

# Communities' Perspectives on Brownfield Redevelopment in Athens and Piraeus, Greece: Contributions to Green Blue Cities and Infrastructure

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The prefecture of Piraeus in Greece is dotted with prior industrial sites that are currently abandoned. This paper addresses the ability of these sites to contribute to sustainable infrastructure and urban development through regeneration, by understanding the history of Piraeus, the environmental and social opportunities that may come from revitalization, and the communities' needs within their municipalities. Additionally, the paper analyzes the European Union's prior policies that have outlined the sustainable development of cities, and the role that the regeneration of brownfields in Greece may play in achieving these policy directives. To do this, the paper addresses the historical emergence of urban sustainability efforts and the funding mechanisms in place today that may be applicable to the case of Piraeus. Additionally, this research takes into account citizens' perspectives on desired future land uses at currently abandoned land in the municipality of Piraeus through public surveys. The paper aims to contextualize future opportunities for the local environments and communities in Piraeus that may come from sustainable regeneration of brownfield sites.

**Keywords:** brownfields, Greece, regeneration, sustainability, Piraeus.

In the present era of globalization, traditional patterns of manufacturing activity have given way to new forms of economic activity. Transnational collaborations facilitate cross-border economic transactions, creating a global network. As a result, the overarching contemporary socio-economic context has been shaped by deregulation procedures and privatizations that have also impacted the physiognomy of cities.

From this point of view, the socio-spatial division of labor has changed rapidly over the past decades. The emergence of brownfield sites, scattered around a city's fabric, is associated with the aforementioned decline of the traditional forms of manufacturing activity. In the case of Greece, the opening up of the Greek economy to foreign investors in Piraeus Port has strongly affected the identity of the city

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## Abstract

## Introduction



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through numerous flagship projects being constructed (5-star hotels, new cruise shipping terminal, casino, new museums, galleries etc.) These new flagship projects, which are bound to change land uses and land prices in the area, are strongly connected to brownfield regeneration. Moreover, current urban regeneration projects along the coastline, change the quality of public space in the area of study. In addition, refurbishment of derelict properties changes the image of Piraeus' cityscape. These market-driven revitalization policies, however, follow a top-down process, neglecting the local community's perspective on brownfield regeneration. Taking this into account, this paper presents the findings of a survey focusing on the community's vision for brownfield renewal in the Athens-Piraeus Region, making the appropriate connections with the international experience.

The survey includes the six municipalities comprising the Prefecture of Piraeus and brownfield sites located along Pireos avenue (which connects Athens to Piraeus). The survey records public opinion data on desired future land uses at currently abandoned sites throughout the region. It focuses on three types of sites: large scale prior industrial sites, small scale derelict residential buildings, and mixed sized abandoned buildings along Pireos avenue. The aim of the research is to put in the forefront communities' perspective on urban green-blue infrastructure through brownfield regeneration, using Piraeus as a case study

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## Methods

The research for this work comprises of both literature review and field work. The literature review comprises of three main directions: 1. The role and significance of participatory tools in urban planning and design, 2. The European Union's policies on sustainable cities and brownfields, and 3. Publications relevant to the specificities of the selected case study. Articles were sourced from relevant urban planning and geography journals, European Union level policy documents, and case studies specific to Greece. This combination of resources provided a foundation to comprehend both the general socio-spatial context where brownfield land has been located and the potential tools and best practices that can be utilized when addressing these spaces.

In terms of field work, we have designed quantitative research so as to understand community's perspectives on brownfield redevelopment, focusing on urban green and blue infrastructures. In particular, to collect public opinion data regarding future land uses at current brownfield sites, we conducted a survey from October 2021 – May 2022, that sought responses from local residents, students, business owners, urban planners, economists, and prior short-term residents of all ages from the Greater Attica Area. Survey data was collected electronically and anonymously through a multiple-choice questionnaire on Google Forms, available in both Greek and English. This survey was disseminated via email to residents, academics, and students in Attica, via scannable QR codes posted at local shops, and via poster to passers-by at educational institutions. Given the online nature of this survey and COVID-19 constraining in-person data collection, we recognize a lack of access for certain population groups that may be underrepresented in the survey results.

Questions were broken into four sections as follows:

1. Demographic information: Information on the respondents' age, education level, employment, and place of residence.
2. Public awareness: Questions about the familiarity of local community members with brownfield sites.
3. General opinions on brownfield sites: Questions on the type of regenerated land use that respondents wanted to see at current brownfield sites and what they felt were the most important features of regenerated sites for attracting visitors. Respondents had the ability to select multiple options and type in their own answer.
4. Site-specific questions: Optional section where respondents who were familiar with specific brownfield sites could express which land use would be most beneficial at the particular site they chose to respond about.

