



Research article

A political concept for the Gragnano Valley of Mills (Valle dei Mulini). Urban redevelopment of cultural-industrial heritage

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Abstract: The scholarly community has been paying more attention to the issue of the revitalization of the historical conservation of cities and their alteration in the wake of Southern Italy's growing urbanization. Experts and scholars are beginning to understand the need for collaborative urban regeneration initiatives, protecting historical and cultural elements, upholding cultural identities, and establishing development districts. The Valley of the Mills of Gragnano, the subject of the proposed case study, is a complex issue that requires the consideration of several factors in addition to urban regeneration. These factors include the need to identify a system of multiple actions to regenerate the area, considering the current requirements for mitigating environmental risk in areas with cultural heritage, and suggesting monitoring and public participation actions for preservation. The complexity of the Valley of the Mills renovation is understood; it goes beyond the simple structural and architectural restoration of the buildings. In other cities similar to Gragnano where industrial, historical archeology and naturalistic significance run the risk of adversely affecting an extremely significant area from a historical and cultural perspective due to naturalistic and anthropogenic impacts, the article's goal is to present the case study of Gragnano as an example of a sustainable and moral urban renewal strategy. This research work aims to be proposed as a policy development guide for policy makers at local and regional levels for the development of the area.

Keywords: Gragnano; Valley of Mills; urban regeneration; resilient cities

1. Introduction

Cities that are considered historic or cultural often have a multitude of architectural treasures that

are a reflection to their long histories. At the European (EU) level, several building and urban policies support sustainable development. Urban solutions support energy transitions, carbon neutrality, affordable and clean energy, reduction of greenhouse gas emissions, biodiversity, climate mitigation, and adaptation. The UN and the European Union (EU) both highlight the significance of the “Green Deal” in advancing sustainability, safety, resilience, and climate adaptation. In addition, the “Paris Climate Agreement” acknowledges the beneficial impact of traditional building methods on climate adaptation since they maximize the use of natural resources [1–8]. Over the past few decades, however, urbanization and economic and social institutions have grown rapidly, and with them, people’s expectations of the built environment and their lifestyles. Residents of old historical towns and municipal officials dislike them for their poor living circumstances and outmoded usages when contrasted to the living standards and practicality of modern cities. Much of a country’s created legacy is being permanently altered and destroyed as a result of the urban modernization process, which is destroying or rebuilding many old buildings and streets of major historical and cultural worth. Since many historic structures and towns are deteriorating and disappearing, the question of how to preserve and regenerate them has become one that needs to be addressed immediately by the local authorities [9–11]. Even today, in many areas in Italy and Southern Italy, there is a valorization of the historical heritage. Artistic and industrial heritage is outside the attention of government bodies, although it has been analyzed in the literature for decades [12–16].

The growth of transportation and communication, along with the rapid spread of globalization, has focused the attention of many city stakeholders and local government authorities on tourism as a strategic accelerator for urban renewal. Both locals and tourists from around the world value a region’s cultural legacy. Historic towns and cities can therefore promote urban renewal, offer fresh experiences, and enhance the tourism industry. Environmental vulnerability, harsh climatic change, seismic activity, and pressure from migrant flows, as well as new situations brought on by the population’s shifting system of values and behavioral patterns, intersect with the “genetic” factor. Changes that have marked the development of Italian cities since the turn of the 20th century and highlighted the emergence of a new, pressing “urban question” [17].

A central point, not current but which has been reflected for years in both practice and empirical evidence, is the connection of the industrial-historical heritage with climate change and the enormous growth of urban centres, the diversion of monetary funds towards interventions not aimed at valorisation, except in some cases. In Italy, the government and municipalities are interested in measures for climate change and urban regeneration [18]. An excellent approach that has been presented is RFI’s (Rete Ferroviaria Italiana) project on the reuse of disused stations and abandoned buildings. In an effort to repurpose industrial architectural treasures, several cities have entered tenders. In this contribution to the field, resources that are managed—whether under public or private ownership—and that are vital to the territory’s economic and tourism history are analyzed and studied.

Moreover, the evaluation of these artifacts’ resilience to climate change—such as heavy rains, floods, landslides, etc.—and its potential to harm cultural legacy is still at the academic level and is not included in many administrative measures. Urban redevelopments around historic or industrial buildings are currently being developed internationally, including in Italy. A few cities in Italy have implemented good and significant practices and set an example for the revitalization of spaces while preserving the historical, artistic, and industrial legacy.

The body of literature, scholarly and scientific debates, and the increasing recognition by national and international organizations of the effects of climate change on the region have all brought attention

in recent years to the necessity of climate-proof policies, strategies, instruments, and activities. An integrated and inter-scalar strategy will be used to update and innovate spatial government technologies in order to accomplish this goal. This scenario has been taken into account in recent EU programming and policies and in literature, as highlighted by [19,20], which are coherent with the goal of the Recovery plan “PNRR” 2021–2027 detailed in the Mission 5 Inclusion and cohesion “Urban regeneration and social housing”, and of the PNR (National research program) 2021/2027 in thematic Area 2 Humanistic culture, creativity, transformations, society of inclusion, Thematic Area 5 Climate and Thematic Area 6 Environment [19,20].

Stakeholders’ reconstruction of abandoned industrial sites started out as an unintended communal project within the larger process of urban regeneration. Compared to other artistic and cultural locations, abandoned plants have several advantages. The cost-effectiveness is the first benefit. Plant renovations typically preserve the buildings’ primary structural elements, which can save a significant amount of time and money. Furthermore, early urban planning policies and regulations regarding industrial property were permissive, making it possible to use and preserve industrial infrastructure.

One of the most important policy approaches aiming at addressing diversity, sustainability, equality, and liveability in cities is culture-based urban regeneration. The promotion of the arts and culture, health and wellness, education and skill development, and families are the main priorities of social and cultural renewal. In this instance, the goal is to provide chances for people living in affected areas to actively participate in community life and larger society in a more significant and group-oriented way. The goal of urban regeneration is to advance energy efficiency and social inclusion in urban areas. These programs are implemented as investments and projects that aim to reallocate possibilities and revitalize underutilized assets, boosting urban prosperity and quality of life.

In this regard, prior research on urban conservation in China has demonstrated the broad range of topics that researchers are interested in, including the cross-cultural application of international conservation principles, heritage as social capital, public participation, and political-economic and social issues in conservation planning, such as power structures and funding systems. These studies place a significant focus on the conceptual and real-world challenges associated with urban conservation in China [21–24].

One example of innovative redevelopment is the industrial areas of Shougang, one of China’s largest steel enterprises, which is now a vivid example of urban regeneration even in literature. The change started before the 2008 Beijing Olympic Games. The ‘Shougang Industrial Park’ became the headquarters of the Organizing Committee of the Beijing 2022 Olympic Games.

China is fertile territory for investigating, from a sociological point of view, how to attract different social groups to live. In the studies presented by [25–27], urban regeneration is analyzed with the approach of scene theory, identifying five components: the neighborhood, the amenities, the people who are classified according to their race, class, gender, education, etc., and the people who live there. Numerous empirical studies on urban regeneration investigate these components either alone or collectively. The findings on the case study of two regeneration projects in Shougang, and Guangzhou are inextricably linked to complex power dynamics, discourses and cultural negotiations. On the one hand, the projects can offer a tool to revitalize local culture, on the other hand they involuntarily lead to cultural conflicts between different social groups. By describing the intricate cultural politics involved in culture-based urban regeneration initiatives, the author’s work adds to the body of knowledge on the relationships between the government, developers, and residents/individuals in the context of culture-led urban regeneration [25], since in many Chinese cities industrial-heritage reuse is strongly regional [26].

Through an analysis of Guangzhou, China's best practices for culture-based urban regeneration, one can see how these projects are entwined with complex power dynamics and cultural settings, where the government's developmental goals, the voice of the local community, developer and user expectations, and lived collective memories all intersect.

