ADAM . Architettura, Disegno, Arte e Modellazione

Architecture, Design, Art, and Modeling

Industrial Archaeology

European approach to recovery productive memory

Mara Capone, Noelia Galván Desvaux

Luis Agustín-Hernández, Lucas Fernández-Trapa

01 . Industrial Archaeology. European approach to recovery productive memory
a cura di | edited by Mara Capone, Noelia Galván Desvaux, Luis Agustin-Hernandez, Lucas Fernández-Trapa

Napoli: FedOAPress, 2024
(ADAM . Architettura, Disegno, Arte e Modellazione | Architecture, Design, Art, and Modeling; 01)
672 pp.; 21x21 cm
Accesso alla versione elettronica | Access to the electronic version
http://www.fedoabooks.unina.it
ISBN: 978-88-6887-234-2
DOI: 10.6093/978-88-6887-234-2

ADAM . Architettura, Disegno, Arte e Modellazione | Architecture, Design, Art, and Modeling
Collana editoriale | Book Series
fedOAPress - Federico II University Press
Tutti i libri sono sottoposti a peer review secondo la modalità del doppio cieco | All books are peer-reviewed in a double-blind mode.

Immagine in copertina | Cover Image
Mario Ferrara

Università degli Studi di Napoli Federico II
Centro di Ateneo per le Biblioteche "Roberto Pettorino"
Piazza Bellini 59-60
80138 Napoli, Italy
http://www.fedoapress.unina.it
Pubblicato in Italia. Prima edizione: giugno 2024 | Published in Italy. First digital edition: june 2024

Federico II University Press

FedOA Press

Mara Capone, Noelia Galván Desvaux
Luis Agustin-Hernandez, Lucas Fernández-Trapa

Industrial Archaeology
European approach to recovery productive memory

ADAM . Architettura, Disegno, Arte e Modellazione | **Architecture, Design, Art, and Modeling**

Federico II University Press

fedOA Press

BLENDED INTENSIVE PROGRAMME
Industrial Archaeology. European approach to recovery productive memory

University of Naples Federico II
Coordinator
Mara Capone

Anna Attademo
Gilda Berruti
Massimiliano Campi
Alessandro Castagnaro
Valeria Cera
Maria Cerreta
Antonella di Luggo
Bruna Di Palma
Orfina Fatigato
Mario Ferrara
Gianluigi Freda
Pasquale Miano
Daniela Palomba
Adele Picone
Marina Rigillo
Fulvio Rino
Sergio Russo Ermolli
Marella Santangelo
Simona Scandurra

Tutors
Anna Teresa Alfieri
Giovanni Angrisani
Gianluca Barile
Francesco Casalbordino
Angela Cicala
Victoria Cotella
Marika Falcone
Mario Galterisi
Giuliano Galluccio
Federica Itri
Cristiana Loffredo
Arianna Lo Pilato
Laura Simona Pappalardo
Sabrina Sacco
Maria Simioli
Sveva Ventre
Pietro Zizzania

Hochschule Koblenz, University of applied science
Local Coordinator
Lucas Fernández-Trapa

Daniel Degner
Stephan Jost
Ulof Rückert

University of Valladolid
Local Coordinator
Noelia Galván Desvaux

Raquel Álvares Arce
Sara Pena Fernandes
David Marcos Gonzáles
Victor Lafuente Sánchez

University of Zaragoza
Local Coordinator
Luis Austin-Hernandez

José Angel Gil-Bordás
Marta Quintilla-Castan

Table of contents

Table of contents

Table of contents

Preface

Michelangelo Russo
Head of DiARC Department of Architecture

The landscape of our cities has undergone a dramatic transformation since the mid-20th century. The shift from an industrial to a service economy, driven by urban development and the search for new economic models, has profoundly impacted both the economic and physical shape of our cities. As industries migrated from city centers, motivated by growing environmental concerns and the need for sustainable practices, they left behind vast, often imposing structures of metal and stone. These former industrial zones, once lively hubs of activity, became isolated areas due to neglect, lack of intervention, and the lingering effects of heavy pollution. However, the growing emphasis on sustainability and preservation has ignited a renewed interest in architecture and urban planning. These concepts have reshaped our approach to the built environment, prioritizing environmentally friendly practices, respect for existing structures, and the creation of spaces that better serve the needs of the population. As a result, cities are now focusing on integrating more green areas and developing creative strategies to repurpose these industrial sites.

Funded by the European Commission under the Erasmus+ Programme, the Blended Intensive Program (BIP) is a collective effort by Federico II University and partner institutions Hochschule Koblenz (Germany), Universidad de Valladolid (Spain), and Universidad de Zaragoza (Spain). It builds upon a profound commitment to preserving and fostering a deeper understanding of Europe's rich industrial legacy. The program aims to bridge the gap between the past and the present, illuminating

the cultural, historical, and architectural value of industrial sites. The project embraces an experimental approach to architecture and design, considering historical, social, and environmental aspects.
The transformation of the ex Corradini in San Giovanni a Teduccio is the targeted area of BIP workshop activities. These activities involved students from Spain, Germany, and Italy who worked together to visualize the San Giovanni district by testing different methods to define proposals for the district's regeneration, to finally aim to create a multifunctional area with urban life diversity in a post-industrial era.
Events detailed in this book include workshop activities and seminars aimed at educating stakeholders about the cultural, historical, and architectural value of industrial heritage sites. Presentations by experts engage the public and encourage participation, exploring topics such as heritage conservation principles, adaptive reuse strategies, and community engagement approaches.
BIP activities complemented the Abit, InhAbiting the Transition, an innovative project led by the Department of Architecture (DiARC) at the University of Naples Federico II. It focuses on adapting living spaces and models towards more sustainable settlement, production, and consumption patterns. Abit's vision holds the transition as a critical stage, demanding the adaptation of living spaces and models in response to this critical moment. It's an evolutionary process extending from the immediate challenges of the short term to the far-reaching transformations of the long term.
In these regards, the BIP was focused on comparing different European approaches to urban regeneration of industrial areas. This book offers a comprehensive overview of the developed activities, aiming to capture the extensiveness of research conducted by DiARC academics on abandoned industrial areas. With a particular focus on the ex Corradini site, the book delves into the program's efforts to achieve inclusive and interdisciplinary understanding of this critical topic.
The transformation of the ex Corradini has been the subject of study for some time, in particular part of the industrial site is involved in the

project drawn up by the Municipality of Naples called "Completamento del restauro degli edifici di archeologia industriale ex Corradini a San Giovanni a Teduccio", for which funding has been allocated.

The book, therefore, has the merit of focusing attention on the urban transformation of the San Giovanni district with the aim of continuing the trend of "urban acupuncture" interventions, which have allowed the partial reactivation of the economy by exploiting the district's potential. Two important interventions have already been carried out: the reconversion Locomotive Factory into the Pietrarsa Railway Museum and the reconversion of the ex Cirio factory into a multifunctional University Center. The ex Corradini's transformation project could be the third urban regeneration project in this area in the next future.

Therefore, the dissemination activities related to the BIP Industrial Archaeology project are crucial for fostering a cultural dialogue about the broader topic of transitional urban spaces. These activities play a key role in sharing knowledge, raising awareness, and engaging stakeholders in the transformation of industrial heritage site.
This book, along with all the related events, will be an important contribution to the regeneration process of San Giovanni district and the work will become a valuable resource for scholars and anyone interested in the preservation and adaptive reuse of industrial heritage sites.

Introduction

Mara Capone
BIP Coordinator

The topic of the disused Industrial Heritage has been the subject of a Blended Intensive Programme (BIP), financed by European Commission in KA131 Mobility of higher education students and staff supported by internal policy funds projects, in which the Federico II University of Naples has played the role of Coordinator.

BIP Industrial Archaeology was developed and implemented in cooperation with three Universities from EU Member States: the Hochschule Koblenz (Germany), Universidad de Valladolid (Spain) and Universidad de Zaragoza (Spain), associated in a Partnership with a Multilateral Inter-Institutional Agreement.

The BIP Industrial Archaeology in Naples involved 26 students and 10 Staff Mobility for Teaching from sending institutions, and 15 students from Federico II University.

Blended intensive programmes are short, intensive programmes that use innovative ways of learning and teaching, including the use of online cooperation typically refers to an educational or training program that combines both online or digital components with in-person or face-to-face interactions.

The online component involves lectures, interactive modules, discussion forums, and assignments that students complete remotely using digital platforms. This aspect allows for flexibility in learning, as students can access materials at their own pace and from any location with an internet connection.

On side. Ex Corradini, industrial heritage. Photo by Maria Ferrara, taken during the Living Lab Inhabiting the City in Transition. Evolutionary Projects for the Reuse of Large Urban Containers (curated by Orfina Fatigato and Gianluigi Freda) included in the program of the Festival of Architecture, CA23 Campania Region Architecture in April 2023.

The in-Person component involves physical meetings, workshops, labs, or seminars where students come together with tutors for hands-on activities, group discussions, presentations, or practical demonstrations. This aspect provides opportunities for direct interaction, collaboration, and deeper engagement with the material component of the topic.
Blending these two modalities offers several advantages such as:
- Flexibility: students can balance their learning with other commitments since online components can often be accessed at any time.
- Engagement: combining online and in-person interactions can share different learning approaches, enhancing overall engagement and understanding.
- Cost-effectiveness: by leveraging online resources, institutions can potentially reduce costs associated with facilities and travel.

Overall, the blended intensive approach seeks to maximize the benefits of both online and in-person learning while minimizing their respective limitations.

In a Blended Intensive Programme (BIP), research activities play a crucial role in fostering deep learning, critical thinking, and application of knowledge. The main research activities integrated in the BIP program are related to:
- Collaborative Projects: BIPs often emphasize collaborative learning and teamwork. Research activities may involve group projects where students work together to design and conduct research studies, analyze data, and present their findings. Online collaboration tools such as shared documents, video conferencing, and project management platforms facilitate communication and coordination among team members.
- In-Person Research Workshops: during the in-person component of the program, students participate in research workshops led by teaching staff from host institution and sending institutions, meeting with stakeholders such as social and cultural associations and doing surveys.

These sessions focus on research methodology, data collection techniques, ethical considerations, and presentation skills. Hands-on activities and group discussions provide opportunities for students

to deepen their understanding and receive feedback on their projects. BIP incorporates fieldwork experiences where students engage in real-world research activities under the guidance of mentors or supervisors. This practical component allows students to apply their knowledge and skills and gain valuable team research experience.
Overall, research activities in a Blended Intensive Programme are designed to cultivate students' research competencies, foster intellectual curiosity, and prepare them for careers or further study in their chosen fields. By integrating online and in-person learning experiences, BIPs offer a dynamic and immersive environment for research and scholarship.
The topic of the BIP Industrial Archaeology is the disused Industrial Heritage, both in material dimension - places/buildings - and intangible - the set of knowledge linked to the memory of the productive activity.
The programme aims to promote an innovative educational system based on an integrated approach to finding possible solutions to complex problems. Priority will be, therefore, the attention to the definition of a replicable methodology for the analysis and representation of the Industrial Archaeological Heritage especially in relation to the identification of the constituent elements (physical, intangible and landscape components) and the construction of multi-scale digital models that will allow to represent the transformation during the time, to simulate processes and to evaluate design alternatives in different contexts.
The program aims to overcome the classical specialisms of Industrial Archaeology to define "European" approach on two fundamental topics:

1. Knowledge and representation of Industrial Heritage.
2. Reuse and urban regeneration strategies definition.

The program is divided into three phases: the activities in the first phase are conducted online, the second phase is in person, and the third and final phase returns to a remote setting.
The virtual component of the program is divided into two phases: the first phase took place on February 28 and 29, 2024, and the final phase on April 29 and 30, 2024.

Fig. 1. BIP operational planning (image by tha author).

During the first online phase, seminars were organized to provide students with basic theoretical knowledge on key topics and were made available on a dedicated YouTube channel.

During the in-person phase, special meetings were held related to:

1. Methods and tools for Industrial Heritage survey and representation.
2. Methods and tools for Industrial Heritage mapping.

3. Brainstorming activity to derive design elements for urban regeneration definition.
4. Meetings with stakeholders relevant to the urban regeneration project, including local residents, community groups, and cultural associations.

The meetings were intended to accomplish two objectives: first, to define theoretical approaches and illustrate best practices; and second, to foster debate and exchange of views among students by comparing different approaches at the international level.

The structure of the meetings aimed to develop an approach to the theme of Industrial Heritage that integrates the different disciplines and encompasses multiple, cross-cutting skills. To achieve this goal, the teaching staff involved in the training pool was connected to different areas, spanning survey, drawing, representation, design, landscape architecture, and evaluation. This different expertise ensured a comprehensive exploration of the Industrial Heritage topic, addressing its complexities and enriching the learning experience for participants.

The aim of the program was to equip learners with essential knowledge to undertake the development of strategic actions for regenerating abandoned industrial contexts, beginning with the survey and analysis of the site within its territorial context.

From the outset, students were actively engaged in group work activities aimed at achieving the following intermediate objectives:

1. Mapping disused industrial areas within the city of Naples.
2. Defining criteria for cataloging Archaeological Industrial Heritage buildings.

The program concluded with an online phase held from April 29th to 30th, 2024. During this stage, concepts developed during the intensive in-person workshop were reviewed and shared for the final presentation. This phase provided an opportunity for participants to consolidate their learnings and refine their strategic approaches for the regeneration of abandoned industrial areas.

The in-person activities were structured as workshops held from April 8 to 13, 2024, at the University of Naples Federico II. The workshop provided students with the opportunity to collaborate within an interdisciplinary team to define urban regeneration scenarios for a real case study in Naples: the ex-Corradini in San Giovanni.
During the in-person activities, a tour of the study area and its surrounding territorial context was organized by teaching staff and experts. This activity was crucial in providing participants with essential information to effectively engage in the workshop activities.
Additionally, a practical laboratory was conducted by teachers from universities of the BIP Partnership, involving stakeholders such as associations and institutions. This laboratory allowed participants to apply the theoretical knowledge gained during the virtual phase of the course, as well as the specific instructions provided during the introductory phase, to the real case study.
The intensive workshop provided participants with the opportunity to collaborate with colleagues and experts in working groups. This collaborative environment facilitated discussions, idea exchange, and problem-solving, enabling participants to delve deeper into the subject matter and develop comprehensive strategies for addressing the challenges of urban regeneration.

The in-person session of the workshop was structured around the following themes:
- Advanced Architectural Survey Techniques: Participants learned and applied advanced procedures for acquiring and processing architectural survey data to create interoperable 3D models representative of the case study. These digital representations facilitated the analysis of key issues and relationships between disused sites and their urban context, both built and natural.
- Spatial Data Visualization Techniques: Participants experimented with digital modeling techniques to visualize spatial data, ranging from the territorial scale of the landscape to the architectural scale. This enabled

them to integrate and support interpretative analyses of the abandoned contexts under examination.

- Construction of Physical Models: Participants engaged in constructing physical models to study the territorial context and the area of the ex-Corradini factory.
- Roundtable Discussions with Stakeholders: Organized and facilitated roundtable discussions involving potential stakeholders to gather community input and solicit feedback from investors interested in the sustainable recovery and reactivation of abandoned industrial complexes.
- Development of Communication Devices: Participants designed communication devices and disseminated analysis and project concepts using digital multimedia systems such as augmented reality (AR) and virtual reality (VR) applications, as well as virtual exhibitions.
- Participatory Concept Elaboration: Brainstorming activities engaged students in participatory concept elaboration to define a range of possible regeneration actions for the examined area and its related abandoned buildings.

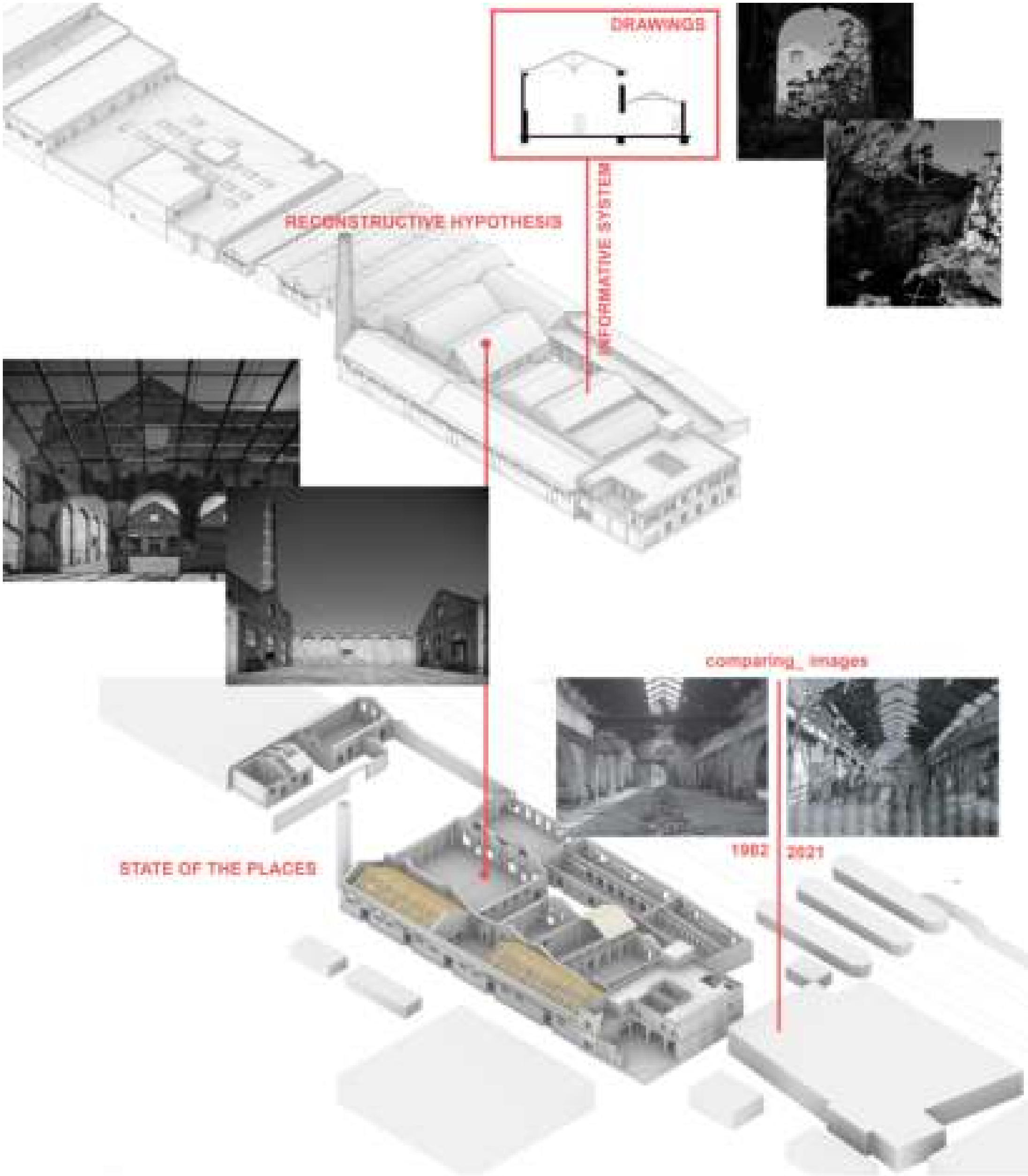
At the end of the BIP we are planning some dissemination activities that are crucial for sharing knowledge, engaging stakeholders, and raising awareness about urban regeneration projects. We are going to organize international events in order to compare different approaches in relation to the main topics and local events in order to engage stakeholders and promote dialogue about the urban regeneration project, that will include presentation of workshop activity results, community meetings, walking tours, and public exhibitions or installations.

CHAPTER 1
Methodology
Mara Capone

In this session, we have collected papers addressing the main methodological issues in Industrial Archaeology. These contributions emphasize the importance of an integrated approach involving disciplines such as drawing, history, urban planning, design, and urban regeneration. These collectively provide a framework for addressing the complexities of Industrial Archaeology and developing innovative solutions for the regeneration of abandoned industrial areas that have great iconic value but are often polluted and inaccessible. To tackle these challenges and consider the value of abandoned industrial sites under national and European laws, a framework has been defined addressing several critical aspects:

- **Ex industrial sites valuation**: establishing criteria for attributing cultural, historical, and economic value, recognizing their significance in heritage preservation and urban regeneration.
- **Legal and regulatory context**: understanding laws that enforce protection and provide guidelines for adaptive reuse.
- **Heritage knowledge**: gathering detailed information about the sites, including historical context, architectural features, and previous functions.
- **Quantitative and qualitative representation**: using advanced survey techniques and digital tools to create detailed site representations that facilitate analysis and planning of future interventions.
- **Intervention strategies**: analyzing sustainable reuse strategies, including adaptive reuse, conservation, and integrating new functionalities while preserving historical value.

On side. Ex Corradini, industrial heritage. Photo by Maria Ferrara, taken during the Living Lab Inhabiting the City in Transition. Evolutionary Projects for the Reuse of Large Urban Containers (curated by Orfina Fatigato and Gianluigi Freda) included in the program of the Festival of Architecture, CA23 Campania Region Architecture in April 2023.


DRAWINGS
RECONSTRUCTIVE HYPOTHESIS
INFORMATIVE SYSTEM
comparing_ images
1982
2021
STATE OF THE PLACES

Analysis, drawing, project.
Tools and methods to manage the Industrial Heritage transformation

Mara Capone

Abandoned industrial areas can be represented and reimagined inclusive, and sustainable urban spaces in relation to their past and their future potential by employing a multidisciplinary approach that integrates documentation, mapping, historical research, conceptual design, community engagement, environmental assessment, and cultural interventions

One of the main goals of this research project is to evaluate various visualization techniques concerning the transformation of Industrial Heritage. The aim is to demonstrate how survey and representation play a crucial role in the regeneration process of abandoned industrial sites with historical value.

Representations such as drawings, physical models, and digital simulations allow stakeholders to visualize abstract concepts and ideas, making them easier to understand and to evaluate different proposals. Visualization tools encourage innovative thinking and experimentation, allowing designers to explore a range of possibilities for the site's redevelopment. Therefore, knowledge is the first step preserving historical memory (Fig. 1).

When developing a design proposal within the constraints of protective restrictions, it's essential to undertake a process to identify the elements that can be effectively integrated.

Survey and Analysis of the site, including any existing structures, the natural features, historical significance, and regulatory restrictions, help you understand the elements present and what limitations or requirements

Fig. 1. Information system design. Raprenting transormations (image edited by Mara Capone).

you must adhere to. These analyses allow you to identify elements that you can demolish and what you must preserve. These could include deteriorating structures, non-historic buildings, or features that area not compatible with proposed design vision. Evaluate the elements that must be preserved due to protective restrictions is crucial. By understanding the reasons behind these restrictions and how they influence your design approach is the first step of the design work. With a clear understanding of what can be demolished and what must be preserved, you can begin planning how to integrate these elements into your design proposal, by considering how new structures can complement existing ones, how to incorporate historic features into modern designs, and how to minimize impact on preserved areas. It can be the starting point to explore creative solutions to challenges posed by the preservation requirements. This could involve adaptive reuse of existing structures, innovative building techniques to blend old and new, or designing around sensitive environmental features.

By starting with a comprehensive understanding of the site and its context, you can define collaboration and consultation step that will support the goals of the design proposal. Working closely with relevant stakeholders, including preservation authorities, local communities, and clients, throughout the design process you can define different possible solutions. Their input and expertise can help ensure that your proposal meets regulatory requirements while also addressing the needs and concerns of all parties involved.

Starting from this fundamental assumption, some of the fundamental issues concerning representation were addressed with particular attention to the issue of tools and, therefore, interoperability and detail, such as the problems connected to different methods of displaying models and the methods of interactive use of these models.

Interactive 3D Models: sharing Data

3D visualization for heritage sites offers benefits, facilitating a deeper understanding of historical contexts and serving as a potent tool for

preservation. Interactive visualization methods open novel avenues for sharing information and presenting heritage sites to the public, transcending barriers of age and background.
You can create detailed reconstructions of heritage sites, providing insights into their original appearance and historical significance. The interactive models can incorporate layers of contextual information, such as historical events, architectural evolution, and cultural relevance, enriching the user's understanding.
3D visualization can create detailed reconstructions of heritage sites, providing insights into their original appearance and historical significance. The interactive models can incorporate layers of contextual information, such as historical events, architectural evolution, and cultural relevance, enriching the user's understanding.
Interactive 3D models engage users in a more dynamic learning experience, making historical information accessible and engaging for a wider audience. 3D visualization allows people worldwide to explore heritage sites remotely, breaking down geographical barriers and making heritage accessible to a broader audience. Interactive models can be designed to cater to diverse audiences, including children, elderly individuals, and people with disabilities, making heritage education inclusive.
Moreover, 3D models facilitate collaboration among researchers, allowing them to share and analyze data more efficiently.
Working on interactive 3D models and various visualization modes has proven to be a significant aspect of our research project. By testing and implementing methods for sharing these models through online platforms and mobile apps, we have successfully made them accessible to a global audience. This approach not only enhances understanding and preservation of heritage sites but also fosters greater public engagement and educational opportunities.
Starting from the early tools that allowed the use of 3D models as interactive interfaces to share information, such as the 3D PDF (Capone, 2013), the advances in this field are closely linked to technological evolution. The 3D PDF was one of the pioneering tools that enabled

users to embed interactive 3D models within PDF documents. It allowed users to rotate, zoom, and interact with 3D models directly in a PDF reader, making it easier to share and present complex spatial information. Despite its innovative approach, 3D PDFs had limitations in terms of rendering quality, file size, and the level of interactivity compared to modern solutions.

Technological Evolution and Advancements are based on Web-Based systems. The advent of HTML5 and WebGL enabled the embedding of interactive 3D models directly into web pages, allowing for seamless online access without additional plugins. Platforms like Sketchfab and Three.js emerged, offering robust tools for hosting and interacting with 3D models on the web.

You can design the information system using interactive elements such as clickable hotspots, annotations, and embedded multimedia (videos, audio clips, images) are integrated to provide a richer, more informative experience.

The evolution of tools for using 3D models as interactive interfaces to share information, from the early 3D PDFs to today's advanced web-based platforms, mobile apps, and VR experiences, has been driven by technological advancements. These tools have significantly improved the accessibility, interactivity, and richness of 3D models, making them powerful mediums for sharing information about heritage sites and beyond. As technology continues to evolve, we can expect even more innovative and immersive ways to interact with and share 3D data (Fig. 2).

We can trace an ideal history of the methods used for defining interactive 3D model interfaces and web-based sharing, but the main steps of the workflow have remained largely unchanged (Capone, 2016). This applies whether we limit ourselves to the interactive use of the model or explore the different methods of web-based sharing (Capone, 2012). The key stages in this workflow are always the same:

- 3D Model Generation
- Information system based on 3D interface
- Visualization modes definition.

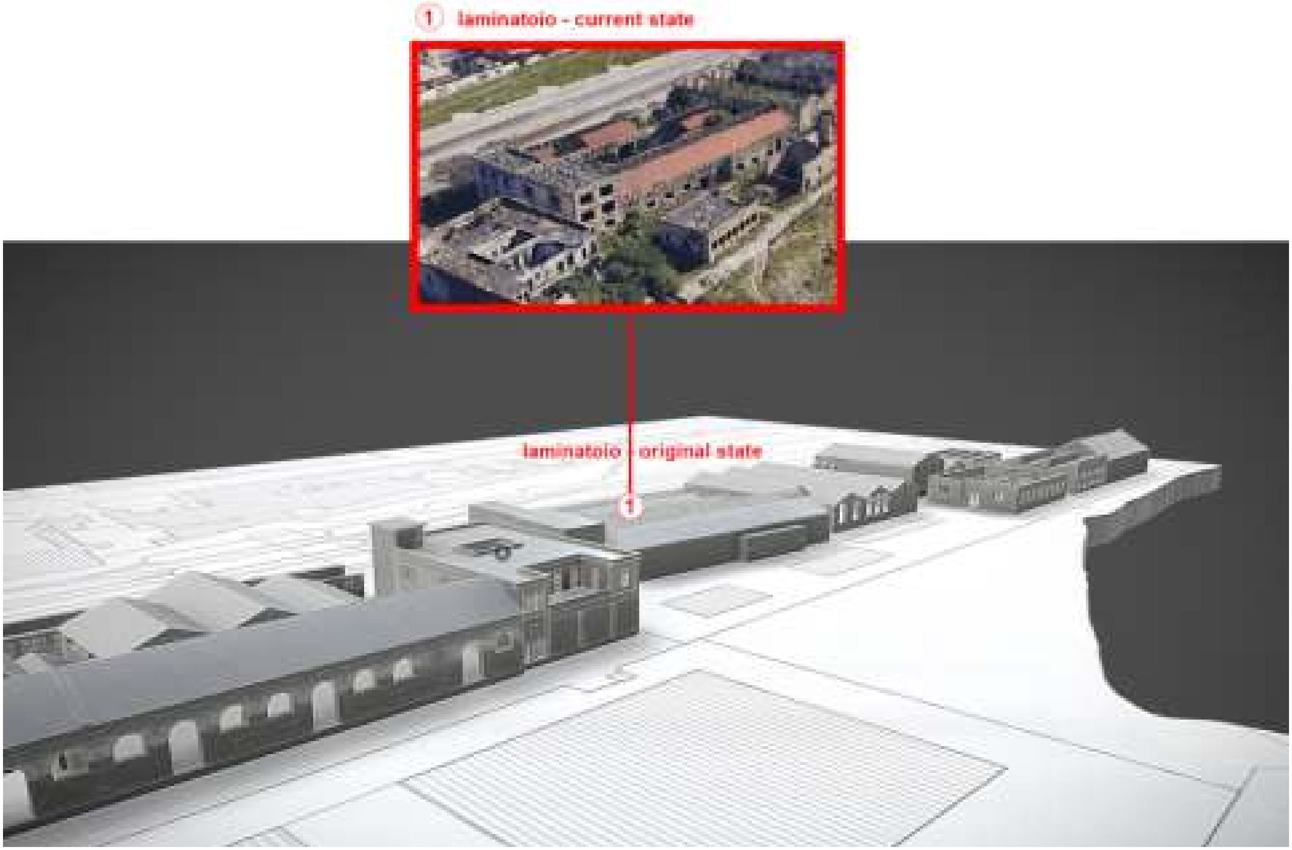
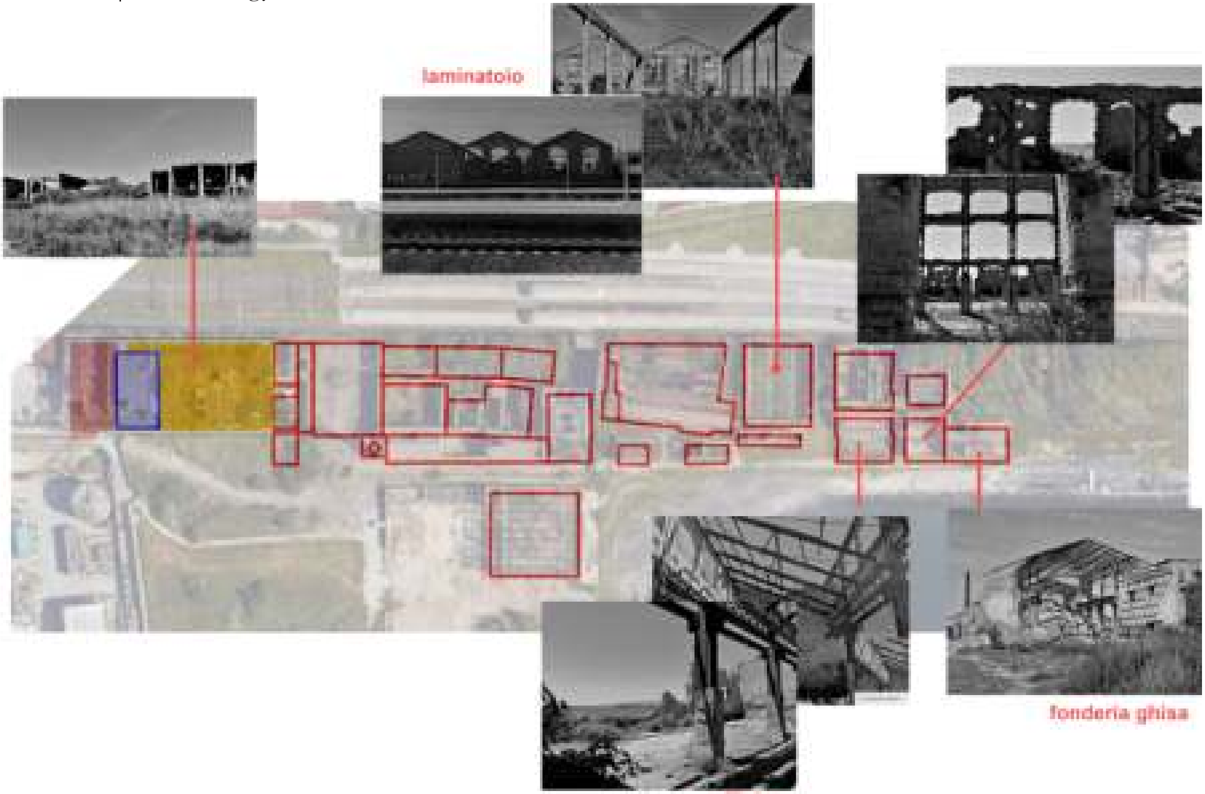


Fig. 2. Web sharing data (image edited by Mara Capone).