The survey data was analyzed at an aggregated level using statistical analysis available through Microsoft Excel. For additional insight we grouped responses according to select demographics to understand response trends among various demographic groups and their desired land use at current brownfield sites.

We chose to conduct this survey as a method of participatory urban planning, so that residents' opinions and needs could be taken into account. This methodology provides a useful supplement to quantitative research and analysis of a city, by providing insights into unobservable or less measurable factors. These factors can include how and when community members gather, what activities they currently leave their locality to do, and what informal uses of land currently exist.

### Participation tools in the urban planning process

Citizens' right to the city has been clearly articulated since the release of Lefebvre's famous homonymous book. Since then, traditional and digital instruments for citizens' participation try to incorporate communities' perspective in decision making. The origins of contemporary approaches on participatory urban planning stem from the UN Habitat document "Building Bridges Through Participatory Planning" (United Nations, 2001). They are also associated with the theory and work of Paulo Freire and Kurt Lewin, while Patrick Geddes and Lewis Mumford are considered to be some of the first participatory planners. According to pertinent literature by Mantysalo (2004), there are various approaches of participatory planning and design that converge on the idea that power should be used legitimately and constructively to bridge the gap between local communities, experts, policy makers, and local authorities. Moreover, the democratization of urban planning and design would be a significant step towards the achievement of just and equal cities. In particular, planning and design could serve as effective democratic tools of social change and therefore must be brought to public domain and popularized.

Efforts to include citizens into the design process have been intensified since 2010 (Ataman et al., 2021). With examples as the 'Build Your Own Pavilion', at the Hong Kong & Shenzhen Bi-city Biennial of Urbanism and Architecture in 2009-2010, and The Commons in Vienna, Austria, the international experience offers valuable knowledge on how to allow and encourage citizens to participate in regeneration projects. Focusing on 'The Commons' in Vienna, a 10-hectare sustainable urban neighborhood involves democratic principles of governance, communication, and participation. Similarly, to our research, the project includes a brownfield site redevelopment that creates a continuous grid of gardens upon which participants place structures from stand-alone houses to multi-family apartment buildings.

Contemporary forms of participatory urban planning and design may include, without being limited to: surveys - qualitative and quantitative research, workshops involving the local community, open access platforms (websites designed for this purpose), phone applications and video games (plan your own neighborhood games). Today, networked participatory design systems, such as the Hybrid Space Lab, foster participatory procedures, making them more appealing and easier to operate. As described in pertinent literature, "gamification" has emerged after 2015 (Ataman et al., 2021), following the trends of the contemporary technological advances. All these entities exist in the realm between architect and client, the traditional shapers of space. These strategies that seek to involve community in the urban planning process turn the residents into the "makers" of the city, offering a bridge between the users of the urban environment and the experts.

From this point of view, the exploration of public opinion in the case of Piraeus might become a useful tool for future analysis in terms of urban regeneration. Local residents and those who frequent the areas of interest provide valuable knowledge on how the land is currently used and what resources are lacking in their communities. For the purposes of this research, authors have used a more traditional approach, a quantitative sample in the area of study so as to comprehend the community's vision on

## Theoretical Framework

brownfield regeneration, while underscoring the need for more inclusive planning procedures in terms of urban sustainability.

### **European Union's policies on sustainable cities**

The 1990s was a period of organized urban sustainability program creation in many cities around the world. Following the publication of the Brundtland Report by the United Nations in 1987, which coined the term "sustainable development", international agreements and environmental goals were brought to the attention of the Rio Declaration on Environment and Development, which led to Agenda 21 (an action plan intended for implementation at various scales) and the Habitat Agenda in 1997 (Cocklin, 2020). The European Sustainable Cities and Towns Campaign was formed in 1994 after the first European Conference on Sustainable Cities in Aalborg, Denmark. The Campaign aims to assist local governments across Europe in implementing important sustainability best practices, with almost 2,000 local governments participating. As a result, communities focused on investigation and implementation of environmental plans, policies, and initiatives concentrating on urban sustainability and greenery between the 1990s and the end of the 2010s (ibid). These agreements, along with their approval by several municipalities, mark the beginning of urban sustainability planning.

Meanwhile, the European Commission introduced the Climate and Energy Package in 2008 (Council of the European Union, 2008). Following this, the Covenant of Mayors was first signed in 2009 as a commitment by signatory cities to go above and beyond the European Union (EU) energy policy objectives of reducing carbon dioxide emissions (CO<sub>2</sub>) by improving energy efficiency and using cleaner production methods, in addition to bettering urban public space, improving air quality, and protecting water resources. Based on the approaches utilized for rapid development since the 2016 Habitat III Conference, which underlined the need to develop urban green areas and participate in social prosperity to develop sustainable cities, this green agenda is projected to be strengthened in the future (United Nations, 2017). Habitat III emphasized that a city that lacks social development, economic opportunities, environmental management, and strong urban administration will not be able to achieve long-term sustainability (United Nations, 2017). It has concentrated on land use for the past 25 years, maintaining natural landscapes and habitats, creating green protection zones to manage water recourses, establishing urban green spaces for residents' health, heat outbreak control, and better air quality.