This paper adds to the body of research already done by emphasizing the flexibility of the roles performed by participants in regeneration projects—where the interactions between local society and the government must be examined within a contextualized framework.

The topic of historical worth is extensively studied in Italy, as demonstrated by Calabrò et al.'s [24] analysis of the Umbertine Forts of Pentimele in Reggio Calabria as an example of how historical and environmental legacy contribute to a city's appeal. To ensure a sustainable future, [27] suggested concentrating on Lake Barrea in historical Italy. According to [28], enhancing the current heritage that supports regeneration activities and cultural values requires improving the quality of life in urban environments. The Building Information Modeling technique can be used to alter the way that humans interact with their surroundings, as per the sustainable development standards outlined in Agenda 2030 by the European Union [11,13].

Concerning the subject of the study, the Region of Campania (Figure 1) has several old and dispersed industrial structures, especially in places that are sensitive to the environment. This study focuses on an area that is not well-known in national administrations or literature: the city of Gragnano in the province of Naples in southern Italy (Figure 1 and 2).



Figure 1. Gragnano location in Campania Region. Source: Author's elaboration.

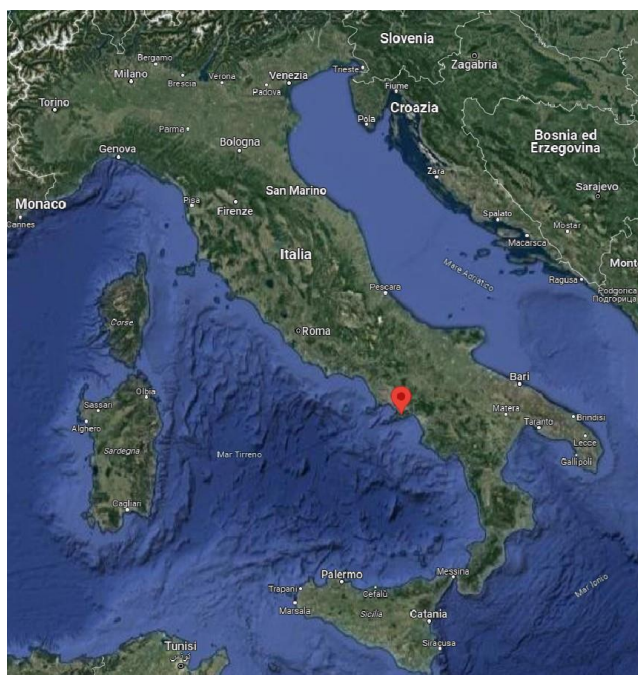


Figure 2. Gragnano's location in Italy. Source: <https://www.googlemaps.com/>.

Urban regeneration is a combination of sectors and measures, while in the light of climate change the phenomenon of integration between emergency measures and maintenance measures for heritage or spaces still seems poorly understood. Due to the interdependence between the various sectors, the strategy must be quantitative and rational, capable of incorporating community requests with accurate knowledge of the territory and regulations derived from European plans. Therefore, it is almost difficult to witness an urban renewal of architecture because, to preserve the area, the legislation provides for the merger of an increasing number of businesses, local administrations, and designer skills.

In the Campania region and the Sorrento Peninsula, numerous historic sites have been abandoned because local authorities were unaware of their potential economic importance. With assistance from UNESCO, which helps identify suitable locations for inclusion, numerous countries are attempting to have their historic cities added to the list of world heritage sites. Historic neighborhoods that have been revitalized frequently draw a wide range of business activity and competition, which draws more tourists and new inhabitants to these regions. As a major component of an urban region, communities form the foundation of cities. People typically share amenities, resources, and public buildings in their areas. Neighborhoods satisfy social demands and encourage the development of human connections, communication, and social participation. Enhancing the historical urban structure's built environment, social fabric, and urban areas also contributes to its increased appeal as travel destinations for both local and foreign travelers. Developing designs that are sensitive to the needs of the community and the surrounding historic environment, while also guaranteeing that history will continue to contribute to the present and future, is a challenge for regeneration. In many historic cities, "local fatigue" may result from overuse of the community's infrastructure and its historically significant buildings. Historic conservation towns that are being restored can benefit the community's economy, citizens, and the progress of social and human development [22].

There are scientific documents on the role of Gragnano and the Valley Mills (Valley of

Mills) (Figures 1 and 3) in the industrial production of the typical product of Gragnano “pasta”, notwithstanding the absence of knowledge regarding the regeneration or structural requalification of the mills [29–33]. It has not been thoroughly looked at outside of a few studies pertaining to the business and manufacturing sectors [27]. Pasta production has been the subject of numerous studies [29]. [33] investigated the technological-economic analysis of the electromechanical machinery of traditional vertical axis water mills for Gragnano “Valley of Mills” as well. Luino et al. [32] note that Gragnano’s evolution was not always linear, which is where the abandonment and degradation of valleys and mills begin.



Figure 3. The list of the mills in Gragnano. Source: valledeimulinigragnano.it [21].

This centuries-old series of events and the clear danger exposure seem to have been overcome by a kind of collective elimination of the problem during the post-World War II era, which was marked by a sharp increase in population. In Gragnano, urban growth occurred sporadically and slowly [32]. To show that agribusiness companies can innovate through tradition by joining a network, [33] concentrated on the agribusiness sector. The Consortium of Pasta di Gragnano, which is a (IGP) “PGI (Protected Geographical Indication)” labeled organization, provided the empirical proof for their findings. The authors conducted a panel data analysis using a quantitative methodology. Rather than attempting a complete restoration, the difficulty facing these historical conservation towns is essentially how to preserve their historical center while integrating local history, culture, distinctive features, and customs with contemporary urban life. Buildings in historical conservation towns should have comprehensive descriptions that include the building’s construction date, architectural style, quality level, and other details. Then, to ensure their continued existence, they should be modified to varied degrees rather than reformed in a “one size fits all” manner [34–38].

For the built environment to be sustainable in the future, especially for older buildings, new and creative solutions will be needed. To preserve these buildings, in addition to extraordinary maintenance, regeneration and limited urban evolution are necessary. According to current empirical evidence and policy measures, what are the existing guidelines for the conservation and preservation of historic assets? These questions do not only look at the buildings but also at the territorial context in which

they are inserted, according to the cities of historical conservation and improvement of the living environment of the local inhabitants. Despite the modern urban lifestyle, redevelopment and historic preservation spread the needs of traditional, historical, and cultural heritage, as well as the economy, to cities. Residents need to be aware of the various variables that influence the level of quality of life in their urban environment [39–44].

In contrast, places seem to be active, that is, as a spatial act and a carrier of political, cultural, and historical interactions; they also seem to be carriers of historical memory, symbols, and signs of political events, or places of interactions. From the perspective of human action on them, the value of Valley of Mills as historic architecture in historical cities represents a unique system that requires new and different perspectives. The tourism sector is one of the most important worldwide industries since it contributes to positive economic growth [45–47].

Urban planning and architecture use regenerative design extensively to address negative effects of climate change, urban sprawl, tourism pressure, and other modern challenging phenomena for environmental preservation and human well-being. Regenerative design helps people re-establish a connection with the natural world. This article discusses the case study of the Valley of Mills in Gragnano as a complex example of urban regeneration as an extended concept of urban renewal, not limiting itself only to the idea of redeveloping the mills as a structure and historical edifices, but to consider the effects and impacts on the relationship with the territory, adding the criticality of climate change on the fragile territory [48–50].

