows that most of those located on the river stretches have a large productive fabric characterized by the presence of now-disused factories. It is not difficult to imagine that the characteristics of the area, combined with the mountainous landscape's richness of materials, favored the development of manufactures, which used water power and represented the region's main economy until the first two decades of the 20th century. The presence of water was the basis for the operation of most of the facilities, as it favored processes in mills, spinning mills, oil mills, sawmills, and tanneries in the area. The interesting aspect of this phenomenon lies in the development of the technologies for the construction of the plants. Indeed, they adapted to the singularities of the river landscape with integrated systems between water networks of locks, reservoirs, aqueducts, dams, and canals. The role of these constructions is fundamental because they allowed for proper management of the flow of water, which, once used, was conveyed to the manufacturing building located further downstream, resulting in a serial pattern that produced control over the river course. This aspect laid the foundation for a reinterpretation of the role of manufacturing in marginal areas. Through a more specific analysis of the succession of production dynamics, it has been possible to investigate the phenomena that have defined its recent historical development, helping to slow down and subsequently accelerate the marginalization process. We refer to the events that led to the construction of the large Enel Mercure Power Plant. Starting with the discovery of lignite deposits, used as a fuel for electricity production, from the 1920s onward, the dynamics of the valley changed abruptly. Inhabitants were employed in tunnel mining and transportation to the Campania centers where the process of combustion and transformation into energy took place. This system completely changes the socio-economic fabric of the valley by attracting a large flow of labor. In the post-war period, the construction of the Power Plant, positioned at lignite mining sites to enable a reduction of time in processing the raw material directly on site, was a turning point. Much of the population was employed at the Power Plant in the early years, and the urban fabric of the municipality was altered to accommodate previously nonexistent functions such as cinemas, theaters, sports fields, after-work spaces, and workers' housing. Castelluccio became the center of a significantly larger manufacturing system, attracting population, new technologies, and new functions and changing the social fabric. The process came to an abrupt halt with the closure of the power plant, which was considered obsolete as early as the 1980s, with major consequences for the Valley's municipalities and population employment, affecting population decline. The extraordinary development helped to reflect on the positive aspects that both manufacturing and industrial production had had on the center of Castelluccio. The manufacturing businesses had successfully exploited the specificities of the area through skillful management of the resources of the individual communities owning the plants, which became collectors of social activities and hubs of aggregation for the inhabitants.

4.1 Projects and Funding

The current condition of the municipality of Castelluccio Inferiore is typical of a municipality that is experiencing depopulation dynamics. Most residents live near the historic center, where mainly tertiary activities are concentrated. Within the historic center, however, many buildings are in a state of disrepair, particularly in the Rizzano and St. Anna districts: the Enel district suffers from depopulation, with several unoccupied dwellings in an obviously advanced state of deterioration.

