Strategies for Democratizing Development. Application of Geodesign in a Low-Context Culture

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Abstract. Geodesign involves multiple stakeholders, including community members, planners, designers, and policy-makers, to collaborating in designing solutions to local development. Public involvement in the co-design process is a worthwhile means of generating consensus on choices and of raising awareness of the territorial structural issues and associated risks. In fact, during the knowledge building phase, spatial critical points can be highlighted in a readily communicative form that can be interpreted even in a low-context culture. Hence, this resilience-oriented co-design approach is part of the MITIGO project, which aims to deploy a framework for innovative and sustainable hydrogeological and seismic risk mitigation solutions targeting road connections and strategic structures in mountain areas typically located in the Basilicata region. In these areas a survey showed the demand for more constancy in the co-participation of the population in decision-making processes by fostering a democratic approach to local development and ensuring iterative planning. The learning process analyzed the territory to train and inform participants, raising awareness of territorial governance and urban transformation issues. The methodology applied in this experience shows alternative participatory approaches to sustainable, inclusive, and innovative future planning in risk scenarios.

Keywords: Geodesign · PPGIS · Resilience-oriented planning · Spatial planning · Co-design

1 Introduction

The field of Geodesign encompasses a collaborative and inclusive approach to urban and regional planning, involving various stakeholders such as community members, planners, designers, and policy-makers [1]. This cooperative effort aims to design solutions for local development while considering territorial structural issues and associated risks [2]. Public involvement in the co-design process holds useful value as it fosters consensus-building and enhances awareness of critical spatial concerns, even within low-context cultures [3].

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Within this context, the MITIGO project emerges as a resilient-oriented co-design project that seeks to deploy innovative and sustainable solutions for hydrogeological and seismic risk mitigation. Specifically, the project focuses on road connections and strategic structures in mountainous areas situated in the Basilicata region. Through surveys conducted in these regions, it has become evident that there is a strong demand for increased public participation in decision-making processes, emphasizing the need for democratic approaches to local development and iterative planning.

This research endeavors to explore alternative participatory methodologies that foster sustainable, inclusive, and innovative future planning in risk-prone scenarios. By examining the territory, training and informing participants, and raising awareness of territorial governance and urban transformation issues, this study contributes to the development of effective and responsive planning strategies. The findings of this research can inform planning practices and policy-making in order to address hydrogeological and seismic risks and promote resilient and sustainable development [4].

2 Geodesign – Designing in a Participatory System Thinking Approach

Recent developments in the disciplinary debate propose Geodesign as an innovative methodological framework to support urban and regional planning in the regenerative design of public spaces. For this purpose, looking at the future challenges for spatial information technology proposed by Wolf in his article: *Reproducibility, Inclusion and Common task* Geodesign seems to be a fitting methodology [5]. Moreover, Jack Dangermond claims that [6]:

> "*Geodesign enables scientist, design professionals, government and stakeholders to work together using a common visual language of maps and spatial analysis method to address global challenges at many scales*".

Indeed, Geodesign proposes an integrated, collaborative, and participatory system thinking approach that initiates with project conceptualization, where stakeholders from various domains and cultural sphere actively engage to establish a shared vision for the development. Then, the shared vision is translated into a series of analytical and simulation-based processes, leveraging the advancements in spatial information systems, which enable the exploration of multiple alternatives and their potential impacts on the analyzed context.

The implementation of Geodesign in spatial planning has already been tested with successful results in many case studies at different scales and worldwide [7, 8].

As pointed out earlier, in Geodesign the role of the methods and tools of geographic information systems is crucial [9]. Especially in today's context, with the vast availability of data sharing and geo-processing services, these tools empower planners to perform dynamic cognitive frameworks that can be continuously update and adapt based even on real-time data or specific-context state of art [10, 11]. This dynamic nature ensures that decision-making is based on the most current and accurate data, enhancing the effectiveness and efficiency of the entire Geodesign process.

On this premise, the primary objective of Geodesign is to make explicit and strengthen the intricate relationships between data, information, knowledge, and subsequent decision-making within the project context. By explicitly connecting these elements, Geodesign aims to bridge the gap between theoretical understanding and practical implementation, ensuring that planning and design choices are grounded in evidence-based knowledge and lead to tangible and sustainable outcomes [12]. This ambitious goal is achieved by comprehensively understanding the existing conditions and exploring alternative future scenarios, Geodesign facilitates informed decision-making and stakeholder collaboration, leading to sustainable and inclusive planning scenario.