As the scientific literature has long demonstrated, human engagement with green infrastructure has many health benefits. It has been proven that there are significant environmental and socio-economic benefits from the rehabilitation of green spaces and the reintegration of the environment into the city, as well as from the equal use of urban green spaces for social activities and the reinforcement of local investments. The 2030 Agenda for Sustainable Development, including Sustainable Development Goal 11 (making cities inclusive, safe, resilient, and sustainable), the Paris Agreement (2015), and the European Commission's Green Deal the New Urban Agenda, all emphasize the need for sustainable transformation. Additionally, the New Leipzig Charter establishes a policy framework for envisioning and implementing these European and global accords at the local level. All of the aforementioned frameworks explicitly specify a greener Europe that secures common livelihoods and guides the social transition to a healthier environment that delivers better ecological living standards, climate-neutral cities, and resilient cities. Additionally, these policies support the development of natural solutions, such as green and blue infrastructure, networks connecting ecosystems and protected areas in spatial planning, and land management, as well as the development of new crisis management tools to increase site resilience in climate-affected areas. Furthermore, such policies aim to raise awareness and empower local and regional communities to maintain, repair, use, and reuse the built environment in order to make cities greener and healthier for modern living.

Brownfields' rehabilitation in Europe offers great prospects for private investment as well as a reduction in land expropriation and urban sprawl, making cities safer, healthier, and more economically appealing (European Commission, 2013). European urban development is key to a sustainable development process and can benefit the environment by recovering brownfields and reducing pollutants in the air, water, and soil (European Commission 2016a). The issue of social, political and spatial cohesion has acquired a nodal role in the European Union's policies since the late 1980s. Starting with the Single European Act (SEA) of 1987, economic and social cohesion has been introduced as an instrument to counterbalance the ramifications of the uneven spatial development. Many EU towns have effectively utilized abandoned areas in recent decades; for instance, the regeneration of industrial and military brownfields proceeded with funding from the European Regional Development Fund/Cohesion Fund (European Court of Auditors, 2012). Brownfield rehabilitation was also a 2014–2020 EU priority that is included in various policies, including the 2030 Sustainable Development Goals and Agenda for Sustainable Development (European Commission 2016a). EU policies consider the direct and indirect effects of land use, such as the use of undeveloped land and natural areas for urban sprawl and energy production.

### **European Union's policies on brownfields and relevant funding opportunities**

Brownfields are strongly associated with dereliction and/or contamination, including a variety of spaces with land and with or without buildings. Based on the paper "The scale and nature of European brownfields", (Oliver et al., 2005) countries across Europe accept different definitions on brownfields and follow different policies. However, there are general guidelines that promote social and spatial cohesion across Europe, where brownfields could play a key-role after successful regeneration.

To be more specific, since 2007, the Leipzig Charter has set the framework for sustainable urban development, incorporating social, economic, and environmental parameters which also affect brownfield regeneration. It has been recently updated in 2020 to follow transformations of socio-economic and environmental factors. To address contemporary challenges that threaten socio-spatial cohesion across Europe, the New Leipzig Charter attempts to tackle crucial environmental issues related to climate change, loss of biodiversity, and resource scarcity (EU, New Leipzig Charter, 2020). Moreover, the Charter takes into account the role of the rapidly transforming economies of the world and their synergies with the European Union's financial activities. To find an effective way to handle future crises, the New Leipzig Charter highlights the important role of cities and their ability to remain resilient under any circumstances. To achieve this goal, a place-based, multi-level, participatory approach is recommended as a useful tool to manage positive change in complex urban environments, to assure an acceptable level of living conditions in all European Cities. In light of the New Leipzig Charter, the EU's Cohesion Policy together with relevant urban-focused research programs have moved to center focus, absorbing significant amounts of the EU's grants. The focus has been on coordination of different administrative levels and different scales of intervention, with emphasis on the role of regeneration at the neighborhood level, the crucial function of local authorities, and the importance of strategic functional areas in each case (EU, New Leipzig Charter, 2020). According to EU's Territorial Agenda 2030, it is of high priority to coordinate different policies and instruments so as to strengthen a variety of public infrastructures, facilities and amenities. These include housing, commercial areas, mobility, services, green and blue infrastructure, material flows, local and regional food systems, and the energy supply (ibid). From this point of view, guidelines for brownfield management and funding instruments can be found in many different EU programs, following the general context of the Cohesion Policy and the Territorial Agenda of 2030.

