Hardcore Brownfield Sites: the Case of the Chemicals and Fertilizers Factory (Lipasmata) in Drapetsona, Piraeus, Greece

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Abstract

The paper presents the main findings of research focusing on hardcore brownfield sites in the post-industrial area of Drapetsona along Piraeus Port in Greece. The research took place from March 2022 to May 2022. The selected case study includes a derelict site of 640.000 m^2 including both buildings and vacant land. Given the opening up of the economy of Piraeus to foreign investors, authors explore the potential of the site in the era of globalization with the view to put in the forefront community's outlook. Research includes literature review and field work. It is important to mention that this research provides original material for an issue that is not fully covered in existing literature; the contemporary situation of the former Chemicals and Fertilizers Factory in Drapetsona, focusing on key-obstacles and positive attributes. Field work includes quantitative and qualitative methods as well as direct observations. Authors used SPSS statistical software to process the selected data. Authors have also organized a workshop together with members of the local community (1st Technical High School EPAL Drapetsonas) to understand residents' perspective on hardcore brownfield redevelopment. Findings from the workshop are presented in combination with quantitative data and results from direct observations. The paper concludes with recommendations for future application.

Keywords: hardcore brownfields, Piraeus, Greece.

Introduction

In the early 20th century Piraeus used to be a hub of industrial activity. However, after the Second World War, especially after the 1980s, industrial activity experienced a major decline (Sayas, 2004). The Chemicals and Fertilizers Factory was constructed in 1910 and until 1946 had a dominant position in the manufacturing activity of Piraeus. During the Second World War, the factory was severely damaged but its activities recovered during the 1950s. According to literature, the period of 1990-2000 was characterized by intense de-industrialization, high rates of unemployment and outflow of permanent citizens. In 1999, the Chemicals and Fertilizers factory fell into disuse (Tsiridis, 2011). Since then, the area has suffered from dereliction and abandonment, being the largest brownfield site in the Piraeus Prefecture. The site has been abandoned since then, while

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most of its infrastructure was demolished in 2003 (ibid). Only few parts of the factory have been declared as Listed monuments as presented in the pictures below (see Fig.1 and 2).

Fig. 1, 2
Listed Architectural Monuments in the area of study, authors' field work 2022

In 2016 an architectural competition took place focusing on the regeneration of the former Chemicals and Fertilizers factory. In 2018 the Municipality of Keratsini-Drapetsona inaugurated an 85-acres recreational area for public use including two municipal catering services, two amphitheatres, one playground, pedestrian and cycling routes along the seashore as depicted in the pictures below (Fig.3,3a).

Fig. 3, 3a
The recent urban intervention (municipal catering services, pedestrian routes and amphitheatres) authors' field work 2022

According to relevant literature, brownfields comprise a variety of properties with possible or evident contamination (US Small Business and Liability Relief and Brownfield Revitalization Act (Public Law 107-118, H.R. 2869, p. 6), Adams et.al., 2007). They may include, but are not limited to, *"decommissioned refineries, railway yards, dilapidated warehouses, abandoned gas stations, former dry cleaners, and other commercial properties where toxic substances may have been stored or used."(ibid).* In particular, hardcore brownfields are sites that suffer from long-term dereliction, with a threshold of 9 years (Otsuka et.al, 2013).

The selected brownfield is located in a former Asia Minor refugee area, with a dense urban core, lack of open public spaces (0,76m^2 of green space per citizen), various former social housing complexes, and small to medium scale brownfields. Until the late 1950s, the area experienced unbearable living conditions, poor public infrastructures and poor housing conditions. The majority of the urban refugee settlements had been located near the existing industrial units, as in the case of

Drapetsona (Sarigiannis, 2000). From 1950 to 1990, various programs of public housing took place in the area to provide affordable housing for the refugee descendants (Elefteriadou, Koutelis, 2018).

The area is also a part of Piraeus Port, close both to the main passengers' station and the terminal container station. Since 2010, the presence of the Chinese firm COSCO in port activities has affected the identity of the area. In particular, Piraeus Port Authority, established in 1930 as a pubic organization, sold 25% of its shares to private investors in 2003, after being listed in the stock exchange as a PLC (Public Limited Company), (Chlomoudis, 2015). In 2005, the Greek government allowed the presence of foreign companies within the port, permitting them to provide port services in terminal container stations (ibid). In 2009, the law N3755/09 validated the interstate contract between Piraeus Port Authority and Piraeus Container Terminal S.A., leasing Pier II and III for 35+5 years (Tsimonis et.al, 2020).

Through these changes, a former regional port became a nodal point for Europe (6th port) and a part of China's new Silk Road. Piraeus acts as the first maritime entry point into Europe along China's One belt One Road initiative. Maritime vessels starting in China make their way through South Asia, East Africa, and the Red Sea before reaching Europe via Piraeus. Given the city's strategic location as a connection point between Asia and Africa and the rest of Europe, it has seen significant international investment following COSCO's investment, with several companies creating distribution centres near the port. As a result, new flagship projects are gradually emerging in Piraeus, following international morphological patterns. In addition, emphasis has been given to the cultural experience that the city offers, using culture as a mechanism to attract tourists and visitors (Sifaki et.al, 2014). However, looking at historical examples of regeneration in Asian cities, it is evident that there are risks from employing internationally informed regeneration strategies that are not designed for a specific city's unique case (Roy and Ong 2011). The new master plan of Piraeus includes various flagship projects, 5-star hotels, cruise shipping terminals, new museums and redevelopment plans for selected enclaves.