Considering the focus of this article, the discussion of the role of urban regeneration for Gragnano and the mill valley is complex system of factors (social, economic, environmental, stakeholders collective, infrastructural, natural risk). As Gragnano today is a city with an industrial vocation (the economy is carried on by small enterprises, and by historical pasta factories, not those in the Valley of the Mills, but other pasta factories active since 1900), and a tourist-naturalistic one, urban regeneration often associated with Gragnano limited it to the recovery of the mills from a structural point of view. This does not go against the spirit of this article, but it does limit it, since the revitalization of the mills (as carried out for other industrial archaeologies) does not allow the valley to be revalued. In fact, what is happening, and will be described in more detail in the following chapters, is the raising of awareness through a process of collective social co-design by volunteers and associations, which have shifted the ‘revival’ value of the mills. From a scientific point of view, this phenomenon is one of the areas that makes up urban regeneration as a development guideline for tourism, architectural conservation and revaluation of the industrial value, memory, and identity of the place and the economic development that the valley can establish with the city of Gragnano.

The approach to the urban regeneration process investigated for the Valley of the Mills considers the present situation as a starting point, in which the aspects of environmental mitigation, public participation and preservation of historical and industrial heritage are analyzed. The process is divided into two phases because, although the ‘regenerative design’ approach is useful in our situation, to answer our research questions regarding the preservation of the context from extreme events and to think in a long-term perspective, it has been enriched by considering the components necessary for Gragnano in the present and in the future and considering foreign experiences as cases of urban regeneration. Therefore, the regenerative design has been used as basis to conceive a global context of urban regeneration including the risk of climate change for the environmental part. The following are the basic concepts: (i) identifying locations and the unique patterns they exhibit; (ii) designing in harmony with the location; and (iii) co-evolution for ongoing project adaptation to outside

changes. “Regenerative heritage,” which emphasizes the revitalization and preservation of local history and knowledge, is the central concept of this strategy. Distinct from “restorative heritage,” which promotes the adaptive reuse of historic structures through increased flexibility, adaptability, and hybridization of functions, is this concept. Communities can respond to the effects of land expansion, environmental deterioration, and harm to cultural heritage more resiliently with the aid of regenerative design. As a result, in addition to heritage management, enhancement, and preservation, the main challenges for their revitalization are also related to environmental issues (such as sustainable development, biodiversity preservation, resource use, and the improvement of local resources and systems), social issues (such as tourism attractions and people’s engagement, wellbeing, training, and education), and economic issues (such as benefits, profits, and innovation).

While the history of Gragnano is clearly different, there are other analogous cases of urban rebirth. In addition to the considerable Chinese experience already discussed, the experience launched in Leeds explored by [51] examines the methods, guidelines, and outcomes of urban renewal in the present, with a focus on the city’s industrial past using a systematic, analytical, and problem-focused methodology. Owing to its importance for history, society, technology, and architecture, industrial legacy is now acknowledged as a component of many locations’ identities and is frequently linked to local interests. Like Leeds, Gragnano was once an industrial town, thus it has a lot of abandoned industrial structures and great development potential. In fact, the Gragnano municipalities contain other historically noteworthy buildings that do not fit the definition of mills. In the Italian southern city of Taranto, [52] proposes another nearby example. Taranto is a dilapidated industrial city plagued by social and environmental issues. [52] focused on a novel strategic planning method which combines a cognitive-map-based interaction model with a scenario-building technique to address the complexity of the Taranto context. Following these observations, this article can become a policy decision support tool for the evaluation of mills and the historic valley.

This case study highlights the complex interplay between multiple factors, including the area’s hydraulic danger, the mountains pressing down on the valley, the torrent (which could potentially cause significant damage to the mills and the valley in the event of severe climate change events), the possibility of landslides, and the abandonment of these artifacts by both public and private administrations. The modern Gragnano pasta was first produced in the valley in 1600, and the mills are now a popular tourist site, a hub for economic growth, a natural attraction (you can access the routes that lead to the coastlines of Amalfi and Sorrento from the Valley), and an architectural landmark. The mills represent a fundamental past for modern living and are a source of historical information.

The Valley of the Mills of Gragnano, as an element of industrial architecture which still performs a function of tourist attraction today, but whose regeneration is purely intended at the building level, their redevelopment extends to the preservation of a large natural area which also includes public participation in the process. In contrast, the region lacks the capacity to adapt to extreme weather events, which puts the historical and cultural heritage at risk. This paper seeks to address the following research problems: How can you protect prominent locations that are located outside of the city and in an extremely vulnerable territory? What issues are brought on by the careless political actions that led to the projects, and what other options are there for recovering the local heritage? What procedures should be used to renovate prestigious buildings while expanding the renovation to a larger area? Can the ‘Valley of Mills’ serve as an example for other places? Offering support for decisions by taking into account all aspects of the area’s regeneration (social, economic, environmental, and technological) is based on [53,54] through the Whole Building Design Guide (WBDG) regenerative design mode approach, which is used

presence of aqueducts and mills. By understanding the architectural objects' constructive and functional characteristics as well as their interactions with the surrounding natural and cultural environments, a plan for their recovery and valuation can be defined.

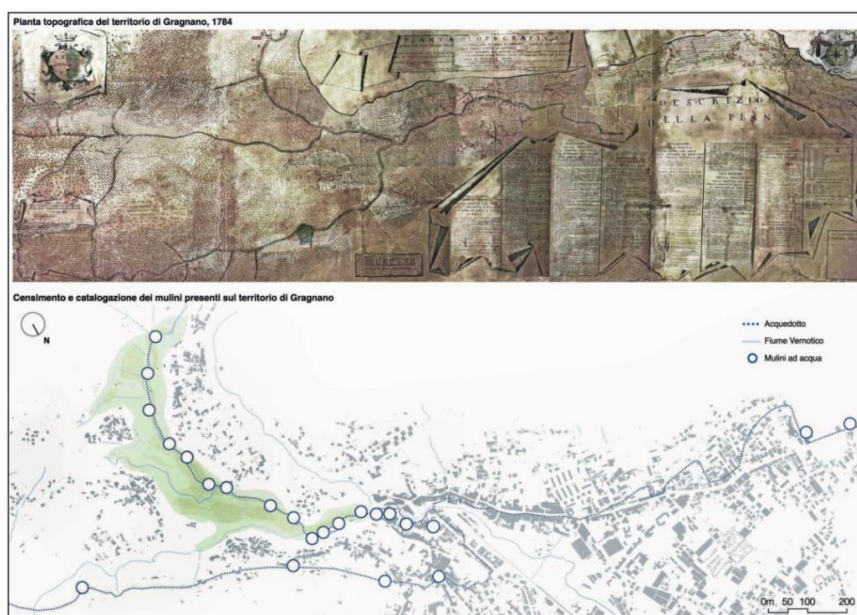


Figure 5. Enumeration and classification of the current state of the Mills on the Gragnano territory in relation to the Chirola planimetry of 1784. Source: Aveta et al. (2017) in: La Baia di Napoli. [55,56]

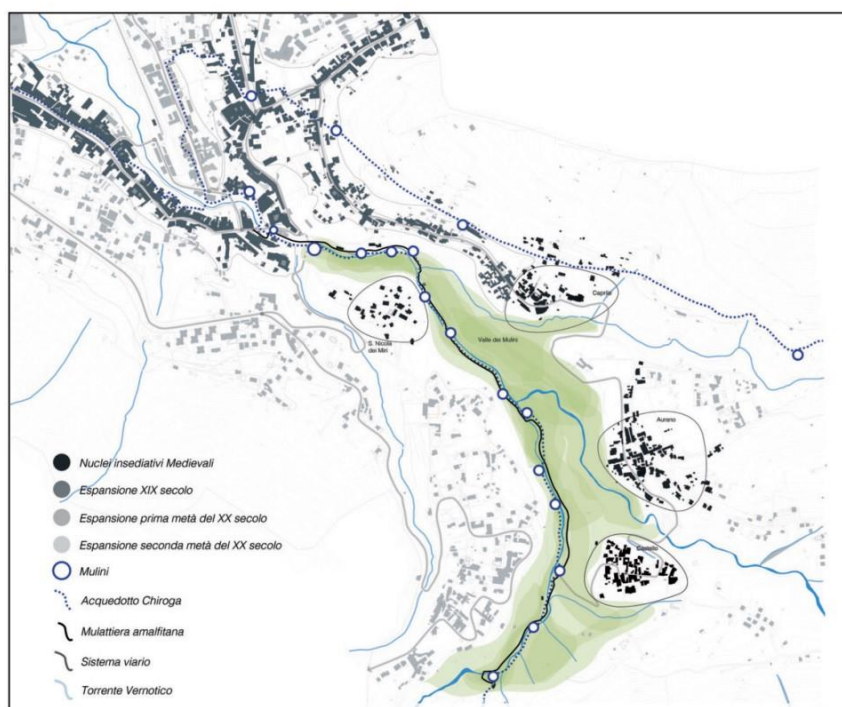


Figure 6. Evolution of Mills. Source: Aveta et al. (2017) in: La Baia di Napoli. [55,56]

