Documentation, Restoration and Reuse of Heritage

2-4 November 2022
Porto, Portugal

BOOK OF PROCEEDINGS

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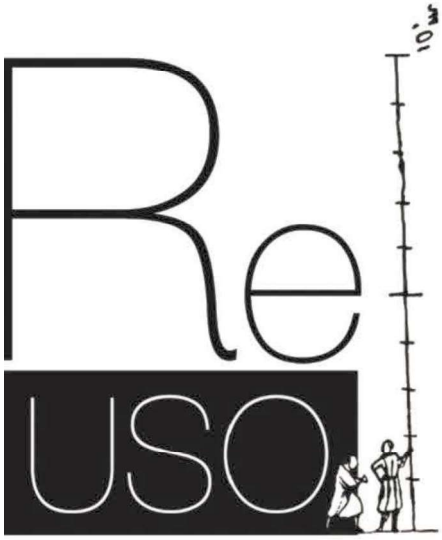

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Strategies for rural settlements and marginal areas regeneration: multiscale and multidisciplinary approach for a systemic process

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Abstract: Depopulation and aging are two factors affecting the future of Europe, mainly in rural areas, where 30% of the total EU population lives. For this reason, lots of international policies encourage local building heritage refurbishment and cultural regeneration projects of minor historic villages, to rebalance and strengthen economic, social, and environmental connections and ties between urban, peri-urban, and rural areas. The research highlight approaches to characterize marginal areas and identify strategies for renovation, starting with a multiscale deep investigation process, a strong collaboration with local communities and stakeholders, and finding out a Vision to translate in objectives and actions. Reuse and refurbishment of historical minor villages is investigated for improving the resilience and adaptation of the building stock, preserving cultural heritage while making it more adaptive to climate change, through the activation of cross-sector sustainable synergies, in a multiscale and multidisciplinary approach, having as reference the case study of Spluga Valley regeneration (Italy). The paper describes methods to recognize the values of pre-existence through the knowledge phase and the indicators, originated from analysis and diagnosis process, to hypothesize new functions compatible with the existing and capable to link the physical renovation to the territory relaunch and the local community.

Keywords: minor historic town centres, reuse, energy retrofit

1. Introduction

The scenario that Europe presents up to now shows a strong tendency towards the centralization of the population in urban areas, causing depopulation of smaller towns, the aging, and the abandonment of the tangible and the intangible heritage of marginal areas, where 30% of the total EU population lives. Moreover, with a consumption of 458 Mtoe in EU territories in 2016, buildings account for 41% of the annual energy consumption [1]; CO2 emissions related to building energy [2] have increased in recent years, reaching 10 GtCO2, the highest level ever recorded. The European Green Deal has posed an urgent challenge by requiring a shift in CO2 emissions, to ensure the EU goals in 2050.

For these reasons, it is necessary to offset the current macro-trend and promote a sustainable development where new emerging post-pandemic challenges become the drivers for implementing regenerative actions beneficial for residents and marginalized social groups, as well as for the protection and safeguarding of the cultural and natural heritage and the development of small and medium-sized businesses through creativity and innovation, hinging on culture and local knowledge [3].

The paper aims to investigate methods to characterize strategic inland areas and small settlements in regions where the fragility of the territory and the built environment affect the social and economic metabolism and to identify strategies and actions for improving the resilience and adaptation of the building stock and preserve the cultural heritage [4].

2. Integrated approach for renovation of rural settlements

2.1. Methodology framework

The regeneration of small rural settlements requires a multiscale and multidisciplinary approach, which involves local communities and resources in a strategic balance; it cannot be tackled separately from integrated regeneration paths of the territories, environments, and landscapes in which they are located and with which they share co-evolutionary processes. Territorial regeneration implies the understanding of complex scenarios and the systematization of multiple challenges whose integrated reading allows to find, through the activation of synergies between sectors and policies, renewed answers for the rebirth of territories where the historic cores are a key resource for redefining the territorial framework to support settled communities [5].

The methodological approach presented in the paper, which is the result of research and experimentation, is based on the actuation of multiple synergies: i) the integration between the different scales of the project that, starting from the comprehension of the context and its resources, leads to the development of territorial regeneration strategies and the identification of the best re-uses; ii) classification and involvement of the different stakeholders in activating co-production and co-design processes of project options but also in the management of the new functions and areas, to guarantee the success of the transformation with long-term strategic visions (Figure 1); iii) find out the best refurbishment techniques starting from a deep investigation of local and rural architecture.