In this context, there is an ongoing discussion for the area of the Chemicals and Fertilizers Factory in Drapetsona due to its large size and the proximity to Piraeus Port. From this point of view, this paper explores the future potential of the area in respect to its rich history and cultural background, so as to provide research data for further consideration. Given the scope of brownfields in Piraeus, this research might have a greater impact since it offers a methodological approach that could find analogies with other brownfield sites in the area. In particular, brownfields in Piraeus currently face challenges with a lack of a centralized policy approach (brownfield-relevant legislation is scattered among different laws), the possible presence of archaeological remains, long term dereliction, structures at certain brownfields being listed as national monuments, and complicated ownership of sites (Tousi and Serraos, 2020). The area may benefit from a unified methodological and legislative approach to regenerating brownfield sites, in addition to government capacity to purchase and regenerate smaller, privately owned brownfield sites and the consideration of local communities' opinions in regeneration projects. As a result, the case of Lipasmata may present useful best practices as a starting off point for further brownfield regeneration in Greece.

Theoretical Framework

The issue of hardcore brownfield sites. The international experience and the case of Greece

Globalization procedures after the 1960s (Aldersen, 1997) have affected the traditional manufacturing activity in the old industrial centers of the Global North. Since the 1970s and the 1980s, the emergence of brownfield sites has altered the cohesion of the urban tissue. Definitions and policies on brownfields vary widely among different countries (ibid). In particular, there are definitions that focus on contamination while others put emphasis on dereliction (Tousi and Serraos, 2020). According to the CABERNET(2010)[1] classification, an expert European network on brownfield re-

1 Connected Action on Brownfield and Economic Regeneration Network

development, the term refers to sites that have been affected by former uses, may have fallen into disuse or are currently being underused, are located in dense urban cores and require specific interventions for future redevelopment (Hula et.al, 2016). There also might be a perceived or real threat for human health because of contamination. It is also important to note that in some cases, sites have been characterized as brownfields because of the obsolete structures, without the presence of hazardous substances (ibid referring to the U.S.A).

An extreme example of abandoned, derelict land is described in literature as "hardcore" brownfield. Relatively recent literature on "hardcore" brownfield sites reveals negative connotations referring to this type of land that suffers from long-term dereliction (Otsuka et al., 2013). Based on the English Partnership study (2003) 16,523 have been identified as hardcore brownfields in England, representing one quarter of the total number of brownfields. The threshold to characterize a brownfield as "hardcore" is to be abandoned for nine years or more, according to the same study (ibid). This threshold has been established during the Roger Tym and English Partnership research where the sites found derelict in 2002 had been found in the same condition during the Derelict Land Survey in April 1993 (ibid). Given this fact, the redevelopment of such sites gradually became one of the critical issues in the UK because of the accumulation of such sites through the lapse of time. According to English Parnterships (2003) some key-obstacles for hardcore brownfield redevelopment are associated with the ground conditions, remediations costs, a weak real estate market, fragmented ownership and inefficient infrastructure (Thornton and Nathanail, 2005). Based on these obstacles, hardcore brownfield sites require strong support from the public sector to experience an urban regeneration. Generally speaking, brownfield redevelopment in the U.K. became a part of the sustainability agenda, including through market driven flagship projects. From this point of view, hardcore brownfield sites are referred to as marginally located and unattractive to the market.

In parallel with the case of the U.K., the example of Japan also offers information about hardcore brownfield sites. These types of sites are described with reference to the commercial viability of a potential development, where soil contamination countermeasures costs about 30% of the current land price (Otsuka et al., 2013). Similar to the example of the U.K., policies focused on property-led regeneration, mostly on large scale sites, as a mechanism to revive the economy in the aftermath of the economic recession. Thus, small scale marginal sites were not of high priority (ibid). In both the U.K. and Japan, the main criterion was to select projects bound to drive economic growth to combat the side effects of recession. In literature, Germany also offers important pieces of information about hardcore brownfield sites. These sites are characterized by an extended dereliction phase with negative impact on the urban fabric (Hula et al., 2016). For Germany, the emergence of hardcore brownfields was recorded during the 1990s after the reunification of the country. The spatial pattern of the hardcore brownfield sites shows an accumulation of such sites in the eastern part of the country (ibid). Some key-aspects of the issue have been associated with the low market values, the level of contamination as well as with the declining population and the overall economic structural transformation. As mentioned in pertinent literature (Hula et al., 2016) one solution for such sites could be either the implementation of soft end uses, permanently or for transitional use or a kind of "reverse site conversion". According to Dixon et al.(2011) there are some crucial factors that facilitate the successful regeneration of the hardcore brownfield sites. These factors comprise the presence of strong markets and solid partnerships, strong branding, integrated development and emphasis on infrastructures (ibid). Needless to say, that such type of regeneration requires a long-term vision for the future of the area and the potential that the area holds, despite the evident disadvantages.

As for the case of Greece, there are numerous hardcore brownfield sites that experience long-term dereliction for more than nine years. One representative example is the selected case study, a former industrial area that has fallen into disuse since the 1990s. The reasons for this situation

are associated with the fragmented legal framework and the lack of a centralized policy on brownfield rehabilitation and redevelopment. There is a case-by-case approach without a coherent policy framework for this type of sites (Tousi and Serraos, 2020). Moreover, the lack of funding and the complex ownership statues adds complexity to an already intricate situation. From this point of view, this paper showcases the opportunities and limitations of one of the largest hardcore brownfields in the Attica Region.

Methods

The aim of this research is to explore the potential of Lipasmata in the era of globalization, by identifying key-obstacles, positive attributes and potential new land uses. The authors also intended to put the community's outlook at the forefront of this work. Considering the accumulation of brownfields spaces through the lapse of time, the issue of hardcore such spaces in Greece becomes more and more timely. Another crucial factor is brownfields' long-term dereliction. By presenting the contemporary situation in one of the most representative cases through the post-industrial area of Drapetsona, authors are attempting to highlight the crucial issues that hinder future development.