The valley is two kilometers long (Figures 5 and 6), clean, and still has the mill ruins surrounded by rich vegetation that Grand Tour visitors from throughout Europe used to come and paint, as well as waterfalls, bridges, the harvest of grapes from the towering pergolas, and rural scenes. A few steep ramps descend from the valley level to the medieval village of Castello, once defended by three rings of walls as a defensive bulwark on the road to Amalfi, whose Duchy Gragnano was the second-largest populous region after the seashore city. One of the rare industrial applications of the Middle Ages in Europe was the water mill, and the ones in the Valley of Mills of Gragnano stand out for having piezometric accumulation towers, often in conjunction with other towers that functioned as flywheels to turn the millstone's horizontal wheel. An ambitious project aimed at transforming them into an outdoor industrial museum finally needs this important historical prestige to prove.

The mills situated along the Vernotico river bear similarity to those situated in the Lattari mountain valleys; they are positioned on the same axis and feature a horizontal wheel, indicating the absence of gears between the wheel and the mill. If the water hits the wheel blades swiftly, these mills can operate at even very low water flow rates of a few tens of liters per second. In the event of a slow flow, a broader wheel can be used to boost power output, and the mill's revolutions per minute can be increased by choosing the right multiplication ratio for the gears that connect the wheel and mill axes. These milling facilities consist of the mill building, which contains the wheel, millstone, and auxiliary equipment, and several hydraulic works for supplying, conditioning, and draining the driving water.

The masonry channels have a smaller internal section, usually about 30 centimeters, in comparison to the millstone feeding system. Placing the well at least ten meters above the riverbank will help prevent the structure from overflowing in the event of flooding, which is crucial for the mill's safety and proper operation. Furthermore, there is the potential to utilize the energy contained in the water itself, which is gathered in an inverted cone-shaped storage well that is about 7 meters deep, with a top diameter of between 90 and 120 centimeters and a bottom diameter of about 25 centimeters. The well has a height difference of between 6 and 8 meters. The accumulation hydraulic effectively, which is constructed with a fabric wall device and medium-sized stone sizes, is housed inside a 2×2 meters square tower that is attached to the water wheel housing. In this manner, the well's bottom is either slightly off by a few decimeters or in line with the wheel's height. The pressurized water jet required to start the wheel itself can escape through a horizontal hole in the well's surrounding wall. When water falls from the wheel, it gathers in a masonry basin beneath it. From there, it crosses the discharge channel and is either sent to the bypass channel or back to the river, depending on the kind of mills that make up the system cascade network that includes one or more mills located downstream.

The "ritrecina," or paddle wheel, which is composed of oak or chestnut wood and is positioned horizontally in relation to the walking surface is the mechanical component of hydraulic mills. It can be detached from the walking surface at a height of a few tens of centimeters. The mill benches and the fixed grindstone linked to it, also known as the undercut grinder, are penetrated by the spindle, the vertical chestnut axis that traverses the prison's vault and falls on the top level. The soprano grinding wheel, which rotates, is attached to the motor shaft through a detachable connection with a cross or butterfly bracket that is secured to the grinding wheel and has a square hole anchored in the middle. This iron, also known as the milling iron, is square-headed and strengthens the spindle's tip. The diameter and thickness of the two millstones vary from 90 to 120 centimeters, respectively, and are directly related to the natural material's consistency. To guarantee the thrust of the ground material towards the exterior, those from Gragnano, composed of thin sections of Vesuvian stone, have radial grooves on the faces in contact with the grinding wheel (Figures 7–9).



Figure 7. Mills in Gragnano (before 2021). Source: valledeimulinigragnano.it [21].



Figure 8. Mills in Gragnano (before 2021). Source: valledeimulinigragnano.it [21].



Figure 9. Mill “Lo Monaco” before the requalification in 2021. Source: valledelimulinigragnano.it [21].

The mills closed in the 19th century when the new pasta industry began using durum wheat instead of soft wheat. The final blow arrived in 1869 with the implementation of a tax requiring a fee to be paid to turn the mill. The tale surrounding the Mills of Gragnano ended in 1900. The Valley of Mills has grown into a tourist-friendly natural area during the 2000s. The now-hidden abandoned mills are a great source of industrial archaeology because of their distinctive architecture, which also led to significant technological advancements that had a significant impact on the era’s economy [57,58].

2.2. The preservation of cultural-industrial and naturalistic heritage for the urban regeneration

The cultural history of the Valley of Mills is being studied as part of a wider research project that looks at more contemporary advances in conservation culture, which blends environmental preservation with the preservation of historic buildings. Given the recentness of this conquest, much work remains to be done to break free from the categorizing and selective readings of the numerous local writers in favor of conquests that are more in keeping with the material reality of the various artifacts and the development of their phases, including the state of conservation now. Despite this growing interest, systematic factory mapping—that is, representations worthy of their complex formal and material reality and thus such that they constitute the fundamental distinction regarding conservation and potential valorization—is still lacking, as are adequate surveys. It is true that reliable sources are hard to come by, particularly for marginal factories, the majority of which are today in a state of collapse. The current condition of conservation for this history is characterized by a great deal of abandonment, for a variety of reasons ranging from the start of industrial production to wars. Decades of neglect and obsolescence caused the antique roofing to deteriorate first. Thus, often, only the walled portion needs to stand, providing cover from the external surroundings that have turned into repositories for the crumbled sections and perfect ground for the growth of flora. In the most severe instances, the collapse of the walls and roofs was accompanied by landslides of nearby lands linked to erosion phenomena; these landslides were only seldom prevented by the growth of plants, which were helpful in counteracting the action of rains and related freezing situations.

Only an equally diversified presentation of restoration can be made in relation to the numerous difficulties that each item raises. Revocation, which can be implemented within the context of long-term re-functionalization initiatives, is the only acceptable course of action if the true storyline of Gragnano's proto-industrial history is abandonment, which is defined as a lack of use and, consequently, of care and maintenance. The efforts of numerous administrations, both past and present, to repair ruins and integrate wall gaps show that, without these programs, any intervention is doomed to remain ineffective. Without deliberate preventive restoration operations, you cannot ensure not only the safety of the artifacts but also the safety of their surroundings. The conversation challenges issues with cultural policy, first focusing on defining specific issues and making clear the restoration's goal. It also acknowledges the inadequacy of certain initiatives and the necessity for projects that are instead carried out at the urban and territorial levels and consider the close relationship between architecture and landscape in the Gragnano region. The mill case, like all similar cases, presents significant challenges in terms of conservation and valuation because it is evident that the surviving factories coexist harmoniously with the natural and landscape contexts that ensured their establishment and continued existence until the emergence of industrial production. In these instances, the museum role appears to be the best way to ensure that the artifacts receive a new lease on life. However, it is evident that this role is limited to a few episodes, as the other episodes must be incorporated into a network that allows for guided use and takes landscape conservation into account. Put another way, the challenge lies in comprehending these artifacts within a dynamic, multi-scale landscape design that can be implemented at several levels. This is because only a skilled planner can fully grasp and regulate the changes occurring, knowing that they become increasingly complex the more historicized the reference landscape becomes. Specific manufacturing interventions, however, need to be adapted to the specific circumstances.