The workflow for creating and sharing interactive 3D models has remained fundamentally unchanged over the years, encompassing model generation, information integration, and varied visualization modes. The evolution of technology has enhanced each of these stages, making the models more detailed, the information systems more robust, and the visualization modes more immersive and accessible. However, the way in which the model is displayed remains a crucial aspect of this process, impacting user engagement, educational value, accessibility, and analytical capabilities.



1980

2021

3d Visualization options_ methods_problems_strategies

The visualization of 3D models for historical heritage presents a unique set of cultural and operational/instrumental challenges. Addressing these issues effectively requires a balanced approach that integrates technological innovation with cultural sensitivity.

Contemporary rendering technologies empower the creation of highly realistic 3D models, effectively depicting historic buildings and landscapes. While these renderings may convey a sense of certainty about the presented historic site, it is important to acknowledge that they might be based on spectacularization about its appearance. This is where non-photorealistic rendering offers a compelling alternative.

Non-Photorealistic Rendering, offers a wide range of illustrative styles that can be experimented with, allowing for creative expression without the pressure to adhere strictly to realism. This flexibility enables the communication of uncertainty about a site's past existence through stylistic elements such as sketchiness, fuzzy edges, transparencies, and saturations (Capone, 2011). Moreover, 3D visualization of historic sites can experiment stylistically to convey temporal aspects and changes over time (Brusaporci, 2017). This transforms the visualization from a mere illustrative representation of the past into a complex translational tool. In this context, 3D images serve not only as iconic representations but also as tools for conveying scientific data acquired through research (Ackerman, 2023). The integration of 3D modeling and non-photorealistic in heritage visualization represents a dynamic approach that encourages exploration, interpretation, and dialogue. It not only enhances our appreciation of the past but also inspires innovative approaches to proposal design. Instead of creating detailed building models, we have to define a process to simplify buildings modelling in relation to representation needs and visualizations aims.

The process of creating detailed 3D models for heritage sites involves several stages, from data collection to model generation, and addresses the challenges of interoperability.

By using a variety of software and ensuring the interoperability of

Fig. 3. Connecting data to represent transformation (image edited by Mara Capone).

models, heritage projects can effectively handle heterogeneous data from different sources. This approach not only enhances the accuracy and detail of the models but also supports collaborative efforts and long-term preservation of cultural heritage data.

Data can be edited, and models can be generated using different tools tailored to specific needs, whether it be BIM tools for detailed architectural modeling or CAD tools for more general design work. Ensuring that models created with different software are interoperable is crucial. This allows for seamless integration and manipulation of models from various sources.

Heritage projects often involve heterogeneous data from different sources, which may not be immediately compatible with each other. Establishing standards and protocols for data exchange and model integration is essential to manage this diversity effectively.

For example, interoperability and simplification are key considerations when working with BIM models for visualization purposes. By reducing the level of detail and converting models to widely supported formats, it is possible to create efficient and compatible 3D visualizations that meet the defined criteria. This approach ensures that the visualizations are not only accurate but also optimized for performance and accessibility in relation to needs.

One effective strategy is to simplify the geometry of the model by reducing the level of detail (LOD). This involves removing unnecessary details that are not essential for visualization purposes.

For examples, removing small elements like screws, bolts, or minor fittings that do not contribute to the visual integrity of the model, simplifying complex decorative features that might not be visible or important in the context of the final visualization and eliminating fine textures that are not needed for the overall appearance, thus reducing the file size and complexity.

BIM software typically uses proprietary file formats that may not be directly compatible with visualization software. You can convert BIM files to more widely supported formats such as OBJ but sometimes you

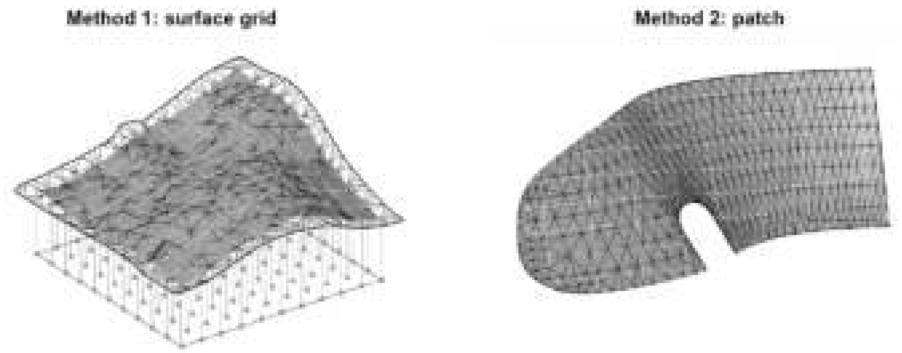


Fig. 4. eComutational approach to convert a mesh model in a nubs model (image edited by Mara Capone. Source: https://hopific.com/mesh-to-surface-ingrasshopper).

can obtain a 3D model with more information you need, and you cannot use this model to obtain the visualizations that meet the defined criteria. You can export the model from BIM software (e.g., Revit) to a widely supported format like OBJ or FBX. During this export, you can choose to simplify the model by selecting lower LOD settings if the software supports it and you can use the tools available in the visualization software to further reduce the complexity of the model, if necessary. This might involve decimating meshes, merging vertices, or simplifying textures, for example.

In the context of addressing interoperability and simplification of BIM models for visualization, a computational approach was tested by transforming complex mesh geometries into more manageable NURBS (Non-Uniform Rational B-Splines) representations.

The geometry is crucial in reusing metadata from different sources, mesh geometry is a common exchange currency for 3D models. Mesh data, while it can be stored in a CAD native format, often is exchanged or shared in a neutral format such as STL or OBJ. You can import or export geometry (solid, surface, or mesh) in OBJ, STL, or DWF format but when you are going to use a mesh model to define different visualization mode sometime there are a lot of limitations. One of the main limitations for mesh visualization option is related to mesh edges because they can be invisible, or they are all visible by default.

Converting a 3D mesh model into a 3D NURBS model offers a methodologically approach for simplifying geometry, improving efficiency, and enhancing the quality of visualizations. It's particularly affordable when dealing with planar surface, in this case NURBS surfaces offer a more streamlined representation compared to complex triangulated meshes. Converting a mesh model into NURBS allows for the creation of smooth, continuous surfaces that accurately represent the original geometry while reducing, in this case, the overall complexity of the model.

Planar surfaces, such as façades, walls, or floors, can be represented with single NURBS surfaces, even if they have openings or holes. This simplifies the model structure and makes it easier to work with.

Understanding the differences between meshes and nurbs surfaces is crucial for determining how to convert one to the other. A mesh is a collection of vertices, edges, and faces that define the shape of a 3D object. It is typically composed of triangular or quadrilateral faces connected by edges, forming a network of polygons. Meshes are commonly used to represent complex geometries with irregular shapes, as they can accurately capture intricate details and contours.

A surface is a mathematical representation of a 2D manifold embedded in 3D space.

Surfaces are defined by mathematical equations or parametric functions that describe their geometric properties, such as curvature, smoothness, and continuity. Unlike meshes, nurbs surfaces do not have discrete elements like vertices, edges, and faces; instead, they are continuous and smooth.

Before converting a mesh into a nurbs surface, it's often beneficial to simplify the mesh by reducing its complexity. This can involve techniques such as polygon reduction, edge collapse, or decimation to reduce the number of vertices and faces while preserving the overall shape and features of the mesh. Once the mesh is simplified converting a mesh to a surface may involve manual modeling techniques, where designers use surface modeling tools to recreate the shape of the mesh using parametric

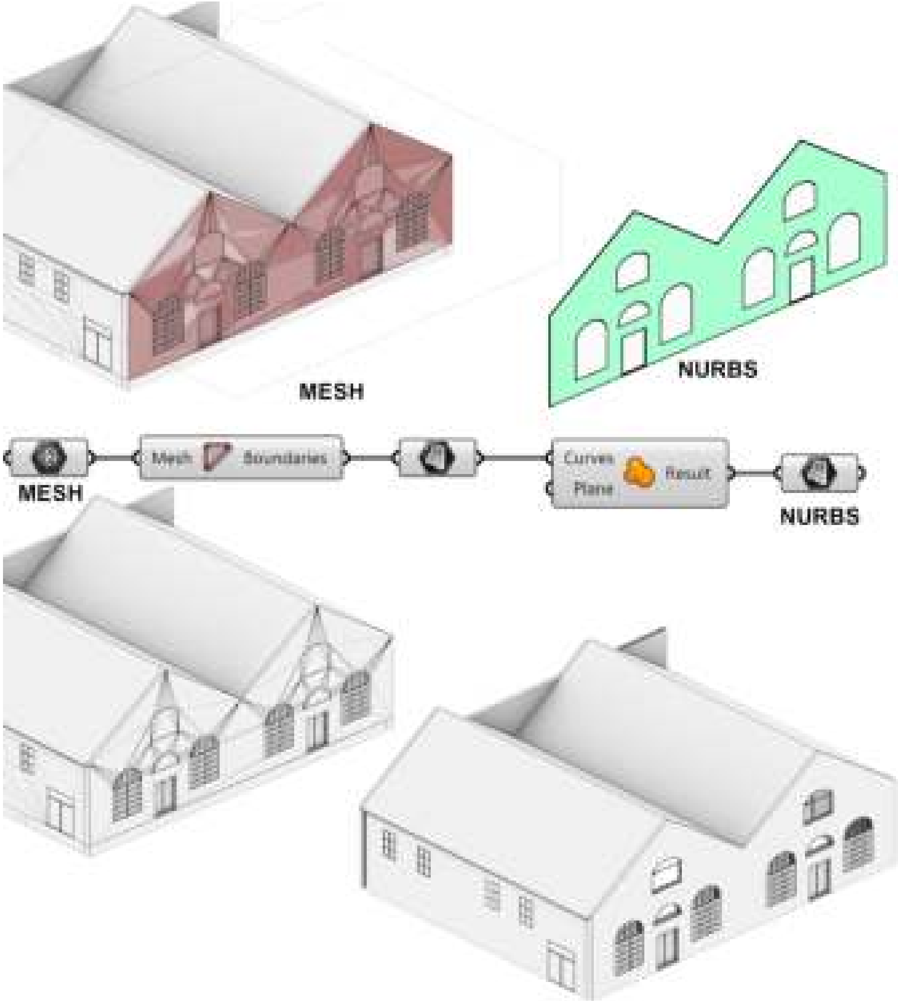


Fig. 5. Algorithm defined by Mara Capone to convert mesh model in nurbs model. Testing using Corradini model from BIM (image edited by Mara Capone).

surfaces. This approach can be more time-consuming and labor-intensive. You can generate a continuous surface representation from the mesh data using a computational approach to solve this problem, by defining reconstruction algorithms that allow you to reconstruct the surface in VPL. These algorithms analyze the connectivity of the mesh vertices

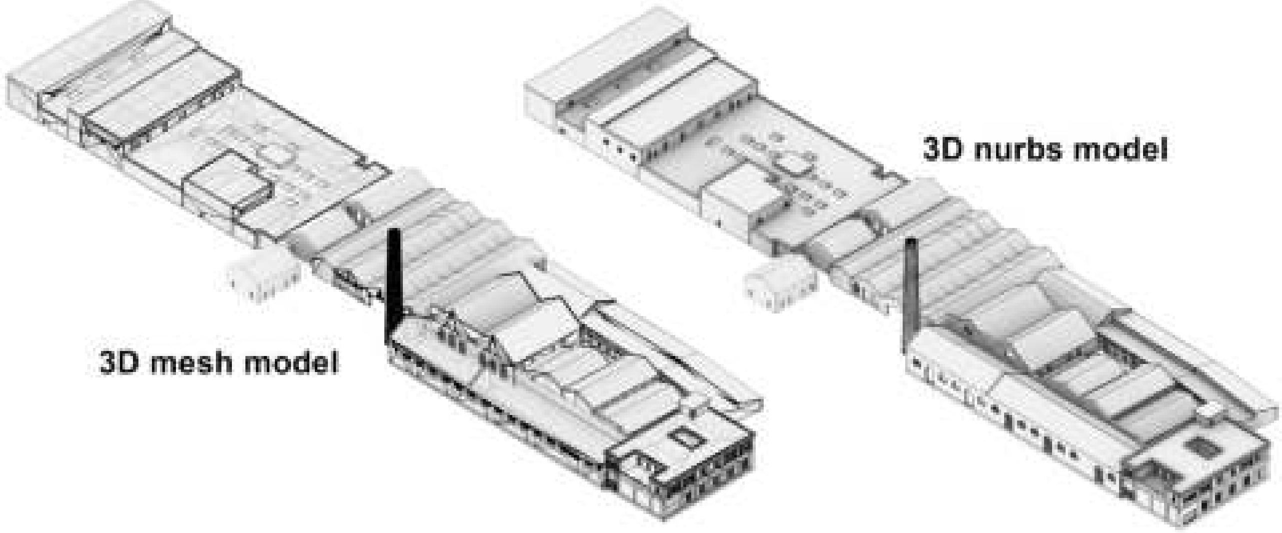


Fig. 6. Testing using Corradini model from BIM (image edited by Mara Capone).

and use interpolation or approximation techniques to construct a smooth surface that closely matches the original mesh geometry
Breaking down the process of transforming a mesh into a nurbs surface into systematic methods makes it much more manageable. By exploring techniques such as resampling the surface from scratch and using the Patch component, designers can weigh the advantages and draw-backs of each approach.
From a methodological standpoint, understanding these nuances is crucial for selecting the technique that best aligns with the specific needs of the project. Whether prioritizing accuracy, efficiency, or flexibility, having a clear understanding of the available options allows for informed decision making.
This experimentation activity serves the main goal of not only mastering the technical aspects of transforming meshes into nurbs surfaces but also developing a deeper understanding of how to apply these methods effectively in representation and visualization process.
Starting from these premises, we defined a script to simplify the meshes

in the models import-ed from BIM software. This was also an interesting opportunity to experiment with the potential and advantages offered using computational tools.
Experimenting with such tools not only expands your skill set but also enables you to explore innovative approaches to design and visualization. The challenges of converting mesh to nurbs surface using a computational approach depends on the way meshes and surfaces are constructed.
Since the two 3D modelling techniques are so different, there is no one way to create a conversion from one to the other. It's important to understand that any conversion will lead to a compromise in accuracy, speed or usability of the resulting output.
You can define two different techniques (Fig. 4) to convert a mesh to a surface suited best for a specific use.
The kind of mesh you are trying to convert, and what you want to do with the resulting surface will determine which method to use.
Imagine you have an extremely detailed mesh, for example, a terrain model with several hundreds of thousands of faces. You just need a small portion of the terrain, and you want to convert it to a surface, so modelling it will be easier and the cleaner.
Turning the mesh into a polysurface is not an option: the sheer number of mesh faces would lead to a huge, slow file.
In this case you can define a regular grid of points and generate a surface from this grid. It is very simple drawing a rectangle in the top view that defines the area to convert into a surface (Tait, 2023).
Subdividing the rectangle to generate a grid of points. Finding the vertical intersection between those points with the mesh you can use those intersection points to generate a single clean surface (Tait, 2023).
In some cases, you want to convert a mesh with non-regular boundary to a surface in order to get a clean and precise trimmed surface. The previous method doesn't work in that case: the Surface Grid approach requires a rectangular, planar outline.
You can extract all the vertices from the mesh and use them as the input for a Surface patch. The surface patch will fit a surface through all the

points provided, even if they are in a random order. Because the surface patch will create a surface that goes beyond the points we specify, we'll need to trim it using the original border.

The case study is simplest than the two samples we have analyzed because all the mesh faces are planar. In this case the process is based on deconstructing the mesh in its faces and connecting them using a Boolean union of the regions. If there are holes, we can use Boolean difference.

From a methodological point of view our goal is to demonstrate how the computational approach can help you to solve some specific problems, in this case we have defined a customized tool to manage heterogenous geometry models.

We tested the defined algorithms to explore different visualization options and to create a coherent 3D model of the case study (Figg. 5,6).

In conclusion, the themes addressed in this contribution underscore the importance of testing the limits and potential of different representation methods to manage transformation processes. Through our exploration of various visualization techniques, we have highlighted the need for accurate, clear, and integrative representations that can effectively communicate complex data and changes over time. Our findings suggest that while each method has its strengths and weaknesses, a nuanced understanding of their capabilities can lead to more informed and effective applications in Heritage management. Moving forward, continued experimentation and refinement of these representation methods will be essential in advancing our ability to manage and visualize transformation processes in diverse contexts.

Notes

[1] The study was carried out as part of a degree thesis entitled Aree industriali dismesse: il caso di Bagnoli. Tutor Prof. A. Baculo Giusti, co-tutor Prof. A di Luggo, candidate A. Mosca, 2004.

References

Ackerman, A., Auwaerter, J., Foulds, E., Page, R., & Robinson, E. (2023). Cultural landscape visualization: The use of non-photorealistic 3D rendering as an analytical tool to convey change at statue of liberty national monument. In *Journal of Cultural Heritage,* Vol. 62, pp. 396-403.

Apollonio, F. I., Giovannini, E. C. (2015). A paradata documentation methodology for the Uncertainty Visualization in digital reconstruction of CH artifacts. In *SCIRES-IT*, Vol. 5, No. 1, pp. 1-24.

Brusaporci, S. (2017). The Importance of Being Honest: Issues of Transparency in Digital Visualization of Architectural Heritage. In A. Ippolito (Ed.). *Handbook of Research on Emerging Technologies for Architectural and Archaeological Heritage,* pp. 333-360. Hershey: IGI Global.

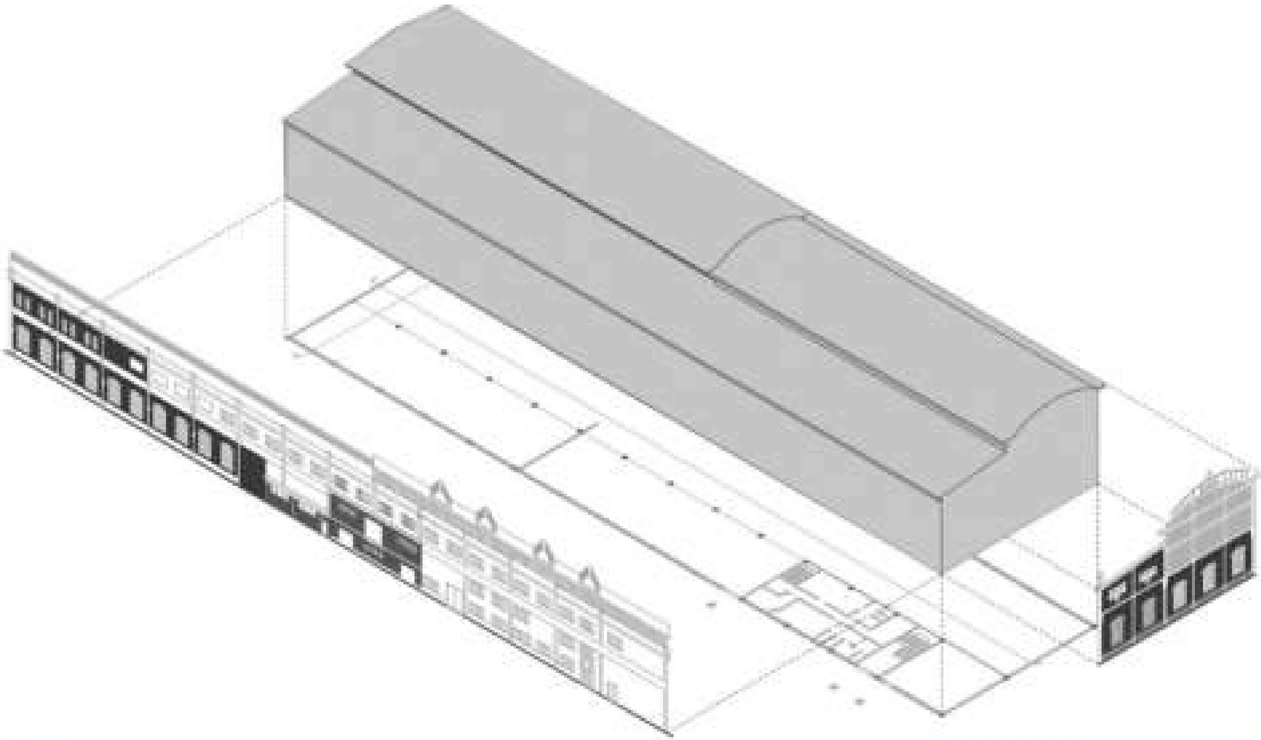
Capone, M. (2011). Archeologia Urbana. Rappresentare l'incertezza: gli scavi archeologici di Piazza Bovio a Napoli. In *DISEGNARE CON,* No.7, pp. 68-80.

Capone, M. (2013). Interactive communication for Architecture and Design Interfaces for an information system based on 3D representation. In R. Florio (Ed.). *MAED Materioteca fisica e virtuale per l'architettura e per il design*, pp. 285-300. Pozzuoli: Paparo Edizioni.

Capone, M. (2016). Interfacce tridimensionali interattive. Percorsi alternativi per la lettura Castel Nuovo. 3D interactive interfaces. Alternative routes rediscovering Castel Nuovo. In M. Losasso, & M. Campi (Eds.). *Conoscenza e valorizzazione del patrimonio culturale del Centro storico di Napoli. ABITARE IL FUTURO,* pp. 154-167. Napoli: Clean.

Capone, M., & Lanzara, E. (2021). Artefatti cognitivi interattivi web-based: edutainment per il patrimonio culturale. In A. Arena, M. Arena, M., D. Mediati, P. Raffa, P. (Eds.). *Connecting – Drawing for weaving relationship. Linguaggi, Distanze, Tecnologie,* pp. 2119-2136. Milano: FrancoAngeli Open Access.

Tait, T. (2 July 2023). Mesh to Surface in Grasshopper: A Comprehensive Guide. <https://hopific.com/mesh-to-surface-in-grasshopper/> (accessed 30 April 2024).



Digital models for industrial building knowledge

Simona Scandurra, Daniela Palomba, Antonella di Luggo

Introduction

The disused industrial heritage constitutes tangible evidence of the material culture of past eras, knowledge of which helps to understand the identity of places and the transformations of territories. It is a heritage made up of abandoned manufacts, often in a precarious structural condition, which over time have taken on a specific cultural value and for which, more and more often, processes of valorization and reconversion are being considered.

The metric and material survey, as well as the survey of construction technologies, the state of conservation and the analysis on a territorial scale of these manufacts, make it possible to prepare multidimensional documentation, useful for an in-depth and articulated understanding on several levels of knowledge and constitute the information base necessary for the formulation of any transformation hypothesis. In fact, these representations are capable of including data of a different nature and at different scales, from those relating to architecture and construction details to those on a territorial scale, contemplating the various singularities and the historical, cultural, social and environmental context of reference. Alongside this, representation plays a fundamental role in decision support, revealing specific aspects of the built reality and making manifest its vocation for transformation, while at the same time allowing for the preservation of its memory.

Moreover, in the contemporary world, representation takes on a position

Fig. 1. Mechanical manufacturing building in Bagnoli, Naples (model by A. Mosca).

of great importance thanks to digitization techniques and archiving on platforms that integrate and correlate data of different natures using effective tools and methods to document, analyze and communicate the specificities of each manufact. In particular, digital models enable interactive visualization and comprehensive information management at different scales of detail, such as BIM models that introduce innovative approaches to knowledge, integrating geometric data with historical data and diagnostic information within a single context.
Through a review of the literature and the analysis of the most used procedures in the field of digital technologies, referring to some case studies referable to the disused industrial heritage in the Campania region, the contribution explores different methods for the realization of representation products, capable of conveying, through figuration, fundamental information data for the documentation of the asset.

The representation of disused industrial sites in the Campania region: graphic models

The city of Naples sees its coastline strongly characterized, both on the western and eastern sides, by the presence and construction, over a long period of time, of buildings and pavilions intended to house various industrial-type settlements. Such a location is obviously linked to strictly practical issues arising from logistics and thus the movement by sea of supplies and obviously also of what was produced there. The declination to the past reflects the current condition that sees many of these settlements, now unused [1]. The reclamation of these sites, their reuse and re-functioning, is an issue that is always alive and well in intervention policies on an urban and architectural scale. While the constellation of industrial-type settlements on the Neapolitan coast has strongly marked the landscape and given a precise connotation to these places, it has in certain respects protected them from major concrete interventions. The most emblematic case is the former industrial area, located on the Coroglio plain, which for over a century - since 1905 - housed the factories of the former Ilva then Italsider, active until 1992. An area that

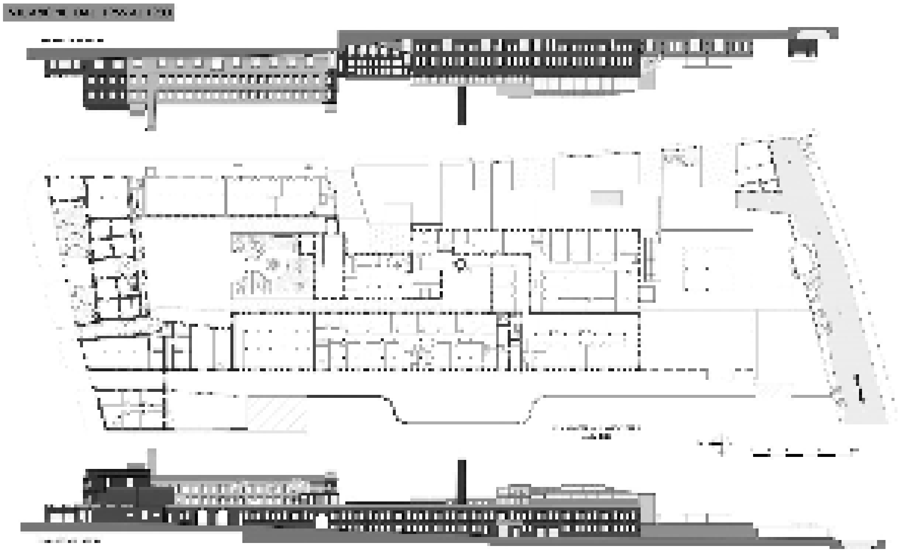


Fig. 2. Buchy and Strangman, textile and spinning mill in Sarno (drawing by A. Mazziotti, A. Marzullo).

is still waiting, for more than thirty years, for concrete actions aimed at its redevelopment. In this context, the role of survey, representation and knowledge are the way in which the discipline of Drawing, considered in an extended sense, proposes itself as a tool capable of preserving the memory of places that may be destined for abandonment, rather than for modification. These are productive realities that have significantly affected the image of the territories and the lives of the people who lived there. It is therefore necessary to address the issue of preserving the memory of these realities.

The images of these sites are often identified with manufacts that have become iconic for the landscape that hosts them. In the case of Bagnoli, this is the case of the great Steelworks which now seems to belong, with its great mass characterized by its dark red colour, to that landscape. The plain is now a different place, a place very different from the image that characterized it for over ninety years. What was once a dense tangle of warehouses is now a large desolate area dotted with a few manufacts scattered haphazardly around. The long boundary wall that perimeters the area, however, leaves room for the view of here tall manufacts, the chimneys, the extinguishing tower and the blast furnace. As part of a study conducted on the area in early 2004, a mapping exercise was carried out to analyse the intrinsic qualities of the manufacts connected to the characteristics of the architecture and the relational qualities referring to the manufact/context relationship, each of them being significantly present elements, as well as concrete evidence of a time gone by. The survey delved into the representation of some of these manufacts and in particular: the Agl Chimney, the Mechanical Workshop and the extinguishing tower.

The selected cases offer an exemplification of different structural configurations, referable to manufacts with a prevalent vertical development, with a repetitive modular scheme, rather than presenting a completely singular conformation that highlights the plastic possibilities of reinforced concrete that conforms atypical objects that find their reason for being in other motivations of a functional nature. For the first two cases, the structural scheme is legible and declared. The reinforced concrete framework and the facing brickwork draw the texture of the façade, offering useful indications for a proportional reading of the compositional and geometrically dimensional components.

But examples of industrial settlements, of sites that can be counted among the 'heritage' of industrial archaeology, multiply and can now be found throughout Campania. By way of example, but also because of its value as a building of historical and cultural interest, we would like to mention the Pratola Serra paper mill in the province of Avellino. Its origin dates back to 1924 and once again it is a building whose refunctioning and recovery has been debated for years. It is a masonry building of great charm characterized by a compositional rhythm designed on the façade by narrow curved windows and the sequence of the wooden trusses of the roofs. In this case too, the survey activities conducted are proposed as a basis to support possible projects, but also to stop - albeit in the digital dimension - the memory of its presence.

Fig. 3. Evolution of Buchy and Strangman building in Sarno (model by A. Mazziotti, A. Marzullo).

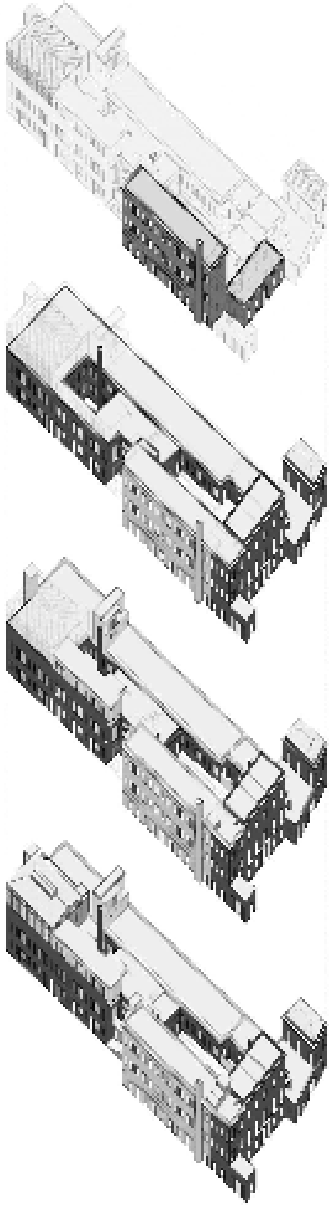
Representing through digital models

Alongside traditional representations on the two-dimensional plane, computer tools offer a wide range of possibilities for the creation of 3D digital models that are functional for specific study and documentation needs (Mandelli & Velo, 2010). The elaboration of models starts, as is well known, from a 'geometric, metric and compositional' analysis of the object to be modelled and leads to different results depending on the type of data to be represented and the objectives of the work.