The Municipality of Castelluccio adopted a program (2024–2029 mandate) to reknit together intentions already made explicit in part from 2020 with the "Tourism, Culture, Major Events Enhancement Project. "The initial goal was to build opportunities fueled by the enhancement of historic sites. Six projects were launched, among them: "revisiting mining sites" for the localization of tunnel portals, "conversion of the former municipal headquarters into a Museum Hub" to narrate the manufacturing history by documenting the features of local industrial archaeology, "the recovery and enhancement of Borgo dei Mulini" including the environmental restoration of the banks of the S. Giovanni river, the conversion of buildings such as the Spinning Mill (which had just been renovated at the time) to house the Interactive Museum on Pollino Geosites, and the inclusion, along Mill Street, of a new building for a Research Center. In the new program (C.C. Resolution 29.6.2024), "Productive Activities & Opportunities for Development and Technological Innovation" also include future intentions related to the former manufacturing areas, and thus the "completion of the existing facilities of the former Spinning Mill and the acquisition of the existing Mill with educational and tourist purposes" and the "reopening of the Lignite Mine" located in Pietrasasso – Fiumara del Pegno, formerly ex SME (Enel) for educational-tourist purposes". The enhancement program is supported by the "realization in the former Municipal House of the Civic Museum where to allocate community artifacts and historical traces" Within the SNAI 2014–2020, the Municipality of Castelluccio Inferiore directly managed 6 projects totaling 656,000 €. The budget was mainly allocated to the Energy theme (62%, 3 projects) with interventions regarding optimization of public lighting, energy efficiency, and electricity production from renewable sources for a school and the municipal house. 30% (1 project for 198,000 €) was earmarked for the redevelopment of Borgo dei Mulini (culture and tourism theme) – FESR Basilicata 2014–2020, while the remaining funds go to the purchase of equipment for carrying out innovative teaching in the middle school (networks and digital services theme) and for fire prevention and firefighting (environment theme). These projects are known to be 90% completed. The Castelluccio center is also involved in inter-municipal and regional projects, such as upgrading the water network to reduce aqueduct network losses, distribution of a defibrillator for each municipality (managed by Francavilla in Sinni), upgrading of SP46 (managed by the provincial administration); hydrogeological works, the renovation of the Outpatient Clinics (managed by ASL PZ), and the installation of the broadband telecommunications network. Regarding manufacturing sites, the Borgo dei Mulini, near the historic center, is where the old manufacturing buildings are located. Considered one of the best-preserved mills and factories in the Lucanian Apennines, the enhancement of the complex involved the architectural recovery of the old Spinning Mill. Unfortunately, upon completion of the works, the building, without a specific purpose, soon became isolated from its context. Hence, the need arose for PA to

define an effective enhancement strategy. From the analysis, the theme of manufacturing is avowedly an identity fact (interest in the village of mills and lignite quarries), and the process of valorization is underway, as proven by the approved programs. Unfortunately, to make this process effective, we lack two elements: the population's effective involvement and coordination throughout project phases. This requires a control room carrying out the process (knowing its stages and objectives) and can build connections on even heterogeneous but synergistic areas to expand diffusion and benefits. Against this backdrop of potential and critical issues, we suggested and proposed to the Castelluccio PA the experimentation of the DeMaCIA and initiated it (§5), to structure the preliminary decision-making phase and support the identification of a final scenario shared by the community and characterized by the ambitious challenges highlighted by the SNAI.

5 Results

The PoliTo research team applied the aforementioned 4-phase methodological approach (DeMaCIA process Method, §3) to the Castelluccio Inferiore (PZ) territory. The following were performed: the definition of the main objectives, synergic with the three SNAI pillars (§2), and the competitive framework; the identification of the elements of the system, the classification of the effects, the structuring of the stakeholders and actors to determine the main potential actors to be involved in enhancement processes to reactivate the territory, the transformation of the effects into impacts for each interest group, and the identification of alternative scenarios to the current state, supporting the phase of assessing the impacts on the development scenario recommended to the PA. Below are the application details and results of each phase:

Phase 0 *Definition of research objectives/PA strategic goals*

This is the preliminary stage where the objectives identified within the critical themes that emerged during the IA context analysis phases were interwoven with those resulting from the dialogue with PAs and citizens. The project's general objectives focused on the themes identified by the SNAI, contextualized through reinterpretation to meet the specific needs of Castelluccio. The strategic goals are: 1. Demographic trend reversal: depopulation/emigration; 2. Increased citizen services: citizenship services, restitution of disused public space, and 3. Territorial heritage enhancement. The proposals devised for the municipality interpret the historical vocation of Mercure and its manufacturing history, articulating it through new forms of energy production related to RECs. The specific project objectives are: 1. Proposal contextualization, by giving attention to the specific characteristics of the territorial context; 2. Innovative development by introducing new forms of sustainable energy production and social innovation for community value rethinking and development through RECs; 3. The enhancement of land resources by proposing functions and activities that can meet the current demand; 4. The ability to trigger an attraction mechanism for potential and future demand from a larger territorial basin through a synergistic process among the Bacino del Mercure municipalities; 5. Participation, intended as the ability to ground systems of involvement to integrate different levels of roles belonging to different types of users with particular regard toward PA, citizens, and businesses; 6. Project compatibility with the physical characteristics

of the asset and with the current urban and planning constraints, aimed at preserving its environmental integrity and historical and cultural value. These goals were explained to the communities. Within this phase, expanded territorial areas were also defined, including territories excluded from the MASV area, to develop and interpret vocations and possibilities of more territories regardless of the administrative limits imposed in the SNAI. The definition of the areas was carried out by identifying the time intervals for the application of the evaluation model, also considering the time required for the preparation, establishment, and steady-state phases of the RECs.