Thus, Geodesign is a structured approach consisting of six models that guide the assessment and intervention phases of the planning process [1]. The initial three models form the assessment phase, or knowledge building phase, and focus on understanding the current conditions of the study area and its potential natural future development. These models are the Representation Model (Inventory - data), which depicts the current state of the study area, the Process Model (Analysis - information), which analyzes the possible evolution of the territory with no interventions, and the Evaluation Model (Suitability map - knowledge), which identify areas that are more/less suitable or change-prone.

While, the intervention phase covers the remaining three models, aimed at determining how the study area should be modified to enhance its current conditions. The Change Model (Scenario alternatives - data) is developed to propose alternative future states for the study area, which are then evaluated for potential environmental, economic, or social impacts through the Impact Model (Changes cause - information). Last but foremost, the Decision Model (Preferred solution - knowledge) supports a negotiation process among decision-makers and stakeholders to reach a consensus on the final development choice.

Throughout the Geodesignhub platform, the results of each phase are shared with stakeholders and visualized through maps, charts, and graphs to facilitate participation [13]. Feedback received during this process allows stakeholders to refine their designs and collaborate towards finding a mutually acceptable solution.

While the Geodesign process is not strictly linear, three iterations are typically undertaken to perform a comprehensive study. The first iteration involves identifying the purpose of the case study, serving as a scoping phase. The second iteration proceeds in reverse order through the six models, clearly defining the methods and tools required based on the specific planning study's needs, acting as a meta-planning phase. Finally, the third iteration entails the full execution of the study. According to Steiniz, the third iteration of Geodesign delivers optimal outcomes. Due to its non-linear nature, the process ensures a comprehensive exploration of the study area, promotes continuous learning, and facilitates the synthesis of knowledge and collaborative decision-making [14]. In practice, by reevaluating and reiterating the models, Geodesign accommodates the evolving context, new data, and changing stakeholder needs. In this way, it promotes adaptability and flexibility, ensuring that the final design solution is robust, responsive, and aligned with the goals of sustainability, livability, and environmental compatibility.

In conclusion, within the spatial planning discipline, Geodesign signifying a paradigm shift towards a holistic approach to the design and development of natural and man-made environments [15]. This approach is underpinned by a commitment to environmental compatibility and sustainable development goals SDGs.

3 The MITIGO Project and Study Area

The MITIGO project aims to explore innovative and sustainable hydrogeological and seismic risk mitigation solutions mainly for road links and strategic structures in mountainous areas typical of the inner areas of Basilicata region. For this purpose, traditional on-site measurements and laboratory tests, surveys and monitoring with terrestrial and satellite systems are carried out [16]. Moreover, innovative and sustainable mitigation strategies or safety interventions are test and alternative minimum-risk connection systems for reduction in travel time are analyzed [17]. All this data and models flow into IT platforms and expert-domain systems to support public administrations, engineers and businesses in managing, planning and designing mitigation initiatives [18].

The municipalities of Pietrapertosa, Castelmezzano, Campomaggiore, and Albano di Lucania were chosen as a suitable study area due to characteristics common to large portions of the Basilicata region territory: morphological features, presence of natural and cultural heritage, conditions of territorial marginality with respect to the main regional service poles, fragility of the infrastructure system, depopulation and weakness of production systems [19].

Similar to the other inner areas of Basilicata and also nationwide, the four municipalities face a significant challenge in the form of hydrogeological instability, which is widespread and poses a notable problem. The susceptibility to such instability can be attributed to natural factors, particularly the geological and geomorphological layout characterized by a young orography and rising relief. However, human actions play a substantial role in exacerbating the hydrogeological vulnerability of the context. Factors such as mountainous land abandonment, ongoing deforestation, environmentally unfriendly farming practices, and neglect of slope and watercourse maintenance have further deteriorated the state of affairs and highlighting the territorial fragility.

In the MITIGO area this is particularly concerning as 18% of the roads are classified as landslide-prone, posing a significant challenge not only to transportation infrastructure but also to the safety of buildings, with approximately 670 inhabitants residing in areas of high hydrogeological risk [20]. Another worrisome aspect is the high percentage of residential buildings constructed before 1980, exceeding 80% in all municipalities, while the provincial and regional average remains below 70% [20]. This prevalence of older and very poorly maintained buildings represents a weakness in terms of safety. Moreover, the study area alone accounts for over 400 decaying, ruined, and dilapidated buildings, further adding to the concerns.