The main research questions could be summarized below:

- Which are the key-obstacles that hinder the development of the former Chemicals and Fertilizers Factory (Lipasmata) in Drapetsona?
- Which are the positive attributes of the area that could be used as a basis for future development?
- Exploration of the potential of supralocal significance

To answer these questions, both literature review and field work have been employed. The research was conducted from March 2022 to May 2022. As for literature review, authors have studied the international experience on hardcore brownfield sites focusing on the documented key-barriers that hinder further development. In addition, authors have studied the BRM- Brownfield Revitalization Methodology, the CABERNET/CLARINET classification methodology and publications relevant to the categorization of brownfields according to their former use (Petrikova et al., 2012). Moreover, authors delved into the case of Greece, taking into account publications relevant to brownfield management and regeneration. In addition, emphasis was given on the historical and socio-cultural background of the area of study. The authors have also studied former surveys (Gonimo Edafos, 2020), relevant to the area of study. Given that literature review alone could not fully answer all of the above-mentioned research questions, the authors have also employed qualitative and quantitative research methods and have conducted direct observations after making multiple visits to the area of study. Taking into account the results of previous surveys and emphasizing the general globalized context in the area of Piraeus, authors designed their survey to focus on the following: the impact of new flagship projects on the Lipasmata brownfield, key-obstacles for further improvement, positive attributes of Lipasmata, and favorable new land uses able to ascribe a supralocal significance to the area. From this point of view, the authors' work offers different information compared to the "Gonimo Edafos" survey.

One of the determinant factors that play a key-role for the area of study, is the fact that part of the brownfield site has been regenerated while most of its area is derelict. The regenerated area includes a coastal zone nearly 50 meters in width, along the seashore. This regeneration project has offered pedestrian routes, cycling lanes, 2 open air amphitheaters, a playground and two cafeterias that attract numerous visitors especially during weekends. However, there is significant of room for further improvement, given the large scale of the site (640,000 m^2). In light of this situation, authors attempted to explore the existing visiting patterns of the selected brownfield site. According to pertinent literature, there are three main factors that define how far people are traveling to access an open green space (Schindler et al., 2022):

1. Households' characteristics (demographic, cultural etc.)
2. Open green space's attributes (size, vegetation and equipment)
3. Local accessibility of urban green spaces.

Taking into consideration these factors, the authors included corresponding questions in the survey. As for the second factor, focusing on the size of the site, the area of study may belong to the "metropolitan parks" as it covers an area of 640.000 square meters (Mpelavilas and Vatavali, 2009). Such a metropolitan park covers a radius of 3.2 Km referring however to the case of London (ibid). The case in the Athens-Piraeus Region may differ because of the scarcity of green spaces and the multicore urban development. From this point of view, people may travel longer distances to reach an open green space. This hypothesis was taken also into account while designing the questionnaire. At this point it is important to highlight the poor analogy of open green spaces per citizen in Attica, so as to understand the importance of the future of the selected brownfield site. According to the World Health Organization, an acceptable amount of green space is defined as 9 square meters per citizen, while in Athens there is only 0,96 m^2 per citizen (Mpelavilas and Vatavali, 2009). This scarcity of open green spaces evokes long distance traveling in order to visit a green public space.

Taking into consideration all the above mentioned, the target population for the quantitative research was organized in two categories; people living in the regional administrative area of Piraeus where the brownfield site is located and people working or studying in the regional administrative area of Piraeus and the adjacent municipalities (but residing in other areas). This selection was made under the assumption that the participants needed to have some knowledge about the site either as residents or as visitors. The questionary was forwarded online via mailing lists to 7 public high schools, 3 nursery schools, 4 elementary schools and 1 language school, to the 6 municipalities of the Regional Administrative Area of Piraeus, to the University of West Attica and the University of Piraeus (students and faculty), to local athletic associations, to 6 centers for Elderly People, to the commercial chamber of Piraeus, Nikea and Keratsini, and to local cultural associations. Given the fact that the aim of the survey is to explore the future potential of the site, people working in the near by area could offer insights on the opportunities and challenges that could be used as the basis for future research. For calculating the size of the sample, the administrative area of Attica has been clustered in two main categories:

a People residing in the Regional Administrative area of Piraeus where the brownfield site is located (448.997 residents according to the Census data of 2011, Hellenic Statistical Authority)
b People working in the wider Piraeus Region and the neighboring Municipalities, but residing in other municipalities outside the Regional Administrative District of Piraeus (3027063 residents according to the Census data of 2011, Hellenic Statistical Authority)

According to literature, the sample should include 384 observations for category A and 384 observations for category B (Shaunders et al., 2009), a total of 768 observations to offer statistical significance. Authors used random sampling, a typical probability method. 783 participants took part in the survey, from which 394 resided in the Regional Administrative Area of Piraeus and 389 in the rest of Attica Region. The results of the quantitative research have been analyzed with the help of SPSS statistical software (descriptive statistics and graphs).

The thematic units of the questionary included:

a Questions about the general situation in Piraeus (opening up of the local economy to foreign investors, new flagship projects, new master plan) so as to detect public awareness
b Questions about the impact of these transformations on the area of Drapetsona
c Questions about the key-barriers that hinder further development of the selected hardcore brownfield site in Drapetsona

d Questions about visiting patterns regarding the specific site and other parks far from the respondent's neighborhood (means of transport, frequency, reasons for not visiting the place)

e Questions about favorable new land uses for the buildings and the open space

f Demographics/ Socio-economic attributes of the participant

With the view to acquire a well-rounded perspective on the contemporary situation of the area, authors employed qualitative research methods as well. The target population included teenagers and young adults, as well as adults working in proximity to the area of study. The method used was focus groups conducted in the 1st Technical High School of Drapetsona (1st EPAL) where the authors had the opportunity to discuss in depth with members of the local community. Authors followed the sequence of the thematic units of the questionary and offered the opportunity for unstructured discussion. The results of the quantitative and qualitative method and the direct observations have been organized into a SWOT analysis. The paper concludes with recommendation for future development and research.