Past initiatives and scholarly pursuits have centered on the survey and building recovery of mills, stopping at architectural laboratory techniques. Both the interest and the local government were forgotten. Since 2010, the reconstruction of the mills and the valley has been championed by a grassroots movement that has emerged locally. A group of volunteers took part in this citizen movement by starting to dig, clean up the area, and do research in the field. This event brings to light citizenship and public participation, which is a crucial element that is frequently overlooked during urban revitalization. In their current state, the mills can be viewed as a fascinating example of a collective practical education involving local associations and individuals. The discussion raises the entire issue of the ruin's rehabilitation, with the widely held goal of transforming it into a genuine resource for the area when it has assumed the status of a landscape in all its varied human and material components. Compatibility with new functions, which enable the preservation and improvement of the architectural artifact itself, is another crucial issue. The ideal scenario calls for the development of a linear park where different industries house research and educational initiatives pertaining to the themes of water and the ingredients needed for healthy eating. Hence, it would be feasible to dispel myths about practical remodeling and stop the crazed building that has been plaguing these areas for several decades [57–60].

2.3. Methodology

The assessment of potential comprehensive urban regeneration strategies for the Valley of Mills is based on the research proposed by [49,53] and the technical of “regenerative design” by WBDG [53,54]

based on three similar theoretical phases, notwithstanding the development of different ideas in this area: (i) “understanding the relationship with place”; (ii) enabling “design in harmony with the place”; and (iii) achieving the “co-evolution” of the design project. This procedure connects these three theoretical processes to three related real-world tasks.

In the study case, limiting the mills’ requalification to structural and architectural analysis using BIM methods would have been one step in the process, after which the cultural value of the patrimony and its relationship to the land would be examined, along with the assessment of environmental risk and public participation. Furthermore, as previously mentioned, the requalification aims to establish accessibility between the surrounding metropolitan area and the valley, where two road access points are available for valley access.

Furthermore, through the application of “regenerative design”, it is intended to prevent diffuse construction with measures of protection and preservation, and instead allow the heritage to return as it has always done, accompanied by awareness of the territory’s fragility. Given that academic research institutions have bravely tackled the possibility of urban recovery without using financial or economic analysis, and considering a citizen movement of recovery and low-value development, the WBDG approach appears to be the most comprehensive way to address a variety of critical points.

Although different, Lucchi’s [49] approach is similar to our case study, which we began with in this work by analyzing our surroundings. The chosen approach aims to attract additional aspects of the analysis and research phase that have an impact on the outcome of the case study, based on the model found in [49] and WBDG [54]. Even though tourism benefits from heritage protection, there are no systems in place to know the involvement of actors. Economic analysis is essential to maintain public safety, revitalize the neighborhood, redevelop structures, re-establish connections with the metropolis and promote urban accessibility. It is necessary to invest in citizens’ knowledge of the identity of the place. These conclusions lead us to think about the three principles of sustainability. Since the phenomena of bottom-up public participation are numerous for the mills of Gragnano, some elements at the local administrative level have been the subject of redevelopment interest. This experience motivates us to resume our efforts to support the regeneration of the area. The group is made up of local volunteers who have started to clean up the area to bring out mills, as well as the road and pedestrian connection to the mills themselves. This coordinated effort highlights the urgent need to revitalize the area through structural strengthening and restoration, the formation of a “zone 30 (max speed 30 km/h)” to allow the use of the mills for tourism and hospitality, and the adaptation of the mills to risk of extreme events.

The methodological proposal (Figure 10) for regeneration is divided into several sections. It involves including the public, including administrations, in the reconstruction of the building and its environs. This might be applied to the mills as well, according to the Whole Building Design Guide’s (WBDG) activities.

The overall methodological paradigm of the article consists of three phases:

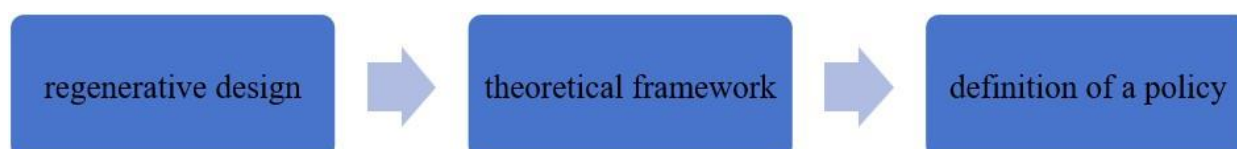


Figure 10. Overall methodological paradigm, author’s elaboration.

The regenerative design is structured in 3 steps, as shown below (Table 1):

Table 1. Regenerative design adaptation from WBDG.

Step	Sub-phases
1. Investigation to understand the connection to location	<ul style="list-style-type: none"> • A1: identify • A2: investigate • A3: connect
2. Enable planning for harmony with place	<ul style="list-style-type: none"> • B1: create • B2: develop • B3: test • B4: reiterate
3. Co-evolution	<ul style="list-style-type: none"> • C1: execute • C2: educate • C3: diffuse • C4: consolidate

The three steps refer to the classic regenerative model and are to start with an investigation into the local context (Step 1), think of measures in harmony with the context (Step 2), and finally co-evolution (Step 3) which is intended to be a co-long-term planning. The measurements or sub-phases of each step are listed:

A1–A3: identify, investigate, and connect; B1–B4: create, develop, test and reiterate; C1–C4: execute, educate, diffuse and consolidate.

Compared to the classic model, the actions of steps 2 and 3 have been extended to adapt it to the case of Gragnano in its current state. The state of the Valley of the Mills of Gragnano is made up of bottom-up participation, in which groups of volunteers and scholars have brought the mills to light, carrying out a collective redevelopment in the area around the mill (cleaning weeds, soil, setting up fences and bridges to reach the mill from the road). This was joined by groups of donors to support the volunteers, providing tools or donations of wooden doors or other useful material for the safety of the valley of mills. The importance of the mills is centuries old, although little is known outside the Gragnano context. It has been at least ten years since, together with national phenomena of cleaning the territory (“Puliamo il mondo” by Legambiente), volunteers have started with bottom-up movements to clean the Valley of the Mills. The conditions between the 90s and the early 2000s were one of neglect on the part of citizens and degradation, as well as institutional carelessness. Over 10 years, the citizens who began to participate in the cleanup increased, leading to the establishment of associations in the area and the current state of a group of permanent volunteers for the work carried out.

Precisely because of this evolution, further ideas were needed to lead us back to the current problem of preserving the environment from hydrogeological risks, to confirm participation, and finally to bring the case study to institutional levels.

Table 2 identifies the measures relating to the current state of the Valley of the Mills to better understand the current state of the components that we want to analyze as the basis of the framework.

Table 2. State of progress of sub-phases for the Valley of the Mills, elaboration of author.

Measures/sub-phases	State of progress
A1: identify	80%
A2: investigate	30%
A3: connect	20%
B1: create	10%
B2: develop	10%
B3: test	0%
B4: reiterate	0%
C1: execute	0%
C2: educate	45%
C3: diffuse	60%
C4: consolidate	30%

2.3.1. Identify, investigate, and connect

Identification of the primary features of the archaeological site at the landscape, urban, and building levels as well as an investigation of the connections between the natural, human, and economic systems are included in the analytical phase for the mills' rehabilitation.

Currently, the machines' functionality and updated maps of the industrial legacy complete the identification. Numerous research projects have also examined the identification, reevaluating the mills in terms of naturalistic inclusion and restoration.