Figure 1. Stakeholders map; source: F. Speciale, A. Fassi, R[A]ISING SPLUGA, Future visions for the valley with the development of the experimental training center in Chiavenna, master thesis.

The definition of the strategic vision is based on transversal approaches and on the ability to recognize resources in the characteristics of the local context, linking together dynamics

related to multiple space-time dimensions, giving responses to local and contingent urgencies and at the same time creating long-term visions competing for the achievement of sustainability objectives on a territorial and global scale [6].

2.2. Strategic component

A strong innovation in design approaches and methodologies is required both in planning and architectural disciplines, strengthening the strategic dimension and the envisioning of places, and integrating the organizational dimension with a design of conscious and adaptive governance processes along the whole transformation process [7].

Criteria guiding the construction of the strategic vision in fragile territories should include:

• new ways of looking at minor historical centers, which allow to find new innovative solutions to local problems enhancing identity aspects based on the values and opportunities of the places' historical, cultural, and environmental heritage;
• spatial flexibility and modularity, both in the interpretation of phenomena and in the construction of solutions, where strategic visions need to seize the opportunities offered by the dynamics of a territorial scale, affecting the micro-scale;
• flexibility and modularity in timing: envisioning implies long-term strategies, but the implementation process must be incremental, giving possibilities to incorporate the change towards flexible scenarios;
• enhancement of these territories from an integrated planning perspective, capable of attributing a crucial and strategic role to the historical rural settlements for the whole country economy [6].

2.3. On field teaching: learn from context and actors' involvement

Rural settlements regeneration requires a detailed assessment of many aspects (historical, cultural, social, economic, and technological), together with the continuous involvement of local communities. About challenges and opportunities for rural settlement renovation mentioned in the previous paragraphs, from the end of 2017 an innovative research and co-design path was promoted by the Lecco Campus of Politecnico di Milano in collaboration with The Chamber of Commerce of Lecco, Lecco Municipality, REsilienceLAB Association and other no-profit bodies promoting research, communication and experts training in environmental policies focused on adaptation and resilience strategies for Lombardy mountain territories. About a hundred subjects were involved in the path (public institutions, networks of local active citizenship, private subjects) included thirty actors from research and design world [8]. Over time several courses of the MSc in Building Engineering-Architecture have been involved in an innovative "in field teaching" with the development of over 30 Master theses, allowing to develop an organic path towards the identification of shared project scenarios through common reflection aspects:

• emerging questions: declining what the current and future needs for regeneration of rural territories and minor historical villages are, inviting actors in working tables to clarify even specific issues then brought back to themes and territorial challenges;
• resources: one of the methodological focuses is the identification of territorial resources forming the basis for strategic regeneration scenarios definition. Heritage includes environmental and ecosystem values, tangible and intangible cultural assets, widespread historical architectural heritage, landscape assets, social and economic resources (such as many initiatives for local promotion and social inclusion or the numerous small and medium-sized enterprises active in different sectors);

• opportunities: the sharing of local initiatives and the example of good practices implemented by other comparable territories gives the possibility to share and imagine opportunities and synergies capable of connecting challenges and resources. So, for example involving promoters of innovative practices linked to the regeneration of mountain areas, to the development of new sustainable and experiential tourism forms, to the enhancement of local culture and the memory of places, to the activation of circular economies, ecosystem services, etc. [5].
From the dialogue with and between the actors involved, it emerges that rural settlements regeneration must be based on a complex approach capable of re-building the deep relationship between environmental resources, cultural and landscape values, and established communities to activate new alliances capable of building renewed identities of those territories [9]. The main themes identified deal with:
• The communities and the centrality of the social dimension, both to guarantee services to the community to ensure stays and attract new inhabitants and, for the role of resource of the established communities, to build new identities by integrating the new inhabitants;
• Sustainable and integrated tourism is a viable opportunity, if strongly oriented towards forms of enhancement of widespread cultural, environmental and landscape resources which must find the opportunity for effective networking and system;
• Education, to create a new network of competence centers that consider the territory as an open-air laboratory, a place of sensitive experimentation in which different interests, disciplines and scales intersect; incubators of ideas and innovation to exercise a propulsive role for the economy and the future, stimulating the birth of new forms of entrepreneurship and high-quality creative craftsmanship. These principals contribute to attract students and researchers, interested in learning new topics in innovative ways, and professionals and experts, coming from public and private institutions, to start long-term collaborations of talents and new creative class, developing a flow of knowledge and skills both in and out [10]. Therefore, in addition to the enhancement of traditional productions, other axes of strengthening the economic structure can be identified in circular economies and the reactivation of production chains connected to agroforestry productions. In this sense, opportunities arise to reactivate production chains connected with the construction sector (innovative materials or innovation of traditional building materials based on circularity or the use of natural materials) [11].