Focusing on funding opportunities for sustainable urban brownfield redevelopment in Greece, support could be found by either National Initiative Programs, which are developed based on national regional plans, or Community Initiative Programs. This is a critical source of funding for

studies in spatial and urban planning. The Community Initiative runs several programs that operate in addition to the Community Support Frameworks and are created following EU rules. They are primarily concerned with programs and actions that promote sustainable urban and regional development. The first period (1989-1993) included the 1st Community Support Framework, covering the first phase of pilot model urban plans with the aim of improving living conditions in urban areas. The second period, spanning from 1994 to 1999, included a second phase combined with Urban Program I, while the third period (2000-2006) included the Program Urban II.

In light of brownfield regeneration, EU polices have a clear target to ameliorate urban living conditions, proposing specific guidelines such as "Cohesion Policy and Cities" from 2007 to 2013. These pilot model urban plans covered different scales inside the city and various sectors (e.g. urban infrastructures, green areas, housing and commercial areas etc.) Local authorities were in charge of selecting the most crucial enclave in the city to register for participation in the Urban program. At this point it is important to mention that according to literature (Andrikopoulou et al., 2014), Greece has been greatly influenced by the EU's Cohesion Policy.

Examples of pilot model urban plans in Greece include case studies in Athens and Thessaloniki, the two main metropolitan areas of the country. As a general overview of the type of the pilot model plans, the first plan implemented in Athens concerned a derelict large public area at the north west part of the urban agglomeration of Athens, named Pyrgos Vassilisis (Queen Amalia's Tower). The intervention included the creation of a park-like open-air museum of indigenous flora with water elements and pedestrian routes, in addition to a center for environmental awareness to host exhibitions and educational activities. An analog plan of the Pyrgos Vassilisis project in Thessaloniki focused on the regeneration of the historic center of the city, boosting the local economy by preserving historical architectural features (ibid). From these two examples, we can see that these pilot model plans combined with the Urban I and II Program were flexible and able to comply with specificities of time and place in each case study.

The "Urban" Program (I and II) is one of the most notable funding tools for upgrading crisis-affected urban areas, as it promotes creative measures and the revitalization of urban regions (Tousi and Serraos, 2020). It strives to improve the support and assistance of vulnerable population groups through strategic planning. It also has as a necessity for the cooperation of all stakeholders to select the actions that will be funded, which could involve: improving the quality of life of residents of deprived areas through the restoration of buildings and landscaping, providing sustainable mobility options, increasing renewable energy sources, or increasing employment opportunities by including locals in training programs.

The "LIFE" Program is also a vital funding tool for promoting community environmental policy and related legislation. It aims to include the "environment" parameter into other policies aimed at achieving long-term development. The activity areas are divided into three categories: Nature, Environment, and Developing countries, with emphasis on environmental improvement being shared by all three. The LIFE-Environment sector covers activities that improve the incorporation of the environmental dimension into spatial and urban planning. (Tousi and Serraos, 2020). The Community Framework for Cooperation in Promoting Sustainable Urban Development is a European Commission legislative tool that strengthens city networks in the legal and technical fields to promote sustainable urban development. It aims to execute community environmental policy at the local level, to support sustainable urban development, and to implement Local Agenda 21. Beneficiaries could include city networks as well as other countries that have signed association agreements (ibid).

Horizon 2020 is an EU funding framework for research and innovation that ran from 2014 to 2020, focused on addressing difficult societal challenges (Morar, 2014). The Program progressed along 3 main axes: 1. Excellent Science – world-class scientific research aimed at attracting the best sci-

entists to the EU, 2. Industrial Leadership – such as private sector participation and the creation of innovative companies, and 3. Addressing societal challenges such as population aging, depletion of energy resources, climate change, etc. (European Commission, 2021). Moreover, the Jessica Program (Joint European Support for Sustainable Investment in City Areas) supports collaborative European assistance for long-term investment in urban areas, which have a high concentration of brownfields. It receives financial assistance from the European Commission, the European Bank, and the Council of Europe Development Bank. The JESSICA program is not a new source of finance, but a novel way to use Structural Fund grants to promote urban development projects.

Taking these programs into account, this research focuses on three types of brownfields that are common within the Piraeus region: large scale prior industrial sites, small scale derelict residential buildings, and mixed sized abandoned buildings along Pireos avenue. These spaces fall into the above-mentioned categories being eligible for registering for EU's financial support. As a result, the above review of EU policies provides useful information for further consideration in terms of funding and sets the general framework on brownfield regeneration.

### **Brownfield land in the Athens-Piraeus Region**

Since the 1990s, brownfield management has started to attract scientific interest with the vision to improve the situation in degraded post-industrial areas. According to literature (Tousi and Serrao 2020b) various different policies are recorded in the Global North and the Global South to manage brownfield land. Some countries, such as the U.S.A, the United Kingdom, Germany, The Netherlands and Belgium, offer several efficient policies and strategies that could function as a model for other countries in the field of brownfield rehabilitation and regeneration (Oliver et.al, 2005). On the other hand, considering the current case of Greece, there are certain challenges in place owed largely to the lack of consistent policies and legal framework that hinder further development (Tousi and Serrao, 2020a).