Some models focus on the accurate representation of the physical characteristics of a building and its details, others focus on the visualization of metric or structural data for analytical or design purposes, and still others - particularly those used for simulations and immersive visualizations - are characterized by being dynamic and interactive.

In the context of the documentation of disused industrial architectures, different digital 3D modelling techniques offer targeted approaches to represent their complexity and specificities at the same time. Of course, the three-dimensional modelling methodology can vary significantly depending on the case study and representation needs, achieving different outcomes depending on the choice of digital tools and modelling techniques used (Di Giacomo, 2018). Plans, sections and other 2D drawings of the manufact form the basic foundation for the realization of dimensionally accurate and true-to-life three-dimensional models, where orthogonal projection drawings act as a guide during the modelling process. On the contrary, conceptual models provide, as is well known, summary indications, although just as effective in terms of information, as for example in modelling the historical evolution of an manufact, which aims to document the transformations that have taken place over time.

In both cases, the reference is to Constructive Solid Geometry (CSG) (Foley, 1996), a modelling technique that, by means of specialized software, allows the creation of three-dimensional models using solids and basic geometric entities combined through a sequence of



Boolean operations. This technique underlies the operation of many Computer-Aided Design (CAD) software that use vector graphics to represent traditional 2D drawing objects. CAD software also uses B-Rep (Boundary Representation) approaches, where three-dimensional objects are represented using surfaces defined by their boundaries and borders. The CSG approach can be used to obtain different shapes, depending on the complexity of the manufact to be modelled and the precision required in its representation, also lending itself to incremental modelling to be carried out in successive stages, the final outcome depending on the precision with which the whole can be broken down into basic geometric shapes. The more detailed and accurate the primitives used and the operations performed, the closer the model comes to the constructed reality or the original idea.

For the modelling of organic or particularly complex shapes, the reference is to NURBS (Non-Uniform Rational B-Spline) processes that make use of methodologies focused on the representation of mathematical curves and surfaces defined by control points [3]. These models are distinguished by their ability to represent architectures that are compositionally characterized by irregular shapes, thus enabling the accurate replication of existing geometries, even in cases where the decomposition into simple solids is complex.

In order to render NURBS surfaces, we resort to transforming them into a polygonal model based on the representation of forms through polygons, each defined by a triad of coordinates that univocally represents a plane (the triangle) and whose ensemble constitutes, as is well known, a mesh. In this case, the curved surfaces are reduced to a sequence of planes, with the number of polygons increasing in proportion to the quality of the desired smoothing, while also increasing the digital weight of the model. Meshes are therefore based on a three-dimensional network of vertices, edges and faces that approximate the surface of objects, whatever their complexity. The overall characteristics of the model depend on topological information between the meshes.

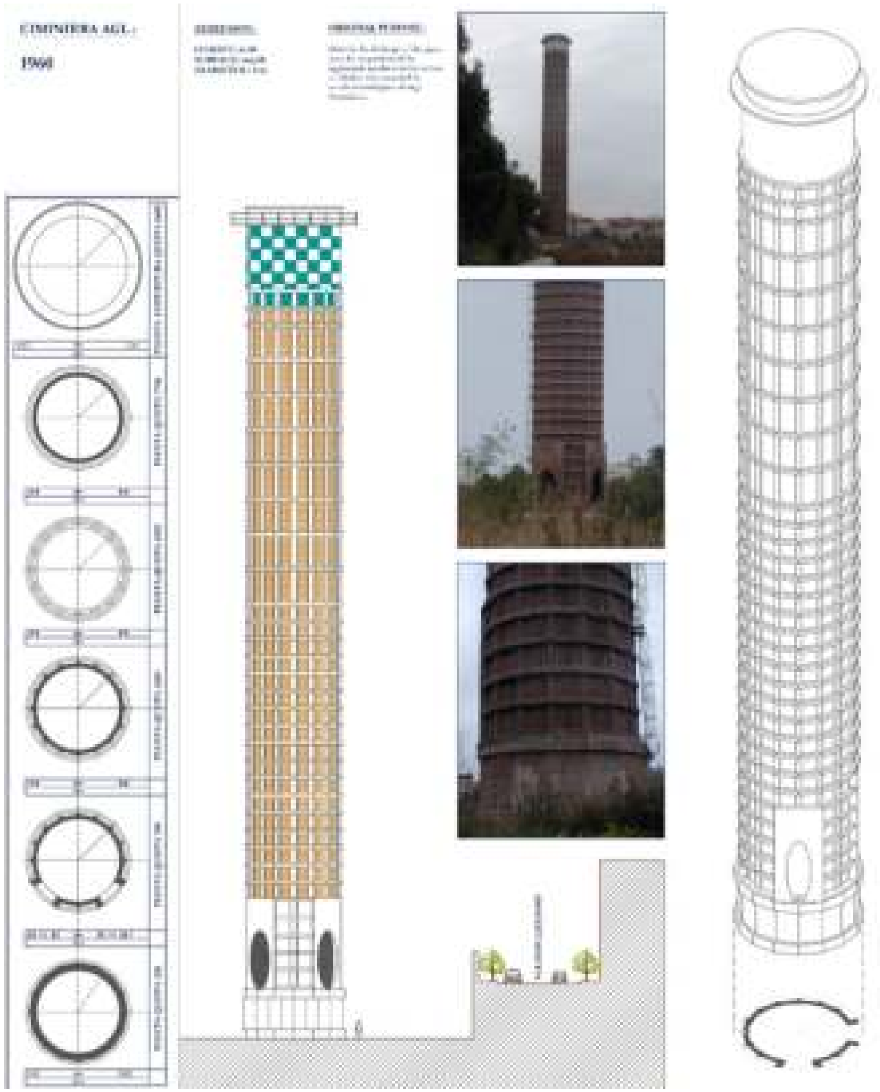


Fig. 4. Survey, graphic representation and 3D model of the disused chimney at Bagnoli, Naples (model by A. Mosca).

Parallel to modelling techniques that are based on decomposition processes, procedures capable of returning models from three-dimensional digital

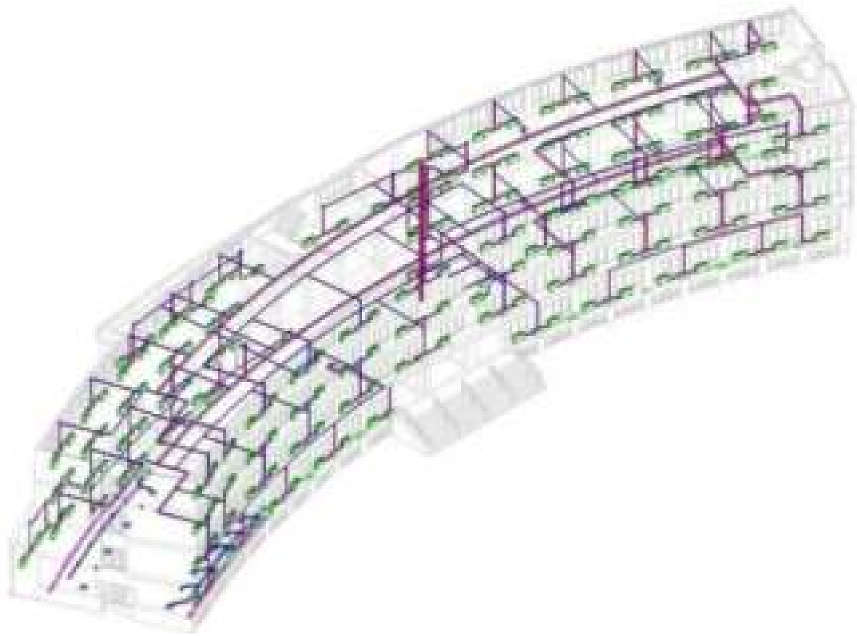


Fig. 5. 3D models can focus attention on a specific aspect such as the internal plant structure, dematerializing other features (Militar hospital in Agnano, model by M. Siconolfi).

survey acquisitions should be considered in this field of reflection. The reference is to reality-based models that derive from the use of LiDAR and digital photogrammetry technologies that allow the rapid creation of three-dimensional models based on metric data. LiDAR (Light Detection and Ranging) technology employs laser light to measure the distance between itself and points belonging to surrounding surfaces, making it possible to obtain point clouds, i.e. a large number of points of known coordinates, arranged in digital three-dimensional space and representing the surfaces of the acquired elements. These data can be processed to be transformed into mesh models so that the discontinuity of the points is transformed into the continuity of the actual surfaces, maintaining high levels of metric accuracy. Alongside this, digital photogrammetry uses photographic images and SfM (Structure for Motion) algorithms to replicate the shape and proportions of photographed objects. This

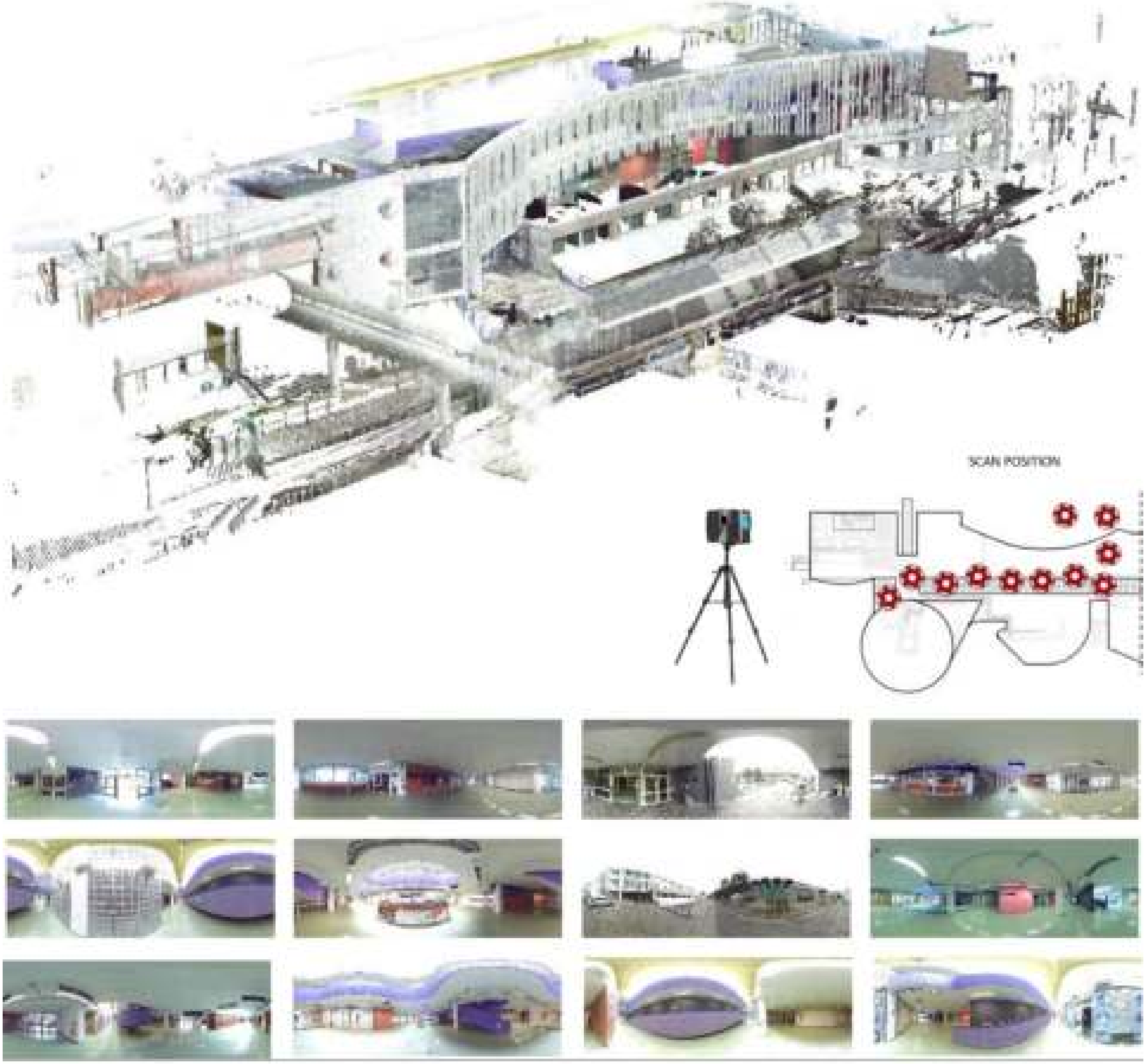
process relies on photographic acquisitions from different viewpoints of homologous points to obtain 3D models from automated reverse perspective and stereoscopy procedures performed by specialized software. The software identifies common points between the images and calculates their position in digital three-dimensional space. The result is once again a dense point cloud representative of the photographed surfaces, from which mesh models can be generated.
The mesh models obtained from reality-based surveys are generally high-density, i.e. they are categorized as high poly (de Carlo, 2007) and are such that they perfectly replicate the course of real surfaces, regardless of their complexity, as long as they were framed by the sensor at the time of acquisition. It is also true that everything that is framed is replicated without any selection, regardless of utility. A true cast of reality (Russo & Guidi, 2010). This results in elements of the architecture appearing in continuity with extraneous elements, such as vegetation.
At the same time, this process appears particularly effective in the documentation of disused industrial buildings that are in a state of high decay and precarious security conditions, as the timeliness of the acquisition process and the possibility of mounting photographic sensors or lidar sensors even on aerial devices such as drones, makes it possible to metrically record and digitally explore even inaccessible areas. Both reality-based technologies offer an efficient and effective way to capture three-dimensional data and create digital models that accurately represent the geometry and dimensions of existing buildings.

Integrations, BIM and digital twin

The combined use of modelling techniques based on decomposition processes and reality-based data acquisition enables a complete and detailed understanding of three-dimensional objects and structures, thus contributing to the documentation and enhancement of architectural heritage. Over the years, protocols and guidelines have been developed for the integration, segmentation and interpretation of reality-based survey

data so that the geometric memory can be interpreted and completed with data equally indispensable to the understanding of an manufact, including a shared, multidisciplinary approach (Balzani & Maietti, 2017).
Building Information Modeling (BIM) is an integrated approach that enables the creation and management of three-dimensional digital models of building manufacts, incorporating detailed information relating to different aspects, from geometry, history, construction techniques, stratigraphy, etc.
The incorporation of different data derives from the principle that underlies the BIM process, which allows data and analyses of different types and formats to be incorporated within a single workspace, with a view to being able to build a digital twin of the real manufact. Digital twins therefore intend to replicate the state of the real manufact, starting from a semantic decomposition of the different components of the architecture and their relationships. Working in BIM as part of a process of knowledge, design and intervention on the built heritage means collecting and systemizing all the necessary information so that the decision-making process is supported and guided by a digital simulation of the outcomes of each operation.
BIM modelling represents an object-oriented approach, in which each component of the architecture takes on the role of a specific element in the model, endowed with unambiguous meaning and behaviour, both individually and in relation to the other elements.
The implementation of the BIM geometric model with data from different sources and with different formats allows the federation of models obtained through various modelling techniques and procedures. In fact, it has become common practice to build BIM models from point clouds, which serve as the basis for fitting and positioning parametric digital elements. Each element of the BIM model is characterized by a specific behaviour defined by the tool algorithm and compliance with domain standards and is parametric. This means that each distinguishing feature is determined by a specific parameter, the value of which is chosen

Fig. 6. The laser scanner point clouds allow us to navigate in 3D in a model that is perfectly metrically close to reality (University building in Monte Sant'Angelo. Survey by S. Scandurra, M. Pulcrano, M. Siconolfi).


SCAN POSITION

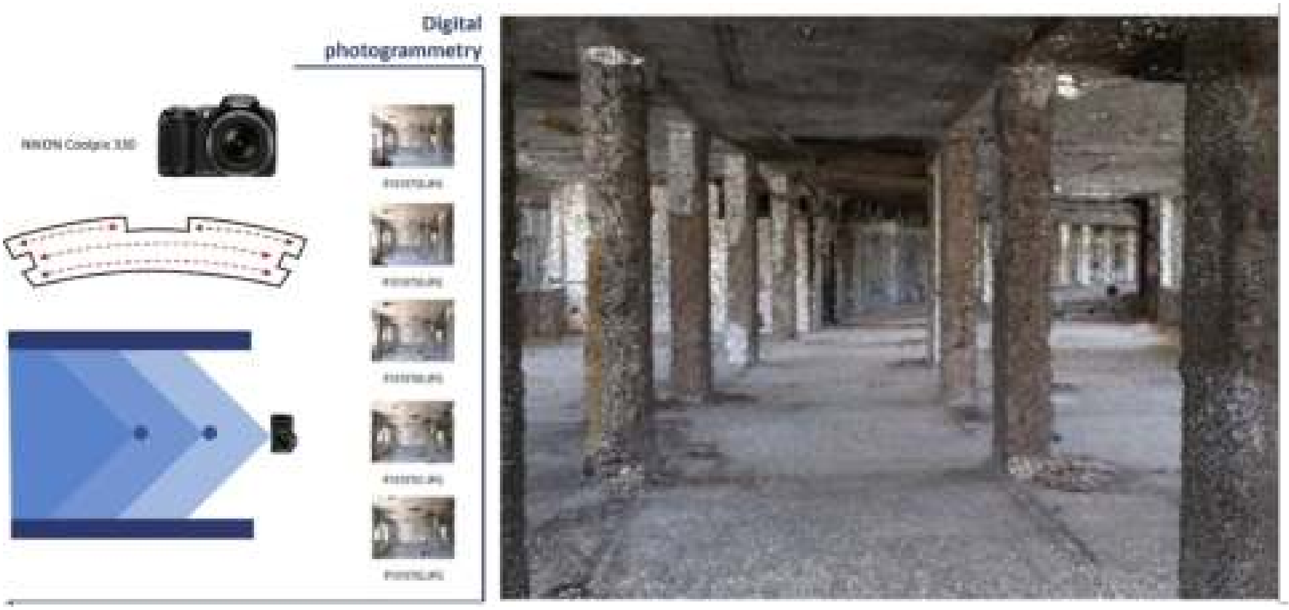


Fig. 7. Point clouds obtained from photogrammetric processes have the advantage of maintaining a high adherence to reality even from a photorealistic point of view (Militar hospital in Agnano, survey by M. Siconolfi and S. Monaco).

based on the specific properties of the manufact.
In other words, BIM modelling allows for the creation of a digital environment in which each architectural element is represented in a detailed and dynamic manner, enabling operators to visualize, analyze and modify the model at any time, verifying any interferences immediately.

Interoperability between different models

The vast choice offered by IT tools and the evolution of computer graphics means, as is well known, that there are considerably different data formats depending on the type of geometric (or non-geometric) information that can be recorded in them. Although in the BIM environment, models, representations and information from different formats and disciplines can be imported and read in superimposition, the need to export and transfer data remains. This need may depend

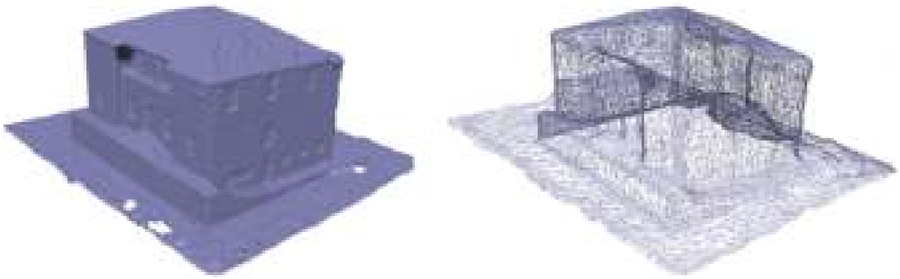


Fig. 8. Reality-based surveys can be transformed into meshes. In the figure, the mesh is displayed as a solid surface (left) and only with triangular mesh borders (right) (model by S. Scandurra).

on several factors. For example, importing into a different software may depend on the desire to carry out manipulations of the data that are impossible to achieve in native software; or it may be necessary to carry out technical analyses in performance simulation software; or it may be necessary to provide a reading of the model to operators who need to provide for the development of specific model components.
The identification and use of an interchange file format that is as neutral as possible (free from the constraints of a specific proprietary software house), ensures that the transfer of geometries and information keeps the native structure of the data firmly in place, avoiding losses.
It should be made clear here that an interchange format may be structured according to two types of translations of the native data, since the exchange output may be editable or only searchable. The choice depends on the purpose of the exchange but also on the level of compatibility possible between the language of the exporting software and the language of the importing software. In a sense, we could define each model as the combination of a “visual computer model” and a “data structure model”. In exchanges where the model can be viewed, consulted, and queried - but does not allow modifications - we could consider only the visual computerized model as transferred. In exchanges where changes to geometry, data or specific properties are permitted, the data structure model is also exported and overwritten by the import software.
For 3D models, the most common open data format for exchanges is the

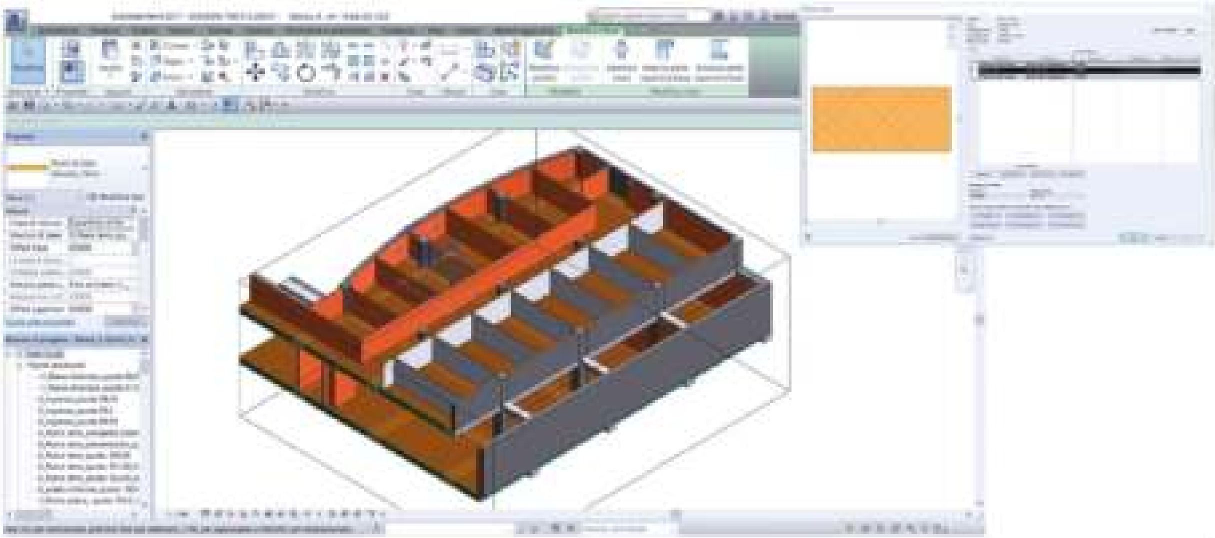


Fig. 9. A BIM model consists of elements that semantically replicate reality, adding relationships and detailed information at different scales (University building in Monte Sant'Angelo, model by F. Laviola).

OBJ format, which effectively allows export and import into software dedicated to even quite different modelling processes. For example, meshes obtained from point clouds can be exported and imported in OBJ, as can 3D CAD models, or NURBS. This is an exchange format that keeps the geometry and, possibly, the texturing unaltered and modifiable. In fact, this interchange format guarantees interoperability between different modelling software while retaining the graphical information of the native data, i.e. the position of each vertex, texture UV coordinates, normals and individual faces.

For point clouds, on the other hand, the exchange format that guarantees interoperability is either the .e57 format or the .xyz format, which record the colour and coordinates of the individual points in the cloud.

For BIM models, the OBJ format is not sufficient as it is deficient in the transfer of information data. In this case, the IFC exchange file format, which is still being continually updated, was prepared. The .ifc format guarantees the exchange of information and collaboration between the

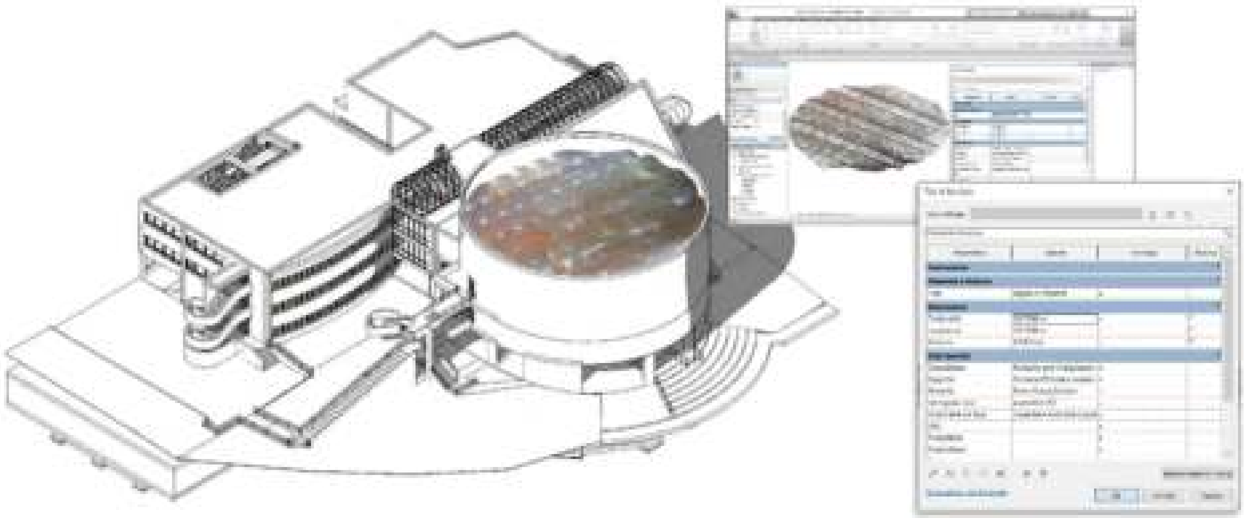


Fig. 10. Different types of models can provide unprecedented readings when integrated with each other. In the example in the figure, the point cloud model of some parts of the building were imported directly into the 3D BIM model (University building in Monte Sant'Angelo, model by M. Siconolfi and S. Scandurra).

different users of the BIM process, but also protects the intellectual property of each of the operators as it exports data that can be consulted but not modified, unless specifically indicated. In BIM interoperability, in fact, the purpose for which a model is exchanged, who is to receive it and how they are to use it, are indispensable information that must be established prior to its transfer, as each export may or may not allow for the consultation and presence of specific features (geometric and non-geometric) rather than others.

Conclusion

Using digital models based on reality-based data, advanced modelling techniques for the replication of complex geometries, semantically recognized BIM elements and databases enriched with numerical and textual information, it is possible to simulate the conformation and state of conservation of an asset from different points of view, to analyze specific aspects, to understand its evolution and potential, and to hypothesize and verify future scenarios. Each model in fact represents a visual prefiguration and a means of communication capable of conveying more information. Only the integration of different models can offer a complete and multidimensional approach to knowledge for the conservation and valorization of the built heritage and in particular the abandoned industrial heritage.

Notes

[1] Examples include the cases of the former Corradini industrial complex in San Giovanni a Teduccio, Italsider in the Bagnoli plain and Sofer in Pozzuoli.

[2] The study was carried out as part of a degree thesis entitled Aree industriali dismesse: il caso di Bagnoli. Tutor Prof. A. Baculo Giusti, co-tutor Prof. A. di Luggo, candidate A. Mosca, 2004.

[3] From the perspective of computer development, NURBS are extremely complex algorithms that enable the construction of curved surfaces in a continuous manner.

References

Balzani, M., & Maietti, F. (2017). Architectural Space in a Protocol for an Integrated 3D Survey aimed at the Documentation, Representation and Conservation of Cultural Heritage. In *Diségno*, No. 1, pp. 113-122.

De Carlo, L. (Ed.) (2007). *Informatica e fondamenti scientifici della rappresentazione*. Roma: Gangemi editore.

Di Giacomo, A. (2018). *Modelli di Architettura*. Roma: NeP edizioni Srls.

Foley, J. D. (1996). Constructive Solid Geometry. In *Computer Graphics: Principles and Practice*. Addison-Wesley Professional, pp. 557-558.

Mandelli, E., & Velo, U. (Eds.) (2010). *Il modello in Architettura. Cultura scientifica e rappresentazione*. Firenze: Alinea Editrice.

Russo, M., & Guidi, G. (2010). La modellazione digitale reality-based ed interpretativa per la valorizzazione del patrimonio culturale. In G. Amoruso, E. Bistagnino, F. Brevi, M. Cecconello, G. Guidi, G. Pierluisi, M. Rossi, M. Russo (Eds.). *La Ricerca nel Disegno di Design*, pp. 202-211. Segrate (Milano): Maggioli Editore.

Surveying inaccessible Industrial sites

Valeria Cera

On the relationship between survey and industrial archaeology. From conceptualization to formalization

The action of surveying, understood precipitously, as part of the broader process of knowledge it constitutes, as the operation of collecting, cataloging, and representing the material features of former industrial factories, has been from the very beginning included in the conceptual determination of "industrial archaeology."

Although the authorship of the term is still doubtful, the close relationship between the practice of surveying and the cognitive approach to industrial heritage is made explicit from the earliest theorizing of the new field of inquiry.

Undoubtedly, many scholars have succeeded and progressively grappled with a definition of what would become a true discipline, extending, from time to time, the time limits, and its field of interest.

With certainty, it is possible to say that the definition of "industrial archaeology" was born in the 1950s, perhaps at the suggestion of the Belgian historian Renè Evrard, who for the first time in 1950 juxtaposed the adjective "industrial" with the noun "archaeology" to argue for the need to safeguard the blast furnace and forge of the Forneau Saint Michel near the town of Saint Hubert, in the province of Luxembourg, recognizing its important value as a testimony to a productive past (Fig. 1).

The most accomplished use of the term, however, is due to Englishman

Fig. 1. Interior of the Forneau Saint Michel industrial site in Luxembourg (source: https://www.fourneausaintmichel.be/les-musees).

Michael Rix, a Birmingham University professor who in 1955 mentioned "industrial archaeology" within an article entitled Industrial Archaeology, published in the journal The Amateur Historian. In the publication, Rix does not provide a true definition of the term but clearly begins by circumscribing the issue to which he refers, namely, the need to safeguard all evidence dating from the period of the Industrial Revolution present on British soil and in those years, corresponding to the post-World War II period, marked by a worrying state of neglect (Rix, 1967).