3. Case study: Spluga Valley and educational Hub in Chiavenna

3.1. Methodology framework

Spluga Valley is an alpine territory which constitutes the extreme northern offshoot of Lombardy towards Switzerland, starting from Chiavenna and ending, after 32 kilometers, with the Spluga pass. The vast area considered is included in an altimetric range from 330 to 3,279 meters above sea level and is entirely part of the Mountain Community of Valchiavenna [12]. Furthermore, it has been defined as Internal Area of the Italian territory, subject to the policies of the National Strategy addressed to it [13]. There are four municipalities that directly overlook the Spluga Valley. The valley is crossed, from south to north by the last stretch of the state road SS36 of Lake Como and Spluga, which leads from Milan to the pass with Switzerland, while in Chiavenna the railway network culminates with the terminus station. There are countless agro-forestry-pastoral routes that branch off from the valley to connect municipalities or to create suggestive cycle-pedestrian and trekking routes. As a mountain territory, it has related orographic, morphological, and hydrological problems, but the fact of being a frontier territory, straddling the two economic and commercial polarities in

Switzerland and Lombardy, favors the potential for each intervention proposal to develop also in a perspective of international and multicultural collaboration, which further consolidates the relationship and exchange between the various European communities that overlook it and confront each other. Analysis of this territory, carried out through fact-finding surveys, questionnaires, field meetings, GIS data mappings, etc., led to the development of a vision and a renovation strategy that involved the four municipalities, tying them together through sustainable mobility implementation strategies, educational centers and the enhancement of the existing heritage. To validate the strategy, we practiced it on a case study, the most emblematic and the one with the best prerequisites for activating the territorial strategy [14]. So, the process went down to the urban and building scale, reiterating the process of analysis, diagnosis and design choices already implemented on territorial scale, to develop a refurbishment project in a holistic view that would act as a pole of attraction for the launch of the Valley strategy. In the third and last phase, the conclusions of this experimentation were expressed in guidelines designed to allow the repetition of this process. The research process thus returns to the territorial scale, strengthened by local experience, to start again by triggering the design of the subsequent interventions hypothesized (Figure 2).

Figure 2. Research project path; source: F. Speciale, A. Fassi, R[A]ISING SPLUGA

Firstly, the state of art and the current prospects for mountain and inland territories were investigated, made up of policies, incentives, regional and national plans, as well as studying and putting us in contact with similar realities taken as case studies.

Since each of these realities poses specific problems, it is necessary to identify them, discover the needs as well as, obviously, the opportunities. The process of analyzing the heritage of a large-scale territory is particularly complex. The expression "heritage" is not limited to the traditional meaning of the term, but rather the set of those tangible and intangible values that belong to a community and that guarantee the safeguarding of the identity traits of a territory and the communities that inhabit it, giving a sense of continuity, and encouraging respect for diversity, creativity, and sustainable development [15]. For this reason, maps of the Spluga Valley heritage have been developed through nine themes: landscape and naturalistic heritage, built heritage, mobility, production chains, historical and cultural assets, communities, services, tourism, education, and research. The first pieces of information collected through a careful examination of the Territory Government Plans of the four municipalities, were implemented by studies conducted on GIS data, socio-economic surveys based on Istat data, as well as in field analyses and continuous contacts with local actors.

As a summary of the maps, the strengths and opportunities are illustrated, i.e. those elements of the territory that can favor and help the project strategy, but also the weaknesses and threats,

which instead represent the constraints to which the project could be subjected (SWOT analysis). An identity map summarizing the previous ones is created, which contains all the characteristic features of the individual municipalities of the valley (concept map). As a synthesis, it collects the significant and long-term elements that characterize the different municipalities, representing their identity, an essential starting point for building a strategy for the valley knowing how to respect and enhance the specific vocation of each of them.