Phase 1 *Analysis of the competitive framework and strategic evaluation*

In this phase, strategically preparatory to the CIA phases in the strict sense, thematic analyses were conducted on the territory (Population, Economy, Environment, Mobility and Accessibility, Heritage, and Processuality) according to the traditional Competitive Framework Analysis Method, synthesized into the SWOT Analysis and CIA explorations [12]. This allowed structuring the System Elements, then fine-tuned in a consolidated form in Phase 2.

Phase 2 *Elements of the territorial system*

In this phase, two complex but strategic application steps were developed, as they are pivotal to the final evaluation phase: 1. The identification of the objectives and system elements; 2. The identification of the effects for interest groups. The applied methodology considers all areas the project intends to act on, dividing subjects by interest groups. Two main categories are identified: 1. Operators-producers, i.e., entities that contribute to activating the territory; 2. Consumers, i.e., passive individuals who consume and use the goods and services produced. To strengthen the bottom-up logic and transparent decision-making, a further technical step of the DeMaCIA included the identification and classification of interest groups according to the taxonomy indicated by Lichfield [11], yet considering their close relation to the objectives defined in Phase 0, and refocused with the PA (see Fig. 3). These technical steps in the method allowed for greater transparency in discussions with interest groups and more detail to explain the strategic levers of the scenarios "under construction.

Phase 3 *Scenarios*

The results of Phases 1 and 2, highlighting strategic elements related to objectives, contexts, timing, and interest groups, have fed the construction of the alternative scenario to Option 0, namely the Bottom-up Scenario (see Fig. 4). It envisions the introduction of an energy community within Bacino del Mercure. In this context, the promotion of the REC as the result of an initiative by the citizens is simulated, providing for greater community management of resources, facilities, and related funding. The role of administrations in this context, while present, is limited to community participation and support. Since all specific contexts and possibilities for the RECs of each specific municipality cannot be studied, in the meta-design proposal, specific solutions have been simulated for the municipality of Castelluccio, and then procedures and outcomes have been extended to neighboring municipalities to study future impacts and effects. Regarding the steps related to the establishment of the REC in this scenario, "mild" solutions are

GOALS
CX_CONTEXTUALISATION
IN_INNOVATION
VA_VALORIZATION
AT_ATTRACTIVENESS
PA_PARTECIPATION
CO_COMPATIBILITY

EXTENDED SCOPE	
LINKAGES	urban services
	transport and accessibility
	circuits and networks
	communication routes
FABRICS	economic
	social
	cultural
	environmental

SITE	
POPULATION	that lives
	that works
	that visits
ARTIFACTS and PHYSICAL ELEMENTS	soil
	structures
	natural resources
	cultural resources
	services
	transport networks
	buildings and areas
	open spaces
ACTIVITIES and USES	residential
	productive
	tertiary
	cultural
	leisure
	consumption

Extract of the table of the assessment of the impacts on the stakeholders selected among those considered most significant for the **BOTTOM-UP SCENARIO** in the 3-10 year time