The theorization of industrial archaeology is, evidently, intimately connected with industrialization, its revolution, and its historical evolution. Therefore, the fact that England is the place where the subject of industrial archaeology was first attested, having been the origin of the Industrial Revolution and the country where this process spread most

widely with a breadth of movement that no other European country has achieved, seems extremely logical and automatic.
The end of World War II had led many European nations to engage in intensive reconstruction of bombed-out towns; at the same time, the conflict had caused a loss of heritage dating back to the period of the Industrial Revolution. In England, the post-World War II situation was exacerbated by the emergence of new and powerful players on the world industrial scene, which had resulted in a loss of centrality of British firms. Britain's manufacturing structure faced considerable problems of competitiveness and survival, so the 1950s marked a period of severe retreat for British industry in comparison with the glories of the past. The first nation in the world to experience widespread industrialization on a large scale, it now faced a massive and sudden industrial resignation, questioning how to manage a built heritage, as well as a historical and cultural one, of undoubted scale. It is therefore in this atmosphere that industrial archaeology was born, initially conceived as a kind of "national revolution," that is, a cultural operation aimed at the recovery and preservation of industrial testimonies as well as raising public awareness of the importance of such manufacturing buildings, which were considered to all intents and purposes monuments, symbols of English industrial supremacy, as well as points of interest for the territory, which were to be considered on a par with cathedrals and castles (Baggio, 2014). Rix's work, in fact, did not have a theoretical intent and was not concerned with theorizing a new discipline; on the contrary, it is connoted by the need to defend England's industrial heritage, preserving it from the unrestrained demolitions and destructions it was facing, manifesting a desire to recognize the monumental character of industrial buildings, a simulacrum of a culture and mentality of local populations, a memory of a certain phase of the past, as well as a strong presence inherent to the English territory and landscape.
Rix's words are echoed by the similar work of further scholars who show how, between the 1960s and the mid-1970s, the new field of investigation

of industrial archaeology was gaining momentum and was fueled by significant developments characterized by a strong commitment to heritage preservation. These included Kenneth Hudson, a journalist who from 1954 to 1966 had been the BBC's correspondent for industrial affairs in the West of England and, therefore, interested in the cultural significance of the industrial monument with respect to which he also reasoned about the relationship between the antiquity of an object and its worthiness to be safeguarded (Hudson, 1963); Angus Buchanan, who reinforced Hudson and Rix's positions (Buchanan, 1972); Neil Cossons, since 1971 director of the newly founded Ironbridge Gorge Museum, sensitive to the changes of those years and to the issue of cultural heritage preservation (Cossons, 1975); Edward Rodney Richey Green, editor of a major industrial archaeology series at David & Charles, also focused on emphasizing the importance of identifying the decommissioned industrial asset as a cultural asset through the concept of monument (Green, 1963).

In this sense, an important boost was given by the creation in 1959 of the Industrial Archaeology Research Committee, a body created for the purpose of cataloging and preserving industrial monuments and providing, precisely, an initial definition of "industrial monument." This, although it does not include objects divorced from their original context, reveals a confidence in and admiration for industrial elements whose new aesthetics are recognized. Manufacturing artifacts, consisting of out-of-scale architectures in which repetition and seriality of elements are distinctive features, are appreciated as symbols of a popular history and expressions of architectural making in which form reflects function.

Gradually, initiatives and actions for the protection of industrial heritage multiplied, originating from the desire to obviate an uncritical preservation of manufacturing buildings for which a priority selection followed by documentation and cataloging, primarily typological, was indicated. For this reason, The Journal of Industrial Archaeology was founded in 1963, and in 1965 the National Record of Industrial Monuments (NRIM)

was established, thus extending monument protection laws to industrial monuments as well. Again, in 1976 the Association for Industrial Archaeology (AIA) was established, and the Industrial Archaeology Review was published.
These were the years in which the discipline made its debut on the Italian scene and began to spread across the country, first in the literary sphere and then in the academic sphere, until it invested public and political opinion. The appearance of the term "industrial archaeology" in Italy is due to the essay Perspectives of Industrial Archaeology published in Nuova Antologia in 1976 and originated from the pen of Franco Borsi, director at the time of the Institute of History of Architecture at the University of Florence. In the essay, Borsi criticizes the Anglo-Saxon model by outlining an idea of industrial archaeology that is renewed and, above all, more adherent to the Italian reality, decidedly distinct and different from the English one (Nesti, 2005). First, Borsi redefines the adjective "industrial" from a temporal point of view, broadening the study of production remains to the period before the industrial revolution in the strict sense, anticipating it to the 16th century, that is, when the first technological solutions heralding the dominance of the factory system occurred. This consideration was, then, closely linked to the issues of Italian industrialization that were much slower than those of Great Britain because of the persistence of artisanal methods, which were widespread throughout the country. Secondly, the Italian professor broadens the field of attention of the discipline, which is now really beginning to consolidate as such. In fact, to the narrow interest that the British reserved for the single artifact, grasped only in relation to economic and technological history, Borsi contrasts a broader view that goes beyond the typological classification typical of the Anglo-Saxons to build more solid roots of investigation, with the introduction of a methodology and a historical and architectural study of productive buildings (Borsi, 1978).
From Borsi's activity, the Italian Society of Industrial Archaeology (SIAI) was born, under the presidency of Eugenio Battisti, in 1977, with the

organization of an International Congress of Studies [1] held in Milan on the occasion of the exhibition on the eighteenth-century community of silk spinners of Caserta "San Leucio: archaeology, history, project," as well as the Center for Industrial Archaeology Documentation and Research. Little by little, initiatives by individual scholars flourished, oriented toward becoming aware of the extent to which in all regions of Italy, albeit with significant differences, an industrial heritage was present and widespread, or rather exemplifications of a process of transformation of landscape and culture dominated by the factory that modified, at the same time, places and objects of working-class life. In Veneto, Giovanni L. Fontana with a 1979 conference paved the way for the valorization process of the workers' village and the old woolen mill in Schio (Fontana, 1985). In Tuscany, Ivan Tognarini makes the case for the importance of Tuscany's industrial steel heritage by taking examples from a series of initiatives spread in other contexts, national and otherwise (Tognarini, 1980). In Umbria, Renato Covino debates the deepening of the disciplinary scope of industrial archaeology and the chronological aspects of the new subject (Covino, 1980). In the Mezzogiorno, Gregorio Rubino brings to attention the peculiarities of southern sites related to steel production, encouraging the establishment of the Association for Industrial Archaeology in the Mezzogiorno and the publication of a Bulletin of the same name (Rubino, 1978). In addition, a series of anthological works enriched and deepened the terms of the question: Massimo and Antonello Negri drafted a volume aimed at defining the methodology through which to understand, read, conserve and enhance industrial monuments; Giancarlo Mainini, Giancarlo Rosa and Adolfo Sajeva gave to the presses for the types of La Nuova Italia, a volume focused on the conservation and reuse of the disused industrial heritage (Mainini et al., 1981). With the coming, then, of the 1980s, industrial archaeology is a recognized and widespread discipline both in academia and among the public, in Italy as in England as in the rest of Europe.

The process of awareness and subsequent reconnaissance of industrial

heritage triggered in the 1950s and established in the following thirty years will continue progressively until today, thanks to the increasingly consistent efforts made by associations and institutional bodies. These include, in addition to the aforementioned AIA, the best known: the Society for Industrial Archaeology (SIA), also born in Great Britain; the Italian SIAI now merged into the Associazione Italiana per il Patrimonio Archeologico Industriale Heritage (AIPAI) [2]; the French Comité d'information et de liaison pour l'archéologie, l'étude et la mise en valeur du patrimoine industriel (CILAC) [3]; the Swiss Association pour le Patrimoine Industriel (API) [4], the association for the Quebec region Association québécoise pour le patrimoine industriel (AQPI) [5], the Swedish Svenska Industriminnesföreningen (SIM) [6], the Portuguese Associação Portuguesa para o Património Industrial (APPI) [7].
There is no shortage of European and international initiatives, some of which originated as a coming together under an international profile of some of the societies mentioned earlier, including: The European Federation of Associations of Industrial and Technical Heritage (EFAITH) [8], a body founded in 1999 to bring together all European associations for the preservation of industrial heritage; The European Route of Industrial Heritage (ERIH) [9], founded in the same year and addressing the tourism aspects of industrial heritage; The International Committee for the Conservation of the Industrial Heritage (TICCIH) [10], a body founded in 1973 with an international character to promote the study of industrial archaeology and the protection and interpretation of industrial heritage. Since 2014, the TICCIH has cooperated with the ICOMOS International Council on Monuments and Sites for better conservation of industrial monuments.

Thanks to the progressive work of the scholars and institutions mentioned above, today the discipline of industrial archaeology is well defined in its being a science with a multidisciplinary value that involves architecture, sociology, urban planning, technology and art history. It, in fact, deals with the study of the evidence of industrial production in all its forms: machines, buildings, technologies, infrastructures, analyzing its impacts, economic and social consequences, relations with the urban fabric and with the transformations of human life and society. The definition of the discipline is not limited to include only tangible material heritage, but also a set of intangible elements such as forms of technical knowledge, modes of production, written and oral memory, and traditions. Thus it is that, to date, UNESCO also includes industrial heritage in its list, and in this case, there are about fifty states with at least one recognized and catalogued heritage. Among these, the United Kingdom undoubtedly has a primary role with no less than eleven industrial sites, including places with significant landscape values due precisely to their industrial or mining presence. Of all the sites on the list, mining sites are undoubtedly the most numerous; however, there is also no shortage of working-class towns and industrial landscapes (such as the example of Ivrea, a 20th-century Italian working-class town linked in its history to industrialist Adriano Olivetti)(Fig. 2), industrial sites linked to water and hydroelectric power serving industries such as textiles (this is the case of the 18th-century Vanvitellian aqueduct serving the silk factories of San Leucio and the Royal Palace of Caserta), individual factories and railways (Astrella).

Fig. 2. The 20th century industrial city of Ivrea, Italy (source: https://www.ivreacittaindustriale.it).

The numerous sites on the UNESCO list, from multiple countries, demonstrate the global value of the impact of the advent of industry on landscapes, territories and cultures and the need, therefore, to formulate actions to safeguard the industrial heritage, aimed not only at the sterile preservation of the envelope but extended to the knowledge of the know-how and technologies used, through the definition of a methodological approach that, on the basis of what has been expressed so far, clearly has in the architectural survey an important and pivotal phase of the cognitive process.

The survey for knowledge of disused industrial heritage. Operational and methodological reflections

Industrial archaeology arose, as demonstrated, from the emergency of providing for the defense and preservation of the now disused manufacturing areas threatened by post-World War II reconstruction and the loss of Britain's industrial supremacy. The main tool for dealing with the urgency and promoting, at the same time, an initial understanding of the industrial monument was the filing of surviving evidence, following a primarily empirical approach to the matter.

Michael Rix defined the subject as an activity of cataloguing, even, in some specific cases, preserving, and interpreting the sites and structures of the early industrial revolution; Angus Buchanan wrote of industrial archaeology as a field of study that is related to the research, surveying, recording, and, in some cases, preservation of industrial monuments; Edward Rodney Richey Green described it as the cataloguing and study of the remains of early industrialism, especially those attributable to the 18th and 19th centuries.

From the very beginning, therefore, the survey of industrial buildings was configured as the main tool of industrial archaeology, taking on the physiognomy of a census of manufacturing sites in order to quantify their consistency, spread and, consequently, cultural significance.

Numerous survey campaigns were thus prepared in various regions,

first in England and then throughout Europe, aimed at cataloguing and describing fully all manufacturing activities and their buildings, in order to relocate them in the coeval urban and landscape fabric.
Industrial sites were identified for each territory, and each building was described in its historical evolution, the technique of the activities that took place there, and its physical characteristics.
The study was conducted by employing the Standard Industrial Classification (SIC) to facilitate heritage cataloging i.e., by grouping buildings by manufacturing macrocategories, the number of which ranged from six to sixteen. In fact, Kenneth Hudson considered six categories based on materials and products: 1. Coal and metals, 2. Energy, 3. Textiles, ceramics and glass, breweries, and distilleries, 4. Railways, inland waterways, and roads, 5. Building materials, and 6. Farms. Ian L. Donnachie, on the other hand, expanded the number by increasing the categorization of manufacturing sectors to sixteen: 1. Power Sources & Prime Movers, 2. Agriculture & Rural Industry, 3. Mining & Quarrying, 4. Food Processing, 5. Chemicals & Associated Industries, 6. Metallurgy, 7. Engineering. 8. Textiles, 9. Leather & Leather Working, 10. Clothing & Footwear, 11. Bricks, Tiles, Pottery, Glass, etc., 12. Timber & Paper, 13. Other Manufacturing Industries, 14. Public Utilities, 15. Communications, 16. Other Features (including Housing) (Donnachie, 1969). Arthur Raisthick, then, proposed six categories based on manufacturing industries: 1. Metallic raw materials and industries based on them, 2. Non-metallic raw materials and industries based on them, 3. Organic raw materials and industries based on them, 4. Energy and fuel, 5. Transportation, and 6. Housing - buildings and structures (Raisthick, 1973).
Similar subdivisions were also taken up by Giancarlo Mainini, Giancarlo Rosa, and Adolfo Sajeva.
The juxtaposition of “archaeology” and “industrial” now appears crystal clear, which, on a first reading, may create some perplexity from both a temporal and an aesthetic point of view (Cerato, 2015). The apparent

aesthetic contradiction lies in the fact that "archaeology" means the study and analysis of artistic artifacts often having great aesthetic value, while "industrial" tends to refer to something in which aesthetics is not a peculiar and/or primary value. This contradiction is overcome by the recognition of value, first and foremost historical as well as architectural, of such industrial artifacts. From a temporal perspective, the contrast arises because one thinks of archaeology as a science that deals with the vestiges of the ancient world and thus with something related to the past, while one associates the term industrial with productive, technological and economic phenomena related to progress and thus to the future. Again, the knot is untied where the archaeological character of the new discipline lies precisely in this direct analysis of a material remnant and its classification, through survey. In addition, as debated in the previous section, the adjective "industrial" is related to the time limit within which to conduct research on physical remains.

The peculiarity and indispensability of an architectural survey for the knowledge of the disused industrial heritage is also confirmed in the statutes and various documents that, over the years, have been promoted to protect and safeguard this heritage. The Nizhny Tagil Charter for the Industrial Heritage, promoted on July 17, 2003, by the TICCIH, reiterates in its articles the importance of an informative collection and cataloguing action of industrial remains that passes through the representation of their metric components. In particular, it is recommended that each territory identify, register and protect its industrial sites by initiating survey campaigns of the different types of factories of which to create inventories, searchable and freely accessible to the public, concerning a complete record of the physical characteristics and conditions of the site. The same directions are reiterated in The Dublin Principles, Joint ICOMOS-TICCIH Principles for the Conservation of Industrial Heritage Sites, Structures, Areas and Landscapes, adopted on November 28, 2011, by the 17th ICOMOS General Assembly. The document

reiterates how essential research and documentation of industrial sites is to their identification and preservation, emphasizing an interdisciplinary approach to the issue, in which the metric dimensional survey of manufacturing evidence plays a central role.
Although confirmed in its relevance, the digitization of abandoned industrial heritage poses quite a few problems in its execution, having to deal with sites often connoted by complete inaccessibility or reduced accessibility, declined in various ways.
Indeed, for abandoned manufacturing buildings it is possible to consider various forms of inaccessibility or "complex" accessibility that inevitably condition the techniques and operational choices for data collection: (i) very substantial surface extension that requires considering expeditious methods of acquisition for documentation; (ii) contexts connoted by difficulty of access with large instrumentation due to the presence of physical barriers (often these are abandoned buildings that have been disused for decades where neglect, vegetation and collapses compromise entry and/or movement inside) and that require considering equipment suitable for collecting information that is easy to use and manageable; (iii) areas located in very difficult socio-cultural contexts from a security point of view (often squatted) for which inexpensive tools for documentary investigation need to be considered; (iv) sites characterized by deposits of material toxic to human health formerly used in the construction field (e.g., asbestos) that require the use of data recording solutions in which the presence of on-site operators is not expected (as with the case study covered by the BIP, the Corradini factory) (Fig. 3).

The range of methodological tools and processes for the digitization of the built heritage is now wider and more varied than ever before. Therefore, the selection of the most appropriate approaches to cope with the problems enunciated above is also possible and supported by the progressive technological advancement that is increasingly affecting the field of architectural surveying.

Fig. 3. Current conditions of the limited accessibility of the ex Corradini industrial factory in Naples (author's photo).

Undoubtedly, the image-based digitization technique is a widely established and effectively used reference for surveying contexts that are particularly extensive and/or difficult to acquire due to factors related to physical and/or social accessibility.
In particular, aerial digital photogrammetry has been employed for more than a decade for surveys of areas connoted by great extension, starting from urban contexts up to archaeological parks, and is well suited, therefore, to applications also in the field of dismissed industrial heritage (Barba et al., 2019; Calisi et al., 2023; Mishra et al., 2024; Nandakishore & Kumar 2024; Saleri et al., 2013). The possibility of employing 'Unmanned Aerial Vehicle' UAVs effectively addresses the need to cover large portions of the territory in a short time, while at the same time making it possible to record sufficiently detailed information according to the parameters of calculating flight altitude, navigation speed, sensor resolution, and resulting GSD 'Ground Sample Distance' value (Six et al., 2024). Contextually, especially in cases of ELOS 'Extended Visual Line Of Sight' or even BVLOS 'Beyond Visual Line Of Sight' piloting, this technique allows for digitization of "complex" areas where it is preferable

to avoid the presence of operators in the scene and, if anything, to consider their presence only close to it.
In the field of photogrammetry, then, particularly useful for contexts connoted by difficulties of access with large instrumentation due to the presence of physical barriers or difficult socio-cultural situations from the point of view of security, is the use of panoramic cameras i.e., spherical photogrammetry. Being low-cost, handy, and portable instruments, this type of photographic sensors lends itself well to surveying complexes, such as abandoned industrial complexes, where it is often difficult to access some environments with bulky instrumentation due to collapses or haunting vegetation, or where the presence of individuals squatting in the spaces compromises the safety of the operators. In this sense, in recent years several studies have been conducted on the validity of applying panoramic imagery and/or video for survey declined at different scales, from urban to architectural to archaeological complexes (Abate et al., 2017; Barazzetti et al., 2022; Cera & Campi, 2022; Herban et al., 2022; Mandelli et al. 2017; Zhao, 2021). Undoubtedly, great impulse in this direction is provided by a mixture of factors: (i) the availability on the market of high-resolution but low-cost panoramic cameras such as Matterport, Insta, GoPro; (ii) the marketing of SfM-type 'Structure from Motion' software for 3D modeling such as Agisoft Metashape, Pix4Dmapper, 3DFZephyr, which can easily support various models of spherical cameras without requiring prior calibration; (ii) the development and sale of extremely simple and friendly smart phone and web applications, e.g., Matterport Capture, which, starting from photographic shots taken with spherical cameras or with one's own cell phone, are able through Artificial Intelligence algorithms, to align and combine such photographic shots by processing a 3D model in the form of a textured mesh (Ingnam et al. , 2020; Shults et al., 2019).
Certainly, as is well known, the accuracy and precision achievable with passive-type optical sensors remain slightly lower than those achievable with active-type optical sensors. The use of range-based techniques for

surveying abandoned production contexts is, clearly, possible and not to be ruled out, although it must confront the limitations of accessibility discussed so far. In this framework, it is possible to state that the most appropriate instrumentation for the digitization of poorly accessible sites is the dynamic type, i.e., LIDAR 'Light Detection and Ranging' sensors that, integrated with SLAM 'Simultaneous localization and mapping' algorithms, are capable of discretizing the space being investigated in the form of a point cloud which, in real time, is determined during the movement (e.g., a walk) of the operator (Bailey & Durrant-Whyte, 2006; Di Stefano et al., 2021; Karam et al., 2019). The main advantage of a SLAM survey lies in the significant contraction of acquisition time, which is extremely useful in the case of very large areas and/or located in scenarios of difficult permanence such as for industrial archaeology. The speed of data collection operations is extremely balanced and commensurate with the accuracy of the recorded information therefore, if the survey understood as a campaign phase is characterized by a speed of execution, the quality of the collected data remains high and aligned with that of active sensors employed in static mode, such as the classic TLS 'Terrestrial Laser Scanner'. The latter, while remaining to date the most accurate tool capable of collecting precise information, proves difficult to employ in complex scenarios such as those specifying decommissioned industrial buildings, both because of the bulkiness of the instrumentation and the stationary mode of acquisitions, which is not very compatible with the precariousness, social and environmental, of the sites under consideration.
An interesting advance in the field of dynamic range-based sensor acquisition is represented by some experiments on the use of robots for architectural surveying, now increasingly popular thanks to the commercialization of agents such as Boston Dynamics' Spot (Fig. 4). These are applications in which, instead of terrestrial 3D laser scanners, mobile LiDAR and photogrammetric images acquired from unmanned aerial vehicles, autonomous robotic agents, almost always biomimetic and

quadrupedal, are used, on which ad hoc sensors, such as LIDARs and cameras, are installed, associated with simultaneous mapping algorithms. Therefore, these autonomous robotic agents are capable of performing the 3D reality modeling process with a systematic and repeatable approach, replacing the physical operator, whose presence is therefore superseded. Based on these considerations, the application potential of mobile robots in architecture and, specifically, in those scenarios in which it is not possible for the surveyor to be present at the scene due to safety issues becomes evident. If, in fact, mobile robots were initially used in difficult situations, such as environmental inspections, home maintenance, forestry and agriculture, and the exploration of inaccessible terrain such as volcano craters; today, another innovative application may be in the analysis and survey of architecture that requires mobile robots to perform difficult tasks in environments with limited human supervision (Cigola et al., 2017; Giakoumidis & Anagnostopoulos, 2024).

Fig. 4. Use for three-dimensional surveying of Boston Dynamics' "Spot" robot employed by Foster + Partners (source: https://www.dezeen.com/2020/11/13/foster-partners-adopts-spot-the-boston-dynamics-robot-dog/).

A final consideration in reference to the possibility of acquiring three-dimensional data by limiting the human presence on site is related to the wide dissemination and availability of open data that, properly processed in appropriate software, return digital models of selected areas (Borisov et al., 2022; La Russa, 2023). One example is the Autodesk Infraworks software, one of several solutions available today for 3D City Modelling, capable through its Model Builder, of reconstructing digital models from the import of a body of information available in open source (Fig. 5). Specifically, the open databases that are exploitable for this purpose are (i) for terrain orography, SRTMGL1, Nasa's Shuttle Radar Topography Mission; (ii) for buildings, highway, and railway, OpenStreetMap; and (iii) for raster imagery applied to DEM, Microsoft Bing Maps satellite imagery (Badenko et al., 2019; Campi et al., 2022).
Similarly, it is now possible to directly employ the three-dimensional data embedded in Google Earth by exploiting a frame debugger such

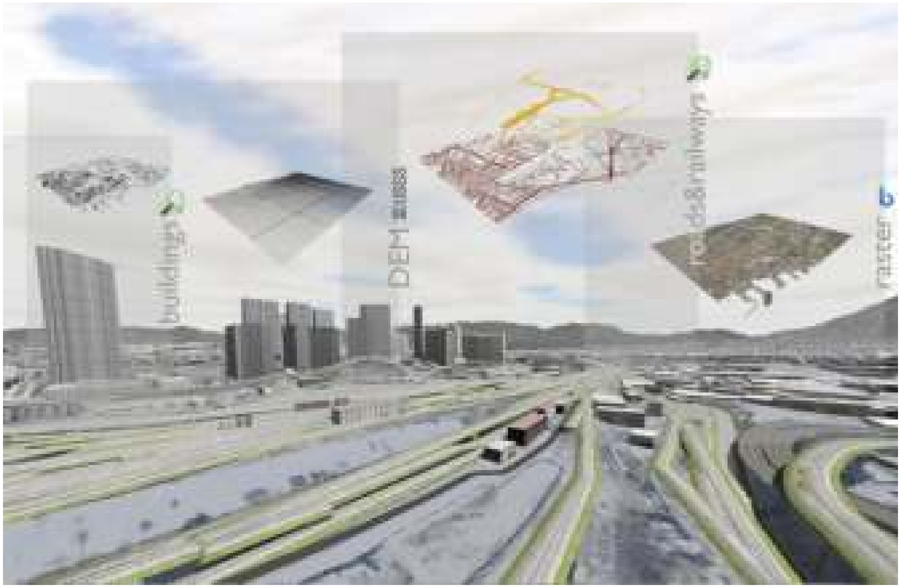


Fig. 5. Example of open data that can be used to produce a digital model in Autodesk Infraworks (image by the author).

as, for example, RenderDoc developed by MIT. Frames captured via the debugger in Google Earth, can be recomposed in Blender software via a special add-on, into a textured polygonal model, to which geographic coordinates similarly obtained from the Google database can also be associated (Stendardo et al., 2022).
In accordance with what has been discussed so far, it is possible to conclude that the issue of the survey of disused industrial sites represents a neuralgic point in the process of knowledge and analysis aimed at the formulation of protection, recovery, and preservation actions. Undoubtedly, the instrumental solutions and methodological processes formulated today make it possible to approach the digitization of these, often inaccessible, contexts with a possible and variously declined data collection project, depending on the type and level of accessibility. It is understood that the discriminating factor will be the level of accuracy and precision of the information recorded which, no less, responds regardless fully to that action of cataloging and census that since the historical definition of "industrial archaeology" has connoted and distinguished the new discipline.

Notes

[1] *Archeologia Industriale. Atti del convegno internazionale di studi*, Milano 24-26 giugno 1977, Milano, Clup, 1978.

[2] https://www.aipaipatrimonioindustriale.com/. L'AIPAI ebbe i suoi prodromi nella SIAI fondata da Eugenio Battisti con sede a Milano, a cui confluì anche l'Associazione per l'Archeologia Industriale Centro di documentazione e ricerca per il Mezzogiorno, nata nello stesso anno ma con sede a Napoli.

[3] http://www.cilac.com/le-cilac-l-association/qui-sommes-nous.html.

[4] https://www.patrimoineindustriel.ch/.

[5] http://www.aqpi.qc.ca/.

[6] http://www.sim.se/about-SIM.

[7] http://www.museudaindustriatextil.org/appi/links.php.

[8] http://www.e-faith.org/.

[9] https://erih.net/.

[10] https://ticcih.org/.

References

Abate, D., Toschi, I., Sturdy-Colls, C., & Remondino, F. (2017). A low-cost panoramic camera for the 3d documentation of contaminated crime scenes. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences,* Vol. XLII-2/W8, pp. 1-8.

Astrella, C. I. Industrial Archaeology. A Historical Outline. Compasses C38. <https://compassesworld.com/premium-lunghi/industrial-archaeology-a-historical-outline/> (accessed 30 April 2024).

Badenko, V., Zotov, D., Muromtseva, N., Volkova, Y., & Chernov, P. (2019). Comparison of software for Airborne Laser Scanning data processing in Smart City applications. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. XLII-5/W2, pp. 9-13.

Baggio, P. M. (2014). *Dall'archeologia industriale al turismo industriale. Il caso dell'alto vicentino*. Bachelor's thesis in Sviluppo interculturale dei sistemi turistici. Supervisor Prof. F. Cavallo. University Ca' Foscari Venezia (Italy).

Bailey, T., & Durrant-Whyte, H. (2006). Simultaneous localization and mapping (slam): Part ii. In *IEEE robotics & automation magazine*, Vol. 13, No. 3, pp. 108-17.

Barazzetti, L., Previtali, M., & Ronconi, F. (2022). 3D modeling with 5K 360° videos. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. XLVI-2/W1-2022, pp. 65-71.

Barba, S., Barbarella, M., Di Benedetto, A., Fiani, M., Gujski, L., & Limongiello, M. (2019). Accuracy Assessment of 3D Photogrammetric Models from an Unmanned Aerial Vehicle. In *Drones*, Vol. 3, No. 4, p. 79.

Borisov, M., Radulović, V., Ilić, Z., Petrović, V.M., & Rakićević, N. (2022). An Automated Process of Creating 3D City Model for Monitoring Urban Infrastructures. In J*ournal of Geographical Research*, Vol. 5, No. 2, pp. 1-11.

Borsi, F. (1978). *Introduzione all'archeologia industriale*. Roma: Officina.

Buchanan, A. (1972). *Industrial Archaeology in Britain*. London: Penguin Books Ltd.

Calisi, D., Botta, S., & Cannata, A. (2023). Integrated Surveying, from Laser Scanning to UAV Systems, for Detailed Documentation of Architectural and Archeological Heritage. In *Drones*, Vol. 7, No. 9, p. 568.

Campi, M., Cera, V., Falcone, M., & Ferrara, M. (2022). La rappresentazione del territorio peri-urbano tra city modelling, rilievo e fotografia. In C. Battini, E. Bistagnino (Eds). *Dialoghi. Visioni e visualità. Testimoniare Comunicare Sperimentare*. Atti del 43° Convegno Internazionale dei Docenti delle Discipline della Rappresentazione, pp. 2165-2185. Milano: Franco Angeli.

Cera, V., & Campi, M. (2022). Fast survey procedures in urban scenarios: some tests with 360° camera. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. XLVIII-2/W1-2022, pp. 45-50.

Cerato, S. (2015). *Il progetto urbano secondo un approccio multidisciplinare: analisi e rifunzionalizzazione dell'area di un manufatto industriale lungo la Riviera del Brenta*. Bachelor's thesis. Supervisor Prof. A. Giordano, co-supervisors Proff. S. Zaggia, L. Stendardo. University of Padua (Italy).

Cigola, M., Gallozzi, A., Senatore, L. J., & Di Maccio, R. (2017). The HeritageBot Project. Putting Robotics into Survey. In M. Ceccarelli, M. Cigola, G. Recinto (Eds.). *New Activities for Cultural Heritage*, pp. 113-121. Springer International Publishing.

Cossons, N. (1965). *The BP book of Industrial Archaeology*. Newton Abbot: David & Charles.

Covino, R. (1980). Archeologia industriale in Italia: ambito disciplinare, termini cronologici. In *Quaderni Storici*, Vol. XV.

Di Stefano, F., Torresani, A., Farella, E. M., Pierdicca, R., Menna, F., & Remondino, F. (2021). 3D surveying of underground built heritage: Opportunities and challenges of mobile technologies. In *Sustainability*, Vol. 13, No. 23, p. 13289.

Donnachie, I. L. (1969). Aids to recording (I). The classification of industrial monuments. In *The Journal of the Industrial Archaeology*, Vol. 6, No. 1, p. 52.

Fontana, G. L. (1985). *Schio e Alessandro Rossi: politica, cultura e paesaggi sociali del secondo Ottocento*. Roma: Edizioni di Storia e Lettaratura.

Giakoumidis, N., & Anagnostopoulos, C. (2024). Autonomous Reality Modelling for Cultural Heritage Sites employing cooperative quadrupedal robots and unmanned aerial vehicles. In *ArXiv*, abs/2402.12794.

Green, E. R.R. (1963). *The Industrial Archaeology of County Down*. London: Belfast H.M. Stationery Office.

Herban, S., Costantino, D., Alfio, V. S., &Pepe, M., (2022). Use of Low-Cost Spherical

Cameras for the Digitisation of Cultural Heritage Structures into 3D Point Clouds. In *Journal of Imaging*, Vol. 8, No. 1, p. 13.

Hudson, K. (1963). *Industrial Archaeology, an introduction*. London: Routledge.

Ingman, M., Virtanen, J.-P., Vaaja, M.T., & Hyyppä, H. (2020). A comparison of Low-Cost sensor systems in automatic cloud-based indoor 3D Modeling. In *Remote Sensing,* No. 12, p. 2624.

Karam, S., Vosselman, G., Peter, M., Hosseinyalamdary, S., & Lehtola, V. (2019). Design, calibration, and evaluation of a backpack indoor mobile mapping system. In *Remote sensing*, Vol. 11, No. 8, p. 905.

La Russa, F. M. (2023). A Proposal for a Parametric 3D City Model Semantic Format. In *Nexus Netw J,* No. 25 (Suppl 1), pp. 481-489.

Mainini, G., Rosa, G., & Sajeva, A. (1981). *Archeologia industriale*. Firenze: La Nuova Italia.

Mandelli, A., Fassi, F., Perfetti, L., & Polari, C. (2017). Testing different survey techniques to model architectonic narrow spaces. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. XLII-2/W5, pp. 505-511.

Mishra, A., Kumar Agnihotri, A., Pipil, S., Gaur, S., & Ohri, A. (2024). Surveying techniques for urban areas. In A. Kumar, P. K. Srivastava, P. Saikia, R. Kumar Mall (Eds). *Earth Observation in Urban Monitoring: Techniques and Challenges*, pp. 69-91. Elsevier.