The absence of a centralized policy leads to a case-by-case approach, depriving the opportunity for holistic, sustainable management. Given the spatial concentration of brownfield sites in certain enclaves within the Athens-Piraeus Region (Sayas, 2004), it is important to provide a consistent framework to identify synergies among brownfield sites as well as current activity at the sites and surrounding land uses. Specifically, since the nomination of Athens as the capital of the New Greek State in 1832 after the Liberation from the Ottoman Regime (Revolution of 1821), a sequence of historical and political incidents has affected the spatial distribution of industrial land uses in the area. To delve into the case of the Athens-Piraeus region, it is significant to outline the general context of the development and decline of industrial activity in the region. According to historical sources, during the late 19th century and the first decade of the 20th century, Piraeus was becoming a prominent cluster for manufacturing activity. Factories had been constructed around Piraeus Port and along the avenue that connects Piraeus to Athens (Pireos Avenue).

The Asia Minor Catastrophe of 1922 altered the existing balances as Greek refugees from Asia Minor were quickly settled in the municipality, inevitably influencing the configuration of urban space. The urban refugee settlements were located outside the perimeter of the central area of Athens and Piraeus near industrial units (Sarigiannis, 2000). In cases where there was no industrial activity in the district (e.g. at the northern part of Athens at New Philadelphia and New Ionia), new manufacturing units succeeded the refugee settlements (ibid). Thus, the spatial division of labor followed certain patterns owed largely to the vast refugee population flow of the interwar period.

After World War II manufacturing activity in the area experienced a significant decline, and by the 1960s the government offered financial incentives to foreign investors to boost national manufacturing activity (Law No/2687/53). According to literature, large manufacturing companies increased their numbers from 394 industrial units in 1957 to 1,453 industrial units in 1973 (Sarigiannis, 2000). Most of these companies had been located inside the Attica Region but were gradually sprawling along the National Road that connects Athens to Patras and along the road that connects Athens to Thiva (ibid).

During the period from 1978-1984, industrial activity in the Attiki Prefecture (the wider urban area of Athens-Piraeus) experienced a crisis followed by signs of recovery through 1988 (Sayas, 2004). During this period, manufacturing activity was spatially concentrated in the “traditional” industrial areas, around Piraeus and Pireos avenue, near the industrial clusters created during the interwar period. In some cases, “new industrial spaces” have been documented in proximity to the “old traditional areas” (ibid). Minor manufacturing activity outside of these main industrial agglomerations was strongly connected to the spatial development of second home residential areas. It is important to mention that from 1973-1978, the peripheral area around the urban conurbation of Athens-Piraeus experienced an increase in the number of large industrial units, such as oil refineries and shipyards.

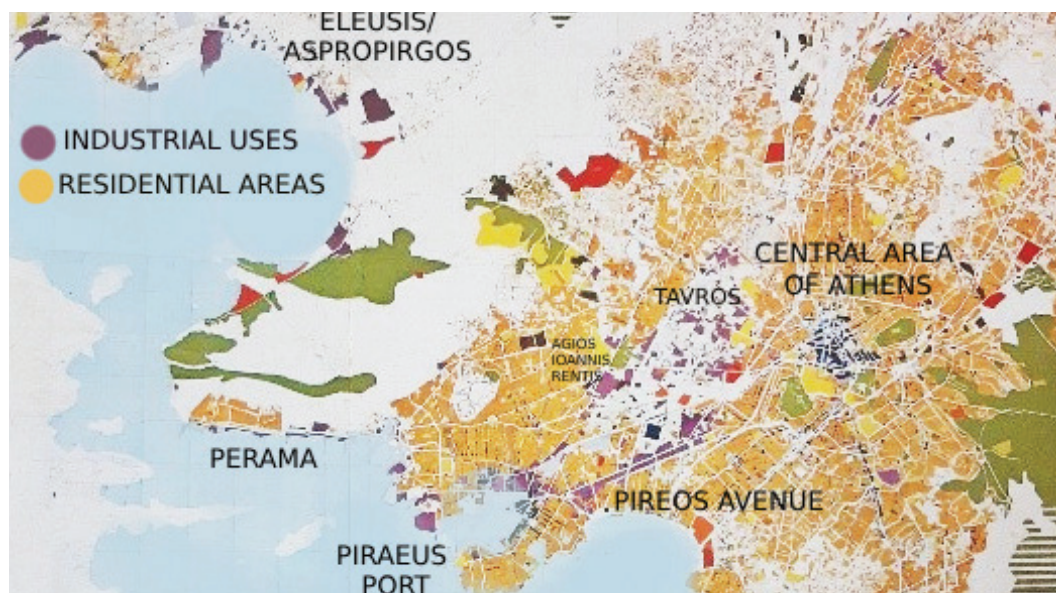
According to literature, these peripheral industrial clusters employed a very high percentage of the corresponding national sectoral workforce, placing the area in the core of industrial activity (ibid). After the 1990s, a significant decline in manufacturing activity was documented, especially for the industries located within the conurbation of Athens-Piraeus, consequently leading to the emergence of brownfield sites. On the other hand, industries located outside the urban agglomeration of Athens-Piraeus were still active.