BOTTOM_UP OPTION						
ASSESSMENT of IMPACTS on DIFFERENT INTEREST GROUPSAND on the RELEVANT SPECIFIC OBJECTIVES on the SITE in REFERENCE to the PIL OT PROJECT (3 – 10 years)						
Goals	**FINALCIAL IMPACT**	**TAXI IMPACT**	**ECONOMIC IMPACT**	**SOCIAL IMPACT**	**CULTURAL IMPACT**	**ENVIRONMENTAL IMPACT**
OPERATORS _ PRODUCERS						
PUBLICS						
EUROPEAN UNION						
CX_	Subsequent funding to encourage energy communities to promote Energy Transition		Choice between different projects to finance (in terms of attractiveness and competitiveness of the system, within a framework of environmental and territorial sustainability and social cohesion)			
ITALIAN STATE						
CX_	Expenditure to support the works	Tax breaks				
IN_			Greater selection of supported projects (of innovative valorisation)			
BASILICATA REGION						
CX_	Provision of funding for recovery and maintenance works			Strengthening social cohesion		
IN_	Provision of funding for recovery and maintenance works			Rethinking and developing community value		
MUNICIPALITY OF CASTELLUCCIO INFERIORE						
CX_	Expenditure to support the works			Participation in the phases of dialogue with citizens as figures supporting the work Investment in involving the entire population to make them an active protagonist of the project	Protection, improvement and enhancement of the conditions of cultural heritage	Environmental redevelopment Reducing emissions
IN_	Expenditure to support the works		Greater selection of projects to support	Improving the way you interact with the PA		Environmental redevelopment
VA_	Expenditure to support the works		Regeneration and enhancement of existing artefacts. Profitable economic asset in the municipal territory			Environmental redevelopment
AT_	Expenditure to support the works			Better visibility of the entire Municipality	Increase in cultural offerings	Greater liveability of public spaces
PRIVATE						
BUILDERS						
CO_	New projects (investments and financial returns) Cost due to the construction of the systems		Economic returns	New job opportunities also in the maintenance sector		
IN_	New projects (investments and financial returns) Cost due to the construction of the systems		Economic returns	New training possibilities		
ENERGY COMMUNITY MEMBERS						
CO_	New projects (investments and financia returns) Lowering of bills	Selling the energy produced at a higher price than the market price	Economic returns	Social cohesion, re-appropriation and dired management of one's assets, possibility of dialogue and negotiation with public bodies and companies	Direct manage-ment and renewal of its cultural heritage, recovery of former mill production spaces, recovery and transmission of the industrial past	Environmental redevelopment
INHABITANTS						
PA_				Greater involvement of workers in the problems, opportunities and positive realities of the Energy Transition	Greater stimuli for cultural growth	
CO_				Management of your assets		Environmental redevelopment
WORKERS						
CX_	Financial Flow Opportunities			Greater involvement of workers in the problems, opportunities and positive realities of the Energy Transition		

Fig. 3. Decision-Making CIA process-Phase 2: system elements and example of assessment of impacts on different groups of interest (Source: Authors' elaboration)

simulated involving smaller generation systems, also considering the community management mode. After the necessary pathways of study, analysis, involvement, and work with the citizenry (preliminary phase), some specific interventions are planned in specific areas of the Municipality for the realization of systems. All the generators present in the territory were mapped and considered; moreover, three main nodes were identified. These play a key role in the transition process of the Municipality of Castelluccio: they are Borgo dei Mulini, the Enel district, and the former railway station.

With reference to the regional technical map, Borgo dei Mulini – where, as already highlighted, there is a complex context of historical manufacturing buildings – in this scenario has been identified as the site of a mini-hydroelectric plant for energy production. This new innovative element aims to fit into the environmental context of Borgo dei Mulini, in continuity with the system of existing manufactures, contributing to their regeneration and the enhancement of existing artifacts. Traditional techniques are adopted, while historical infrastructures are relied on to guarantee the protection of the environmental context of the San Giovanni torrent.