Nandakishore, S. S., & Kumar, A. (2024). Advanced Application of Unmanned Aerial Vehicle (UAV) for Rapid Surveying and Mapping: A Case Study from Maharashtra, India. In S. Ghosh, M. Kumari, V. N. Mishra (Eds). *Geospatial Technology to Support Communities and Policy. Geotechnologies and the Environment*, Vol 26, pp. 185-202. Springer, Cham.

Nesti, A. (2005). L' archeologia industriale in Italia tra storia dell'architettura e storia economica. In *Storia Economica*, Vol. VIII, No. 1, pp. 247-257.

Raisthick, A. (1973). *Industrial Archeaology. An Historical Survey*. Frogmore: Paladin.

Rix, M. (1967). *Industrial Archaeology*. London: Historical Association.

Rubino, G. E. (1978). *Archeologia industriale e Mezzogiorno. Problemi di architettura degli impianti, tecnologia, società*. Roma: Giuditta Editore.

Saleri, R., Cappellini, V., Nony, N., De Luca, L., Pierrot-Deseilligny, M., Bardiere, E., & Campi, M. (2013). UAV photogrammetry for archaeological survey: The Theaters area of Pompeii. In *Digital Heritage International Congress (DigitalHeritage)*. Conference proceedings. Marseille, France, 28 October - 1 November 2013, Vol. 2, pp. 497-502. Institute of Electrical and Electronics Engineers.

Stendardo, L., Spera, R., Campi, M., Cera, V., & di Luggo, A. (2022). Urban design strategies for the upcycling of urban infrastructure residual pockets: 3D City Modelling from Open Data and low-cost rapid mapping tools. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. XLVIII-3/W2-2022, pp. 59-65.

Shults, R., Levin, E., Habibi, R., Shenoy, S., Honcheruk, O., Hart, T., & An, Z. (2019). Capability of matterport 3d camera for industrial archaeology sites inventory. In *The International Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. 42(2/W11), pp. 1059-1064.

Six, Y., Barreau, J.-B., & Giligny, F. (2024). 3D modeling, surveys and reconstruction of the Varenne forges. In *Digital Applications in Archaeology and Cultural Heritage*, Vol. 32, p. e00306.

Tognarini, I. (1980). L'archeologia industriale 'édifice encore naissante': alcuni contribuiti francesi. In *Ricerche Storiche*, Vol. X.

Zhao, C. (2021). *Creating point clouds, textured meshed models and orthophotos with Weiss AG Civetta - 230 megapixels 360°HDR camera*. <https://docplayer.net/209971609-Civetta-agisoft-metashape.html> (accessed 30 April 2024).

Industrial Heritage.
A methodology for digital photogrammetry and digital survey

David Marcos Gonzales, Víctor Lafuente Sanchez

Introduction

Industrial heritage is a vital testimony to the era of industrial exploitation, encompassing a wide range of immovable, movable and intangible assets. These include sawmills, fulling mills, wineries, lime kilns, shearing mills, forges and racks, wine presses, wool washers, fishing factories, weavers, optical telegraphs, plastering plants, mills, water mills, flour factories, tanning factories, blacksmith shops, or even homes and the social infrastructure related to those industries (del Pozo et al., 2008). In Spain, the recognition and conservation of this heritage began to take shape in the 1980s, culminating in the creation of the National Industrial Heritage Plan between 2001 and 2002. This plan focuses on cataloguing, protecting, and promoting these assets, although currently in Spain there are a large number that still stand to be studied and consolidated.

Industrial heritage can play a crucial role in promoting sustainability, as highlighted in the United Nations, Sustainable Development Goals, where the importance of sustainable cities and communities is emphasized [1]. The adaptive reuse of historic industrial structures, for example, can offer innovative solutions for housing, commerce, and public spaces, contributing to urban resilience and sustainable development. In this sense, projects such as the San Antonio flour factory in Medina de Rioseco, the steel museum in Sabero, the Olivares' mills in Zamora or the rehabilitation of silos in Spain (Fig. 1) are examples of how industrial heritage can be transformed and reintegrated into the contemporary

Fig. 1. From left to right: San Antonio flour factory in Medina de Rioseco (Valladolid); Sabero steel industry museum (León); Olivares mills (Zamora (images: Architectural Photogrammetry Laboratory, Valladolid).

fabric of cities, maintaining its historical essence while adapting to new functions. The importance of safeguarding this heritage goes beyond mere conservation; it is a matter of recognizing and valuing the heritage received from the industrial age and understanding how it has shaped contemporary society.

Architectural restoration is a discipline that combines art, science and history, and is essential to preserve the cultural legacy of our society. Before intervening in a historic building, it is essential to carry out exhaustive research that includes the study of ancient documents, structural analyzes and evaluations of its state of conservation. This process allows restorers to understand not only the building's physical history and original construction techniques, but also previous interventions and their impact on current structural integrity. With all this knowledge, professionals can plan a respectful intervention that preserves the essence of the heritage, while ensuring its safety and functionality for future generations. Careful and knowledgeable restoration ensures that historic buildings remain living witnesses to our past, while remaining an active part of the present community.

This is what Luis Cervera Vera (1984) was referring to in his work with the term anatomy of the building where the collection of data from the building and its critical analysis allowed him to break down the construction stages and the elements that were part of an architecture in each moment, synthesizing the result in graphic representations of the different formal configurations, which reflected a return in time, eliminating successive additions over the course of the building's life. A thorough understanding of this architectural heritage requires comprehensive documentation covering both the building and its surroundings.

To achieve this, advanced 3D digitization tools will be used, such as photogrammetry (terrestrial and aerial) and laser scanning, which allow physical reality to be captured with extraordinary precision and detail. Photogrammetry uses photographic images to create 3D models, taking advantage of the parallax between photos taken from different points of view. On the other hand, laser scanning is based on the emission of a beam of light that, when incident on surfaces, allows distances to be measured and thus generates an accurate three-dimensional point cloud representation of the scanned object.

These techniques not only facilitate heritage conservation, but also provide a solid basis for any future interventions, allowing experts to analyze and plan with a complete view of the current state of the cultural property. Furthermore, 3D digitization opens the door to the possibility of sharing this heritage with the world, either through immersive experiences in virtual reality or by reproducing exact replicas with 3D printing.

With the implementation of these technologies, it is ensured that the historical and cultural richness of the buildings is not only preserved, but also enhanced and made accessible for future generations. The accuracy and richness of data these tools provide are critical to fully understanding the magnitude and importance of heritage sites, ensuring that every detail, from the texture of materials to the subtleties of architecture, is accurately captured and documented in the greatest possible fidelity.

Documentation Methodology

To the data collecting, the use of two tools is proposed that can be used independently or can be combined, resulting in a much more complete model; these are the laser scanner and photogrammetry. In both cases, the result will be a digital twin of the real object that will accurately show the geometric and colour state at the time of being documented.

Fig. 2. 3D visualization of a single point cloud obtained using a laser scanner from the Santa María del Páramo tanning factory (León) (image: Architectural Photogrammetry Laboratory, Valladolid).

Laser scanner

A three-dimensional laser scanner is based on lidar technology, from the English acronym LiDAR [2] (*Light Detection and Ranging o Laser Imaging Detection and Ranging*); it is a device that allows to determine the distance from an object or surface to the emitter using a beam of laser pulses [3], and combined with the camera they incorporate (in the first scanners it was an external element) they also manage to capture visible range information (color).

These devices have been evolving both from a formal and functional point of view, since at the beginning they were large devices with a significant but not excessive weight, which also required the need for many auxiliary elements for their operation (external batteries, cables, computers, cameras, etc.). Today they are smaller, lighter, faster and are capable of capturing a greater number of points per second.

At the same time, they are incorporating multiple camera systems around the perimeter of the scanner housing that allow colour to be captured

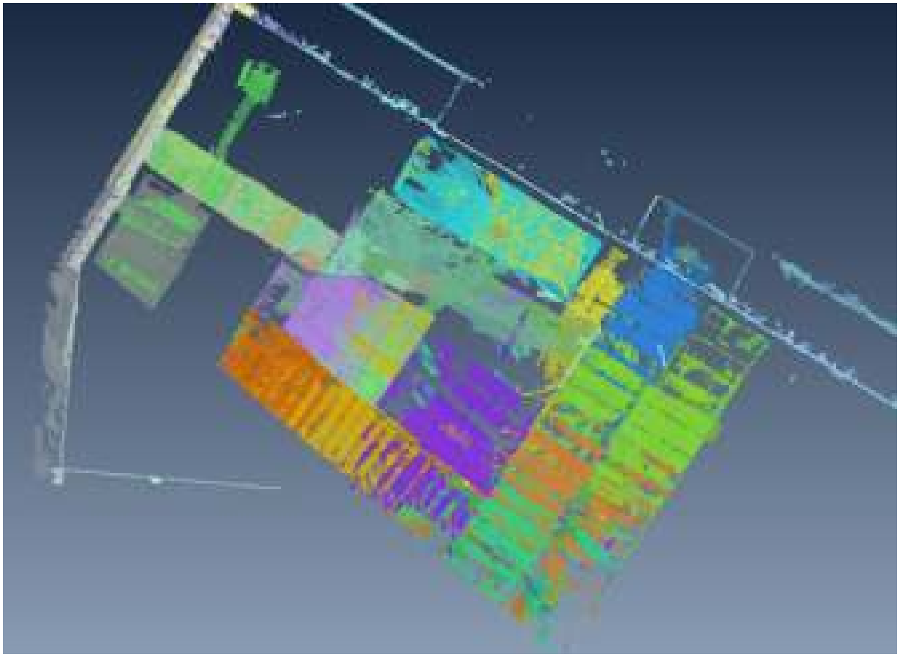


Fig. 3. Process of aligning several scans with each other to obtain a point cloud of the set. Santa María del Páramo tanning factory (León) (image: Architectural Photogrammetry Laboratory, Valladolid).

with HDR images in less time; and also, during movement between parking lots, these cameras perform continuous tracking during the data collection process, which allows them to automatically pre-register the scans.

They are devices that contain extensive measurement technology, positioning, inertial systems, etc., inside. The distance to the object is determined by measuring the time elapsed between the emission of the pulse and its reception through the reflected signal. With the measurement made on the object or surface, it is able to capture the geometry and color with millimeter precision. To do this, it performs a laser scan of the building or object that we are studying, obtaining a metric point cloud of the geometry (Fig. 2). This point cloud [4] is raw, that is, the data capture is not selective, but rather it is a massive data collection in which it does not discriminate any of the points; it captures information about

Fig. 4. Process of obtaining detailed documentation from a point cloud model. San Antonio flour factory in Medina de Rioseco (Valladolid) (image: Architectural Photogrammetry Laboratory, Valladolid).

everything in the device's environment. This classification or selection of points is something that the technician will have to do later, when evaluating the data and performing the registration or alignment between the different scans (Fig. 3).

In short, the laser scanner has great potential, allowing all objects or surfaces surrounding the device to be recorded in a limited radius in a matter of minutes and without the need for contact with the measured objects.

The data obtained from the scanner is a collection of points oriented with reference to a system centered on the origin of the scanner's coordinates, information to which is eventually also added the color of the object, or even some other data related to its physical aspects.

The documentation obtained by the scanner provides the generation of three-dimensional full-scale point cloud models of the building object of the survey which, after subsequent processing, will lead us to generate sufficient documentation (Fig. 4) for the evaluation of the building.

Laser scanners, due to the way they are positioned when performing scans, can be divided into two categories: static and dynamic.

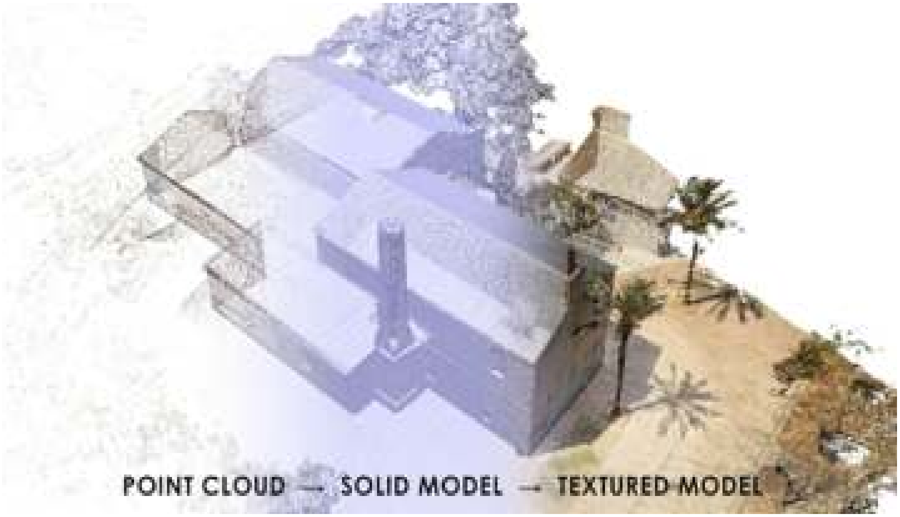
- Static are those scanners that remain in a fixed position during data collection; it is the most used method when performing terrestrial scans. The advantage of this method is its high precision.
- Dynamic are those scanners that are mounted on a mobile platform,

such as a vehicle, train, ship, plane, unmanned aerial platforms or personal backpacks; these systems are also known as Mobile Mapping. Because the device is constantly moving, these systems require other additional positioning devices such as Inertial Navigation Systems (INS) or Global Positioning Systems (GPS), which makes the complete system more expensive and complex.

The most important advantages of using a laser scanner in survey and documentation projects are:

- Medidas. 3D scanning is a technological revolution in the field of measurement and modelling. It allows to capture the physical form of objects and spaces with millimetre precision, transforming them into detailed digital models. This technology is invaluable to architects, engineers, and construction professionals as it makes it easier to detect discrepancies between the planned design and the current structure, thus optimizing the construction and maintenance process (Vacca et al., 2016).
- Security. 3D scanners have revolutionized the way measurements can be obtained from dangerous or hard-to-reach spaces. These devices, thanks to their ability to take data remotely, allow operators to perform complete and fast measurements without compromising their safety. This technology is especially valuable in industries such as mining, construction, and archaeology, where on-site risks can be significant. By using 3D scanners, not only personnel safety is improved, but also the efficiency and accuracy of the data collected, allowing for better planning and decision-making based on detailed and reliable information (Marcos et al., 2016).
- Non intrusive (Garcia Fernandez et al., 2013). To collect data, it is not necessary to make stops of operators or works, nor does it interfere with the work times. Furthermore, as it is a device that works remotely, it is not necessary to get into a space as long as it is possible to do so from a certain distance. An example of this could be an archaeological excavation, in which we can make measurements from the perimeter without having to enter the archaeological tastings.
- Project in the office. By obtaining a complete model of the object/

Fig. 5. Phases of the process of generating a three-dimensional model using photogrammetry. Alfonso's oil mill in Valencia (image: Architectural Photogrammetry Laboratory, Valladolid).



building with all the geometry true to reality, we can consult the model and extract any information or measurements at any time.

- Generation of BIM modelling or faster plans. When performing scans, all the information from reality is taken to a 3D model from which the current state of the object can be modelled (Campi et al., 2017; Pepe et al., 2021).

Digital photogrammetry

Another digitization tool is the creation of 3D models from collections of photographs. These solid models will improve the level of detail compared to the point cloud models obtained with the laser scanner.

Computer advances have led to a return to photogrammetry, to the use of photographs to generate a virtual model. Although now we are not talking about stereoscopic pairs, but rather about a photographic "mosaic", a set of a large number of photographic images that, taken under certain conditions and positioning, allow the generation of a three-dimensional model with high photographic resolution.

- All these problems have been solved through the use of computer

processes; the fact of not having to develop the photographs on a physical support eliminates deformations to a certain extent, so that only the calibration of the deformations inherent to the camera lens is necessary.
- The inclusion of computerized processes in the restitution through filters or contour recognition has greatly facilitated the work; so that computing time has replaced the analytical process and, once this objective was achieved, it was a matter of time before the use of such strict conditions in data collection was no longer necessary.
- Despite this, for this type of 3D reconstruction programs to be able to align all the photographs with each other and generate error-free data, it is necessary to meet a series of conditions in the photographs. The positions of the photographs have to be different. If any coincide in the same position, it will introduce errors into the model and noise points. It is recommended that all photo collections have to be taken with the same orientation, landscape (horizontal) or portrait (vertical). Use the same focal length for an entire collection of photographs. All photographs must be well exposed, without very dark or burnt areas since in these areas the software will not be able to recognize points. The photographs must be well focused. A blurry photograph introduces errors into calculations. The reconstruction process of these programs is similar; what differs between them are the calculation algorithms, which makes some faster than others in generating three-dimensional models.
The first step once the images are loaded into the program is to calculate the orientation points between the photographs. It is very similar to the process that was carried out in analog restorers, in which the external orientation or position of the cameras is sought. Additionally, camera lens calibration data is calculated in this step. The result is a sparse point cloud or orientation cloud.
The second step is the calculation of the three-dimensional geometric reconstruction of the object. This is a very long process, since the software uses algorithms to calculate each of the points that define our object; what it does is analyze and match, in pairs, all the photographs and calculate all the points using depth maps. The result is a dense cloud

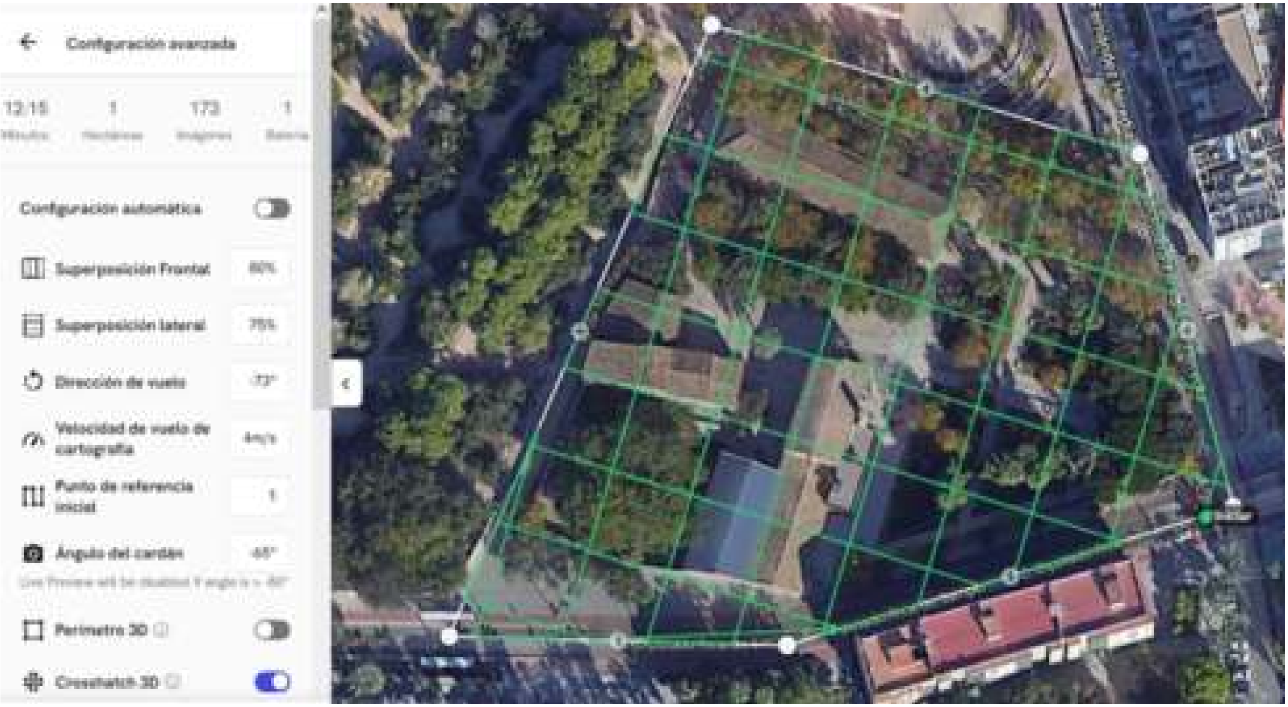


Fig. 6. Configuration window of a scheduled flight using a double grid, to obtain photographs of the Alfonso oil mill in Valencia (image: Architectural Photogrammetry Laboratory, Valladolid).

of points (Fig. 5). The next step would be the transformation of the dense point cloud into a mesh of triangles with colouring per vertex from the pixels of the photographs used in the reconstruction. Next, the mesh would be mapped or texturized from the photographs. The result obtained by processing these collections of convergent photographs is a three-dimensional mesh mapped from the photographs. These meshes allow us to obtain completely orthogonal views of the building being surveyed, providing the technician with a metric and quality drawing base. These processes can be completed through topographical support, geolocation of the survey components, or the addition of parallel survey processes that complete the model, whether three-dimensional or the two-dimensional documentation that is necessary to generate. The usefulness of having a comprehensive model of the building not only allows the preparation of semi-automatic plans, provided by the photographic ortho projections of the building's facades, but also the study of the deformations, alterations and geometry of the architecture that replaces the model. The great development that has occurred in photogrammetry, in the new digital photogrammetry, has given rise to the appearance of different modeling programs based on the registration of a collection of photographs that cover the entire volume of the building, but also of its interior. In all of them the problem to be solved is, on the one hand, to guarantee adequate overlap between the photographs taken; on the other hand, to collect all the surfaces that define the architecture of the building. Here, the problem that arises is to be able to photograph what is above our vision, what is not accessible to our camera.

The use of drones

Initially, these photogrammetric models could only be carried out at ground level or slightly elevated using expensive auxiliary means, this is what is known as terrestrial photogrammetry. But the appearance of new devices such as hot-air or captive balloons made it possible to take photographs from new, higher points of view, making it easier to document parts that until then were quite inaccessible, thus achieving 3D models with coverage of almost 100% of the documented buildings. There was only one drawback in this type of system and that was that they were uncontrollable, since the wind was what determined the movement and direction of the balloon, making the operator unable to take photographs from specific positions. For this reason, the distribution of image capture did not follow a homogeneous pattern.

This problem is today solved, in an easy and economically affordable way, with the use of photographic cameras placed on drones, more stable and controllable systems, allowing for a more precise and homogeneous distribution of image capture. The unusual views that the drone camera provides make it possible to arrange complete photographic collections of the building and, with this, the development of solid comprehensive models of high precision and definition.

Currently, capturing aerial images using drones is a process that has been simplified thanks to the development of specialized applications that allow you to create a scheduled flight (Fig. 6) by means of defining a specific area of interest by drawing a polygon on a map or satellite image. Once the study area is established, parameters are introduced such as:

- Aircraft model.
- Flight height.
- Aircraft speed.
- Longitudinal superimposition of images.
- Transverse overlay of images.
- Tilt or angle of the camera.

With automatic flight scheduling, consistent and efficient data collection is ensured, facilitating decision making based on detailed and up-to-date terrain information.

Subsequently, the integration of three-dimensional models from laser scanning and aerial photogrammetry will be necessary, a process that requires precision and attention to detail. Strategic placement of targets in the study area is essential to ensure exact alignment between the two models. These targets, distributed both on the ground and on the vertical faces of existing structures, serve as essential reference points during the data fusion process. Measuring these targets with a total station allows obtaining precise coordinates that are crucial for the calibration and spatial registration of the models. This method ensures that overlays and transitions between data captured by laser scanning and those obtained by photogrammetry are consistent and accurate, resulting in a high-fidelity composite model that can be used for various applications, such as heritage conservation, urban planning, or civil engineering. Accuracy in target placement and measurement is a critical step that should not be underestimated, as any error at this stage can propagate through the final model, affecting its quality and usefulness.

Generation of results from digital models

These digital models obtained are exact replicas of the original objects,

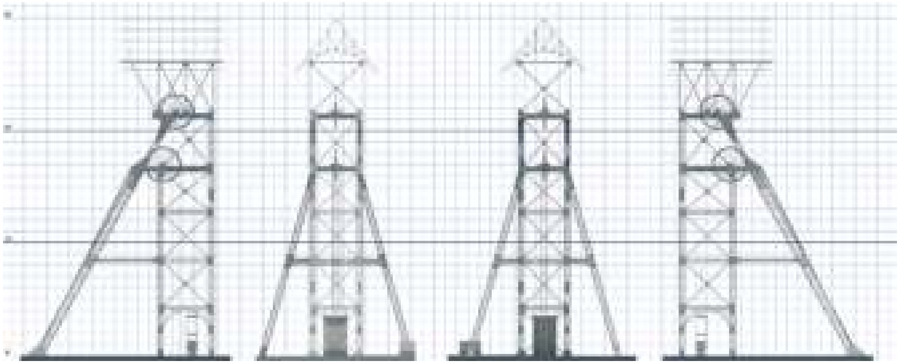


Fig. 7. Analysis of the structural elements of the tower of the Pozo Herrera I mining complex in Sabero (León) (image: Architectural Photogrammetry Laboratory, Valladolid).

containing all the geometric and colour information that is visible. The internal parts of walls or those that are hidden cannot be documented; this would require the use of other types of equipment such as georadars, X-rays, etc. to complete the documentation process.
These 3D models will allow new types of documentation to be extracted in addition to general planimetry documentation such as elevation plans and sections.
- Thematic maps, such as a damage map on facades in which all the pathologies, cracks, deteriorations and flaws are shown.
- Metric quantification; as they are exact replicas of the original documented building or object, we can measure any element at any time.
- Data verification; these models reflect with great precision the real geometry of the object, allowing the veracity of documentation prior to data collection to be verified with these tools. An example of this is checking the geometry of a building's floor plan.
- Constructive analysis; the great geometric and color precision of the 3D model allows you to study the stone pieces or the different construction elements, allowing you to analyze the different construction phases of the building.
- Structural analysis of all the elements that appear in the model, being able to study their dimensions, deformations, etc. (Fig. 7).These models have a drawback, and that is that they are the result of massive data capture

Fig. 8. Photograph of the abandoned mining complex of Pozo Herrera I in Sabero (León) (image: Architectural Photogrammetry Laboratory, Valladolid).

without discriminating anything. So, they have a lot of information, and they are files that take up a lot of space, being heavy to handle. For this reason, it will be essential to create a model with simplified geometry using computer-aided design (CAD) programs. This allows the complexity of the models to be simplified, thereby reducing file size, and improving efficiency in data processing and manipulation. Creating models with simplified geometry is a common practice in various industries, especially when it comes to handling large volumes of data. This approach not only optimizes the storage and management of computing resources, but also facilitates visualization, simulation, and analysis in real time, which is crucial in fields such as engineering or architecture, where speed and precision are fundamental. These simplified models will also allow us to make animations using virtual or augmented reality processes to explain how they work and thus understand the manufacturing process carried out in them. These animations are a valuable educational tool, providing an immersive experience that improves understanding and retention of information. Without a doubt, virtual and augmented reality are setting a new standard in training and skills development in the heritage documentation sector. An example of this could be the 3D models made of the Pozo Herrera I mining complex located in the Sabero area (Fig. 8). It began operating in 1915 and closed around 1950, being the first vertical well built in the province of León, reaching a depth of 150 m. This

Fig. 9. Simplified 3D model used to disseminate the coal extraction processes of the Sabero mining basin (León) (image: Architectural Photogrammetry Laboratory, Valladolid).

model becomes an example of dissemination to explain the operation of the coal extraction process to the surface through the machinery and the most important buildings of the complex (Fig. 9).

Conclusion

Laser scanning and photogrammetry are essential tools for capturing three-dimensional data, allowing precise and detailed measurements of objects and environments to be obtained. These technologies are crucial in heritage documentation and preservation, as they provide a solid foundation for research and conservation. The resulting digital models are valuable tools for recording and inventory, as well as for planning and executing conservation and restoration interventions. Furthermore, these models are fundamental for the dissemination of heritage, facilitating public access to digital replicas of sites and objects that may be fragile or inaccessible. The complexity of photogrammetric models reflects the richness and precision of the data captured, but also requires a simplification process for use in different applications, such as virtual reality or educational video games. This simplification process must balance model fidelity with processing efficiency and ease of use, ensuring that models are both accurate and accessible.

Notes

[1] https://www.un.org/sustainabledevelopment/es/cities/

[2] https://blogfundacion.arquia.es/2019/02/2030-el-papel-del-patrimonio-industrial-en-los-objetivos-de-desarrollo-sostenible.

[3] Term frequently used to refer to airborne laser scanning but also applied to some ground systems.

[4] Laser (acronym for Light Amplification by Simulated Emission of Radiation), is an intense beam of light that produces images with electronic pulses.

[5] Set of XYZ coordinates in a three-dimensional coordinate system. It may also include additional information, such as color and reflectivity values.

References

Campi, M., di Luggo, A., & Scandurra, S. (2017). 3D modeling for the knowledge of architectural heritage and virtual reconstruction of its historical memory. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. XLII-2/W3, pp. 133-139.

Cervera Vera, L. (1984). Iglesia de Arcas (Cuenca). In *Iglesia de Arcas (Cuenca)*. Diputación Provincial de Cuenca.

del Pozo, P., López González, A., Pascual Ruiz-Valdepeñas, H., & Calderón, B. (2008). *Territorio y patrimonio industrial en Castilla y León*. Univesidad de León, Secretariado de Publicaciones.

Garcia Fernandez, J., Socci, L., & Fernandez, J. (2013). Methodology of efficient assessment of structural deformation from non-intrusive techniques for civil heritage conservation. In *Second conference on smart monitoring, assessment and rehabilitation of civil structures*.

Marcos, D., García, L. A., San José, J. I., & Sánchez, J. I. (2016). Virtualización del patrimonio arquitectónico caído. La Torre de la Iglesia de San Esteban en Valdespina, Palencia. In Aa.Vv. (Eds.). *REHABEND 2016*, p. 339. Spain: Gráficas Iguña, S.A.

Pepe, M., Domenica, C., Alfio, V., Restuccia, A., & Papalino, N. (2021). Scan to BIM for the digital management and representation in 3D GIS environment of cultural heritage site. In *Journal of Cultural Heritage*, Vol. 50, pp. 115-125.

Vacca, G., Mistretta, F., Stochino, F., & Dessi, A. (2016). Terrestrial Laser scanner for monitoring the deformations and the damages of buildings. In *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. XLI-B5, pp. 453-460.

Study of historical cartography for a comprehensive knowledge of industrial heritage

Miguel Sancho-Mir; Beatriz Martín-Domínguez & Angélica Fernández-Morales

The transformation of productive uses resulting from the industrial revolution had important repercussions on the morphology and functioning of cities, although this process did not have the same impact everywhere, generating great differences between industrialised areas and those that remained more on the fringes of this phenomenon, between the urban and the rural.

The establishment of new industries that required large spaces took place mainly in peri-urban areas, in some cases coexisting with existing uses and in other cases displacing or amortising them, as tanneries, mills and potteries had already coexisted with agricultural and forestry operations in these areas.

The growth and structural expansion of cities during the nineteenth century and more markedly in the twentieth century meant that, in many cases, industries that were born practically isolated were absorbed into the fabric of the city, which radically changed their immediate context, which, moreover, have suffered the abandonment of production and currently, the factories of the first industrialisation that are still active are scarce (Biel, 2016, p. 161). This transformation of the environment, the relationship of these buildings with a new urban reality is a process that has characterised a large part of Industrial Heritage and has made it particularly sensitive, as it has suffered real estate pressure in such a way that many of these complexes have been victims of speculation and have been demolished, a phenomenon that we continue to suffer in our cities

Fig. 1. Evolution of the surroundings of the Parellada tile factory in Zaragoza between 1869 and 1908 (GRAPHyC with cartographies from: Geographic Documentation Service and Library of the National Geographic Institute (IGN) (Spain)).

and that in the case of Zaragoza, the recent demolition of a large part of the Averly Foundry is a good example of this.