Other recent studies carried out on the same area reveals that 59% of the total area falls into land features with severe limitations that render them unsuitable for profitable conventional agricultural activities [21]. Consequently, there is a lack of agricultural specialization in high-value production, and the municipalities do not hold recognized quality and valorization marks for any agricultural products. This represents a significant weakness in terms of agricultural potential and possibility of economic development [22]. Additionally, the increasing trend of depopulation poses another relevant issue since primary and secondary health and institutional services offered to the residents are inadequate and inefficient [23]. Additionally, the organization of the tourist offer in the region is inadequate considering the local natural and cultural heritage potential

[24]. This poses yet another relevant weakness, as the tourism sector fails to effectively capitalize on the region's resources and attract visitors [25].

In summary, the challenges facing the MITIGO area encompass hydrogeological instability due to both natural and human factors, the prevalence of older and deteriorating buildings, limited agricultural specialization, and an inadequate organization of the supply of institutional services. Addressing these weaknesses will require comprehensive planning and strategic interventions to ensure the safety, sustainability, and economic development of the context [26].

Furthermore, the spatial distance from economic and political centers of power can also shape cultural perceptions and accentuate the discomfort experienced by residents [27]. Thus, territory that are geographically distant from these centers and have a relevant weakness on many sectors may be deemed "culturally disadvantaged" or "peripheral" in relation to areas with greater financial resources, established cultural institutions, and intellectual elites. Consequently, such regions may have limited access to the resources necessary to promote and sustain education and cultural expressions considered "high" or "sophisticated" [28]. This spatial distance can potentially result in a higher prevalence of local cultural expressions, popular traditions, and less complex or less refined forms of social and political active participation [29]. Thus, the MITIGO project's area might be categorized as "low-context" if the specific cultural parameters mentioned above are taken into account.

4 Evaluation Maps for MITIGO

Public involvement in the co-design process become also a worthwhile means of generating consensus on choices and of raising awareness of the territorial structural issues and associated risks. In fact, during the knowledge building phase, spatial critical areas can be highlighted in a readily communicative form that can be interpreted even in a "low-context" culture [30]. Hence, this resilience-oriented co-design approach is part of the MITIGO project, which aims to deploy a framework for innovative and sustainable hydrogeological and seismic risk mitigation solutions and enhancing citizen's awareness [31].

Since Geodesign is a complex participatory framework and each policy or project has multiple consequences on different domains, 10 systems are set in the framework as the basis for the comparison of design impacts. To make the methodology comparable with other projects worldwide, nine systems are common to all project and the last one is more flexible for highlight a local priority. In this exercise, the flexible system is set up as the tourism one. In such manner, the systems are summarized as follow:

- tourism (TOUR);
- green infrastructure (GI);
- water infrastructure (WI);
- energy infrastructure (EI);
- grey infrastructure (TRAN);
- agriculture (AG);
- industry (IND);
- housing lower density (LDH);

- institutional (INST).

Therefore, the preliminary analysis was to disaggregate the territory into these ten systems and conduct an on-desk study through an overlay analysis and then revise the outcomes taking into account the "place-people factor." The figure below, see Fig. 1, shows the suitability maps designed for the Geodesign workshop of MITIGO project.

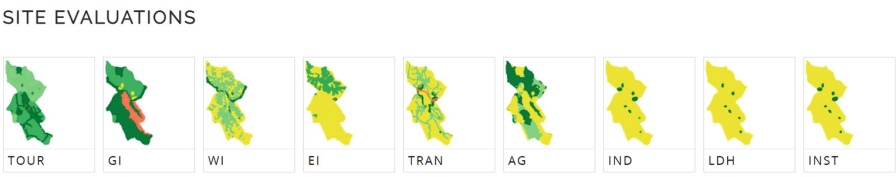

Fig. 1. Site evaluation for the ten systems designed for the Geodesign workshop of MITIGO project.

In particular, the tourism system and the grey infrastructure system are detailed here, and the components of each system and the functions performed are briefly described. The discussion is limited to these two because in our view the grey infrastructure is representative of the current main weakness in the area, but otherwise the tourism system gives the opportunity for local economic development.