In addition to being a key part of the municipality's history, the Enel district is an interesting node for integrating renewable energy generation and (virtual) self-consumption systems. The required redevelopment work on buildings has been turned into an opportunity to combine residential spaces with productive systems placed on roofs. As anticipated, the last item concerns the former Castelluccio train station. The railway track dismission left the artifact completely isolated from its context, at the center of an open space used for parking. The reconversion of the railroad track into a bicycle path also helps consolidate the image of this part of the city as a key element in the city's territorial connection. Within this scenario, the artifact and its neighboring space are rethought as elements serving the community. When the REC's development reaches maturity, the former station can become the site of a center for the logistical management of transport and connections. It will also be possible to include innovative electric public transport to serve REC member municipalities, spaces for charging electric cars, and an e-bike system to serve the population and tourist flows to Pollino Park. The community resource management of the REC is intended as an opportunity for the citizenry to rethink the role of buildings and production infrastructure. In the past, these communities' economy and survival revolved around manufacturing buildings such as mills, olive oil mills, and spinning mills. Similarly, the transformation nodes developed within this scenario are meant as possible community attractors. The aim of combining energy production and management with community spaces such as green areas, spaces for children and the elderly, and venues for associations and cultural activities is to rebuild a connection between the population and the productive artifacts to create a direct relationship between the objects and the people who own them. Indeed, a consultation step with the stakeholder groups identified in Phase 2 will take place (Fig. 4).

Phase 4 *Analysis and evaluation of the impacts of the scenarios*

The "winning" Bottom-up Option scenario, subjected to the CIA's preliminary assessment and presented to the assembly, turned out to be the one most aligned with the SNAI challenges and generates the most positive impacts for the largest number of community groups involved (see Fig. 5). Some transversal themes emerged through the development of the model, bearing particular relevance in the final evaluation. These

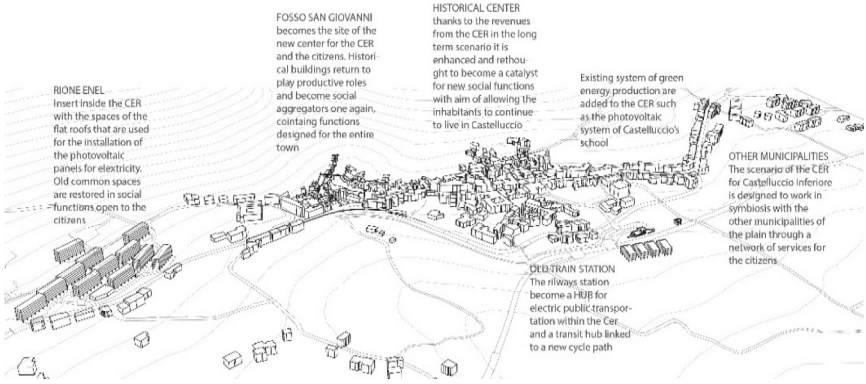

Fig. 4. View of the proposed interventions for the Bottom-up scenario of Castelluccio Inferiore (Source: Authors' elaboration)

pivotal elements can be traced to three keywords: Governance, Heritage, and People. Governance indicates the important role that PAs, at various levels, play in project development. The role of the public is considered to be of fundamental importance in each of the scenarios, as it is not possible to imagine the development of a REC without taking it into account. In the Bottom-up scenario, the relationship between the public and private sectors is horizontal; in this proposal, entities serve as involved subjects and are not directly responsible for processes, as they operate in favor of REC members by supporting their decisions and operational steps.

This approach enables the coordinated management of assets and production facilities by fostering dialogue between administrations and their citizens, sharing expenses, responsibilities, and burdens. The second point concerns heritage and the relationship of energy communities with it, both regarding the landscape and the built environment. In the Bottom-up scenario, this is favored by a Bottom-up awareness-raising process on heritage, with a focus on manufacturing heritage. The direct management of artifacts, as in the case of Castelluccio, not only fosters knowledge collection on the area and the development of a collective memory of the industrial age but also a sense of belonging for the community members toward their historical artifacts. The last theme, indicated by the keyword "people," concerns people and citizens. As already anticipated, user involvement is one of the cornerstones of the development of RECs. For this reason, the Bottom-up scenario adopts the optimal path for the establishment of the energy community.