Today, the spatial distribution of brownfield sites covers the area around Piraeus Port and Pireos Avenue. The map below (Fig.1) depicts the land use distribution in Attica since the 1960s, where the concentration of industrial units may be found around Piraeus Port, along Pireos Avenue, in Tavros and Agios Ioannis Rentis and outside the urban agglomeration of Athens-Piraeus as in the case of Eleusis and Aspropirgos. Especially in the case of Piraeus and Pireos Avenue, industrial activity faced a major decline since the 1980s-1990s and today the area is covered with scattered brownfield sites of different scales.

Recent urban planning legislation has placed the area in the forefront, due to the overall transformation of the city as a new international hub for business and tourism. A series of flagship projects is expected to rapidly change the once industrial area by altering the existing land uses. These projects include regeneration of the Papastratos Tobacco factory, which has been redesigned into a cultural and artistic hub, Drapetzone’s Chemicals and Fertilizers Factory, which now hosts an oceanfront boardwalk with an outdoor café and amphitheater, and the XROPEI industrial plant, which is slated to be an innovation and R&D hub.

**Fig. 1**

Industrial units are largely centered in Piraeus on the coast of Attica. The shades of the purple on the map depict industrial activity, the map is designed with the help of archival material from the Ministry of Public works, published in 1960 and it includes authors editing

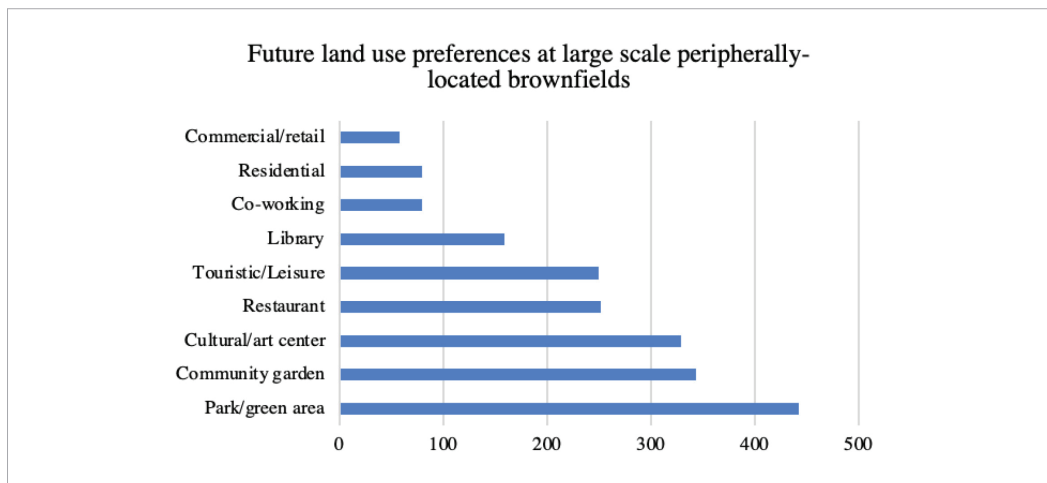




Taking into account the aforementioned context, the designed survey seeks to highlight the community's outlook towards brownfield regeneration in the greater Piraeus Region, with the view to promote sustainable development through supporting the city's green and blue infrastructure. Particularly, in seeking public opinion on future uses of brownfield land in Piraeus, our survey collected unique responses from 586 participants. We frame the responses within the three categories of abandoned land through which we posed the question of desired future land use: 1. Large scale, peripheral industrial sites, 2. Small scale buildings in central Piraeus, and 3. Mixed size, mixed use buildings along Pireos Avenue. We note that respondents had the ability to select multiple options for regeneration preferences from the list of choices we provided.