3.2. Large-scale strategic dimension

The guidelines of the preliminary territorial project now began to be outlined, starting from the vision up to its translation into specific actions, passing through the objectives that lead to the choice of solutions to be subsequently translated into the Masterplan. Here follows the Noos (Not only one solution) process described by Danilo Palazzo: the designer's objectives and strategies are united under a single term: choices [16]. These objectives are not the direct transposition of the requests of actors and territory, but the conditions are established through the elaboration of a set of ideas, images, writings, and graphic symbols, summarized by the word “Concept”. First, a list of a few objectives was drawn up; it included several strategies and actions related to them and localized in the territory. This led to the definition of a project Vision, a motto that communicates in a few words the set of objectives, prefiguring the image of how the territory could appear in the future. Starting from the specifics of the territory, and in contrast to the current strong tendency towards polarization, the aim of the strategy is to create a physical and relational network to systematize all the elements of the territory together with a set of interventions to be carried out, aimed at expanding the educational offer of the valley. Indeed, in such fragile territories, a single intervention without the support of the other realities would not have the necessary strength to start a real relaunch. The strategy intends to build a widespread educational system which must provide for a connection among the individual elements; the enhancement of the state road 36 is proposed as effective and sustainable connective element: various actions are intended to improve accessibility towards sustainable mobility: car-sharing stations, panoramic viewpoints with charging stations, strengthening of public roads with multifunctional shelters and a general improvement of accessibility for the disabled, shared mobility incentives. Moreover, slow-moving paths intertwine and adequate maintenance of the existing historical-landscape paths, e-bikes in the inhabited centers and a system of equipped rentals, bike parks, autonomous rental stations, electric bicycles, with a mapping service for cycle paths and footpaths, integrating them into a system with simple smart technologies. Interchange nodes are fundamental, such as the railway station in Chiavenna, where a bike station is provided with a rental point for tourists (Figure 3).

Figure 3. Concept view of bus stop and belvedere with interactive tools; source: F. Speciale, A. Fassi, R[A]ISING SPLUGA

Several Spots have been identified that could trigger a series of repercussions throughout the territory, multiplying the usefulness of the single intervention, aimed at the well-being of communities, occasional users and, above all, the natural and landscape environment of the valley. The interconnection of these Spots is the key to optimizing the strategy, as the single intervention is extremely strengthened by the relationship with the whole system. The strategy chosen is a widespread Mountain Academy, which encourages the system of flows and skills in the valley through the innovation and digitization, enhancing the resources of the territory and allows them to be relaunched in full respect, studying it carefully to always propose ad hoc solutions. Knowledge is the tool given to the valley to self-manage and self-regenerate without seeing predetermined functions descended from. The creation of new research, educational and innovation centers, spread throughout the valley, is only part of the interventions necessary for the strategy. Many actions identify the pre-existence of natural resiliencies in the territory that become fertile ground for the grafting of sustainable projects, the purpose of which, like acupuncture, is to bring greater authenticity, better liveability, and a sense of well-being to the whole body of the valley [17] (Figure 4). To identify the priorities, those areas of emergency that require imminent intervention were carefully sought, to include them as Spots within the valley strategy. Therefore, we first examined the areas of urban transformation; the sorting process starts from the desire for zero land use, so from the exclusion of currently undeveloped land in which a new construction process is envisaged; the choice and consequent cataloguing focused on transformation areas, currently abandoned: all provide for the refurbishment of existing volumes, with a possible limited increase, and the introduction of tertiary, craft and cultural functions for leisure and education. The choice also considered the availability of the property. Based on municipalities identity map developed, a restoration area was chosen for each one and analyzed to find the best solutions to be installed for the widespread mountain academy: i) functions and activities foreseen in the first Spot in Chiavenna intend to study the territory and the built heritage, to be able to develop new techniques for the reuse and restoration of many of the emergency areas present in the valley; ii) in San Giacomo it is planned to create a single consortium to manage the wooded heritage of the valley in a shared and unified manner, allowing a sustainable and responsible use of the area's environmental resources; iii) the A2A School educational project, launched in recent years and consisting of various initiatives and training courses mainly about hydroelectricity, an important source of energy for the valley, is included in the strategy [18]. The Accademia network needs structures able to host students, visitors, and professionals, thus fostering a flow of knowledge and skills and promoting dialogue and personal exchange. Finally, a training school for specialized reception figures is provided in the touristic side of the valley.