Fortunately, a greater awareness of the values of industrial heritage and its potential for new uses has led to many of these buildings being preserved and reconverted, mainly as new spaces for leisure and culture. But this trend is not without its dangers, since, as Professor Pilar Biel points out (Biel, 2016, p. 176): "In a large number of cases, this accommodation is carried out on protected buildings where legal protection has not been a limit or an obstacle to prevent their emptying, the elimination of their structure or the amputation of part of their elements. These intervention criteria are not questioned, and the relevance of their use is not subject to criticism, even though the buildings on which intervention is carried out belong to the cultural heritage of society. In short, industrial heritage is subjected to a trivialisation typical of the post-industrial society that leads citizens to lose awareness of the importance of the history of work, a key stage without which it would have been impossible to reach the current situation".

This reflection reaffirms the needs of architectural and urban heritage in terms of the protection of its values, with instruments such as the correct cataloguing, the necessary enhancement, through research, dissemination and, if necessary, intervention, and always together with preventive conservation.

In the face of changing theories on the conservation of architectural and urban heritage, one approach is irrefutable: the need for a comprehensive knowledge of it in order to identify its values and be able to protect them. To this end, the architectural survey is an indispensable step, which, together with a study of the different existing sources, can reconstruct as accurately as possible the life of the building: its different construction phases, the material, functional and stylistic characteristics in relation to the period in which they were built. But, furthermore, a heritage asset should not be understood as an isolated element, as it is largely a consequence of the environment in which it is located and this also evolves, changes over time, and these changes affect its image, the way it is perceived from the outside, and also its function, the way it is used, which is why it should be studied as an indissoluble whole. In this sense, studies on the evolution of the landscape and urban morphology are essential.

Cartography, by its very nature and purpose, is presented as the main source of information on the evolution of urban form, which is why the study of historical cartography is established as an essential stage for a comprehensive knowledge of architectural and urban heritage. The aim of this text is precisely to explain a methodology for analysing cartographic and aerial photographic documentation with technical rigour for the study of the historical image of the city or territory.

The proposed procedure proposes the coordination of cartography based on the georeferencing or georectification of previously digitised historical planimetries and their subsequent vector restitution, resulting in what we call a historiographic cartography, as they have been prepared with the aim of studying history, in this case architectural and urban heritage through the critical analysis of the sources.

A prior search, study and selection of the existing cartography must be carried out, taking into account its chronology, relevant data provided, definition and the evolution of the field of study itself. In the search for historical cartographies, it is necessary to search the different public and private archives at municipal, regional, national, or international level, as

Fig. 2. Some maps of Naples in the 19th century (GRAPHyC with cartographies from: Utrecht University Library, Harvard University Library and SDUK).

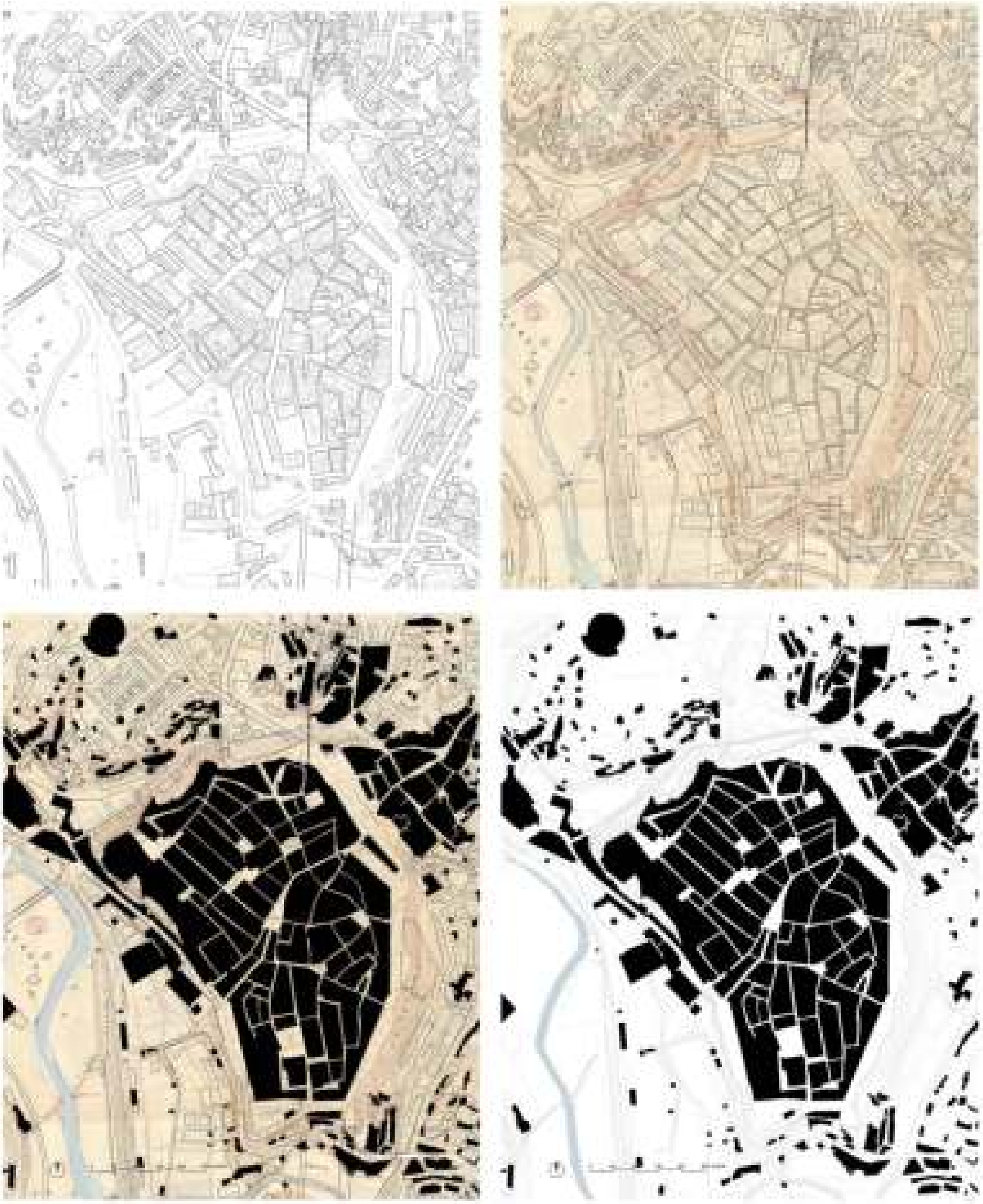
well as the geoportals of spatial data infrastructures that facilitate the dissemination of geographic information.

Cartographic coordination is a "verification of relationships between cartographies from different periods, taking as support points the permanencies or invariants that ensure comparison throughout the sequence studied" (Cordovez, 2008, p. 68). This is an inverse process, in which work begins with the most recent cartography, which is more precise, and gradually advances to the oldest, thus making it possible to evaluate and correct a large part of the errors derived from cartographic inaccuracies.

It is very important to have a base cartography of proven rigour, as the precision of the procedure is based, to a large extent, on this geometry. For this purpose, it is preferable to make use of the various official institutions that must ensure the quality and traceability of the geographic information supplied, and to study and store the metadata associated with it. If an official cartographic base is not available, other open access sources can be used, such as the geographic information of the OpenStreetMap (OSM) collaborative project, but in this case, although the current greater availability of aerial photographs and the use of other commercial and public data sources have allowed for greater accuracy, it is necessary to be aware of their degree of reliability.

Likewise, it is necessary to assess that the scale of the base cartography is appropriate to the scale of the historical cartography studied, since the cartographies made for small scales, designed to define a wide area of territory, usually have less detail derived from the process of simplification of the geometry represented, known as generalisation. Another fundamental aspect is the control of the datum used, which provides a valid reference frame. It is advisable to use the official geodetic reference system of the place of study, which should be the one used in the base cartography, in the case of Spain (ETRS89). In this case, the cartography must be georeferenced in this system in UTM projection, as well as the new cartography generated. This facilitates the interoperability and comparative study of cartographies with the required accuracy.

To carry out the coordination, the cartography is georeferenced or georectified, as appropriate, and, after comparative analysis, the resulting map of the corresponding period is restored in vector format. This mapping serves as the basis for the following coordination and planimetric



restitution, in this way always working on a reliable basis, thus reducing the accumulated cartographic error to a minimum.

Georeferencing is the process in which a map is assigned a metric reference relative to a global coordinate system or its equivalent cartographic projection system (Balleti, 2006, p. 34).

This must start with the previous work of preparing the cartographic material, which consists of the rasterisation of the plans through contact scanners or other photogrammetric procedures (Ballarin et al., 2015;

Fig. 3. Vector restitution process of the 1912 plan by georeferencing it (order from right to left and from top to bottom) (image: GRAPHyC).

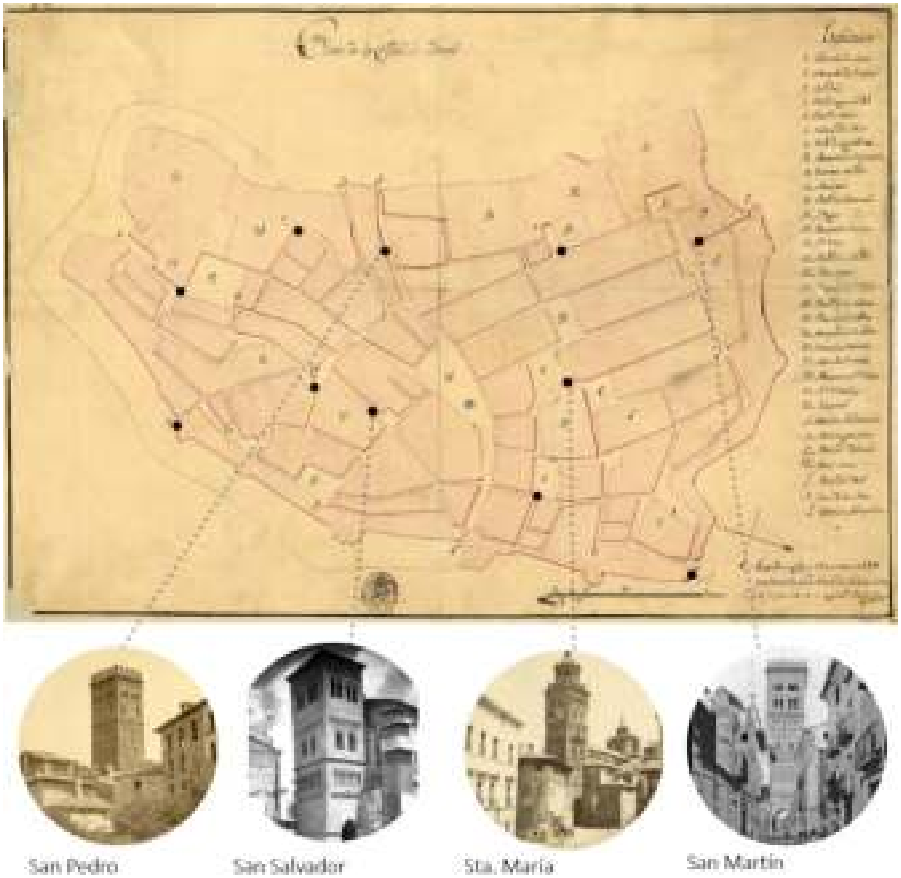


Fig. 4. Selected invariant points for the georeferencing of the map of the city of Teruel copied in 1811, including buildings such as the four Mudejar towers, which are a World Heritage Site (image: GRAPHyC).

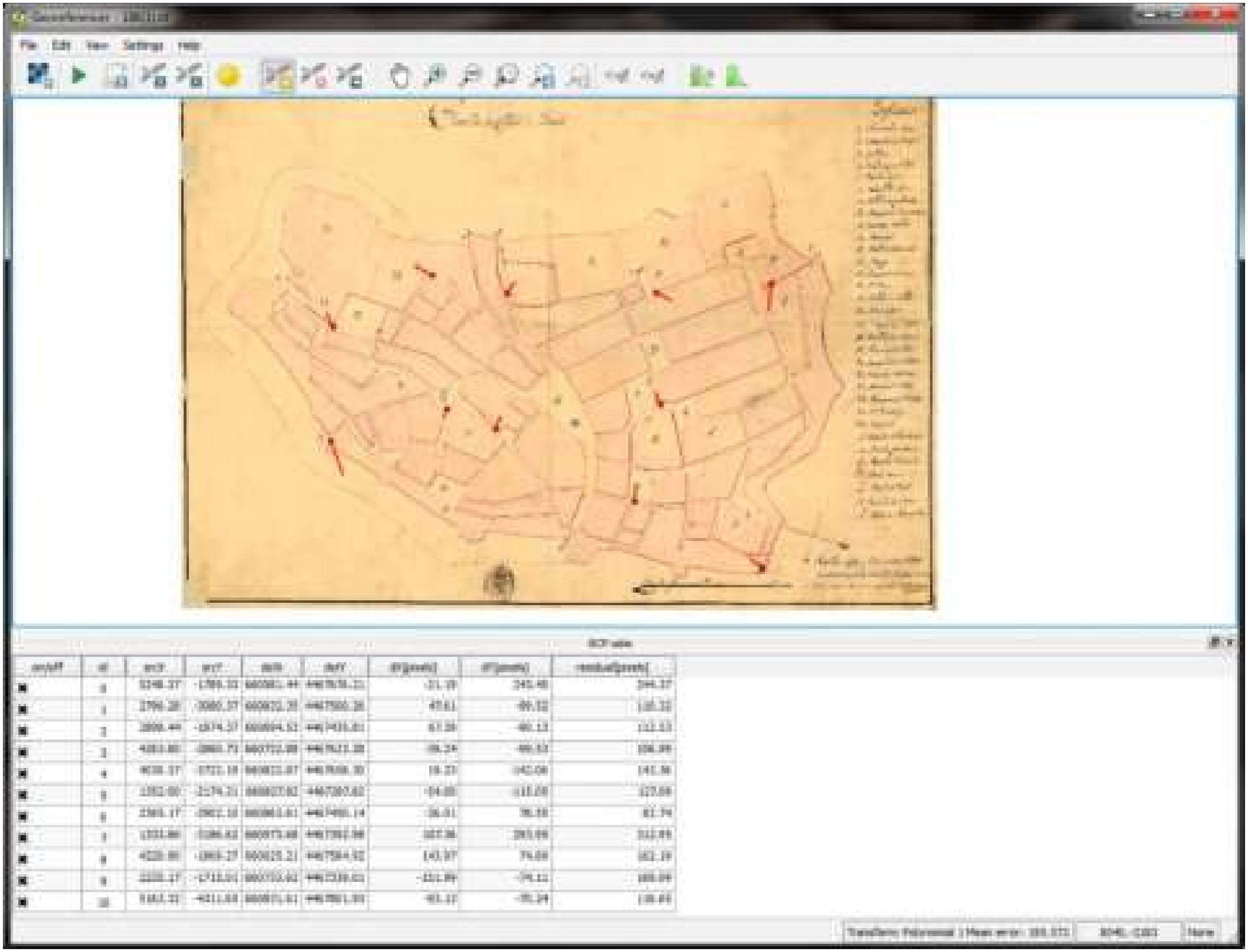


Fig. 5. Residual value, graphic and numerical, of the control points of the map of the city of Teruel copied in 1811 (image: GRAPHyC).

Ballarin & Vernier, 2014). The digitisation of cartographic material must be a methodical process in which all possible information associated with the treated element is recorded in a database (Chías & Abad, 2008).

Once the cartographic material has been digitised, the colour, brightness and contrast levels can be readjusted, if necessary, due to the tonal distortion that can be produced by scanning (Cid, 2014). After this first preparatory phase, the next step consists of identifying common points of the reference plane with the plane to be georeferenced, these are the so-called invariant points or control points, and the most suitable are points conveniently distributed and easily recognisable on the plane, belonging to constructed buildings that have not undergone modifications over time that affect their footprint on the plane (Baiocchi & Lelo, 2005, p.115), so this process requires sufficient knowledge of the area of study. In short, it is a matter of assigning coordinates to certain points on a map in a previously established system, an assignment that is carried out in a Geographic Information System, which also allows control of the existing error in the cartography. To do this, a transformation is applied with an algorithm that performs the rotation, scale and translation of the raster, without deformation, and the software calculates in pixels the residual values of each control point, graphically and numerically, and the average residual value. Having the original size of the document and its scale, the error in the metric system can be obtained.

Once the accuracy of the map has been checked, a georeferenced raster file is generated and can be inserted with the reference cartography. In the event that the cartographic quality of the map is not sufficient, which is usually the case with historical cartographies, the process must be redone, applying a transformation with an algorithm that allows a global deformation of the raster, in order to achieve a better adjustment to the reference plane; in this case it would be a georectification and a greater number of reference points is necessary, which will depend on the algorithm used. If with this procedure the adjustment is not acceptable, it would be necessary to resort to a transformation with an algorithm that allows local deformations, suitable for cartographies with low topographic precision.

The proposed methodology uses QGIS, a free and open-source cross-platform geographic information system with a georeferencing tool that allows the georectification of rasters [1]. This tool allows, once the vector base layer is loaded in the programme, to add the historical cartography

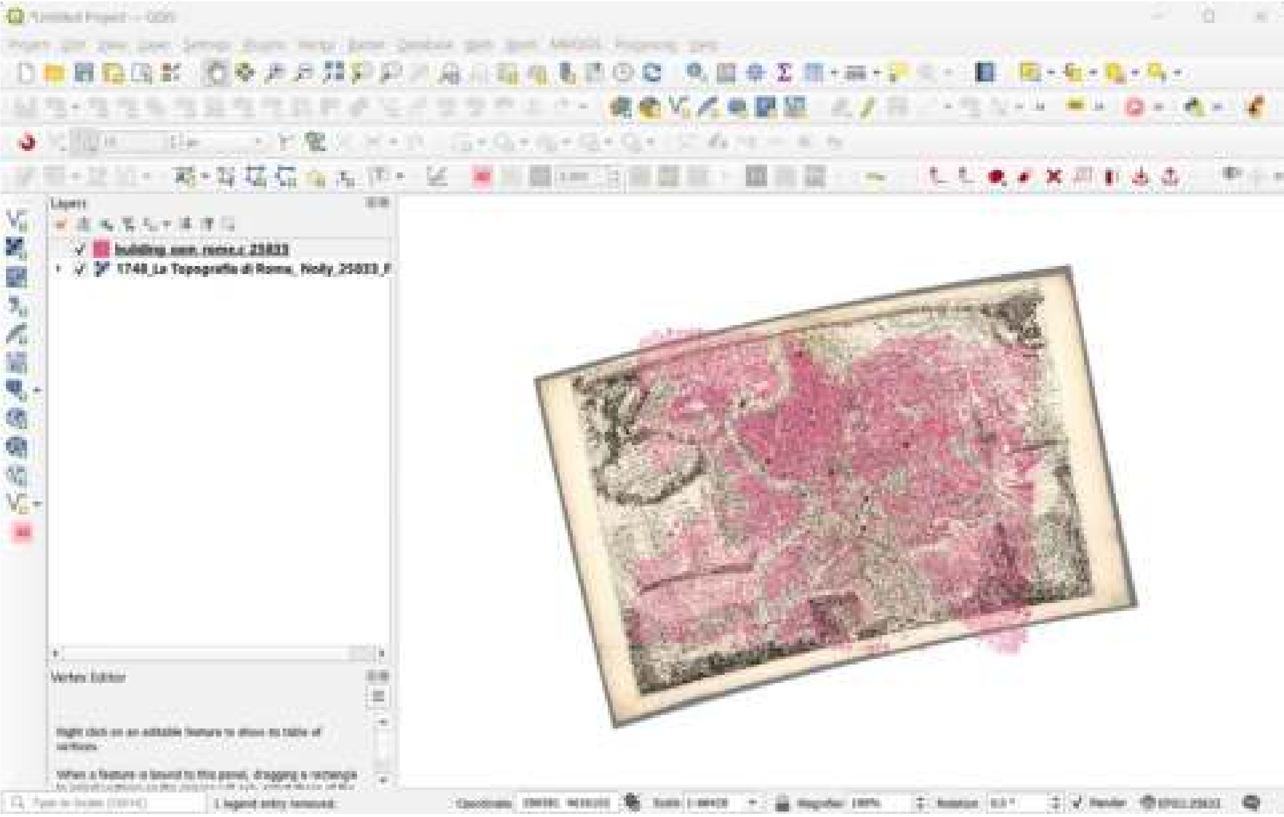


Fig. 6. Georrectification of La Topografia di Roma elaborated in 1748 by Gio Battista Nolly (image: GRAPHyC).

in raster format, and to define, among other aspects, the algorithm or type of transformation, the Reference Coordinate System, which must be the same as the base layer, and the resampling method. Once the transformation configuration has been defined, the ground control points (GCPs) are introduced, which can be done graphically with the reference cartography. Regarding the types of transformation, in the current version, we can choose between:

- The Linear algorithm It allows positioning (translating) the image and uniform scaling, but no rotation or other transformations. (At least 2 GCPs are needed).

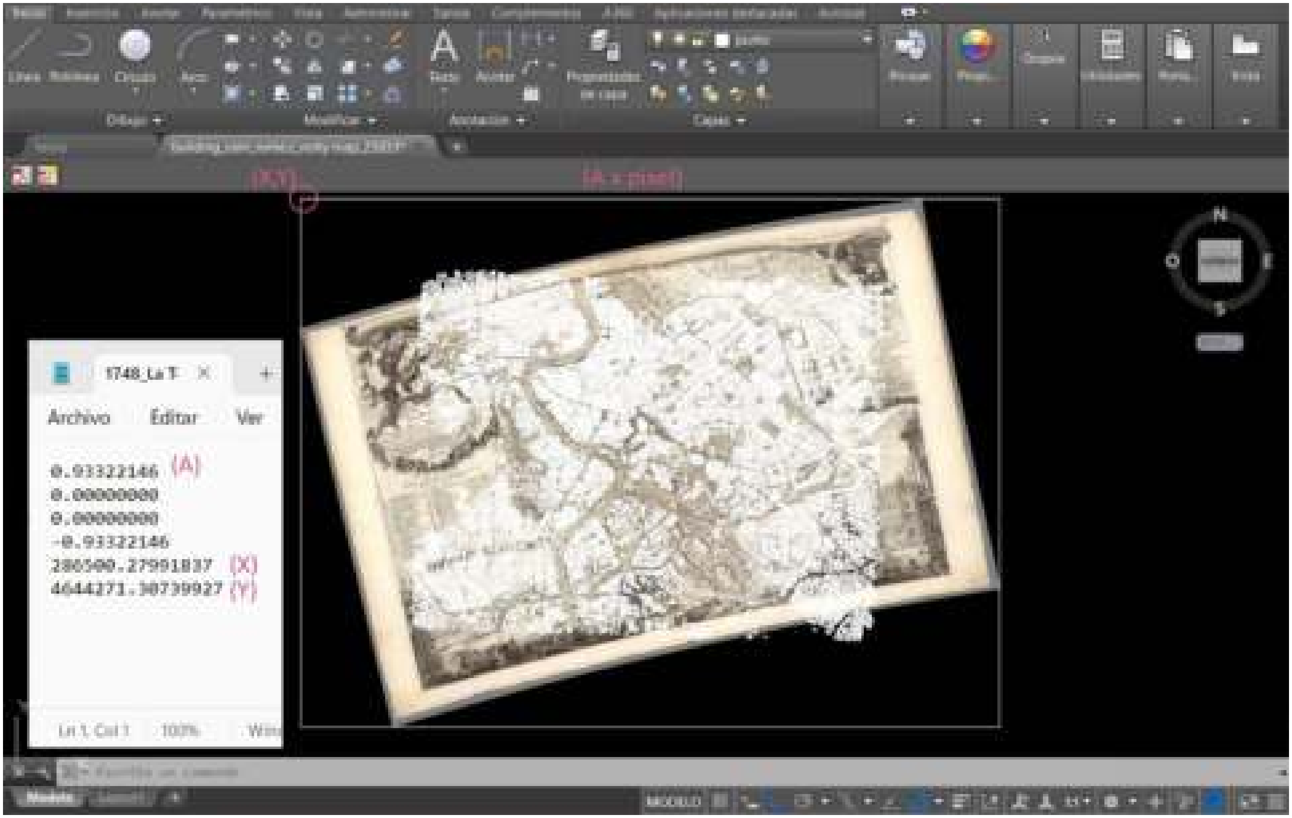


Fig. 7. Georetified cartography of La Topografia di Roma elaborated in 1748 Gio Battista Nolly georeferenced in CAD (image: GRAPHyC).

-The Helmert algorithm allows positioning (translating) the image, uniform scaling, and rotation. (At least 2 GCPs are needed).
-The Polynomial 1 algorithm allows a more general affine transformation, in particular also a uniform shear. (At least 3 GCPs are needed).
- The Polynomial 2-3 algorithm allows them to account for curvature or other systematic warping of the image. (At least 6-10 GCPs are needed).
- The Projective algorithm generalizes Polynomial 1 in a different way, allowing transformations representing a central projection between 2 non-parallel planes, the image and the map canvas. (At least 4 GCPs are needed).

- Thin Plate Spline (TPS) algorithm allows local deformations. Areas away from GCPs will be moved around in the output to accommodate the GCP matching but will otherwise be minimally locally deformed. (It technically requires a minimum of 10 GCPs, but usually more to be successful).

These options allow the operations described above to be performed for georeferencing, georectification and error control of the historical cartography.

It should be noted that the inaccuracy of historical cartographies may be due not only to the quality of the survey, but also to the degradation of the physical support, the digitalisation process or the cartographic generalisation used for smaller scale plans or maps. In this case, the inaccuracies derived from the projection system used for the scale of the cartographies used for the study of urban and architectural heritage have been ignored. The inaccuracy of some graphic documents may make it inadvisable to use them as geometric references, but they can still serve as information on the layout, the road network or the size of public spaces, among other important features.

Once the cartography has been georectified, the vector restitution of the historiographic cartography is carried out, whose elaboration should not be based on the simple transcription of the traces, but on a critical and comparative analysis, such as the comparison of the historical plans by applying a percentage of transparency to the raster (Chías & Abad, 2009, p.63), which facilitates the interpretation of the data provided, for which it is necessary to take into account the variable reliability of the source by calculating its cartographic error or the intention and origin of the source itself, which often leads cartographers to not reflect the existing reality, so that in this process it is essential to study and contrast the different sources available.

The vector restitution process can be elaborated in the Geographic Information System itself by creating a new vector layer for each type of geometry required, whether point, line or polygon, but it can also be done in CAD software, for which the base layer must be exported in .dxf

format and the positioning data of the georeferenced image must be extracted and both layers in the same Coordinate Reference System. The vector layer must be converted from polygon to line before exporting, otherwise it will be exported as a hatch. In the case of the raster layer the projection must be extracted which generates a world file (.wld or .tfw) and to be georeferenced in the cad program it is necessary to open this file with a text editor and interpret the data provided in the six rows:
Line 1: pixel size in the x-direction in map units (meters)
Line 2: rotation about y-axis.
Line 3: rotation about x-axis.
Line 4: pixel size in the y-direction in map in map units (meters)
Line 5: x-coordinate of the upper left corner of the image.
Line 6: y-coordinate of the upper left corner of the image.
As pixels are considered as square lines 1 and 4 are the same, lines 2 and 3 are zero in this type of images as they are generated without rotation, so to georeference the image correctly it must be scaled by multiplying the pixel dimension of the image by the pixel size in that direction and take as positional reference the upper left point of the image.
The lack of historical cartography prior to a certain date can force us to make hypotheses. A process which, based on the coordination and cartographic restitution carried out, must be based on the law of the persistence of the plan, since, as Professor Beatriz Arizaga explains: "The urban plan, whose basic elements are the public road network and the plot, persists over time, from the first foundation with greater or lesser success. We can compare it to parchments that are reused, rewritten. It seems that nowadays the law of the persistence of the plan is fully accepted, since buildings are replaced over time, but plots and road networks can remain" (Arizaga, 2002, pp. 69-70).
And, furthermore, in the information provided by the various documentary or archaeological sources, which will modify or confirm the aforementioned permanence, with which sufficiently reliable hypotheses can be established (Cárcel-García, 2016, p. 255). Reliability that is greater the more precise the knowledge of the urban history of the city and

the closer it is, chronologically speaking, to the last contrasted graphic reference, but which is always subject to the appearance of new data that modify the urban morphology proposed.
The restitution of historiographic cartography is established as a reliable and rigorous means of studying the evolution of the urban form of the city, and therefore, as a procedure that complements the integral knowledge of the architectural and urban heritage. Thanks to Geographic Information Systems, it is possible to control the error of the historical cartography used and, therefore, its reliability. The study of the different existing sources, together with the necessary cartographic concepts and the use of the digital tools employed, are the only conditioning factors for the correct application of the proposed method to urban environments other than the case study.
The work for the writing of this paper has been carried out in Grupo de Representación Arquitectónica del Patrimonio Histórico y Contemporáneo. GRAPHyC, Ref: H32_23R. University of Zaragoza.

Notes

[1] Currently this tool also allows working with vector layers, but for the proposed methodology only raster is required.

References

Arizaga Bolumburu, B. (2002). *La imagen de la ciudad medieval: la recuperación del paisaje urbano*. Santander: Editorial de la Universidad de Cantabria.

Baiocchi, V., & Lelo, K. (2005). Georeferencing the historical maps of Rome between the seventeenth and eighteenth centuries. In *CIPA 2005 XX International Symposium-International cooperation to save the world's cultural heritage*, pp. 114-118.

Ballarin, M., Balleti, C., & Gottardi, C. (2015). Automatic Systems for Digitizing Historical Maps. In *e-Perimetron*, Vol. 10, No. 1, pp. 21-29.

Ballarin, M., & Vernier, P. (2014). Digitization of Maps Belonging to Cultural Heritage. In *e-Perimetron*, Vol. 9, No. 4, pp. 196-205.

Balleti, C. (2006). Georeference in the analysis of the geometric content of early maps. In *e-Perimetron*, Vol. 1, No. 1, pp. 32-42.

Biel Ibáñez, M. P. (2016). El patrimonio industrial en el siglo XXI y su relación con la ciudad posindustrial. In A. Hernández Martínez (Ed.) *Conservando el pasado, proyectando el futuro: tendencias en la restauración monumental en el siglo XXI. Preserving the past, projecting the future: tendences in 21 st century monumental restoration*, pp. 157-176. Zaragoza: Institución ''Fernando el Católico''.

Cárcel-García, C. (2016). La cartografía histórica como método de estudio morfológico del paisaje tradicional de Campanar. In *EGA. Revista de expresión gráfica arquitectónica,* Vol. 21, No. 27, pp. 254-261.