The tourism system, see Fig. 2, through the care and promotion of territory, enables the enhancement of local heritage and its ascription in a broader process oriented to the tourist enhancement of places and to create networks of relationships with high economic, social and cultural value [32]. The hospitality sector, consisting of activities and services with a multi-purpose character, is capable of encompassing in a systemic form the territorial entities, the organizations and businesses that provide tourists with assistance, directions and information useful for the enjoyment and discovery of the territory and cultural attractors [33].

The tourism vocation of the area is mainly linked to the geomorphological singularities, typical of the Lucanian Dolomite complex, and to the macro-attraction “volo dell’angelo” between the settlements of Castelmezzano and Pietrapertosa.

In these municipalities, already included in the network of the Most Beautiful Villages of Italy, the main tourist flows are directed.

Notwithstanding, the centers of Albano and Campomaggiore present natural landscape and cultural peculiarities scattered over the territories but not supported by a structured hospitality system. Throughout the area, the tourism supply shows a strong seasonality. Hence, the long-term impacts of the tourism ecosystem, in terms of territorial development opportunities, are currently low [25]. Additionally, the organization of the tourist offer in the region is inadequate considering the area’s potential. This issue offers an opportunity local economic development.

If the tourism system represents an element of attractiveness and potential economic development, on the contrary, the transport system identifies elements of territorial vulnerability since it presents multiple issues especially within the road connections to the main arteries located in the valley that leading into regional poles, Potenza and Matera. The map, see Fig. 3, also highlights the paucity of road graph links with the primary road

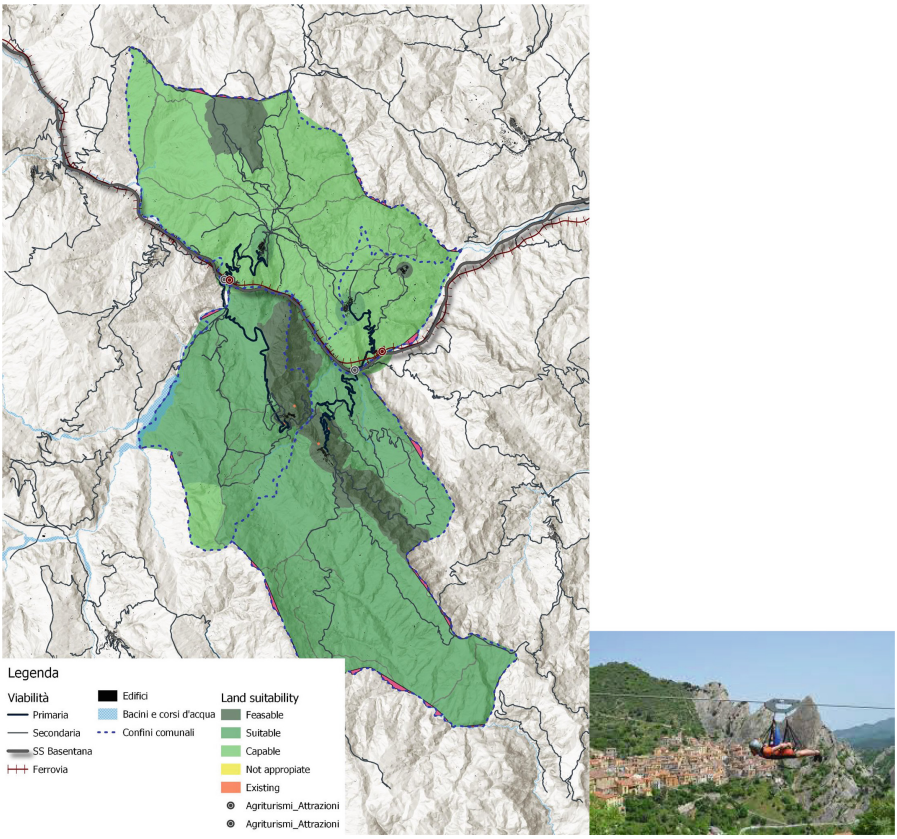

Fig. 2. The suitability map of tourism system and the macro-attraction "volo dell'angelo" between the settlements of Castelmezzano and Pietrapertosa.

system and the distance of the settlement between intermodal hubs. The twisted shape of the roads also highlights the nonlinearity of these links that are mainly caused by the Dolomite complex and slope instability. Indeed, the landslide risk is high along these routes and very often the only way to the municipality of Pietrapertosa is interrupted. This critical situation in terms of dealing with co-occurring emergencies should also make us to think about the possibility of multi-hazard civil protection plan to increase the resilience [34].