Figure 4. Zoom of the territorial strategy masterplan; source: F. Speciale, A. Fassi, R[A]ISING SPLUGA

The promotion of the territory is configured as a storytelling, narrating its history through experiences, capable of transmitting its Genius Loci, the particularities that make it different and recognizable. For these reasons, it is necessary to create a unique and original brand, which narrates the territory, and which carries out a unifying action of all the heritage. Interventions underline the importance of creating synergistic networks between mobility infrastructures, between nodes and poles, so that they communicate and collaborate with each other, as well as networks of common support between companies, local actors, institutions schools and communities. To map and classify this stakeholders, three categories are considered: public, private profit and non-profit actors. Involvement concerns different phases of the project development process, generally summarized in the following four: design, implementation, management, and use. The management aspect no longer refers to the practical aspects related to the maintenance, but is increasingly integrating the organizational, monitoring and promotion needs, activities in which private individuals play more and more important roles to keep the interest in the project and its use. Finally, to evaluate the sustainability of the strategy, we choose the 2030 Agenda SDGs as indicators, indicating for each action to which goals it was linked.

3.3 Refurbishment and reuse of the built heritage - knowledge and intervention strategies

For choosing the intervention area to be designed, a matrix was developed that considered the best predispositions, potentials, and the impact on the strategy of each proposed intervention. Therefore, the case study is also the pilot intervention, the one with the best assumptions both in terms of feasibility and from the positive impact it could generate in the valley, acting as a trigger. We proceeded with a more in-depth analysis of the city and the intervention area, producing an urban SWOT for environment, mobility, services and buildings. Urban design envisages the systemic redevelopment of an important part of the city, triggered by the creation of the new educational hub, capable of giving importance and relevance to the other areas of transformation considered. A project to mend the urban texture, with thematic itineraries, industrial archeology itineraries, cycling and hiking trails. The flexibility of the different access to the area is also guaranteed by the circuit configuration assumed by the flows and the hyper connection of them. The historical analysis of the area was fundamental: to recognize the phases in which the different areas were built, the value of the same and the old destinations of use, producing data sheets of the individual buildings with an evaluation of the state of conservation, has allowed a first screening for the evaluation of the maintenance or not of the buildings and of the possible uses. Even at this project scale, a SWOT analysis was used [19]. The survey of the state of conservation, geometric material, and decay through adequate instrumentation, proved to be an important operation of reading, cognitive investigation, and research, aimed at identifying the origin of the buildings, the vicissitudes undergone, their transformations and any anomalies and inconsistencies (Figure 5). Decay and pre-diagnosis sheets were produced to trace the causes of the degradation. Finally, the technological survey highlights the construction systems and the technological elements of each building, to devise the best refurbishment solutions [20].