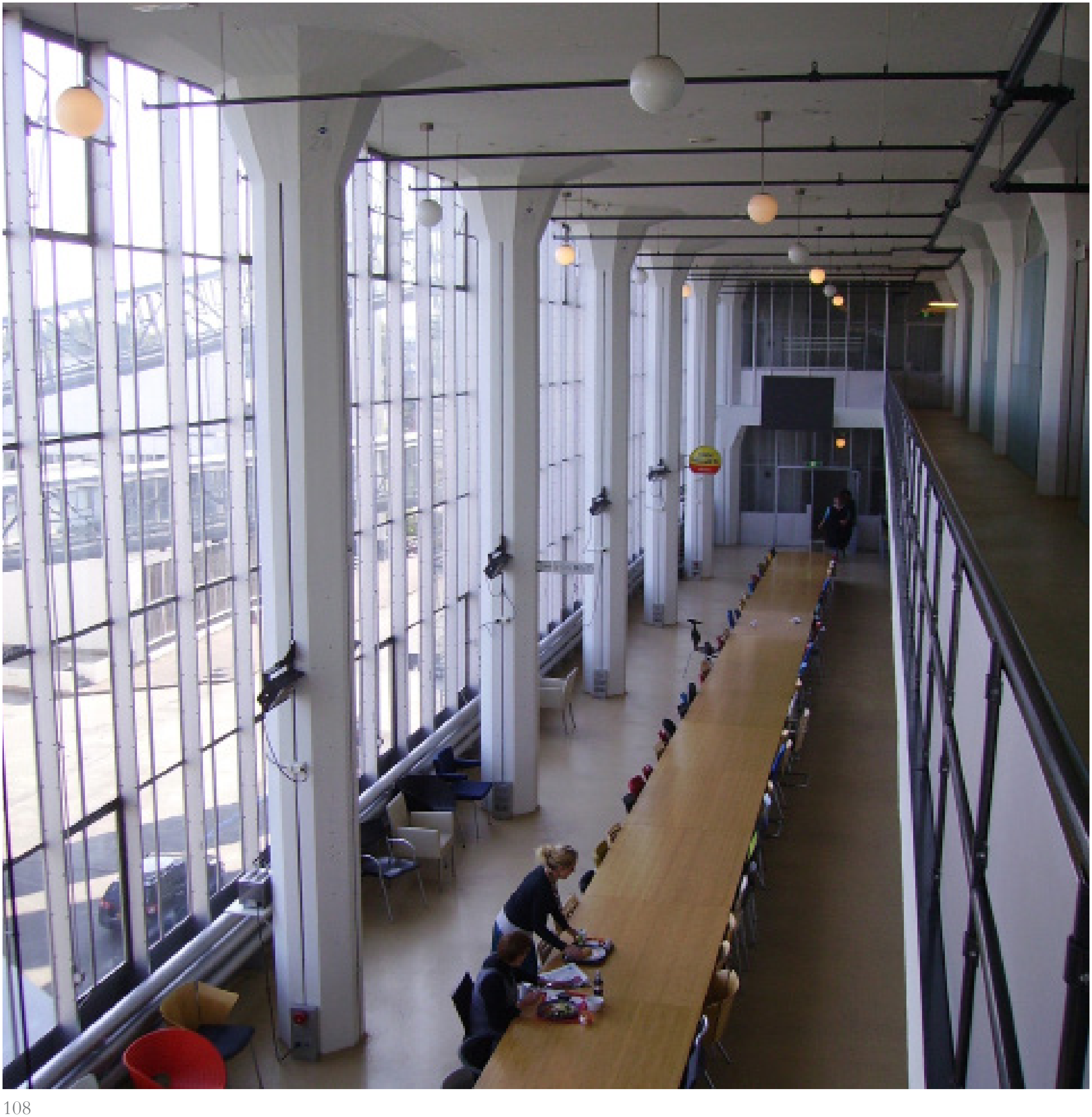
Chías, P., & Abad, T. (2009). GIS tools for comparing historical and contemporary landscapes through local map series. In *e-Perimetron,* Vol. 4, No. 2, pp. 61-72.

Chías, P., & Abad, T. (2008). A GIS in Ancient Cartography. In *3rd International Workshop– ICA Commission on Digital Technologies in Cartographic Heritage. Barcelona*. pp. 290-296.

Cid Mendoza, A.del (2014). Cartografía histórica y nuevas tecnologías para el análisis urbano: la Granada de finales del siglo XIX. In *Seminario Internacional de Investigación en Urbanismo "VI Seminario Internacional de Investigación en Urbanismo, Barcelona-Bogotá, junio 2014",* No. 6. Barcelona: Departament d'Urbanisme i Ordenació del Territori. Universitat Politècnica de Catalunya.

Sancho Mir, M., Agustín Hernández, L., & Llopis Verdú, J. (2017). Análisis y generación de cartografías historiográficas en el estudio de la evolución de la forma urbana: el caso de la ciudad de Teruel. In *EGA. Revista de Expresión Gráfica Arquitectónica*, Vol. 22, No 30, pp. 180-189.

Temes Cordovez, R. R. (2008). Las fuentes catastrales y la identificación de las transformaciones en los tejidos inversos. In *CT: Catastro*, No. 64, pp. 55-78.



Refurbishing the Industrial Heritage in the age of transition

Paola Ascione

Introduction

The redevelopment of places born with and for industry requires complex and long-term processes, investing interventions of different scales and magnitudes, from reclamation operations to reuse and redevelopment issues, from urban to architectural scales.

A motivation for urgent action is the National Recovery and Resilience Plan (PNRR). In light of the Plan, disused industrial heritage could take on a new centrality if seen as a potential resource for the hoped-for recovery. There are many experiences since the turn of the millennium that can be regarded as a basis for comparison for different approaches to regeneration and redevelopment. Vast areas once earmarked for manufacturing plants are now large parks where designed greenery, mainly not spontaneous, symbolically takes over from old buildings: smokestacks and steel mills that once discharged polluting fumes now stand as monuments/ruins, icons of a past civilization.

But there are still too many brownfield sites and buildings abandoned to decay without adequate projects. Many questions are still open including the conflict between cultural aspects and technical-economic issues that inevitably slow down the decision-making process. Meanwhile, the question that the scientific community needs to address concerns the real possibility of looking at industrial archaeology as a heritage to be enhanced, recognizing in industrial ruins resources and potential for the contemporary project of redevelopment of the existing.

Fig. 1. Van Nelle Fabriek, Rotterdam, Johannes Andreas Brinkman, 1925-1931. Design Reuse by Wessel de Jonge 1999-2004 (Paola Ascione, 2008).

Fig. 2. Van Nelle Fabriek, Rotterdam, Johannes Andreas Brinkman, 1925-1931. Design Reuse by Wessel de Jonge 1999-2004. Facade (Paola Ascione, 2008).

Archaeology or Industrial Heritage?

The delicate passage from the concept of Archaeology to the concept of Heritage, shifts the focus toward a more conscious recognition of the peculiarities of former factories, not always ascribable to mere historical evidence of a production cycle. In fact, the term Industrial Archaeology originated in England around the 1950s as a designation for a new discipline that studies the artifacts and evidence from the era of the Industrial Revolution (machines, buildings, technologies, infrastructure) and the economic and social effects that follow. Specifically, Industrial Archaeology is the science that studies the origins and development of the machine civilization and the marks left by the industrialization process in daily life, culture and society, and "of which both the content and the denomination itself are debated" (Corti, 1991). Conversely, the term heritage for us architects here take on a double meaning, delimiting the field of investigation to the buildings and settlements that are the subject of the intervention and at the same time restoring an implicit value to these objects by entrusting the landscape and industrial architectures with a denser signification than the mere aesthetic or documentary bearing. Essentially, the locution Industrial Heritage is charged with the added value of heritable property. In line with Faro's assertion (Faro Convention, 2005), when we speak of heritage, we are referring to the value of a legacy used wisely as a resource for sustainable development and improvement of urban quality. Hence the need to unveil the peculiarities of what emerges in the most negative sense as waste or at most as inconvenient testimony of a dying civilization, evoking hard work, source of disease, environmental damage. How willing are we today to take action for in-depth knowledge of the sites also interfacing with the communities involved? Aipai, the Italian Association for Industrial Archaeological Heritage, has activated an observatory and urges institutional parties to monitor ongoing and upcoming PNRR programs and projects that variously affect industrial heritage. Certainly, European funding for national recovery can trigger virtuous development actions for projects on brownfield sites, including and especially on those sites of recognized architectural and/or landscape interest, still awaiting urgent interventions for the necessary safety and preliminary to redevelopment. The fear is that the procedures determined by the tight timeframes for design and execution of works, do not reserve sufficient space for the knowledge and verification activities that redevelopment programs would require.

Criticality and quality of modern industrial heritage

The issue of the transmission of industrial testimonies to posterity becomes particularly delicate in the case of more recent artifacts. It was not until 2011 that Walter Gropius's Fagus Workshops, the first case of modern architecture for industry, were inscribed on the UNESCO World Heritage List (WHL), some 30 years after the Wieliczka Mine, the first industrial site to become a World Heritage Site. The late recognition of the Fagus Werk demonstrates the slow pace of interest in warehouses, plants, and infrastructure. Equally late is the recognition as a universal good of Olivetti Industrial City in Ivrea, a unique case nationally and worldwide, which is considered a true laboratory for leading Italian architects, an example of a way of conceiving architecture "with and for industry" that embodies the Olivettian thought of Community.

Docomomo Italia (DOcumentation and COnservation of buildings, sites and neighbourhoods of the MOdern MOvement) has been reporting for years on the poor state of preservation and the risks to the heritage in the SOS '900 column on its website. The association's interest is focused on the sites and architectures that constitute the outcomes of the architectural culture of the twentieth century; among them, factories and plants that were fertile ground of experimentation of the Modern, a privileged place of innovation in the field of structural engineering but also of technological solutions and construction systems that drew inspiration from the product and industrial culture.

Thanks to the audacity of skilled professionals, the construction of sheds and plants returned new typological models and a solid basis for verification of the knowledge achieved in science through new disciplines, aimed at understanding the potential of structures and other parts of the

Fig. 3. Cartiera Burgo, Mantova, Pier Luigi Nervi, 1960 – 1964. Design recovery and redevelopment by Studio: Massimo Narduzzo / CREA.RE. (Massimo Narduzzo, Rehabilitation of Cartiera Burgo in Mantova, Docomomo fiche https://www.docomomoitalia.it/wp-content/uploads/2021/03/cartiera-burgo-eng.pdf).

building system arising from the use of new materials (from cast iron to steel, from reinforced concrete to glass) as well as the new products of the building industry.

The higher the threshold of experimentation, technological-constructive and structural, contained in an industrial building, the more the fragility of the architecture increases in terms of durability and material and mechanical strength. Demolition may appear to be the most cost-effective solution in economic terms, but it can have serious issues in terms of environmental cost (think of the problems of remediation and the production of nonassimilable waste from a circular economy perspective). Unfortunately, there are not a few cases of demolition of factories of fampus designers. The latest report received by Docomomo concerns the Masterplan planned for the former Necchi area of Pavia, where the 1960-1961 expansion designed by Marco Zanuso is at risk. Bulldozers have already demolished much of the AD2-Necchi and Scalo FS compartment where Zanuso's pavilion falls. On the other hand, the Piano di Governo del Territorio (PGT) allocates the entire area for demolition, except for the first Necchi factory from the early 20th century, which is instead constrained and would remain the only survivor within the new neighborhood paradoxically named "Supernova" after one of Necchi's most famous sewing machines designed by Nizzoli in 1954, which was awarded the Compasso d'Oro Prize in the same year. In fact, the risk of demolition is higher where the factory designed by great architects, would have difficulty in the recognition of protection as it would not yet have completed 70 years since its construction as required by the regulations.

Industrial heritage must earn a living

"*Any attempt to understand why those factories and silos look so beautiful to us now must also try to understand the ambitions, the expectations, the mindset that drove the founding fathers of the Modern Movement to adopt these monuments as models for their new architecture* " (Banham, 1986). Reyner Banham's words connect aesthetic bearing and deeper meaning of modern artifacts. The density of meanings, aesthetic and symbolic, can become key to contemporary design. Without attention "...to the meaning that the factory encloses in its walls, to the use that has been made there of construction technologies and procedures, to reiterate needs, to emphasize vocations" (Zorgno, 1998) the redevelopment project risks not going beyond the ruins, at best included in the contemporary project as a commemorative "document," which does not go beyond the evocation of a forced industrial aesthetic. The search for a balance between continuitỳ and change is always desirable in interventions on the existing. Our task today is to observe, monitor and act responsibly to put values/resources back into circulation. Difficult to generalize, each case is case by case, due to contingent issues. In the words of Louis Bergeron 'industrial heritage has to make a living,' it is preserved provided it is assigned a role in response to current demand. One has to come to terms with the financial conditions and operating costs that are not inseparable from identifying a useful and compatible reuse. In most cases, former industrial warehouses currently contain large and flexible spaces that can be adapted to new and varied functions. The

Fig. 4. "The Haunted House" Fondazione Prada, Milano. Reuse of the ancient distillery by OMA (Paola Ascione, 2023).

Tate Modern in London or the Van Nelle Factory in Rotterdam (Aa. Vv., 2005), have for years demonstrated the capacity of these containers to absorb different usages while maintaining their own identity. From exhibition galleries to performing and creative activities, to service sector activities, to new places for social interaction, work, culture, artistic experimentation, and leisure.

Questioning the measure of contemporary design today, in the light of the experiences of brownfield redevelopment and industrial architecture, shows how we have not yet arrived at the large-scale diffusion of good practices, which nevertheless exist in Italy, as demonstrated by the recent intervention on the Burgo Paper Mill, which started from the recognition and enhancement of the intrinsic qualities of Nervi's architecture. The Paper Mill (1961-64), a unicum in the design career of Pier Luigi Nervi, revealed the great expressive power and value as an icon of modern industry, welcoming in itself all the originality of a manifesto work, where the ancient synthesis of form-function and technique returns a unique architecture based on the principles of modernity, such as: the free plan (single room 250 meters long and 30 meters wide), the free and transparent facade (160 meters), the experimentation with materials and techniques based on the logic of optimizing the form-structure relationship that returns an innovative language, the adherence of interior spaces to the need for flexibility of the production cycle. An online petition with a request for rapid reactivation immediately started the process of enhancing the work in order to avoid the irreversible degradation of the reinforced concrete structure.

A subsequent appeal in 2016, signed by Docomomo Italia (Italian Association for the Documentation and Preservation of Modern Urban Buildings and Complexes) by Aipai (Italian Industrial Archaeological Heritage Association) and the Pier Luigi Nervi Project Association, was addressed to the Superintendence for Architectural and Landscape Heritage for the provinces of Brescia, Cremona, and Mantua to ask for a timely and effective protection measure. The General Directorate for Contemporary Art and Architecture and the Peripheries supported the

initiative, which was translated into a declaration of interest in November 2016, obtaining from the Ministry the affixing of a protection bond to the building complex as a "property of particularly important cultural interest.
Commissioned by PRO-GEST, designed by Massimo Narduzzo and Giuseppe Ruscica with CREA:RE, the rehabilitation of the Burgo Paper Mill was awarded the Docomomo Rehabilitation Award 2021 in the Sustained uses category, as an exemplary renovation that introduces contemporary standards of safety, sustainability and improved technologies while maintaining the buildings' function and identity. However, it remains an exceptional case in which the original function is repurposed.
There is no doubt that the rich production of documents has certainly enabled current planners to rebuild 'piece by piece' the process from the conception to the execution of the work, right down to the transformations undergone in the management phase. In fact, the interpretations that contemporary design has given in recent years to the industrial pre-existence are various, more or less aimed at exalting the aesthetic values expressed in the forms and types of artifacts.
To cite an altogether different intervention, with an original design approach aimed at highlighting the contrast between the new and the pre-existing on an unrestricted factory, one must mention the Fondazione Prada in Milan. Rem Koolhaas has in this case transformed a distillery dating back to the first decade of the last century into a lively multipurpose center through an articulate architectural configuration.
The Oma studio's guiding line, Koolhaas clearly explains: "The Foundation is not a conservation project, and it is not new architecture. Two conditions that are usually kept separate here confront each other in a state of permanent interaction that offers a set of fragments that does not coagulate into a single image, nor does it allow one part to dominate the others" (Koolhaas, 2005). Alongside the seven existing buildings, the project adds three new structures that highlight the change: Museum, Cinema, and Tower, dedicated respectively to temporary exhibitions,

Fig. 5. Ex ILVA, Bagnoli, Napoli (Paola Ascione, 2023).

multimedia auditorium, and a permanent ten-storey exhibition space for the Foundation's collection and activities.

This is an attractive hub that fits into one of the urban transformation areas of the Milanese suburbs, within a broader vision of city development that is substantially changing the characters of the urban landscape.

Post-industrial parks vs. industrial landscapes

Examples of neighborhoods that have become places of degradation and social marginalization as a result of the industrial crisis now transformed into centers of city development and rebirth are not uncommon. It happened in Liverpool and Manchester, it is happening for sites such as Ivrea, an experimental laboratory for Italian twentieth-century architecture, which are recognized as a heritage resource capable, as in the past but in absolutely different terms, of conferring high added value to urban transformation interventions.

Today we are aware of the disruptive impact of industry on the ecosystem, the industrial landscape devoid of the motive that had dictated its construction, tends to be assumed in its aesthetic dimension. Rethinking brownfields in terms of landscape is a direction that has already been clearly expressed in interventions to redevelop large former industrial basins such as the Ruhr and Lusatia.
In some examples of the redevelopment of industrial areas, nature seems to take over the remnants of the plants. However, the aestheticizing vision of ruins, suspended between a distant past and a near future, tends to take them on as sculptures, high-impact representative fragments charged with the representation of what they were.
Hard to generalize, the industrial landscape is multifaceted, just as industrial architecture is multifaceted. Different production activities have connoted landscapes of mines, textile industries, steel mills. What we see is just the latest outcome of a continuous evolution dictated by technological development: "The valorization of an industrial landscape must not forget that what is presented to our eyes is nothing more than the last frame of that invisible film that shows the history of a factory" (Preite, 2018). Recently, some interesting criticisms have been raised against a certain idea of the post-industrial park. Michael Friedrich writes that "landscape architects have created popular public spaces by superimposing the pastoral (wildflowers, water features) over the post-industrial (steel, concrete), evoking nostalgia for a lost urban wilderness." Almost as if the juxtaposition of wilderness and the wreckage of industrial icons showed the unraveling of an anthropocentric vision represented by the ruined factories, which reverses the human-nature relationship by showing the fragilities of the human environment against the strength of the aestheticized wilderness that makes the post-industrial landscape uncanny, sublime in its extremes (Bodei, 2018). But even in these cases we find the exceptions that testify to a creativity in reinterpreting those places to the measure of today's society. Intervention where places do not lose the memory of a past civilization, with all that technological progress has generated, for better or worse.

The complete erasure of industrial 'archaeologies' may diminish the meaning they hold for local communities. 'Post-industrial' parks can serve as reminders of a past but only if they are also economic generators of communities can they have a future. In this sense, the idea of reclaiming open spaces and artifacts by dedicating them to temporary uses in projection of projects to be defined in the long term, allows for gradual operation on the ground. A reactivation phase that would allow, on the one hand, a direct confrontation with stakeholders to measure the real possibilities of introducing new functions, even permanent ones, and on the other, the search for appropriate forms of financing and management without which these places will be abandoned to an uncertain and nebulous fate.

References

Aa.Vv. (2005). *Van Nelle. Monument in progress*. Rotterdam: Utgeverij De Hef.

Banham, R. (1986). *A concrete Atlantis. U.S. Industrial building and european modern architecture 1900-1925*. Cambridge, Mass.: MIT Press.

Bodei, R. (2008). *Paesaggi sublimi. Gli uomini davanti alla natura selvaggia*. Milano: Bompiani.

Convenzione Faro, (2005). <https://ufficiostudi.beniculturali.it/mibac/multimedia/UfficioStudi/documents/1362477547947_Convenzione_di_Faro.pdf> (accessed 24 may 2023).

Corti, B. (1991). Archeologia Industriale. In *Enciclopedia Italiana, V Appendice*. <https://www.treccani.it/enciclopedia/archeologia-industriale_res-27358d04-87ea-11dc-8e9d-0016357eee51_(Enciclopedia-Italiana)/> (accessed 2 may 2024).

Koolhaas, R. (2005). <https://www.domusweb.it/it/architettura/2015/05/11/fondazione_prada_a_milano.html> (accessed 2 May 2024).

Preite, M. (2018). Paesaggi industriali e patrimonio Unesco. <https://www.letture.org/paesaggi-industriali-e-patrimonio-unesco-massimo-preite> (accessed 2 may 2024).

The Massachusetts Institute of Technology, trad. it. Banham R. (1990). L'Atlantide di cemento. Edifici industriali americani e architettura moderna europea 1900-1925. Bari: Laterza.

Zorgno, A.M. (1998). Patrimonio industriale e modernità. In *docomomo Italia giornale*, No. 4, p. 1.

Transitory uses and transition processes of vacant buildings for inclusive and circular city

Orfina Fatigato

Introduction

Within the framework delineated by the Blended intensive programme *Industrial Archaeology. European approach to recovery productive memory*, the present article seeks to convey an experience originating in Naples. This engagement unfolded within the context of an interesting initiative showcased at the CA23 Plural Territories Architecture Festival, held alternately in April in Naples and in October in Paris. This platform offered the opportunity to explore the more general topic of transitional uses in urban regeneration processes. At the core of this research lies an examination of the intrinsic value conferred by transitional uses to processes of urban regeneration and transformation. Transitional uses function as pivotal catalysts, instigating enduring and multifaceted transformations that necessitate a re-evaluation of the spatial and temporal dimensions inherent in urban development. Methodologically, this inquiry necessitates a deliberate consideration of how design processes can assimilate temporal dynamics, thereby facilitating the evolution of project, engendering nuanced engagements with a heterogeneous array of stakeholders.

The concept of transitioning disused spaces towards an inclusive and circular city encapsulates the thematic focus of this article. Transition inherently acknowledges that projects materialize within preexisting contexts, exerting a reciprocal influence on these contexts over time as spatial and temporal dimensions converge and interplay. Converging

events, both anticipated and unforeseen, coalesce to propel these transition processes forward, shaping the trajectory of urban development.
This paradigm of an inclusive and circular city advocates for reactivation processes that embrace innovative housing models and nurture socially, economically, and ecologically sustainable urban living paradigms.

The living lab "Living in the City in Transition": an experiment in Naples

Reflective attention toward the experimentation of transitory uses has now extended to Italian municipalities, where several administrations are actively engaged in leveraging temporary (and/or transitory) uses as a strategic mechanism for revitalizing publicly-owned buildings that have fallen into disuse.
The legislative recognition of transitory uses was initially introduced as an amendment to Article 23 of Presidential Decree 380/2001 and subsequently adopted by various regions, including Lombardy, Emilia Romagna, and Campania itself. Notably, Campania enacted Regional Law 13 of 2022, titled 'Provisions on building simplification, urban regeneration, and the redevelopment of the existing building stock.' These legislative measures constitute a series of regulatory and procedural frameworks aimed at legitimizing the temporary reuse of buildings and abandoned areas. They also provide flexibility for alternative uses beyond those originally envisioned by the existing regulatory framework.
The city of Naples, by approving *Delibera di Giunta Comunale n. 30/2022* "Draft Convention for the Regulation of Temporary Uses for Public Spaces and Publicly Owned Properties," aimed to promote processes for the temporary use of public assets. However, this project currently finds limited concrete projects, partly due to the difficulty of collaboration among different offices required for a temporary reuse project.
Within the framework of the CA23 Territori Plurali Architecture Festival, held in various locations in Campania and Paris in 2023, the theme of temporary uses was addressed through the work of one of the six Living Labs of the Festival. In particular, in Naples, in collaboration with the

Fig. 1. CA23 Architecture Festival CA23 Plural Territories, Living Lab Inhabiting the City in Transition (source: Living Lab photos).

Department of Architecture of the University Federico II and ENSA Paris Malaquais, the Living Lab "Living in the City in Transition: Evolutionary Projects for the Reuse of Large Urban Containers" was held, focusing on the theme of temporary uses, starting from the significant regulatory changes implemented by the Campania Region and the Municipality of Naples (Fig. 1).

The living lab was conceived and structured as a collective laboratory that examined the processes of regeneration of some large disused containers in the city of Naples, starting from the activation of possible temporary uses. Together, they discussed the co-creation of innovative programs, new forms of accommodation to inhabit these spaces again, proposing open and incremental strategies over time.

Co-creation was systematically explored through the engagement of participants spanning diverse backgrounds, including architecture students, local community associations, and interested residents. This collaborative endeavor sought to innovate novel programs aimed at fostering communal living arrangements. The strategies devised were characterized by their openness and incremental nature, emphasizing adaptability and evolution over time. During the LL, the specificities, 'stories' and potentialities of some disused buildings that, at different scales, populate the urban territory of Naples were explored.

Fig. 2. Exhibition Cubic Metres in Transition curated by Orfina Fatigato and Gianluigi Freda, ex Chiesa dei Santi Demetrio e Bonifacio, Naples, 17 - 28 April 2023 (Photos by Mario Ferrara).

Living Lab participants and communities of inhabitants together with architects, photographers, artists, students and university lecturers questioned the value of these containers as 'places of the ignored possible' (Fig. 2).

Integrated projects were tested on some of the numerous abandoned buildings that dot the urban landscape of the city of Naples, returning metaprocesses aimed at demonstrating the feasibility and potential that can be activated through the experimentation of transitional uses. The integrated methodological approach started from the elaboration of an interactive and expandable map of the disused urban heritage, of public and private property, of the East Naples area.

An interesting observation to emerge from the mapping work, despite its relatively short duration, is the large number of empty and abandoned buildings in the East Naples area. Making use of available resources, the mapping work has documented a substantial volume of empty cubic metres within approximately one third of the urban landscape of Naples. The decision to quantify space in terms of cubic metres, rather than square metres, arose from the desire to emphasise the capacity of these abandoned volumes to be inhabited.

Throughout the Living Lab activities, in-depth discussions were held on various identified urban structures. Accompanying these discussions were a series of photographs meticulously captured by architect Mario Ferrara. This artistic representation induces the contemplation of the

Fig. 3. Map of vacant buildings East Naples for Living Lab Living the city in transition (source: Living Lab photos).

bare and monumental presence of these buildings, of various sizes, sometimes very imposing.
Among the buildings mapped is the Corradini factory, an industrial landmark emblematic of Naples' rich architectural heritage. The photograph returned by Mario Ferrara effectively conveys the diverse nature of these architectural ruins, each of which carries its own historical significance and narrative. The juxtaposition of emblematic buildings, such as the Corradini factory, alongside more recent postmodern structures underlines the complex interaction between architectural preservation and urban revitalisation in contemporary urban landscapes (Fig. 3).
There are many examples throughout Europe, and partly in Italy, of empty buildings and spaces being used to host social and cultural experimentation. Re-inhabiting these empty spaces represents an act of emancipation from the constraints imposed by the capitalist urban system. The failures of the capitalist urban model are witnessed by

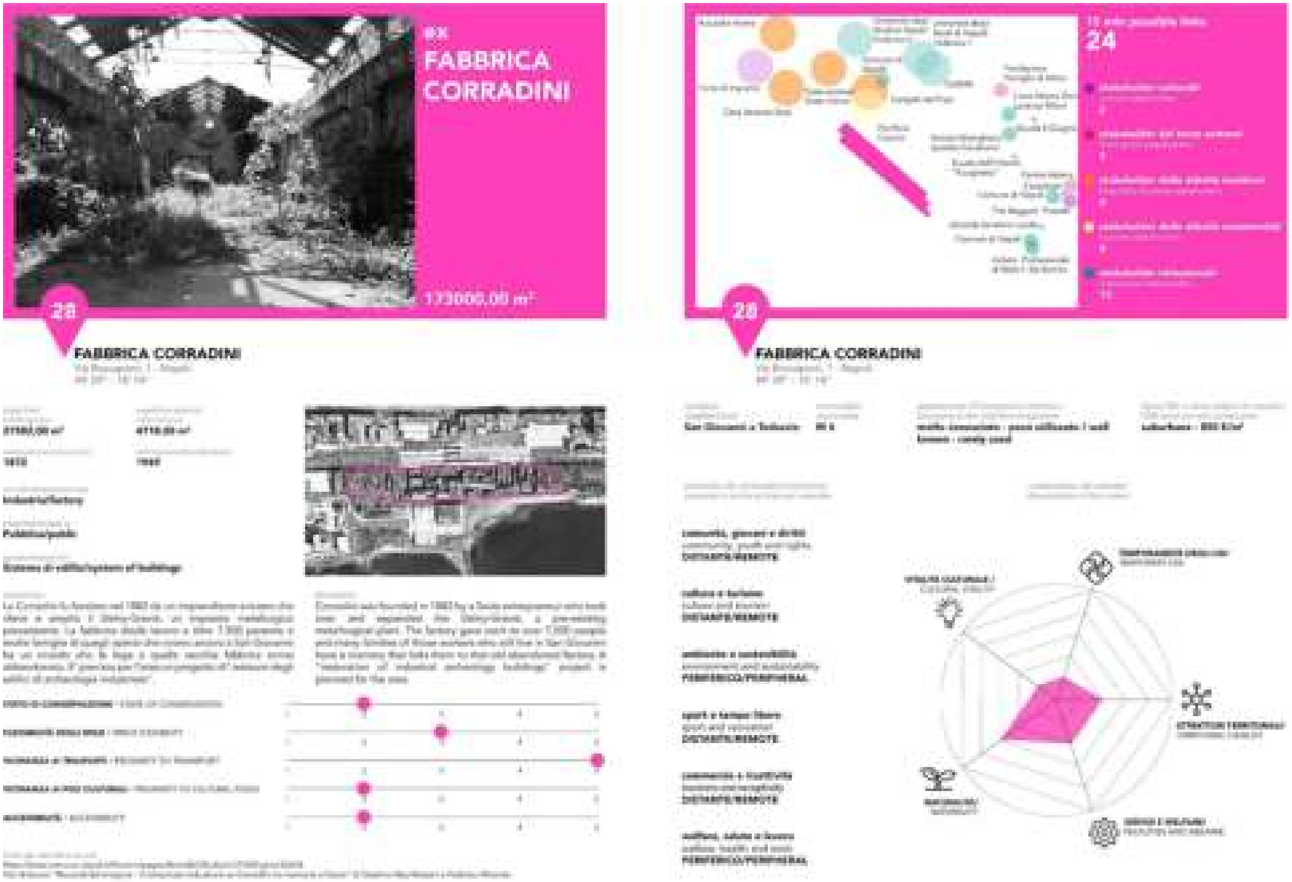


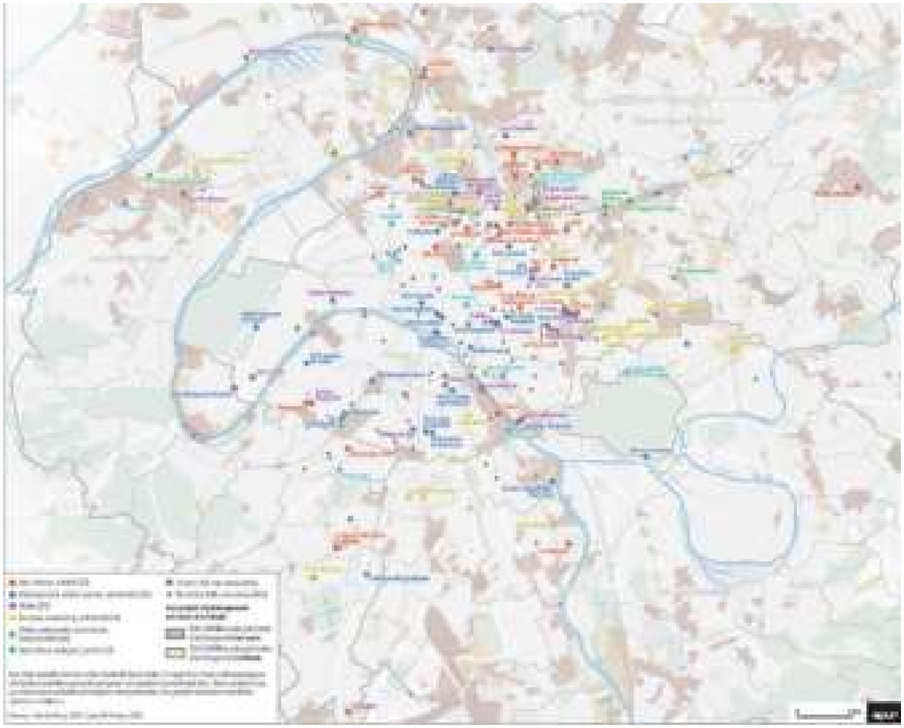
Fig. 4. Example of analytical interpretative map of vacant buildings in Naples: ex Corradini factory (elaborated during the Living Lab Inhabiting the City in Transition).

the proliferation of disused, once productive sites scattered across the territories.