Results and Discussion

Data analysis - quantitative research

The survey that was conducted for the purposes of this research collected 783 responses, including 394 citizens of Piraeus and 389 respondents residing in the rest of Attica Region who work or study in the Greater Piraeus Region and its neighboring Municipalities. The sample's demographics are presented in the tables below.

The first section of the questionary focused on public awareness regarding the forthcoming regeneration projects in the Greater Piraeus Region. According to the survey's results, 62,7% of the participants were aware of the ongoing regeneration and only 37,3% of the respondents were not. The majority of the respondents recognized the renovation of the Piraeus Tower as the most well-known project (402 respondents). Following the renovation of the Piraeus Tower, urban renewal in Microlimano-Bay was the second most popular project (345 respondents).

The majority of the respondents agreed that these projects will have a positive impact on the Piraeus Region (74,7%) while only the 23,6% of the participants were sceptical about the impact of

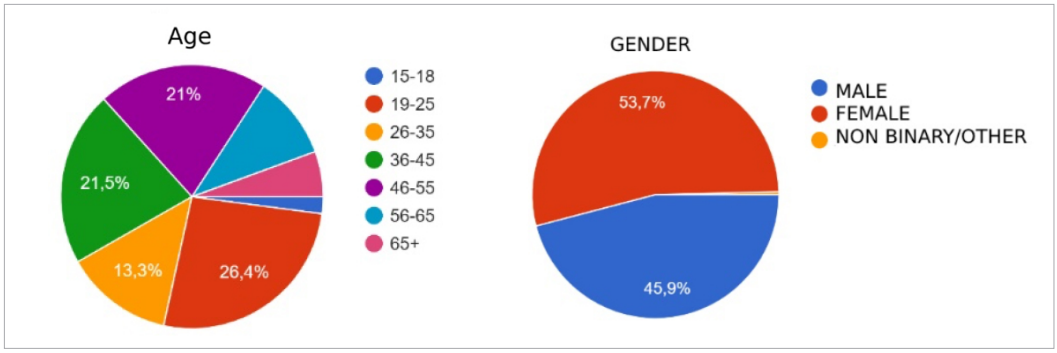


Fig. 4, 5
Age and Gender of the survey participants, authors work

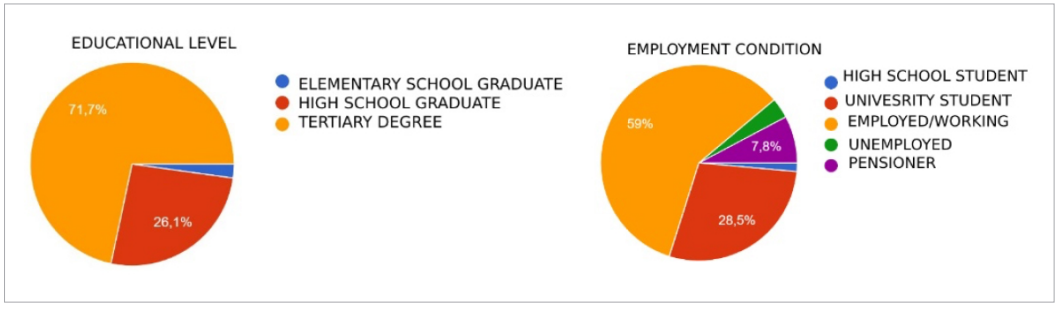


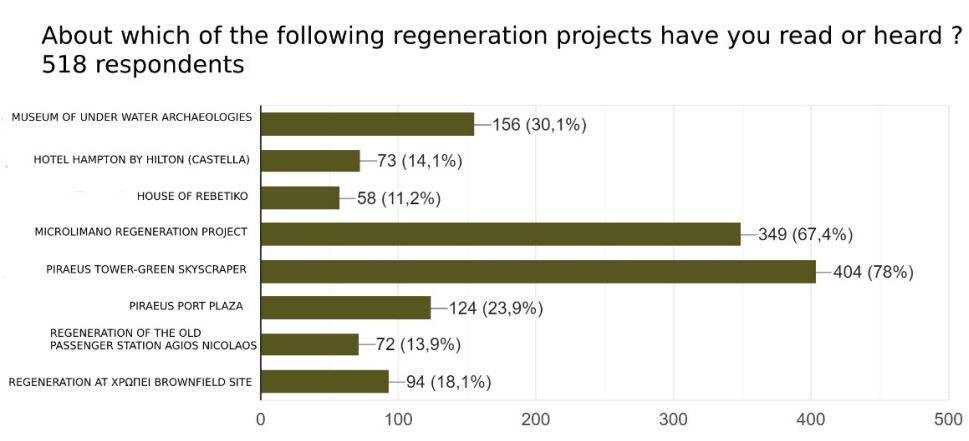
Fig. 6, 7
Educational Level and Employment condition of the survey respondents, authors' work

Fig. 8
Participants' place of permanent residence, authors' work SPSS analysis

Where is your permanent residence ?