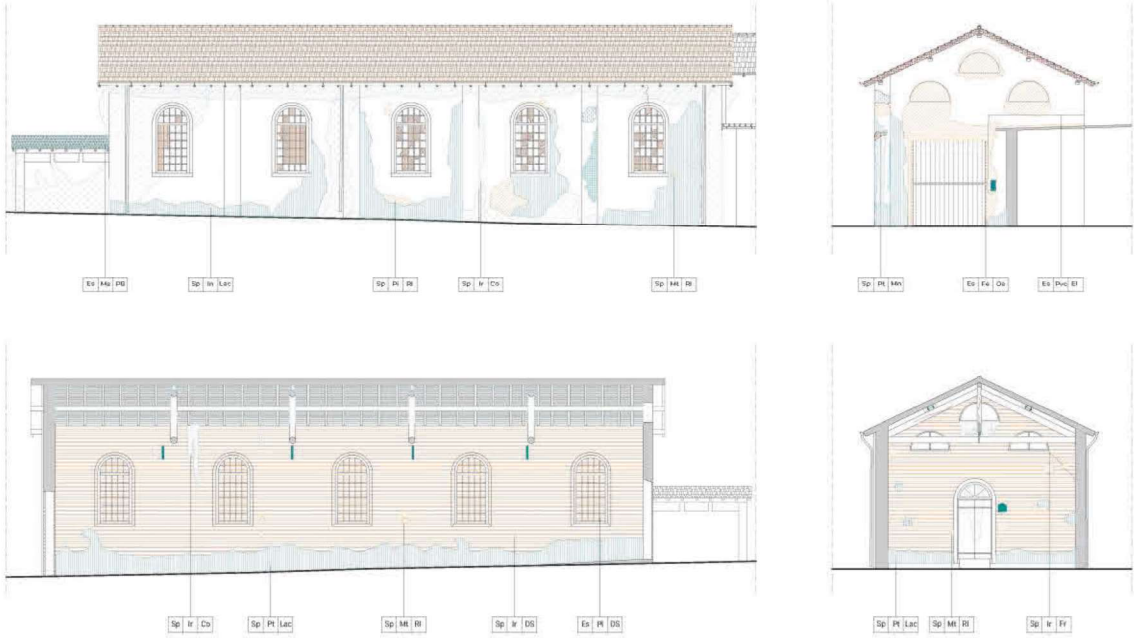

Figure 5. Decay survey example; source: F. Speciale, A. Fassi, R[A]ISING SPLUGA

Simultaneously, a meta-design phase was carried out to investigate the best use destinations for the area, in addition to the macro-destination of the educational hub. The goal is to characterize it with multifunctionality, pluri-circularity and visibility to activate a positive, continuous and lively presence in the area. The potential users, periods, and hours of use of the area were analyzed based on the activities chosen (hourly maps), a functional organization chart based on the educational function but complete with other satellite sub-functions that allow the continuous use of the area and flows analysis. We also mapped possible partners who can activate courses and workshops with the center such as territorial schools, local artisans for know-how, territorial businesses, and local companies. An analysis of case studies with similar functions and boundary conditions was carried out, eg Valldaura Labs, a Self-Sufficient Habitat Laboratory, promoted by the Institute for Advanced Architecture of Catalonia and located in the Collserola Natural Park in Barcelona [14]. The approach adopted is holistic, so the systemization of the various aspects of the project becomes the very strength of the intervention: we prefigure few values such as sustainability, quality of life and useful innovation and specific strategies, such as the diversification of functions, different refurbishment approaches, spaces and time flexibility, passive strategies adoption, residual performance implementation, use of dry mortarless construction techniques, use of renewable energy sources and self-sufficiency of the area, strong relationship with context and increase of biodiversity (Figure 6).

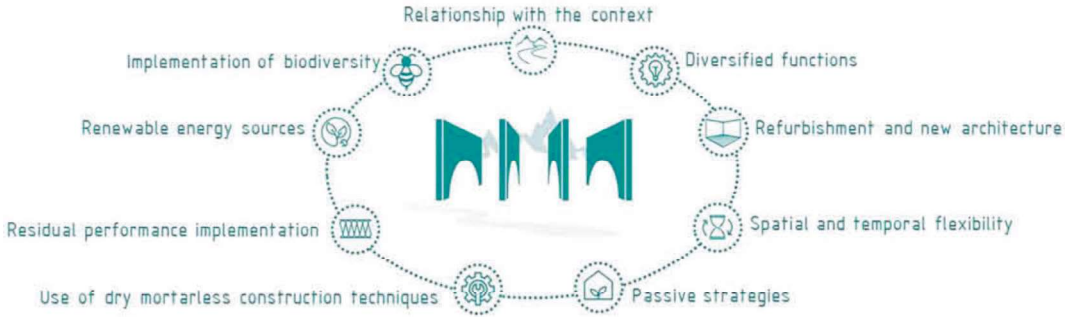

Figure 6. Strategies adopted in design process; source: F. Speciale, A. Fassi, R[A]ISING SPLUGA

The masterplan is the translation of all these identified values, combining the two souls of the area, the rigid industrial one of buildings opposed to the soft and fluid one of the surrounding nature, emphasized and recalled by us with new sinuous paths. Thanks to the analysis campaign, we recognized the different value of the buildings and the natural context in which they are inserted, preferring the opening towards the surrounding natural elements, and imagining the area as the attack on the ground of the mountain and consequent accompaniment towards the river, making nature mistress intervention (Figure 7).

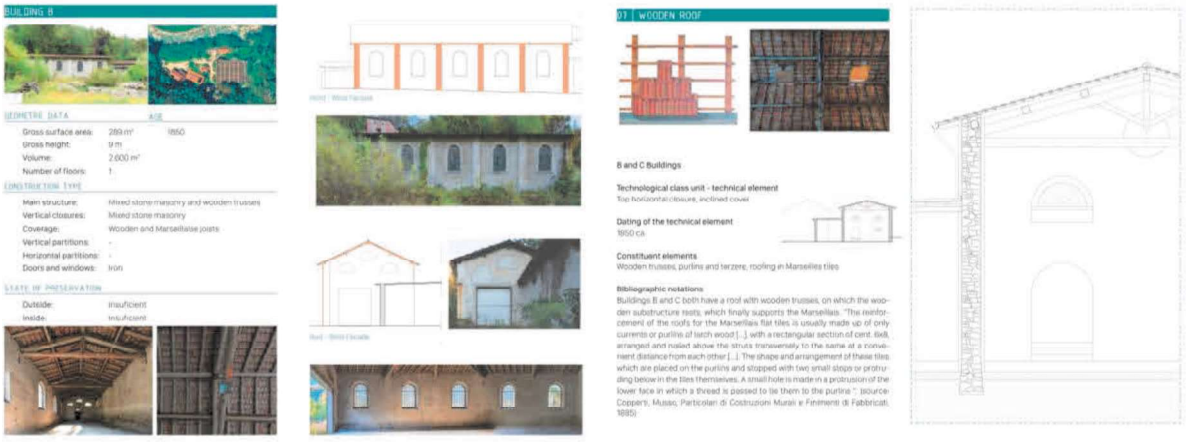

Figure 7. Building data card and Technological sheet; source: F. Speciale, A. Fassi, R[A]ISING SPLUGA