The mills are unconnected to human and natural hazards, as well as the functional, economic, and tourism issues of the area, in relation to the inquiry phase. The potential of the mills will not be immediately apparent during the regeneration process, but they should be the linking element that brings the past and the future together in a way that enhances heritage value, protects biodiversity, and provides a reference for landscaping, as well as creating economic and social value on an ongoing basis. The creation of fundamental design schemes and principles, as well as their execution in the form of systemic designs, integrated plans, and construction procedures, are the following stages of the design phase. Currently, in contrast to [49,61], we have additionally included a list of risk and weakness elements that operate as both natural and anthropogenic impediments to the valley's regeneration. Industrial activity near the valley creates anthropogenic barriers, as evidenced by the high emissions, pollution, and thermal vehicle pollution levels brought on by traffic. Natural barriers also lead to landslides on the slope, hydraulic influence in the center of the region, and inadequate weather event monitoring. The naturalistic element is often absent from urban regeneration measures, while in this case, the "connect" sub-phase was also added to the WBDG process to increase the role of networking between public and private and between various public bodies.

The Gragnano area has always been subject to medium-high hydraulic risk, and since the valley is already naturally disposed to areas with risk of landslides, long-term and large-impact meteoric events can cause the loss of heritage, as well as pose danger to human life in the area itself.

2.3.2. Create, develop, test, reiterate

The measures create, develop, test, and reiterate intend to identify the strengths and weaknesses

through qualitative analyses and participation techniques to create a cooperation model. These phases have been added to the first three WBDG design standards because, in solving problems related to building and natural heritage, it is necessary to have a model available that can be tested and modified according to different needs. At the base, in the first phase where knowledge is constituted, the idealization of the various architectural, anthropic, naturalistic, strategic, and planning elements is added.

The example of the mills challenges us to imagine the valley as preserved and revitalized, with interventions that go beyond the simple fortification of the structure, to maximize the regeneration value. Second, the project proposal phase includes the inclusion of the regeneration phase with an in-depth understanding of needs, hazards, and priorities. This serves as the basis for the development of customized interventions for structures and monuments. The idea of an interactive interaction between all experts participating in the design process is the basis for the regeneration and reconstruction of the area. This relationship will help reduce project unknowns, change orders, and support quality control. Public involvement and consultation are essential to formulate ideas, guiding concepts and long-term solutions to preserve and enhance the area. Gragnano is an example of how generative cocreation approaches, usually applied in social sciences, have been incorporated into urban and architectural regeneration to structure heritage, environmental, human, and economic systems in a dynamic way. Public participation enables the Government to implement conservation and reconstruction plans.

In this phase, the meeting between stakeholders makes use of the development of a matrix of the parts by associating the themes to be covered in the codesign sessions, to harmonize the needs of the stakeholders with different needs, to make the model broader than ruins, buildings, landscapes, infrastructure, and services, also improving the economic benefits of the area. In addition to public participation, two mills have been redeveloped by the population to restore a social function to the industrial heritage. One of them has been completely renovated and redeveloped to produce pasta from a local pasta factory. Such measures once again highlight the limits of regeneration, which it encounters when public authorities act late, when buildings are redeveloped for private use, or when only a group of citizen volunteers aims at the regeneration work of the area. The elements described represent the critical issues to be overcome, which through the regenerative design model, aims to consider all phases to harmonize the heritage with the surrounding context.

2.3.3. Execute, educate, diffuse and consolidate

How can regeneration be accomplished without failing? At the very least, urban planning, landscape design, architecture, engineering, restoration, ecology, climatology, sociology, and economy are involved in the “Integrated-Design-Process” (IDP) workflow, which is a transdisciplinary, open, conscious, and participatory method that takes “multifaceted systems thinking” into consideration from the outset. Schematic designs, or rough sketches and drawings that show the general idea, design developments, or plans, perspectives, sections, axonometries, and renderings that show the design concept in detail, construction drawings, or technical specifications, details, and notes required for bidding, permit application, and construction, and technical documentation, or cost and time management, building quality control, and commissioning, are required for regenerative design for the mills.

Figures 11 and 12 highlight the local point with the general point. Structural redevelopment is an element that intersects the natural context of preservation from natural elements, protection from heavy rains and the probability of landslides. An additional feature that is missing in urban regeneration scenarios is described in Figures 13 and 14. To properly redevelop the mill “Lo Monaco”, including

the architecture, structure, and surrounding urban setting, the installation and operation of the hydraulic systems is a required stage afterward.

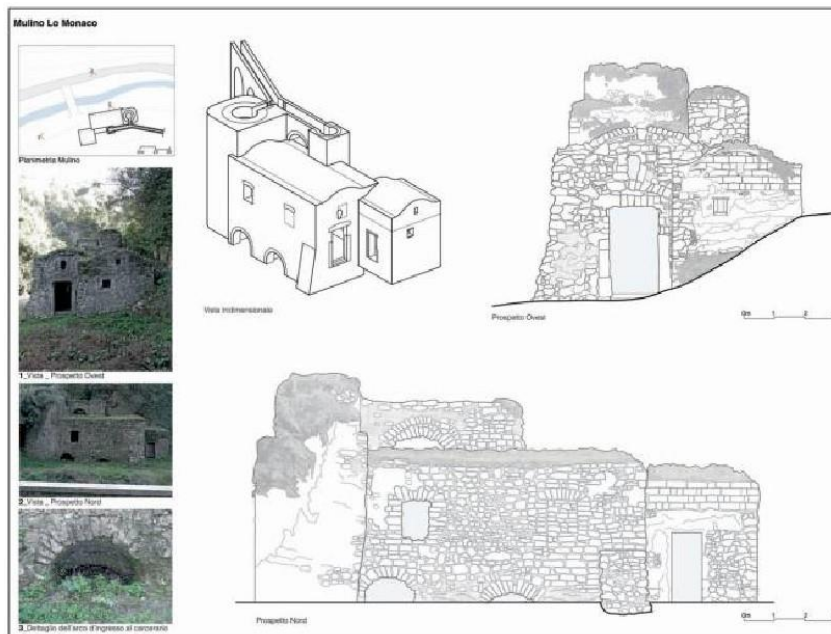


Figure 11. Mill “Lo Monaco” in the Valley of the Mills (Valle dei Mulini) of Gragnano. Example of an architectonic relief with an asymptotic, settentrional, and oriental perspective. Source: Aveta et al. (2017) in: La Baia di Napoli. [55,56].

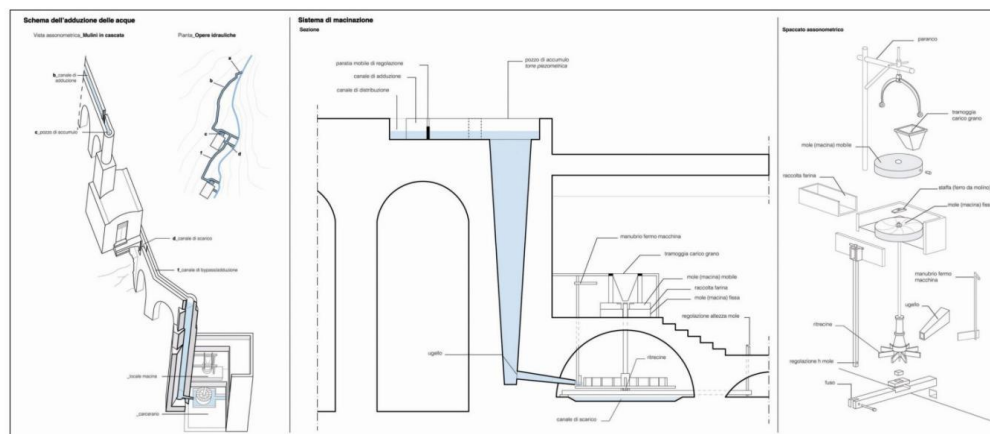


Figure 12. On the left side is the schematic representation of the hydraulics operations required for a mouse’s proper operation; on the right side is the assonometric separation and spacing of the structure and individual parts of the motor system. Source: Aveta et al. (2017) in: La Baia di Napoli. [55,56]

The Lo Monaco Mill’s hydraulic circuit has been concluded (Figures 13 and 14) allowing the mill’s horizontal blade to rotate once more, allowing visitors to relive the times when wheat was being ground. This remarkable outcome was the result of an extraordinary amount of teamwork and synergy.