Starting from the preparation phase, engagement is developed by raising awareness among citizens, leading them to act on their energy and resource consumption habits. It is important to see how the scenarios continuously overlap regarding their themes and expected effects and outcomes; this characteristic denotes a complexity in the theme of

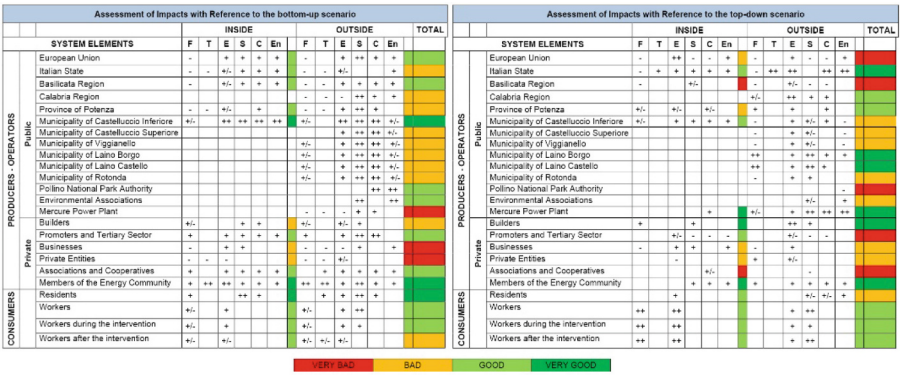

Fig. 5. Decision-Making CIA Process - Phase 4: the Final Evaluation Grid Final Impact Assessment (Source: Authors' elaboration)

RECs, which this paper has attempted to address without claiming to propose definitive solutions[2]. These sporadic experiences, still lacking clear regulations and decrees, prove that such a radical process of change requires considerable time and effort. In any case, the bottom-up option turns out to be an extremely interesting alternative for the development of energy communities in IAs, because it allows for transversal work between the main themes, and because it produces more continuous and distributed effects over time, leading to cohesive development of the whole territory as visible in the simulation for Mercure and the Municipality of Castelluccio Inferiore.

Figure 5 reports the summary of the final evaluation, where the numerous effects of the bottom-up scenario (Fig. 3 – Phase 2), linked to the strategic objectives of the interventions (submitted to the moment of consultation and co-design and therefore shared in Phase 3) are traced back to a taxonomy of impacts (of a quantitative, qualitative and mixed nature) already indicated by Lichfiled: F (Financial), T (Tax), E (Economics), S (Social), C (Cultural), En (Environmental). The evaluation of the impacts is carried out about the different "community groups" (classified into active/public and public operators and passive/public and private consumers), but also taking into account the territorial variable (on-site and off-site) and the temporal variable (short-term impacts and medium/long-term impacts). DeMaCIA draws on the CIA (not the CIE), since it is an approach to be applied in the process of building strategic intervention scenarios (in

[2] Since there is no comprehensive mapping of REC experiences in municipalities within IAs, a few specific cases deemed significant by experiences and outcomes are here reported. According to GSE (Gestore Servizi Energetici) data alone, in Italy as of the end of 2022, there were 67 active configurations and a total of 501end customers connected to CSC (Collective Self-Consumption) and REC configurations. Regarding RECs active in areas involved in the SNAI, we highlight the experience of the Gubbio Energy Community, 2023. Several are projects underway: *BeCom*E project, Comuni Bandiere Arancioni, and Ciclovia dell'Appennino to concretely implement these new forms of renewable energy diffusion in 25 small Italian municipalities. The Nextappenino program presented 25 eligible projects funded by the NRP Supplementary Fund measure dedicated to the economic and social revitalization of earthquake-affected areas. Regarding European calls for proposals, we highlight the LIFE project "Encom HUB".

our case the bottom-up scenario) compared to the more conservative top-down scenario. The evaluation process takes place in a descriptive-qualitative form: the different impacts are indicated (where present) according to their positive gradient (creation of resources and/or positive externalities, light and dark green, with scores from + to ++) or according to their negative gradient (expenditure of resources and/or social costs, yellow and red, with scores from – to --) or by indicating a coexistence of positive and negative impacts. The right column (Total) of the two scenarios shown in Fig. 5 represents the final result, according to a graphic restitution that takes into account the synthesis of the impacts for each community group and highlights the scenario that generates the greatest number of positive impacts (and the containment of the greatest number of negative impacts) for the majority of the stakeholders involved.