The intervention strategies were different based on the different configurations of the buildings present: the demolition of the smaller and superfluous buildings was foreseen, we proceeded with different refurbishment strategies, one more conservative than the other, alongside a new construction, all in terms of modularity, flexibility, integrability and permeability towards the context, locating inside in rigid blocks all the auxiliary services. All buildings have been designed as flexible and reconfigurable, according to principles of the territorial strategy: a flexibility that is declined both at the distribution and compositional level. For example, the different housing developments, designed in the two sheds intended for co-living functions, which develop around a central core and allow different configurations, give life to countless types of rooms, thanks also to the consolidation technologies used, such as a new internal structure in Xlam independent of the existing masonry, consolidated and insulated internally by implementing the residual performances. Wood fiber internal panels have been used to achieve new required performances, while masonry has been consolidated with connection beams in foundations and reinforcement of the roofing to create a rigid plan (Figure 8).

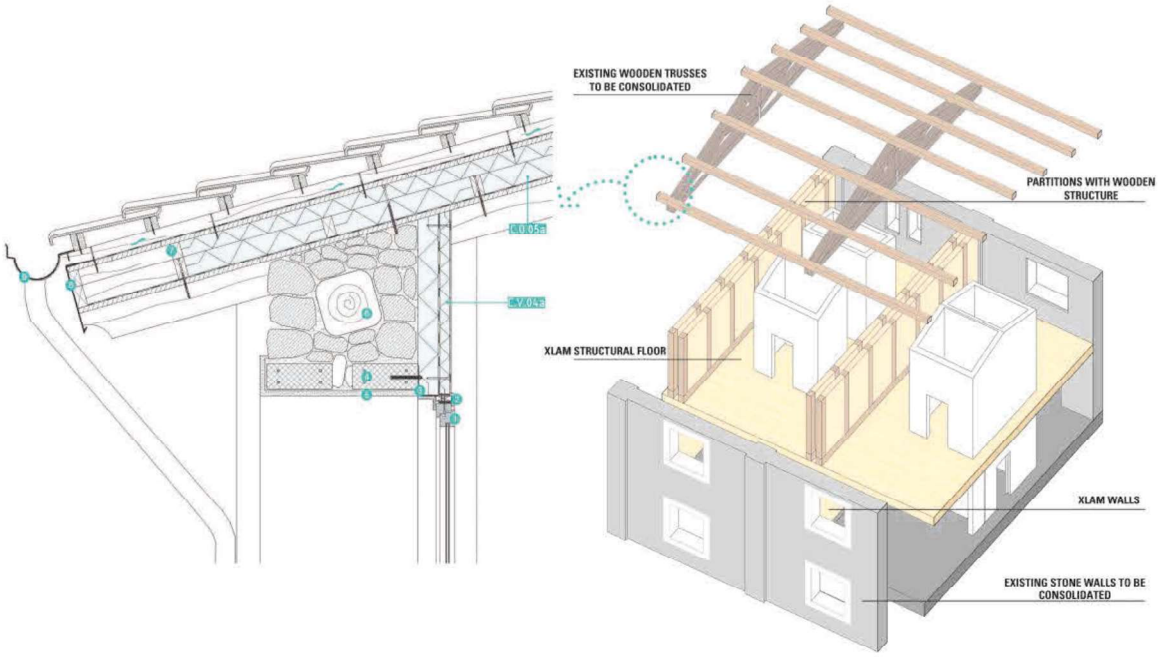

Figure 8. Technical detail of roof intervention - Exploded axonometry of the intervention with Xlam technology for box in the box strategy; source: F. Speciale, A. Fassi, R[A]ISING SPLUGA