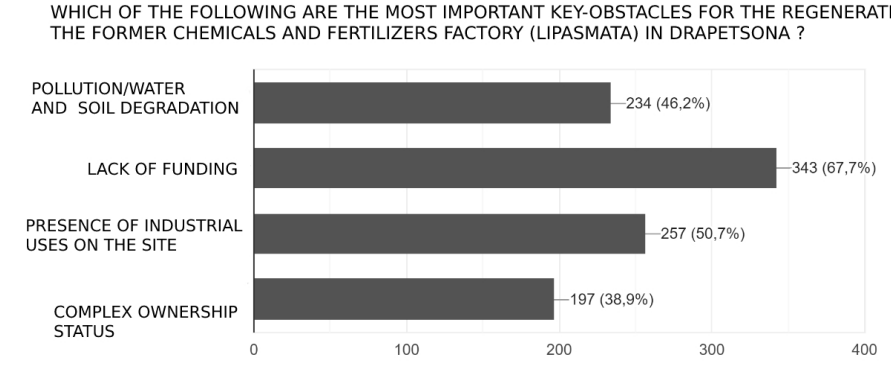
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Nothern Sector of Athens	56	7,1	7,2	7,
	Southern Sector of Athens	66	8,4	8,5	15,
	West Attica	104	13,2	13,4	29,
	East Attica	41	5,2	5,3	34,
	Piraeus Prefecture (without the municipality of Keratsini-Drapetsona)	256	32,5	32,9	67,
	Municipality of Keratsini-Drapetsona	136	17,3	17,5	84,
	Central Sector of Athens	119	15,1	15,3	100,
	Total	778	98,7	100,0	
Missing	System	10	1,3		
Total		788	100,0		

Fig. 9
Public awareness on Piraeus area regeneration projects, authors' work



the aforementioned regeneration projects. A very small percentage of 1,7%, believed that these projects will not have a positive impact on the city. Nonetheless, the majority of respondents recognized evident elements of degradation in the area of study (Fig.10). In this context, the respondents identified certain key-obstacles for the further development of the selected brownfield site, as presented in the chart below.

Fig. 10
Participants opinion on issues of degradation and key-obstacles that hinder further development in the area of study (Lipasmata Drapetsona), authors' work



At this point it is important to mention that from the 783 people that took part in the survey the 74,9% were familiar with the site and 60,8% of the respondents had actually visited the site. For the participants who had not visited the site, the main reason was the physical distance from their residence (55%) and at a lower percentage, the lack of certain land uses that could make the site appealing. From these percentages we assume that the majority of the respondents have good knowledge of the area of study, demonstrating the importance of considering their opinions. As for the visiting patterns regarding the area of study, 77,5% of the participants use their car, 14,6% approach the area on foot and the remainder use means of public transport. From these results, we may assume that the area reveals a car-dependent visiting pattern especially for people living outside the Greater Piraeus Region. This fact is evaluated in the recommendations section of the study, so as to propose solutions that promote sustainable mobility in the city.

Focusing on the ongoing urban transformation of Piraeus, 45,7% of the respondents believe that the urban regeneration in Piraeus will not have a significant impact on the selected brownfield site. 4% of the participants believe that in the near future, no regeneration program will be implemented in the area of study and that the area will remain idle for even more years. However, the area of study has certain positive attributes that hold potential for supralocal development, as depicted in the charts below.

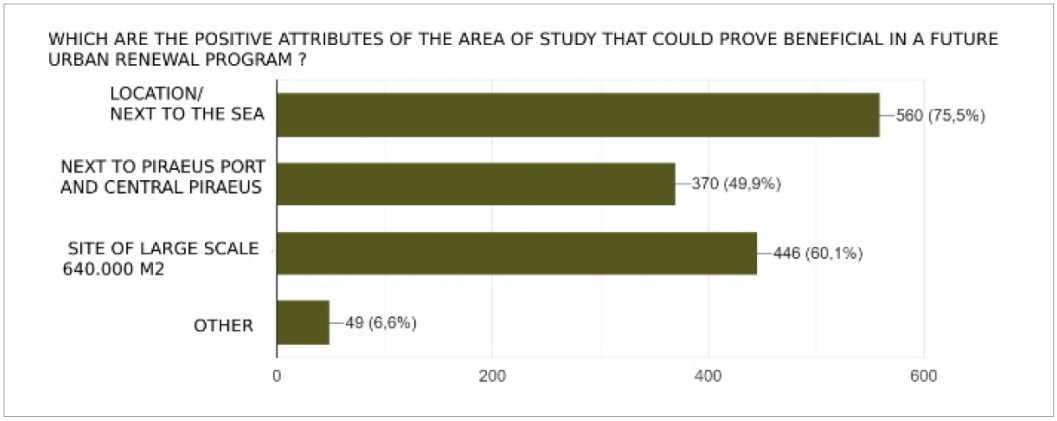


Fig. 11
Positive attributes of the site bound to ascribe supralocal significance and potential for supralocal significance according to respondents, authors' work

As for the preferable land uses that could attract visitors from other areas, most of the respondents chose cultural land uses (69,7%) and catering services combined with open green spaces (65,2%). At a lower but not insignificant percentage of 56,9%, participants chose open green spaces without any services. Having space for athletic uses, parks, or water sports were seen as less significant in attracting visitors.