The Mulino Lo Monaco in Figures 13 and 14 is an enlightened example of restyling by the volunteers; here, always with cooperation and synergies, they began to foresee the risk of losing the heritage and abandoning the things that represent the mills in the local and national identity.



Figure 13. Mulino Lo Monaco, before and after of local regeneration. Source: valledeimulinigragnano.it.



Figure 14. Mulino Castello di sopra, before and after of local regeneration. Source: valledeimulinigragnano.it.

Preservation of the environment and cultural heritage are essential to aging. “Heritage conservation, enhancement, and management” began with an appreciation of the intrinsic worth of ancient structures, ruins, artifacts from archaeology, and the surrounding natural environments. To maintain their values, adaptive reuse of existing buildings and ruins was preferred over demolition and redevelopment. The “flexibility and adaptability” of the spaces, furnishings, constructions, layouts, and infrastructure served as the foundation for the new expansions. To encourage interaction between guests, employees, residents, and associations, functional mix, multipurpose buildings, and adaptable spaces for group activities (such as meetings, training, education, associations, shopping, gaming, exposition, etc.) were recommended. Similarly, to facilitate both horizontal and vertical growth, structural modularity and dry-construction solutions composed of recycled iron or lamellar wood were selected. To improve landslide defence, wind resistance, water supply, rainfall adsorption, human comfort, accessibility, and maintenance, environmental needs must be identified. Redevelopment techniques utilizing BIM and the integration of natural and artificial elements can serve as the

foundation for the area's and the buildings' regeneration, with consideration given to the emissions produced by potential mill systems.

By providing ecosystem services like soil, water purification, air quality regulation, and local climate control, these solutions enhanced sustainability and resilience. In a similar vein, "environmental and water preservation" (i.e., managing and cleaning stormwater, recycling, and reusing water for on-site use) was seen as a crucial component in fostering a healthy relationship with nature. The growth of roots and the habitat of insects were encouraged by the sand and pebbles on the surface. Native plants were chosen to progressively facilitate the emergence of little biological communities. New buildings and facilities were made to be quickly removed, with minimal damage on the soil and without complicated installations.

Ultimately, throughout the implementation stage of the revitalization project, the site's "universal design" and "accessibility" were enhanced in a variety of ways. These included the provision of small-scale electric vehicle shuttle services from public transportation hubs, the lack of architectural barriers, flat areas for playscapes, workshops, terraces, picnics, and bird watching, gentle slope paths, shelters, benches, touches, and surfaces. Furthermore, the sizing of paths considers people flows by permitting unhindered movement for pedestrians, bicyclists, and people with disabilities. Additionally, the roads surrounding the site were built to accommodate emergency and maintenance vehicles. Another tenet of the initiatives was heritage as an economic resource. We looked at two primary strategies.

3. Results and discussion

Based on the methodology described, the results are exposed as support for design a framework that allows for more general aspects of sustainability to be integrated into urban regeneration processes in the industrial heritage districts of Gragnano. The approach aims to establish three aspects of sustainability of the Gragnano mills.

From the methodology proposed by [49,53] this process was extended as expressed in Tables 1 and 2, and further examined in Table 3 to actualize the requalification process and provide more discussion points regarding the study.

A summary table that emphasizes the approach's value as well as its innovative component is suggested to help people better comprehend how the approach's development might be of assistance. The Valley of Mills is currently reliant on the voluntary actions of individuals with interventions by the public administration, rather than having an advanced recovery plan or program meant as a type of urban redevelopment. The disparity between the actual and anticipated states using the urban regeneration approach is displayed in Table 3. Table 3 proposes a difference between the current situation (state of the art) and the state of progress expected by applying the proposed method in the long term, while Table 3 described the sub-phases (A1–C4), and its sub-phases, to be observed according to existing conflicts arising from the regeneration process, as well as the integration of several physical and human dimensions.

Table 3. State of progress of measures for the Valley of Mills, elaboration of author.

Sub-phases	State of progress (state of art)	State of progress (expected progress after the methodology applied)
A1: identify	80%	90%
A2: investigate	30%	50%
A3: connect	20%	50%
B1: create	10%	50%
B2: develop	10%	40%
B3: test	0%	30%
B4: reiterate	0%	20%
C1: execute	0%	10%
C2: educate	45%	60%
C3: diffuse	60%	70%
C4: consolidate	10%	30%

Table 4. State of progress of sub-phase for the Valley of Mills, elaboration of author.

Sub-phases	Difficulties to overcome	Present conflicts
A1: identify	Preservation of historical heritage and cultural conservation	Incomplete territorial analysis, from the analysis of stakeholders, impacts, short-term hydrogeological risks
A2: investigate		
A3: connect	Local realities, communities	Absence of interest, absence of measures, urban development
B1: create		
B2: develop	Plans and programs for global regeneration	Absence of network
B3: test	Model basis to build	
B4: reiterate		
C1: execute	Decision support	Absence of targeted measures for the valley of the mills, and of co-creation of values with the community
C2: educate	Little cohesion between citizens and institutions	
C3: diffuse	Regeneration model to build	Absent plans and measures for valley-city integration
C4: consolidate	Complete the program with monitoring	

Prioritizing the attempts to revitalize the city means tackling the existing issues. Second, we should describe our plan for resolving these issues. The issues that have been previously discussed include, but are not limited to, conflicts between urban development and historic landmark protection, economic development, and cultural conservation, and considering visual changes while thinking about rehabilitation.

Strategy directions that are quite common to the three dimensions of sustainability have emerged, to ensure long-term urban renewal considering the unique characteristics of each individual case of the various mills.

The urban context under study, according to the spirit of this article, is incomplete without this expanded framework of sustainability characteristics, which include social inclusion, participation, safety, quality of life, feeling of community and social interaction. In this sense, the topic of monitoring physical events for climate change must be included in the diffusion and creation phases of processes between public and private parties.

The final method proposal of the sustainability process of regeneration for the dimensions of the cultural, naturalistic, and social heritage of the Valley of Mills, starting from phases 1–3, become actions, taking into consideration Tables 3 and 4 which leads back to Table 5, to aggregate the main 3 actions (Table 5) under the environmental and human dimensions (according to the concepts of physical and human geography):

Table 5. Analysis of measure under the two main dimensions, elaboration of author.

N.	Actions	Measures Environment dimension	Measures Human dimensions
1	Recognition of significance	1.1) Protection of cultural and natural heritage (waterways, greenery, tracks and paths).	1.2) Creation of knowledge and background of identity neighborhood organizations 1.3) Education programs for institutions and subject-matter experts.
2	Developing a policy	2.1) Analysis of hydrogeological risk and climate risk. 2.3) Protection of historic structures in synergy with the natural environment. 2.4) Exaltation of the natural territory and preservation of sensitive areas.	2.2) Gathering information through regional and online media channels; doing preparatory actions; carrying out the plan; public (and/or neighborhood) participation meetings.
3	Monitoring of the policy	3.1) Assessing the factors that affect heritage revitalization in a way that is socially sustainable.	3.2 Determining what factors affect rebuilding that is culturally sustainable.

The recent history of the Valley of Mills has underestimated the importance of understanding the relevance of a monumental heritage with urban context and territorial fragility. The importance of understanding a heritage site has been underestimated in the recent history of the Valley of Mills, even from a public point of view (authorities of different territorial scales). Starting from the regeneration model, the first phase of analysis is constructed to define the context of the operation and finally the proposition of a policy (understood as a set of sub-actions). The first point of the sustainability process was achieved using the methods described in point 3. For this reason, this is the most crucial step to take when addressing the problem of heritage regeneration. The second stage of the process consists of developing a policy based on the defined model. This research is interested in the process of developing the methodological foundations for effective management implementation. All aspects and problems have been broadly outlined at this point; they are essential for developing policies and creating management plans. Actions 1–3 of Table 5, similar to the steps of the methodology of [46–48], are actually a subsequent step. Starting from the state of the art, which concludes with the methodology, point 2 offers the basis for proposing a policy to support administrations and active citizenship.