Only local materials have been chosen, such as wood and Spluga stone, deriving from the traditional constructions of Valchiavenna, mapping the neighbouring producers. The flexibility of the spaces is made possible thanks to sliding panels or packable glass partitions, completely closed in the most frequent configuration of courses and workshops, and completely open in the case of large events and festivals. In the main building, all the furnishing elements, systems and the structure are integrated into dry technologies. The structure, transformed in 1980 with impacting concrete elements, is hidden but entirely reused, evaluating the residual performances through a diagnostic campaign, and implementing them, introducing a foundation grating to connect the existing plinths and a steel framework. We decided to reuse the prefabricated roof tiles, dismantling them to replace with a green roof but reusing them as urban furniture in the square (Figure 9). Given the strong naturalistic context, the landscape project was also a restored intervention, reintroducing local essences to implement area biodiversity and developing different microclimates through experimental urban gardens and the riparian shore renaturalized through selective replacement. To ensure user comfort, all passive strategies to minimize consumption have been studied, such as the strategic positioning near the facade of deciduous trees and the exploitation of the greenhouse for thermal comfort and natural ventilation of the rooms. All this was quantified by inserting the BIM model inside the Edilclima certified software, with which, through the transmittance of the packages, and the internal contributions, we were able to estimate the summer and winter energy needs of the building, which was already in energy class A4 and classified as NZEB. For the complete achievement of internal comfort, an all-air system was chosen, to ensure that the building result as all-electric, and to exploit as only source the electricity produced by the photovoltaic panels and by the mini hydroelectric plant, reusing the historic hydroelectric plant present in the area since 1883, to underline the importance of enhancing the vocation of the areas in which we operate. We implemented the least possible intervention while maintaining the original characteristics of the plant, located in an artificial derivation not affecting the river course, reducing the concession flow rate and replacing the turbine, settled on the primary energy demand not covered by the photovoltaic. Finally, we imagined to partially store the excess

hydroelectric energy supply, but mostly to give it to neighbouring public schools to underline how the intervention is aimed at supporting the community in all senses.

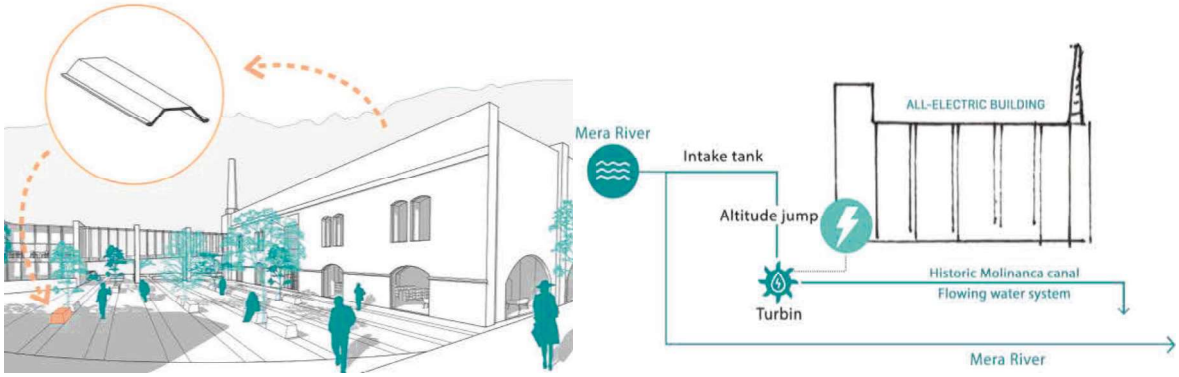

Figure 9-10. Schematic view of roof tiles reuse; Operation diagram of the reused hydroelectric plant; source: F. Speciale, A. Fassi, R[A]ISING SPLUGA

4. Conclusions

Nowadays it is clear how marginal areas have considerable potential economic development because here are the fundamental resources and potential to guarantee long-term visions period of ecosystem rebalancing based on material and immaterial cultural values in a context where the territorial capital is very considerable. The regeneration of this territories must face complex and urgent challenges, requiring a radical change of approach that shifts attention to the process as an object and project act, ensuring the success of the transformation over time and the improvement of contexts towards lasting and sustainable scenarios. The research path highlights the importance of the knowledge phase to find out the best specific solutions for each reality, to put in a systemic strategic plan of renovation. The path has investigated and analyzed different scales and areas, starting from the territorial one, passing through the urban one and finally arriving at the local of the building intervention, developed highlighting the history, the social and economic context, the landscape, and the physical consistency of the place. The approach adopted is holistic, multidisciplinary, and participatory, first applied to the general territorial context and subsequently on a particular solution to extrapolate guidelines flexible and replicable for other interventions in Valley.

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