6 Conclusions

The 3 research questions highlighted in §2 were answered (outlining a process and a decision-making methodology) in the DeMaCIA process, supporting the PA and interest groups, and producing bottom-up community engagement. The sharing-based sequence of consultation and reporting phases, which outline the strategic objectives in coherence with the SNAI objectives and the specific characteristics of the context, the elements of the IAs system, the multidimensional impacts, the interest groups involved, etc., makes the decision-making process more transparent, despite its complexity and, often, unpredictability and conflictuality, and can be traced back to the three keywords: Governance, Heritage, and People.

An initial answer is provided in the preparatory phases required for designing a knowledge acquisition process for building shared strategies through a problem-solving approach. These DeMaCIA phases have systematized and made interoperable (and sometimes geo-referenced) data and information despite the multi-layered nature of the heritage, which often makes interactions between public actors unharmonized and deficient. In addition, DeMaCIA presents some notable technical aspects: expanding the scope and the strategic analysis to a wider territory (“expanded” territorial scopes), including both the Lagonegrese area, with Lagonegro as the main node for managing territorial flows, and Valle del Mercure-Lao, suggested analyzing a crucial theme for the area under study: manufacturing. Phases 0, 1, and 2, which included the definition of the system elements and the potential development levers for the configuration of a new shared bottom-up scenario, have brought out more clearly the most strongly identity-based processes in the area: indeed, in most urban centers located on river courses, the production fabric is characterized by the presence of now-disused mills. In the reconstruction of the competitive framework and the evaluation phase of the SWOT Analysis, the focus is on the role of large-scale production in the context of Castelluccio, stressing the transformations that the production process has triggered since the early 1900s. For a certain time, Castelluccio had become the center of a significantly larger production system capable of attracting population, new technologies, and new functions, and changing its social fabric. All these elements have disappeared in the contemporary situation.

The DeMaCIA proposal updated the traditional CIA method based on some operational assumptions (particularly for the identification of community groups to interact with and the assessment of impact based on categories attributed to subjects). These seem suitable for different conditions of marginality, the gaps to identify, and the different transformation trajectories in different contexts. The integrated preparatory investigations (Phase 0, 1, 2, and 3) prior to Phase 4, aimed at the qualitative-descriptive assessment of impacts, highlight a significant potential for analysis and decision support, scalable in contexts like IAs, where information and databases are sometimes incomplete or not systematized and interoperable.

DeMaCIA's premise is to root decision-making in Bottom-up community involvement, in continuous interaction with the PA and supporting collaboration even in potential conflict situations. The theme of identity and memory is closely linked to heritage and the relationship of RECs with their heritage, both landscape and built environment: in the Bottom-up scenario, this is fostered through a bottom-up awareness-raising process on heritage, particularly manufactures. About the final results, it was decided to continue the development of this work with the bottom-up option. On the one hand, this is because it allows for intersecting; on the other hand, its effects are decidedly more widespread and distributed over time (Fig. 5). This leads to a cohesive development of the entire Mercure territory and, in particular, the Municipality of Castelluccio Inferiore. In this sense, despite not representing a final solution, the final scenario may provide the PA and communities with a new starting point and even a better focus for current funding. Concerning DeMaCIA, consultation methods (Focus Groups, PSMs, etc.) and other Evaluation methods can be identified and better fine-tuned, as a complement to the currently tested methodology to identify more accurately the demand targets in the stakeholder tables. These include the Delphi Method (expert evaluation on final scenarios) or other tools [17, 18]. The experimentation illustrated here represents an initial application that can provide elements to decision-makers for the subsequent transition, also exploiting more quantitative and monetary-based assessment tools (CIE, LCC, LCA, DCFA, Business Plan, etc.).

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