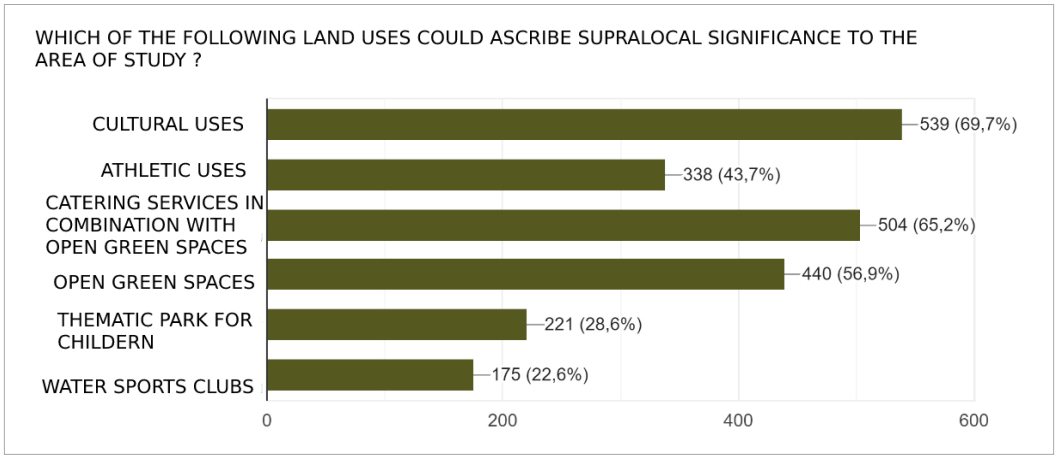


Fig. 12
Respondents' prefered land uses for the area of study, authors' work

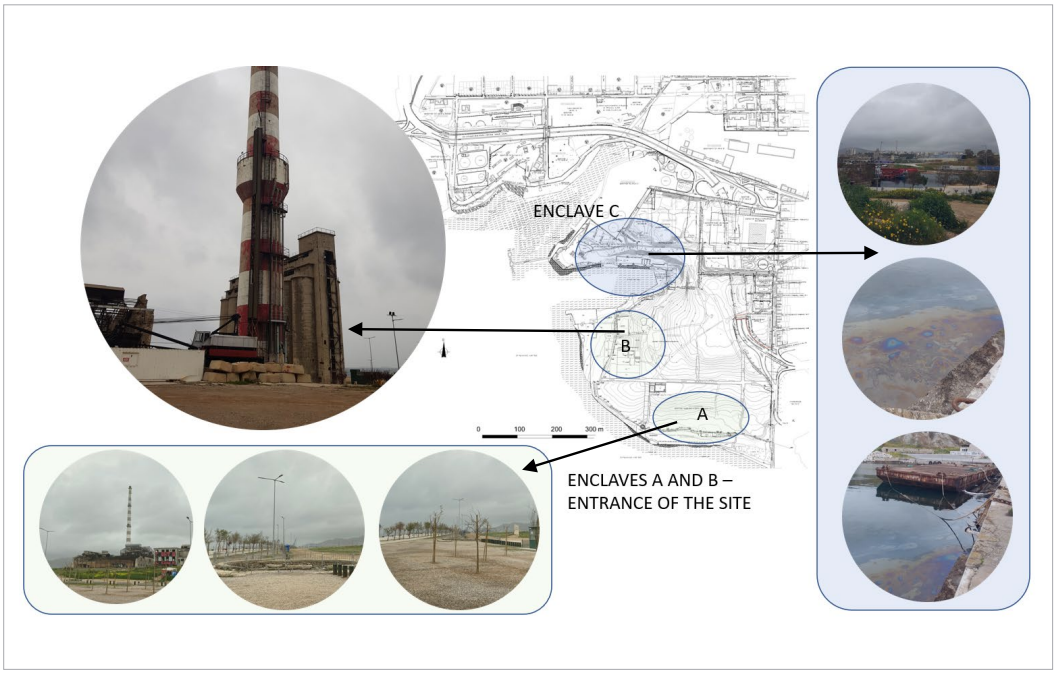
Field work findings: direct observations and focus groups

According to authors' direct observations, the selected brownfield site has potential for further development, given its location next to the sea and its large scale. It could offer an escapade from the dense city core. It is located near central Piraeus and relatively close to Athens' city centre (25 minutes by car). The regeneration project of 2018 that provides pedestrian and cycling routes along the seashore, may be expanded to the rest of the site following principles of sustainable urban design, focusing on thermal comfort throughout the year, restoration of the urban ecosystem, restoration of urban biodiversity.

After visiting the site, authors have identified three crucial enclaves; enclave A and B near the entrance of the site and enclave C, as presented in Fig. 13. As far as enclaves A and B are concerned, the existing Listed Architectural Monuments suffer from long term dereliction and poor preservation condition. In enclave C, there is evident water pollution and existence of light ship repairing uses. Given the partial regeneration of the site (only along the seashore, a zone of 50 meters width) there are evident discrepancies as far as the quality of the urban environment is concerned and the urban infrastructures. Taking into consideration the lack of green public spaces in central Piraeus, this site might function as a nodal point for recreation and outdoor activities. However, as authors observed during their visits, there are graffiti's claiming that the remaining industrial activities are the major cause of environmental degradation. This notion was expressed during the focus groups procedure as well, where participants stressed the need for the relocation of the remaining industrial activities. The participants in the qualitative research, were high school students and faculty members of the 1st Technical High School of Drapetsona that is located next to the brownfield site. They feel that the area is degraded and that there is an urgent need for urban renewal. The main cause of degradation, according to their opinion, is associated with various forms of pollution (water, soil, air, noise). They also proposed new uses that may attract teenagers and young adults (beach volleyball courts, Go Kart facilities etc.). They also highlighted the necessity for educational uses as reading rooms, libraries and co-working spaces.

Fig. 13

Identification of crucial enclaves, authors' field work 2022, background map source: Technical services of the Municipality of Keratsini- Drapetsona



Lipasmata Brownfield categorization and Recommendations

According to the BRM brownfield classification method, the CLARINET/CABERNET classification and the categorization of brownfield sites based on their former use, authors have attempted to describe the selected case study. Based on the BRM categorization, the selected case study does not fall into one certain category, rather, it could be described as a combination of categories A and D: derelict buildings and land and buildings for which the need for renewal has been recognized but not being allocated to a local plan. As for the CLARINET/CABERNET classification, the Lipasmata brownfield site might fall into category B; a site less preferable for private investors. As for the former use, the site is a typical post-industrial plot with land, buildings and infrastructures that has been idle since the late 1990s. Thus, it is considered a hardcore brownfield site.