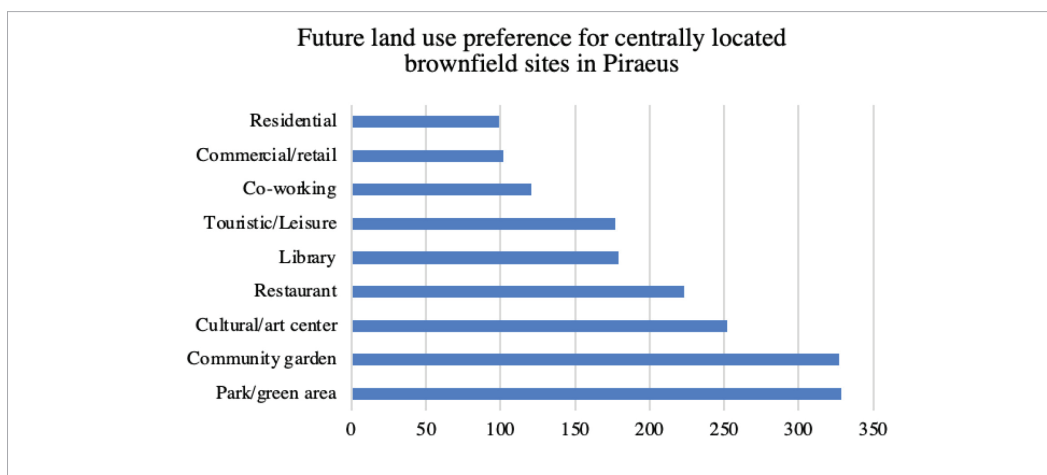
For large scale prior industrial sites in the peripheral areas of Piraeus, respondents were largely in favor of outdoor green space, with 76% (443) of participants selecting the option for a park or green area (Fig. 2). Respondents similarly favored options for a park/green area or community garden for smaller abandoned sites in the center of Piraeus, with 56% of participants selecting each of these options (Fig. 3). For abandoned industrial sites and factories that are located along Pireos avenue, the clear choice was for a cultural center, museum, or art exhibition space, with 60% of respondents choosing this option (Fig. 4). Furthermore, for this category of site, no other option received votes from more than 45% of respondents, demonstrating that respondents did indeed have different preferences for regenerated sites by location, as opposed to selecting additional green space for all areas covered by the survey.

## Results



**Fig. 2**

Residents prefer to see green spaces in the form of parks, natural trails, and green spaces at large scale brownfield sites in the outskirts of Piraeus, authors work

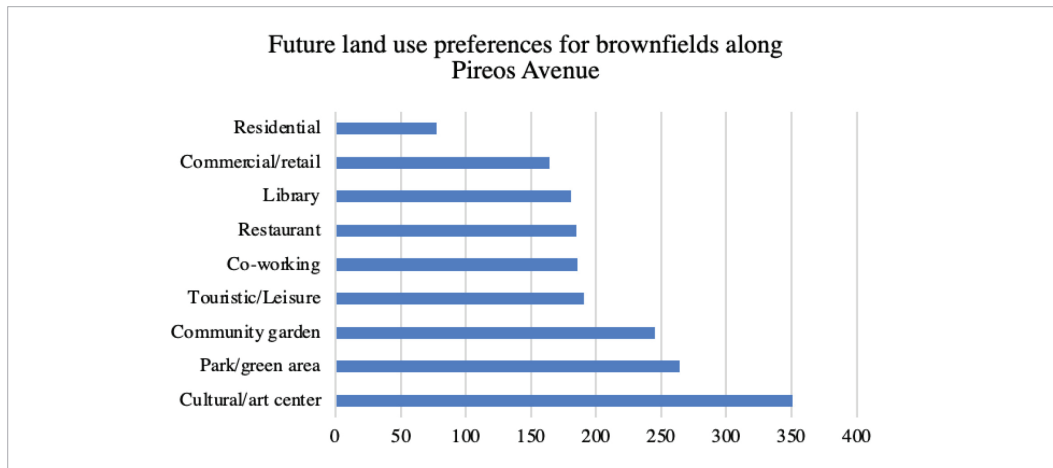


**Fig. 3**

Participants seek additional green spaces at smaller abandoned units within central Piraeus, authors work

Fig. 4

Respondents have a preference for currently abandoned industrial sites and factories along Pireos Avenue to be transformed into cultural centers or museums, authors work



## Discussion

When asked generally which features of a regenerated brownfield site would be most significant in attracting supra-local visitors to the site, the majority of respondents (over 60%) converged around four main characteristics: offering greenspace, having cultural or artistic uses, being well connected with public transport, and having proximity to the sea. Notably, there is significant interest by the public to utilize the currently abandoned land, with 97% of participants responding that they personally would visit a regenerated brownfield site with a cultural center or developed green space in Piraeus.

Examining the preferences for future land uses in central and peripheral Piraeus, it is evident that the dense urban core of the area impacts the daily lives of residents, explaining the partiality for additional green spaces in the area. Green space per square meter per citizen is 0.96 in Athens, according to the OECD (2014), versus the WHO recommendation of 9.0. Furthermore, it is significant that respondents had diversified opinions about land uses along Pireos avenue versus central and peripheral Piraeus. Currently, the area already is home to several museums and cultural spaces, such as the Benaki Museum Pireos, Hellenic Cosmos Cultural Center, Technopolis, AND Old Depot OSY/Amastasio.