The third phase (Figure 10, Tables 1 and 2), which can be found in sub-actions 3 and 4, also establishes the existence of creating a regeneration plan essential for all future management of the estate. To conduct an adequate post-implementation quality check and utilize the results to enhance future projects, it is imperative to have a monitoring of results and evaluation of plans that is adequately planned.

We introduce participation in the sustainability process through the on-site participation experiment.

The actions in the framework are suggested based on the three aspects. The actor engagement tool is the basis of urban regeneration in terms of participatory method components. In the Valley of the Mills, it is clear that no one is actively participating, which is why we want to support step 3 and the on-site intervention organization (step “educate”, actions 1 and sub-actions 1.1, 1.2).

In this civilization, participation is frequently lacking, and by promoting participatory methods, the neighbourhood’s overall revitalization can eventually be more effective. Urban regeneration is strengthened by cultural identity, and can be fully supported and developed to promote the valley and shield it from the dangers of pollution, landslides, and archaeological. It becomes evident that culture is essential to sustained growth. The implementation carried out by the model [49,53,54] for the Valley of Mills with the methodology proposed in Figure 10 highlights the roles of policies and actors in public regeneration. The public actors highlighted are citizens and associations. Public administrations should consider the joint value of the place to unite cultural identity, with new climate change mitigation strategies in urban regeneration [61–64]. Precisely the experiences of [60–66] are examples to be considered to enrich the model of urban regeneration and industrial heritage.

In addition to fostering social cohesion, culture may serve as a source of identity, meaning, and belonging as well as a justification for social exclusion and xenophobia and collective memory [61]. In addition to the obvious physical traits, other intangible aspects of the past that are connected to communal memory include language, customs, and behaviour. In the context of urban regeneration, it has to do with the routines, exchanges, and perceptions that people associated with the district before its transformation.

Heritage, both visible and intangible, is deeply ingrained in all facets of human life and is seen as an essential part of and record of peoples’ everyday lives. Preserving legacy and its memories provides a strong link to a place’s identity. In the restoration phase of a heritage property, a location’s identity can play a significant role in promoting social cohesion. The technique also identifies the aspects influencing social sustainability in the mill community, which is helpful for decision makers.

First, the location parameter is one of the most important things that needs to be looked at before the industrial site regeneration process starts. In a densely populated area, it could develop into a significant area of interest. Depending on its size and physical characteristics, it has the potential to become a new social hub and recognizable landmark in the city if the rehabilitation process is completed successfully. But, abandoned buildings can easily turn into hubs for vandalism, which can have a bad effect on the neighbourhood and even the community. One element that influences how well a community is generally received by its residents is security and safety. It has been stated that the contemporary concept of urban safety is a helpful supplement to crime prevention because it focuses on enhancing an individual’s quality of life.

To encourage citizen participation in the heritage evaluation process, two things are necessary: information dissemination and a vehicle for participation. Moreover, usability is equally crucial to the other suggestions made. Accessibility is a key component of social inclusion and quality of life, since it enables easy access to the services, cities, and employment that each socioeconomic group most desires. Another method to make one feel more a part of the community is to respect its needs, especially those in one’s close area. The maintenance and management of the neighbourhood is another factor that is strongly associated with social pleasure. Improperly maintained parks and streets, badly managed waste disposal, or any combination of these problems can have a detrimental effect on the general well-being of a community.

Given the material value of history, it is crucial that all sides acknowledge the significance of heritage values following a war. Although it is the responsibility of public authorities to inform the public on the importance and worth of heritage assets, this duty is occasionally lacking in post-conflict contexts. The activities and live expressions that have been passed down from our ancestors to our descendants, such as performing arts, oral traditions, social norms, rituals, celebrations, and the capacity to conduct customary arts and crafts, are included in the intangible values of heritage [61].

This approach demonstrated how to accomplish the e-economic aspect of urban redevelopment. It can be challenging at first to assess the financial advantages of redeveloping an abandoned cultural site. Potential private investors, the community, and government agencies are discouraged by its state of neglect, negative connotations, costly maintenance and removal costs, and poor perception and memories linked with a certain location. Many examples show why restoring industrial heritage can be beneficial since older structures have a unique character and place value that is unmatched by newer development. One of the elements utilized to replace the Gragnano mills in accordance with the research criteria to safeguard them is raised public knowledge of the public's financial interest in the area's rehabilitation.

The politics of the last several decades have been more heavily influenced by the town of Gragnano's identity and potential as a leisure and tourism destination than by the region's historical industrial function, which is centred around south Italy. Lastly, a list of accessibility-related points is provided to help make the valley a liveable place. An internal route that crosses the valley to link a portion of Gragnano with the metropolitan centre is the current state of the road connection. It is emphasized that there are no privileged pathways for vulnerable users and people based on the phenomenon of knowledge and documentation collecting in the area. Additionally, when emissions rise, the natural region becomes less liveable. To meet the requirements of a habitable place and allow for the use of the mills for tourism, the regeneration will need to offer access routes for all age groups at various times of the day. The mills must be preserved with a confinement area from motor vehicles to prevent pollution.

Connected with the environment, accessibility shifts the focus to preserving the valley's natural environment. Combined erosion-recovery approaches have been the subject of professional research, with the aim of facilitating the recovery of the entire valley under the protection of UNESCO-protected natural resources and cultural heritage. Furthermore, in an urban environment with variable degrees of urbanization, the suggested model allows the integration of the different processes necessary to regenerate the Valley of Mills.

4. Conclusion

In addition to elevating Gragnano to a scientific level and tackling the issue of making public administrators aware of the dangers of using insufficient protocols for Gragnano regeneration, this works seeks to do more than just add to the body of literature. Not only does the valley hold historical and cultural significance, but its natural pathways can also draw in more tourists and boost the local economy. Moreover, the significance of taking climate change and urban regeneration into account forces us to take urgent measures to protect mills from significant atmospheric events that may expose them to environmental stress.

This article aimed to bring to the field of literature an ongoing case study in which urban regeneration means, in addition to redevelopment measures, building renovation but also inclusive

participation, co-design and proposal of measures for the monitoring of cultural and industrial heritage under extreme events due to climate change. In the literature, debates about planning and climate change are starting to emerge [59–61]. However, while the research amounts in a general way, we tried to answer several research questions for this complex and detailed case study. With a view to clarifying and placing emphasis on the urgent need to redevelop urban areas and existing buildings and, at the same time, explore their intricate relationship with the urban spaces in which they are located, the city of Gragnano is not in continuous expansion, but many spaces are given up for building and construction use, even in the Valley of the Mills area. The need to make the natural area sustainable places emphasis on new perimeters of tolerance for construction and redevelopment. Regarding the accessibility part, it is reiterated that, to observe the principles of sustainability [63], it is essential to think about a dynamic and not just static rental regeneration. By providing strategic resolution guidelines for Gragnano, this integrated methodology aims to be a practice for other cities.

As a proposal for future research, this article proposes to carry out practical analyses on the involvement of stakeholders, attempting to comprehend the function of involvement in urban regeneration operations. In this specific example, what is clearly lacking is city cohesion and the development of participatory mechanisms that might serve as a real foundation. Furthermore, analyzing the ecosystem through the lens of climate issues would help this research to identify the most vulnerable locations. The final aim of future research is to further examine aspects of this work from the perspective of participatory processes.

Use of AI tools declaration

The author declares he has not used Artificial Intelligence (AI) tools in the creation of this article.

Acknowledgments

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Conflict of interest

No conflicts of interest.

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