Delving into literature and studying international case studies, the authors have drawn the conclusion that there are specificities of time and place that cannot be overlooked in the case of Greece. From this point of view, the standard categorization and brownfield evaluation methodologies (especially the CLARINET/CABERNET) might not fully describe the selected case study. There are cases of hardcore brownfield sites, as the example of Lipasmata, that despite their attractive location and the low level of contamination, remain idle for decades. For various reasons they do not attract private investors. Further investigation focusing on the economic structure and the real estate market of Greece should be undertaken in association with the existing hardcore brownfield sites, so as to interpret the forces that shape their contemporary condition. Given this situation, further research should be conducted to propose a solid methodology for the case of Greece and countries that might have similar urban growth patterns. In addition, there are funding opportunities for brownfield sites from the European Union and relevant research programs (e.g. the BRODISE) that could benefit the future development of the area of the former Chemicals and Fertilizers Factory (Tousi and Serraos, 2020).

Focusing on the strengths and weaknesses of the area of study, the majority of the survey respondents (75%) stated that the positive elements of the site (location next to the sea and Piraeus Port, large scale) are stronger than the key-obstacles (pollution, lack of funding, complex ownership status) presented in the previous chapter. However, issues relevant to water and soil pollution raise concerns for any type of future development. According to the participants there is room for further improvement as far as the landscape design of the area is concerned. Moreover, the presence of light industrial uses might lead to further environmental degradation. Given the emergence of new flagship projects in the area of Piraeus, participants seemed skeptical about the type of regeneration in the area of study, expressing concerns regarding severe gentrification. Based on the aforementioned opportunities and challenges, authors made recommendations organizing the suggested urban interventions into short-term, medium-term and long-term timelines as presented in the Table below. For each intervention, the authors followed the pillars of sustainability; society/culture, environment and economy for organizing the suggested intervention.

Conclusions

Based on research findings, the selected brownfield site holds potential for further development focusing on providing uses that could benefit the local community. Its large scale and its proximity to the sea might function as drivers for future regeneration despite significant disadvantages as the lack of funding, the complex ownership status, the possibility of water and soil contamination and the presence of light industrial uses. Lipasmata also presents a relevant example for future regeneration projects as it relates to public engagement throughout regeneration. Although the site is not fully completed and the abandoned building units still remain, the area is already open to pedestrians and is frequented by visitors. This case demonstrates that despite the length of regeneration projects, there is potential opportunity for public benefit early in the regeneration process through outdoor features.

According to the survey conducted for the purposes of this research, the site might acquire supralocal significance and attract visitors from other municipalities within the Attica Region. Following a suitable timeline for urban intervention, the site could eliminate its negative elements and strengthen the positive ones, offering uses for members of the local community and its visitors, as cultural and educational facilities, selected healthcare services for children and outdoor activities combined with large scale well landscaped green spaces. Moreover, research and funding opportunities from the European Union might support actions towards urban renewal of the wider area. Forms of participatory planning and design might function as a shield against severe gentrification evoked by market driven proposals in the context of the globalization procedures that affect the Greater Piraeus Region. As David Harvey has claimed in his "Rebel Cities" urban renewal should not be undertaken with environmental hazardous ways and social injustice procedures (Harvey, 2013). From this point of view, future regeneration in the selected brownfield site should take into consideration environmental principles and socio-economic parameters so as to support social cohesion in the area, avoiding any kind of socio-spatial inequalities.

Table 1
Recommendations for urban intervention, authors' work

Pillars of sustainability	Short term proposals	Medium-term proposals	Long term proposals
Environment	Improvement of the existing urban furniture along the seashore. Addition of high to medium-height trees and shrubs along the pedestrian routes in order to protect walking alleys from the cold winter winds. Shading installations for providing thermal comfort during the summer period.	Clean up of the area (soil and water) / Monitoring / regular controls. Phytoremediation. Additional green spaces.	Explore the potential of urban agriculture in selected enclaves of the site. Relocation of the remaining industrial facilities. Improve the connection to the means of public transport e.g., tram line.
Society/culture	Music festivals / open air art exhibitions / seminars – educational activities for adults and children. Workshops relevant to the regeneration of the site so as to encourage community's engagement and involvement.	Preservation and renovation of the existing buildings (included in the Listed Monuments Catalogue). Implementation of new uses according to the community's needs (educational facilities).	Addition of public healthcare services for children. Interconnection between site's educational facilities and near by Universities (University of Piraeus and the University of West Attica) Actions to improve social cohesion and equal opportunities in the area of study.
Economy	Further development and support of the existing municipal catering services.	Implementation of new athletic (municipal) facilities e.g., swimming pool, volley ball court etc.	Application of forms of circular economy (e.g., cultivation and supply of the products of the urban agriculture).