Despite scarcity of open green spaces along Pireos avenue, people still prefer to see land uses that support the spatial pattern already emerging in the area over the last decade, which focuses on artistic uses and turning former industrial units into cultural hubs. Many of these hard landscaped areas are open-air and offer space for social exchange, and we believe that combining these cultural uses with green space could have the added benefit of reducing temperatures in the city. This is of particular importance as Athens faces the urban heat island effect, with as much as a 10°C temperature difference between the city center and rural outskirts (Santamouris, 2001). The size and spatial arrangement of buildings impacts the temperature of urban surfaces by absorbing, storing, and emitting radiant energy (Erell et al., 2011).

Therefore, as the design of cities contributes to the urban microclimate, it is possible to use targeted and informed design to optimize urban heat – which is impacted by building density, facing, materials, human activity, and vegetation, among other factors (ibid). Vegetation has the ability to make a significant impact on surface temperatures when compared to paved surfaces, as it shades the surface, blocks incoming long-wave radiation from the sun, and provides moisture (ibid). As a result, incorporating green space into brownfield sites can provide green outlets for residents and help lower surface temperatures.

With the continuing global transition to greener technologies, Greece faces the risk of future brownfield sites emerging, as currently active industrial sites may become obsolete. WWF Greece has found that 3% of Greece's total productive capital is at risk of stranding, meaning it is exposed

to transition risks. This includes 49% of mining infrastructure, 8% of manufacturing infrastructure, and 17% of electricity and gas infrastructure (WWF Greece, 2020). Therefore, it is important to find sustainable ways to regenerate these sites before they cause environmental harm to local communities or take Greece off-track from meeting environmental targets, such as incorporating legislation on cleanup requirements for current companies to prevent future dereliction.

In addition to citizen's desires for more green space, consultancies have found that in order for Greece to achieve its 2030 target of 55% emissions reductions from 1990 levels and carbon neutrality by 2050, it will require €500bn of investment (Bellos, 2021). Therefore, emissions should be among the top considerations when redeveloping brownfield sites, in order to ensure the regenerated projects are both sustainable from a GHG point of view and from a longevity standpoint. Additionally, considering the scope of brownfield sites in the country, Greece can benefit from a consolidated policy framework to address the regeneration of brownfield sites on a national scale (Chernila and Tousi, 2022). This may include reducing the number of one-off, privately funded projects and creating a unified policy for clean-up procedures and for determining new land uses at currently abandoned sites.

Given the convergence of citizens' desires for more public green space and the EU policy directives towards improving resiliency in cities, increasing greenspace, and decreasing social stratification, the regeneration of brownfield sites presents an opportunity to fulfill these goals. Through our research we find that key to these strategies is the role of participatory urban planning, to prevent neglect of social parameters throughout the regeneration process.

The regeneration of brownfield sites presents environmental, economic, and communal opportunities at multiple stages. Not only can it provide employment in the remediation and construction of revitalized sites, but it can also contribute to the enhancement of beneficial features of the city's green spaces by improving the microclimate, filtering the atmosphere, and preserving the soil and subsurface water supply.

Given the fact that the area of study belongs to the Athenian Riviera strategic territory, further development of brownfield sites is bound to be of interest in the future growth of the area. While these conversions may raise prices of surrounding land, they also have the ability to increase the quality of life for local communities through urban redevelopment and environmental improvement. As a result, it is essential to incorporate local residents into the decision-making process, in order to keep a balance between market driven strategies and the local community's needs.

Citizens' apparent preferences for a greener approach to any future attempt at upgrading brownfields confirms what we already know about the vulnerabilities of modern cities and is also reflected in European level environmental regulations. Bridging environmental, social and economic components requires extensive research in many areas, including socio-economic, socio-cultural, geographical, and environmental dimensions, as well as the identification of possible typologies.

Looking ahead to potential future brownfield sites, a path for redevelopment provides opportunities for the owners of this land to give it a second use. This is of particular importance as additional manufacturing units or energy-related industrial sites may become obsolete in the future. Given the European Union's focus on sustainable cities, brownfield regeneration is becoming a high priority among member states.

The funding opportunities of the EU programs can facilitate brownfield regeneration in the area of study. To reach Europe's sustainability goals for resilient cities it is vital to reinforce urban green and blue infrastructures in the area of Athens and Piraeus. For the fulfilment of this purpose, mobilization at different administrative levels is necessary together with community input. From this point of view, the findings of this research might become a useful tool for recognizing citizens' perspectives on brownfield regeneration and could be used as the basis for further consideration and research.

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## Conclusion

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