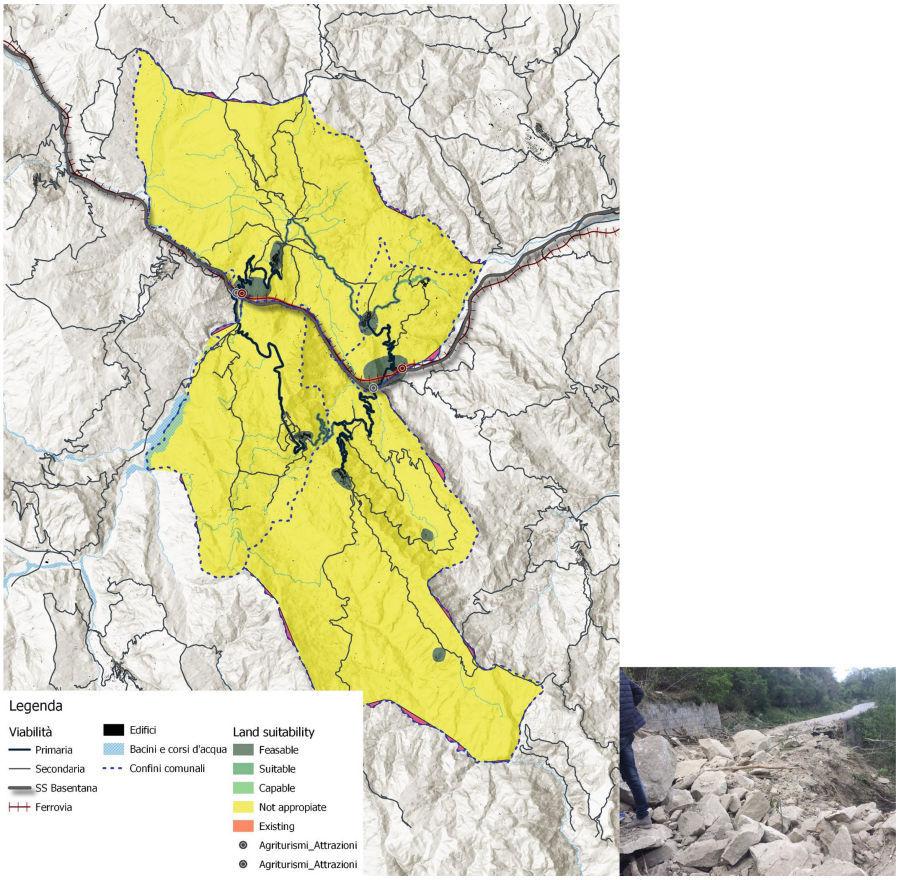

Fig. 3. The suitability map of grey infrastructure system and the road connection between the settlements of Castelmezzano and Pietrapertosa interrupted by a landslide.

5 Conclusion

In conclusion, by embracing Geodesign principles and integrating the outcomes of the evaluation maps, the MITIGO project and similar initiatives can contribute to the safety, sustainability, and economic development of the context. The participatory and system thinking approach of Geodesign allows for adaptive and flexible planning, incorporating evolving contexts, new data, and changing stakeholder needs [21]. Through continuous learning, collaboration, and evidence-based decision-making, Geodesign promotes resilient and inclusive spatial planning, aligning with the goals of environmental compatibility and sustainable development [35]. This cooperative effort aims to design solutions for local development while considering territorial infrastructural issues and associated risks. Public involvement in the co-design process holds useful value as it fosters consensus-building and enhances awareness of critical spatial concerns, even within "low-context" cultures.

Moreover, a survey conducted in these areas showed the demand for more consistent co-participation of the population in decision-making processes and increased awareness of the risks associated with the area in which they live [36]. Although limited to the knowledge building phase, interaction with communities is being pursued to conclude the Geodesign workshop and promote a democratic and participatory approach to future local development.

However, one of the major limitations in the advancement of the participatory process is the willingness of the public administration to actively interact in the workshop. As pointed out earlier, the community has understood the potential of the participatory planning tool to bring forward its instances and contribute to the local development vision. While this has been exposed in a positive sense, institutions are still not ready to expose themselves to actively discuss proposals that come from a bottom-up approach. For these reasons, efforts are being made to raise awareness and prepare institutions for the future workshop's activity. In this way, the shared planning process (community-institutions) can help to perform the quality and the evolution of the planning process.

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