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References

Aldersen, A. (1997). Globalization and Deindustrialization: Direct Investment and the Decline of Manufacturing Employment in 17 OECD Nations. Journal of World-Systems Research. 3. 1. 10.5195/jwsr.1997.119., available at https://www.researchgate.net/publication/282391073_Globalization_and_Deindustrialization_Direct_Investment_and_the_Decline_of_Manufacturing_Employment_in_17_OECD_Nations.https://doi.org/10.5195/jwsr.1997.119

Chlomoudis C. (2015) The development of the Piraeus Port Authority and COSCO, Athens Social Atlas, available at https://www.athenssocialatlas.gr/en/article/piraeus-and-cosco/

Dixon T., Otsuka N., Abec H. (2011) Critical factors in urban brownfield regeneration: AN analysis of hardcore sites in Manchester and Osaka during the economic recession (2009-2010), Environment and Planning A, volume 43, issue 4, p.961-980. https://doi.org/10.1068/a43468

Elefteriadou E. Koutelis Ch. (2018) Refugee Housing in Drapetsona avialbel at https://drive.google.com/file/d/1JYpp7eaZCkY-N2H9qPDdeqBiIvNsZ_8X/view (in Greek)

English Partnerships, 2003. Towards a National Brownfield Strategy. English Partnerships, London.

Harvey D. (2013) Rebel Cities, Verso Publications

Hula R., Reese L.A., (2016) Reclaiming Brownfields: A Comparative Analysis of Adaptive Reuse of Contaminated Properties, Routledge, ISBN 9781138267060. https://doi.org/10.4324/9781315603902

Kaloudis S., Kamperidis G., Polytseris Z., Galanopoulou S., Lorentzos N. (2017) Πάρκα αναψυχής στον αστικό ιστό του Λεκανοπεδίου Αττικής (Urban parks in the Attica Region) 2nd conference of Geographical Infromations Systems and Spatial Analysis in Agriculture and Environment, Athens 25-26 May 2017 ISBN: 978-960-6806-21-6, available at http://gis2017.aua.gr/sites/default/files/attachedfiles/Kaloudis_et_al.pdf

Mpelavilas N., Vatavali F. (2009) Πράσινο και ελεύθεροι χώροι στην πόλη (Green Open spaces in Cities) WWF Ellas, ISBN: 978-960-85918-8-2, available at https://www.contentarchive.wwf.gr/images/pdfs/Odigos_AstikoPrasino.pdf

Otsuka N, Dixon T., Abec H. (2013) Stock measurement and regeneration policy approaches to ‚hardcore' BROWNFIELD SITES: ENGLAND AND JAPAN COMPARED, Land Use Policy 33 (2013) 36- 41, Elsevier. https://doi.org/10.1016/j.landusepol.2012.12.002

Petríková, & Vojovdíková, & Finka, Maros & Jamečný, & Samson, & Toptchiyski, & Rusu, Olivia & Zúbková, & Grigorovschi, & Ladzianska, Zuzana & Toptchiyska, Denitza & Pletnická, & Ciolacu, & Jaššo, Matej & Bláha, & Maturová, & Lukš, & Kralchevska, & Majstríková, Tereza & Bergatt,. (2012). BROWNTRANS: Brownfields - Handbook, available at https://www.researchgate.net/publication/242336824_BROWNTRANS_Brownfields_-_Handbook

Roy A., Ong A., (2011) Worlding Cities: Asian Experiments and the Art of being Global, Blackwell Publishing Limited, https://doi.org/10.1002/9781444346800

Sifaki, E., Stamou, A. (2014). Αστική αναζωογόνηση και κοινωνική συνοχή. Σχεδιάζοντας την κοινωνική και πολιτισμική ταυτότητα του Πειραιά., available at https://www.researchgate.net/publication/344459795_Astike_anazoogonese_kai_koinonike_synoche_Schediazontas_ten_koinonike_kai_politismike_tautoteta_tou_Peiraia

Sayas, J. (2004). An exploration of the social and spatial division of labour in the athenian urban space. Επιθεώρηση Κοινωνικών Ερευνών, 113, 167-206. https://www.researchgate.net/publication/299422013_AN_EXPLORATION_OF_THE_SOCIAL_AND_SPATIAL_DIVISION_OF_LABOUR_IN_THE_ATHENIAN_URBAN_SPACE. https://doi.org/10.12681/grsr.9357

Sarigiannis G. (2000) Athens 1830-2000, Symmetria Publications (in Greek)

Saunders M., Lewis P., Thornhill A., (2009) Research Methods for Business Students, 5th Edition, Pearson Education Publications

Schindler, Mirjam & Le Texier, Marion & Caruso, Geoffrey. (2022). How far do people travel to use urban green space? A comparison of three European cities. Applied Geography. 141. 102673. 10.1016/j.apgeog.2022.102673., available at https://www.researchgate.net/publication/359199854_How_far_do_people_travel_to_use_urban_green_space_A_comparison_of_three_European_cities. https://doi.org/10.1016/j.apgeog.2022.102673

Thornton, G., Nathanail, P., 2005. Are incentives for regenerating UK brownfield sites sustainable? Land Contamination & Reclamation 13 (4), 327-338. https://doi.org/10.2462/09670513.693

Tsimonis, K., Rogelja, I. , Ciută, I., Frantzeskaki, An., Nikolovska, E., Pesha, B. (2020). A Synergy of Failures: Environmental Protection and Chinese Capital in Southeast Europe. Journal of Current Chinese Affairs. 48. 186810262091986. 10.1177/1868102620919861., available at https://www.researchgate.net/publication/341516425_A_Synergy_of_Failures_Environmental_Protection_and_Chinese_Capital_in_Southeast_Europe.https://doi.org/10.1177/1868102620919861

Tousi E., Serraos K. (2020) Brownfield Management in Greece. The case of Piraeus, Journal of Sustainable Architecture and Civil Engineering, Kaunas University of Technology. https://doi.org/10.5755/j01.sace.27.2.25175

Tousi E. Serraos K. (2020) Brownfields: Environmental and Socio-economic Dimentions, Sakoulas University Press

Tsiridis G. (2011) Our Regeneration (Η δική μας Ανάπλαση), Balkan Express Publications

Other sources: Archival material from the technical services of the Municipality of Keratsini-Drapetsona

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