Marc Augé writes in *Le temps en ruines* (2002): "Urban planning and architecture have always been intertwined with power and politics, and the current forms of the contemporary city - which multiply the areas of poverty, the fields and by-products of uncontrolled urban development - underline the cynical evidence of this exploitation of the land". For Augé,

these abandoned spaces embody a sense of time, evoking past memories and potential futures without attempting to summarise or conclude their narratives in the illusion of knowledge and beauty. Instead of mere places, these ruins symbolise the beauty of what could have been, what has been and what is yet to come. They evoke a vision of a possible future in which experimentation with new forms and ways of living in the contemporary city finds expression in these buildings.
Through the mapping of empty buildings in East Naples drawn up during the Festival Territori plurali - which was not exhaustive, partial and carried out in the short time available during the LL's activities - approximately ninety buildings were in any case identified, for each of which a multi-criteria interpretation sheet was subsequently drawn up (Fig. 4).
The buildings were first of all divided into three groups according to the square metres surveyed. The cards were structured in two distinct parts, side A and side B. The front (side A) was conceived as a sort of identity card for the building in which historical, dimensional, and typological information on the building was reported, flanked by the identification of some useful indicators in the perspective of the transitional reuse of the analysed building such as: the state of conservation, flexibility of the spaces, proximity to transport, proximity to cultural poles, accessibility. On the back side (side B) of the sheet, possible networks at different scales were indicated, into which the building could be grafted, starting from its reuse: of stakeholders (cultural, institutional, third sector), of receptive activities, of commercial activities, intercepted within a radius of about 15 minutes' walk from the building (Fig. 5).
Various polarities overlap these "white constellations" of empty buildings, resembling stars of different colors, representing the various activities of the third sector and active realities within the territories. The overlap between the maps of these different constellations shows how abandoned buildings are often located within vibrant and culturally and economically active contexts. These are not just isolated structures, but rather spaces integrated into lively urban environments.

Fig. 5. Cartography France Tiers Lieux @ www.francetierslieux.fr.



Transitory uses and third places in urban regeneration project in France

In France, over the last decade, the reuse of abandoned spaces has occurred through the activation of transitional uses. This tool for urban regeneration has transitioned from a conceptual framework to a widespread practice, even at the institutional level. Regulation for transitional uses has been formalized, and currently, many urban transformation projects include a structured initial phase focused on transitional uses. Interdisciplinary design teams are tasked, through tender or competition procedures, with managing the temporary utilization of buildings and large abandoned areas within urban regeneration processes.

Central to this evolution was the introduction of the law on freedom of creation for architecture and heritage, notably Article 88, which sanctioned the experimentation with transitional uses in abandoned spaces for a defined period. This legislative milestone marked a shift from a culture of regulatory norms to one focused on objectives. It provided a framework for activating transitional uses while upholding principles of inclusivity,

The regulatory framework surrounding transitional uses in France exemplifies a balanced approach that prioritizes experimentation, innovation, and community engagement while navigating regulatory constraints. It underscores the transformative potential of temporary interventions in shaping more inclusive, sustainable, and vibrant urban environments.

Coinciding with these developments in France, a significant exhibition titled "Infinite Places" was showcased at the Venice Biennale. Presented in the French Pavilion, the exhibition narrated the stories of ten places defined as ecological and solidarity collaborative pioneers.

These ten places, each with their specific nature, often involve experiments in temporary use and highlight the notion of co-management involving multiple actors. These spaces are all akin to "third places." Coined by sociologist Holden Berg in the 1990s, the term refers to hybrid spaces that distinguish themselves from traditional living or working environments; Bouret further developed this concept, emphasizing its experimental nature.

These third places serve as dynamic environments where living, working, and learning intersect, facilitating experimentation and innovation. In France, many large abandoned buildings utilized for transitional uses are identified as third places, embodying the ethos of experimentation and community engagement (Fig. 6).

Certainly, the principles around which the concept of third places revolves can be encapsulated in key words that signify collaboration, experimentation, incrementality, and indeterminacy.

Collaboration is integral to the ethos of third places, characterized by multifaceted cooperation among diverse actors such as cooperatives,

Fig. 6. Processuality of project, credits Agence Construire, Patrick Bouchain et Loic Julienne.

multidisciplinary groups, citizens, and economic stakeholders. Unlike spaces managed by singular entities, third places thrive on collaborative efforts, fostering a sense of community ownership and engagement.
Experimentation lies at the heart of third places, epitomized by the motto of groups like Plateau Urban, which advocates for putting creativity at the forefront. These spaces serve as laboratories for testing ideas, concepts, and activities, continuously evolving based on feedback and outcomes.
Incrementality underscores the iterative nature of third place projects, where developments unfold gradually over time. Collaboration not only shapes the initial configuration of these spaces but also influences their ongoing adaptation and transformation. This principle emphasizes the importance of flexibility, adaptability, and responsiveness to evolving needs and dynamics (Fig. 7).
Indeterminacy, as advocated by Patrick Bouchain, embraces uncertainty and spontaneity within third places. Bouchain's notion of the "architecture of disagreement" highlights the value of creating spaces that challenge preconceived notions and allow for unexpected encounters and experiences. This principle encourages designers and facilitators to embrace variability and embrace the unforeseen, fostering a culture of openness, curiosity, and innovation.
Third places embody a dynamic interplay of collaboration,

Fig. 7. Project of urbanisme transitoire Le Grands Voisins (Parigi 2012-2020) (source: www.lesgrandsvoisins.org).

experimentation, incrementality, and indeterminacy, creating vibrant, inclusive, and adaptive environments that resonate with the evolving needs and aspirations of their users and communities.

The Le Grands Voisins project in Paris stands as a significant example of successful implementation of transitional uses within a complex urban setting. Formerly an abandoned hospital comprised of multiple pavilions, this initiative has paved the way for various interdisciplinary groups in France to explore the potential of managing transitory uses in a large-scale, multifaceted environment over a period of 10 years (Fig. 8).

A notable aspect of the Le Grands Voisins project is its emphasis on hospitality: The project initially repurposed spaces within the hospital for temporary accommodation of asylum seekers, while concurrently hosting workshop activities facilitated by other associations. This approach not only provided essential support to asylum seekers but also fostered a sense of autonomy and respect within the shared spaces.

As the project evolved, additional connections and relationships were established, leading to the introduction of initiatives such as a restaurant specializing in migrant cuisine. This integration not only offered employment opportunities to asylum seekers but also contributed to the project's economic sustainability. Furthermore, the project attracted artists and other creatives who leased workshop spaces within the premises, generating revenue that supported both economic and non-economic activities.

This intricate economic ecosystem underscores the project's commitment to achieving a circular and inclusive urban environment. By balancing

Fig. 8. Césure, project of transitory uses managed by Plateau urbain (Paris) (photos by O. Fatigato).

revenue-generating activities with socially impactful initiatives, the project demonstrates a holistic approach to urban regeneration that prioritizes both economic viability and social well-being. Moreover, the project's long-term duration allowed for the gradual evolution of activities and relationships, further enriching the fabric of the community and fostering a sense of belonging among its participants.

The Cesure project offers another compelling example of ongoing transitional use within urban spaces. Located in a former Sorbonne building in Paris, this initiative represents an active endeavor to repurpose the space while awaiting renovation. The Sorbonne company, responsible for managing the building, initiated a tender process to enable a transitional use of the premises for a period of seven years. This transitional phase serves not only to activate the building but also to gather valuable insights and feedback that can inform future renovation plans and potential alternative uses (Fig. 9). Transitional uses like Cesure highlight the diverse objectives that can drive such initiatives. Beyond merely filling empty spaces, these projects serve as platforms for experimentation, information gathering, and even cost-saving measures for property owners. By repurposing vacant buildings, even on a temporary basis, owners can mitigate the financial burden of maintenance while generating interest from potential economic stakeholders.
The complexity of transitional use projects underscores the intricate interplay between spatial, temporal, and economic dimensions. Understanding and engaging with these processes are crucial steps toward realizing the vision of an inclusive, contemporary city. By embracing innovative approaches to urban regeneration, such as transitional use projects like Cesure, cities can unlock the latent potential of their built environments while fostering dynamic and vibrant communities.
Third places are interesting, as they serve as pivotal reservoirs for social capital accumulation and experimental urban practices (Fig. 10). In furtherance of this discourse, a thorough analysis conducted by the Atelier Parisien d'Urbanisme underscores the multifaceted nature of groups engaged in transitional urbanism across France, including Communa, Plateau Urbain, and Soal Mar Camp. Despite their varied approaches, these groups collectively assume the role of real estate actors, orchestrating the management of temporary spaces. Their endeavors not only augment the tangible value of real estate assets but also address broader societal concerns pertaining to urban space vacant utilization.
There are many activities within these transitional spaces, ranging from

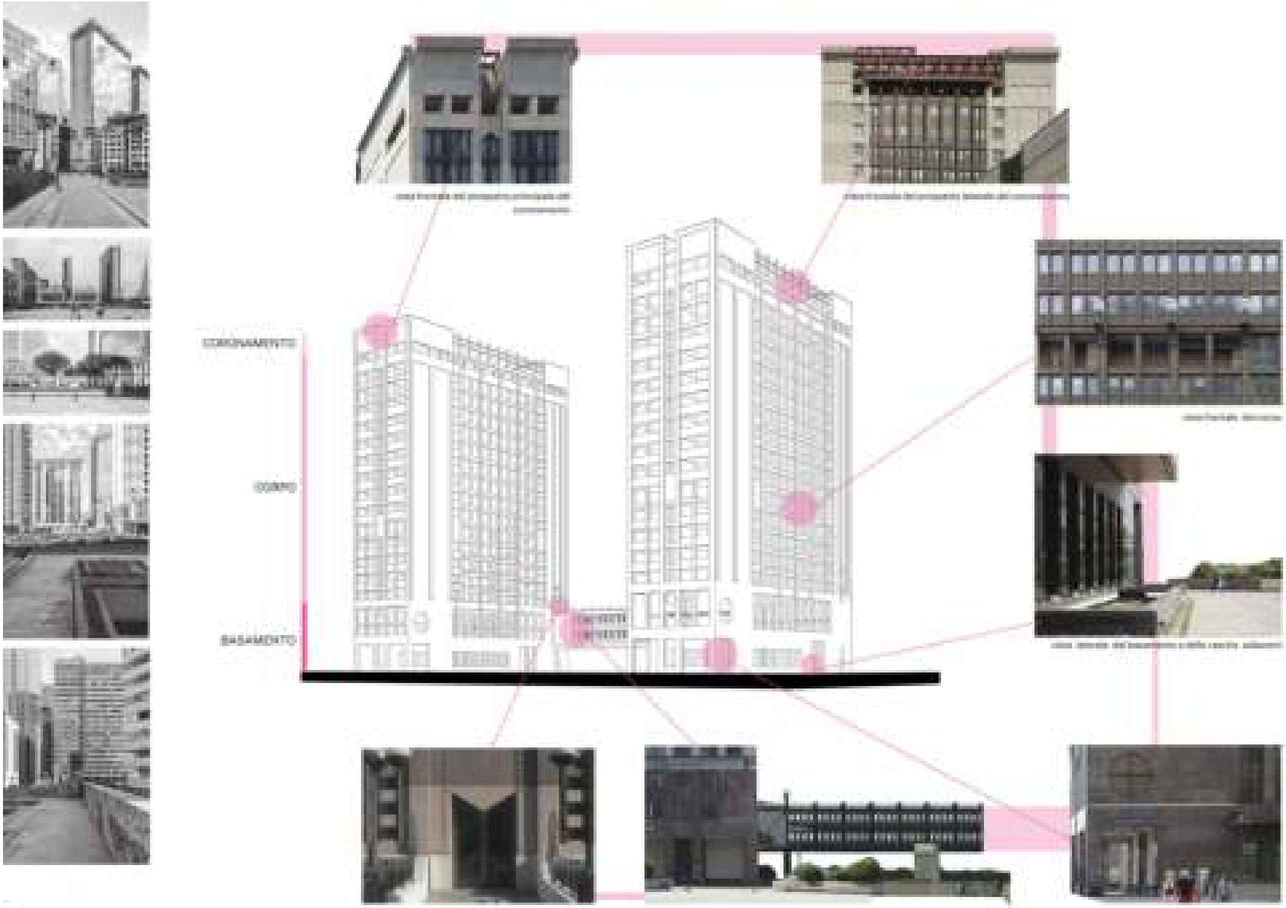


Fig. 9. Studies for the design of transitory uses for the Banco di Napoli building, Centro Direzionale Naples. (Students of the Design Laboratory 2022 -2023 CdS MAPA, Unina).

cultural engagement to educational initiatives. Moreover, these groups experiment with different economic models to support their efforts, emblematic of their innovative stance towards urban development and community empowerment. Through an interdisciplinary lens, such studies contribute invaluable insights into the adaptive mechanisms underlying transitional urbanism, illuminating pathways for sustainable urban regeneration and inclusive community development.

Projects of transitory uses in Naples: experimental metaprojects

During the Living Lab (Festival of Architecture CA23 Plural Territories), the specificities, "stories," and potential of some disused buildings that populate the urban territory of Naples were explored at different scales. Living Lab participants and community members, along with architects, photographers, artists, students, and university professors, questioned the value of these containers as 'places of possibility.'

Among the explored vacant buildings, there is one situated on Poggio Reale Street (Fig. 11), initially designated for postal services before being abandoned. Adjacent to still-occupied residential towers, this significant structure now stands deserted. Preliminary calculations reveal that substantial expenses have been incurred over the past two decades solely to maintain the closed facility, encompassing security costs and minimal maintenance expenditures. Recognizing the financial burden of abandonment underscores the urgent need to explore alternative management approaches. Experimental trials of temporary management strategies have been conducted to showcase how they could lead to significant cost savings for property owners, while also fostering opportunities for experimentation and revitalization.

Similarly, the Towers of the former Banco di Napoli (Fig. 12), located within the business district of Naples, represent another intriguing case study. These towers, designed by architect N. Pagliara, now stand as vast voids amidst a landscape of partially occupied and degraded buildings. Through visual aids such as videos and presentations, proposed transformation projects for these towers aim to demonstrate the potential for adaptive reuse and urban revitalization that could arise from their transient utilization.

The approach employed in both case studies was based on a thorough examination of contextual conditions. This involved identifying key areas and spaces suitable for activating temporary uses, aligning overarching goals with specific actions through a decision-making framework. Each action was meticulously planned, considering factors such as location, required resources, involved stakeholders, and desired impact. A crucial

Fig. 10. The cost of emptiness, extract from Simona Capaldo's thesis project (tutor O. Fatigato, M. Cerreta, HALL - Hemicycal Agrifood Living Lab" in the East of Naples.

aspect of the approach was the construction of an incremental program for interventions within the building spaces.

Another experimental project on temporary uses and incremental development was undertaken as part of Simona Capaldo's thesis (supervised by O. Fatigato and M. Cerreta). The project focused on a former fire station dating back to the late 19th century, situated within an intriguing urban block. Methodologically, the project evolved by intersecting design methods with appraisal and evaluation techniques. The starting point of the work was an assessment of the cost of the building's decommissioning during the period of abandonment (eight years).

An essential aspect of the project has involved archival research, aiming to restore dignity to these empty buildings by uncovering their rich history. These buildings, even though abandoned, bear witness to past lives, captured in photographs and memories, underscoring the need to recognize them as integral parts of our urban fabric. This archival work serves to testify to the vibrant life that once thrived around these structures.

The urban complex, with a semi-circular building from the mid-nineteenth century alongside industrial factories, reflects the area's evolution over time. Despite the current state of abandonment, the project has proposed a transformative approach, envisioning a space dedicated to new forms of production. Situated amidst hilly landscapes near Capodimonte and the botanical garden, the area is nestled among dense urban fabrics, fragments of resilient urban agriculture, and third landscapes of abandonment. The project, titled "Agrifood Living Lab," focuses on the transition process of the urban block towards new forms of agriculture in the eastern area of Naples. In the thesis project, an urban strategy was implemented to revitalize the block, starting with the creation of a bike path to reconnect the abandoned areas.

Further interventions made the introverted walls of the block more porous and permeable, improving connectivity with the square in front of the semi-circular building. This attention to transversality and permeability extended to the creation of new internal courtyards, promoting public spaces conducive to the experimental and productive aspects of urban agriculture.

The process over time is structured into three phases: the seeding phase - initial investment with limited economic profitability; the economically more profitable growth phase, and the harvesting phase. Each action is outlined in different spatial phases involving various actors, visualized from economic actors to privileged interlocutors and hypothetical investors.

The project axonometry (Fig. 13) portrays the evolution of the project over time, including the construction of a new volume that expands over time. The design of the new system between the ground floors of the volumes expresses the desire to create porous spaces within the block, connecting the historic building, the industrial hangars, and the new construction.

The intervention involves the conservation and transformation of the industrial warehouses: one into a market space with movable volumes for indoor-outdoor use, and the other used for hydroponic cultivation. The newly constructed building aims to accommodate researchers and features spaces for culinary experimentation, aligning with the growing

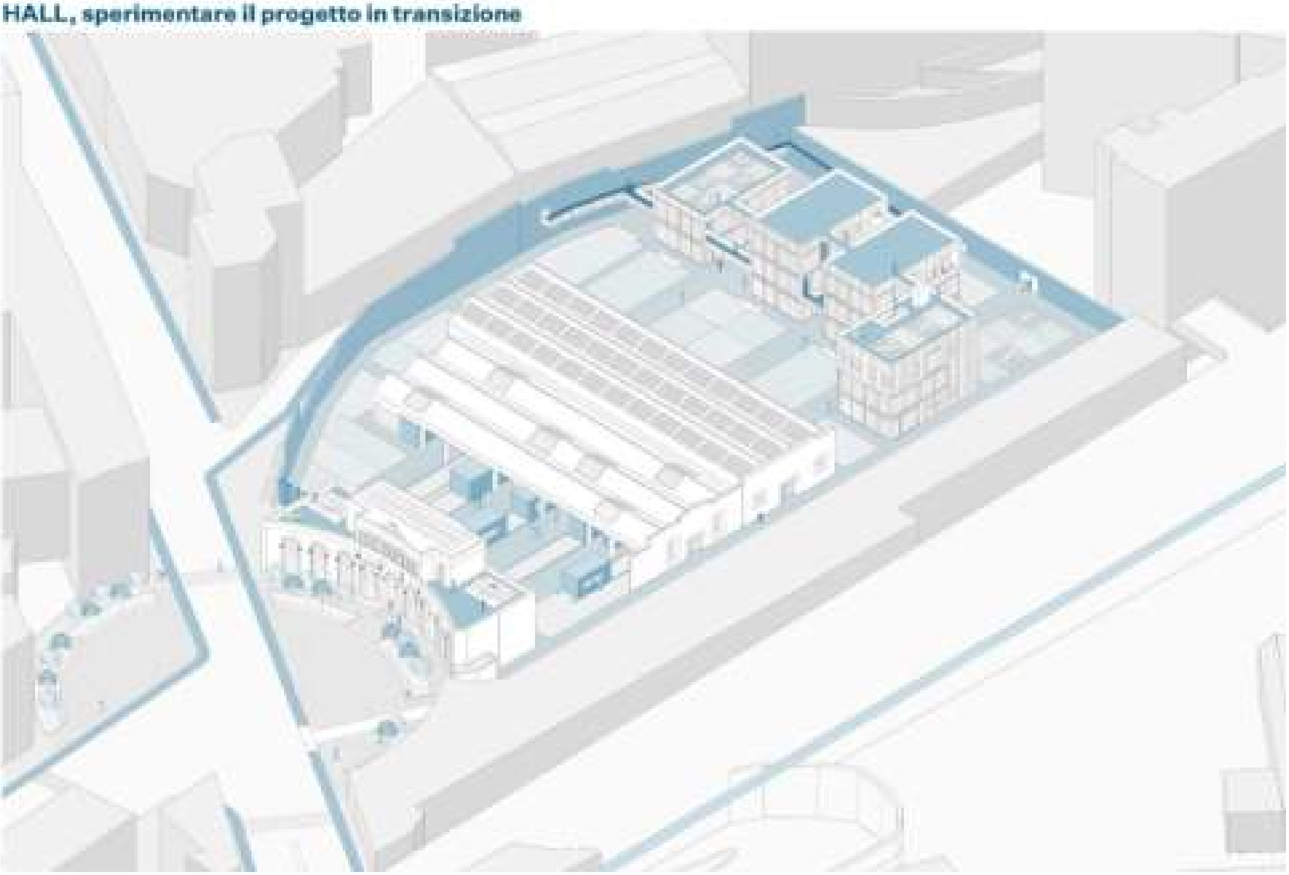


Fig. 11. Axonometry of Simona Capaldo's thesis project HALL - Hemicycal Agrifood Living Lab" in the East of Naples.

interest in agricultural productivity and food culture in Naples. Alternative scenarios proposed by the thesis explore other potential outcomes. These scenarios reveal the economic value inherent in disuse and abandonment, highlighting the multiple dimensions (cultural, economic, social, spatial) involved in urban regeneration projects.

Conclusion

In conclusion, the key concepts discussed are underscored, shedding light on the theme of transitory uses and the intricate relationship between temporary and transitory interventions. The term "transitory" denotes transformational actions that occur in a moment but are embedded within a longer-term temporal process, akin to the initial pieces of a system that must evolve and adapt over time. Conversely, "temporary" implies a use that may be ephemeral but remains essential to consider.

Examining the dichotomy between the public and private spheres, it becomes crucial to explore how they intersect within complex processes; the analysed case studies prompt reflection on the distinction between single management systems and co-management systems that are more suitable for addressing the regeneration process. From a design perspective, it is indispensable to distinguish the theme of space transformation through transitory uses from the repetitive adoption of a temporary aesthetic. Instead, attention should focus on understanding the evolutionary nature of spatial transformations.

Through design experiments of multiple case studies, we considered desirable project actions to 'reclaim' spaces in disused buildings, which often appear uninviting due to their alienating scale or evident obsolescence. Simultaneously, we focused on the potential for proposals to evolve as a necessary condition for space activation.

The relationships and connections between space users are in constant flux and transformation. It's as if the design of these experimental spaces must remain partly "open" to evolve, change, and adapt over time in harmony with the people and the "living" world (Clément, 2006) that inhabit them.

References

Agamben, G. (2018). *Abitare e costruire*. Macerata: Quodlibet.

Augé, M. (2002). *Le temps en ruine*. Paris: Galilee.

Berger, A. (2006). *Drosscape: Wasting Land in Urban America*. Princeton Architectural.

Boano, C. (2020). *Progetto minore. alla ricerca della minorità nel progetto urbanistico ed architettonico*. Siracusa: Letteraventidue.

CHAPTER 1

Borges, J. L. (2020). *Storia dell'eternità*. Milano: Adelphi.

Bouchain, P. (2006). *Construire autrement: comment faire?*. Arles: Actes Sud.

Clément, G. (2006). *Une écologie humaniste.* Avignon: Aubanel Editeur.

Donadieu P., & Mazas E. (2002). *Des mots de paysage et de jardin*. Dijon: Educagri.

Encore Heureux Architectes (2018). *Lieux infinis* : *construire des bâtiments ou des lieux ?* Paris: B42.

Sendra, P., & Sennett, R. (2023). *Progettare il disordine*. Roma: Treccani.

Sennett, R. (2018). *Costruire e abitare. etica per la città*. Milano: Feltrinelli.

Lacy, P., Long, J., & Spindler, W. (2020). *The Circular Economy Handbook: Realizing the Circular Advantage*. London: Palgrave Macmillan.

Pasqui, G. (2019). Futuri anteriori: il tempo del progetto. In *Rivista di estetica, the science of future*. Promises and previsions in architecture and philosophy, No. 71, pp. 50-56.

Robiglio, M. (2017). *RE-USE, 20 American Stories of Adaptive Reuse. A toolkit for post-industrial cities.* Berlin: Jovis Verlag.

Living the spaces of post-production: design scenarios for Bagnoli

Giovanni Multari, Margherita Maurea, Paola Ascione, Vincenzo Gioffrè

"The existing" as potentially structuring material for the architectural design

More than other places, industrial abandoned areas appear suspended, where time, although passed by, manifests itself through present permanencies, in a condition between past and present, between the loss of values and the immense potential they offer to the contemporary city. In this context, the relationship between architecture and time emerges as a crucial interpretative key to address the issue of productive memory recovery.

The project for the regeneration of these areas is required to balance the permanence of identity elements with the necessity of adaptation and variation. It is essential to start from the identification of the intrinsic identity of these spaces, considering their historical, cultural, and social characteristics. The transformation process must be guided by the specific needs and requirements of the local community, in constant dialogue with the surrounding context, through gradual steps and actions that allow for continuous evaluation of the outcome.

In the broader context of transformation processes in the peripheral areas of contemporary cities, there emerges the need for an inclusive approach that sees architectural project not only as a means to transform physical spaces, but also as a catalyst to activate sociocultural processes that can sustain transformations over time.

The thesis studio is configured as a valuable moment to organize and

structure design research dedicated to the regeneration of abandoned sites, with the aim of redefining how public space is used. The methodology adopted explores the possibility of interpreting "the existing" as potentially structuring material for the architectural project to re-signify these areas, introducing strategies that can be replicated in similar contexts.
A tangible example of these challenges is the former Bagnoli steel plant, located on the western suburbs of Naples (Fig. 1).
Founded in 1910, the plant experienced significant growth until World War II, becoming a key industrial hub in southern Italy but simultaneously causing severe environmental damage.
The blast furnace, towers, and industrial spills, directed into the coastal sea, made it one of the most polluted places in the South of Italy.
With the closure of the plants in 1992, a long and unprofitable discussion began on the future of Bagnoli and the re-covery of the area to the point that it "[...] had become so identified with the factory that, when it disappeared, it au-tomatically became a nothing, a non-place, an absence. Above all, an absence of the future" (Rea, 2002, p. 184). Decades of confrontations are closed – finally – with the international competition "UrbaNAture" curated by Invitalia, the agency of the Ministry of Economy and Finance. A competition to transform the 250 hectares of the former in-dustrial area of Naples into one of the largest and most fascinating urban parks on an international scale.
However, despite exciting prospects, uncertainty and carelessness persist in the area, as previous plans have failed to draw sufficient resources and interest to initiate a meaningful reactivation.
There is a long waiting period expected for the new large urban park project to be implemented. Therefore, in the most immediate terms, a series of questions emerge: what actions can be taken towards final implementation? How can we take effective action on such a critical and unique site? Most importantly, can the actions we take now be in-tegrated or related to the final project?
In response to these challenges, the need emerged for a phased and

Fig. 1. Two Faces of Bagnoli: On the traces of its industrial past, the large structures emerge among the lush vegetation that is slowly reclaiming the area. A visual contrast that reflects the ongoing transition, where the industrial legacy merges with the rebirth of the landscape (photographs: A. Cherillo and C. Prezioso).

inclusive approach that actively involves the local community and enhances the existing industrial heritage.

The thesis studio was a key moment in this process, providing a space for theoretical investigation and design exper-imentation, which involved site visits, seminars with experts, making study models and graphic re-elaborations. The different stages of the process involved the knowledge of different disciplines that informed the architectural project by leading the discussion with different stakeholders, including residents, third sector organizations, academic institu-tions, associations; the definition of the urban and architectural strategies; the relationship with the existing industrial heritage, the approaches related to landscape project, up to the essential actions to manage, maintain and sustain the regenerated spaces.

The Ex-Italsider area represents a testimony to the material and intangible culture that has helped determining the landscape. It is a complex system in which nature, economy, culture, and the built environment meet and relate to each other. The regeneration of this heritage and its related values (both tangible and intangible) necessarily presup-poses a holistic approach that starts with a deep understanding of it. Knowledge, as a fundamental act, constituted the starting point for building the intentions of a design strategy, which reads "the existing" as a project issue. In this sense, the reconstruction of the levels of perception and consistency of the territory – including settlement, infra-structure, environmental, regulatory, and social aspects – emerged as the result of a careful reading practice aimed at tracing the demand for transformation. The multiplicity of views made possible the construction of diversified but coherent design scenarios, which constitute – as a whole – a macro-strategy of transformation that, by drawing on two absolutely crucial aspects for the regeneration of Bagnoli, the landscape and the industrial heritage, reflects on the idea of "an intermediate time" between the area's current condition of suspension (Fig. 2) and the realization of the future urban park. In this perspective, the output of the research is the intermediate time plan named "Living the spaces of post-production" (Fig. 3), which proposes an incremental series of design actions aimed at

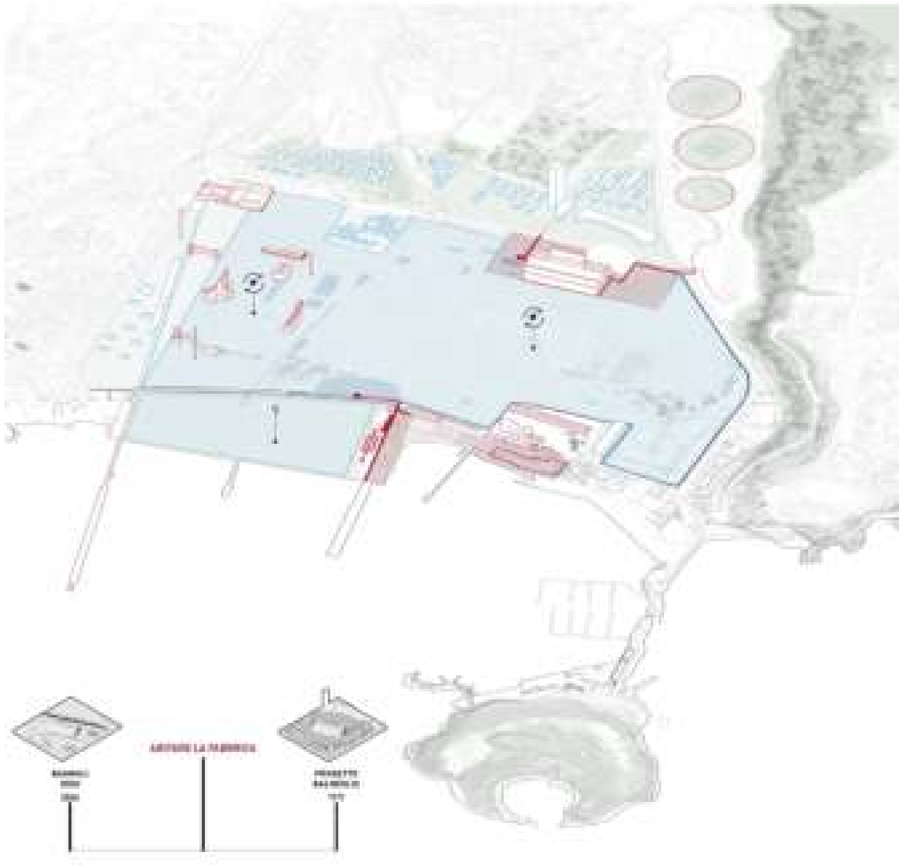
Fig. 2. Axonometric diagram illustrating the current condition of the Bagnoli area, highlighting the boundary delineated by the fence wall separating the former industrial area from the surrounding neighborhood (drawing: A. Cherillo and C. Prezioso).

engaging the community and gradually regenerating the area, to relate, in a further step, to what will be the final project (Fig. 4).

This approach aims not only to physically transform the space, but also to promote a shared collective vision and es-tablish an operational model that can be replicated in other similar settings. The goal is to provide the community with new ways to living for previously abandoned or neglected spaces, while the large urban park is being realized.

The urge to start from the "places of post-production" imposes

Fig. 3. Axonometric diagram illustrating the progress of the proposed interventions of the "Balnolis" project combined with the incremental activation actions of two pilot areas (drawing: A. Cherillo and C. Prezioso).

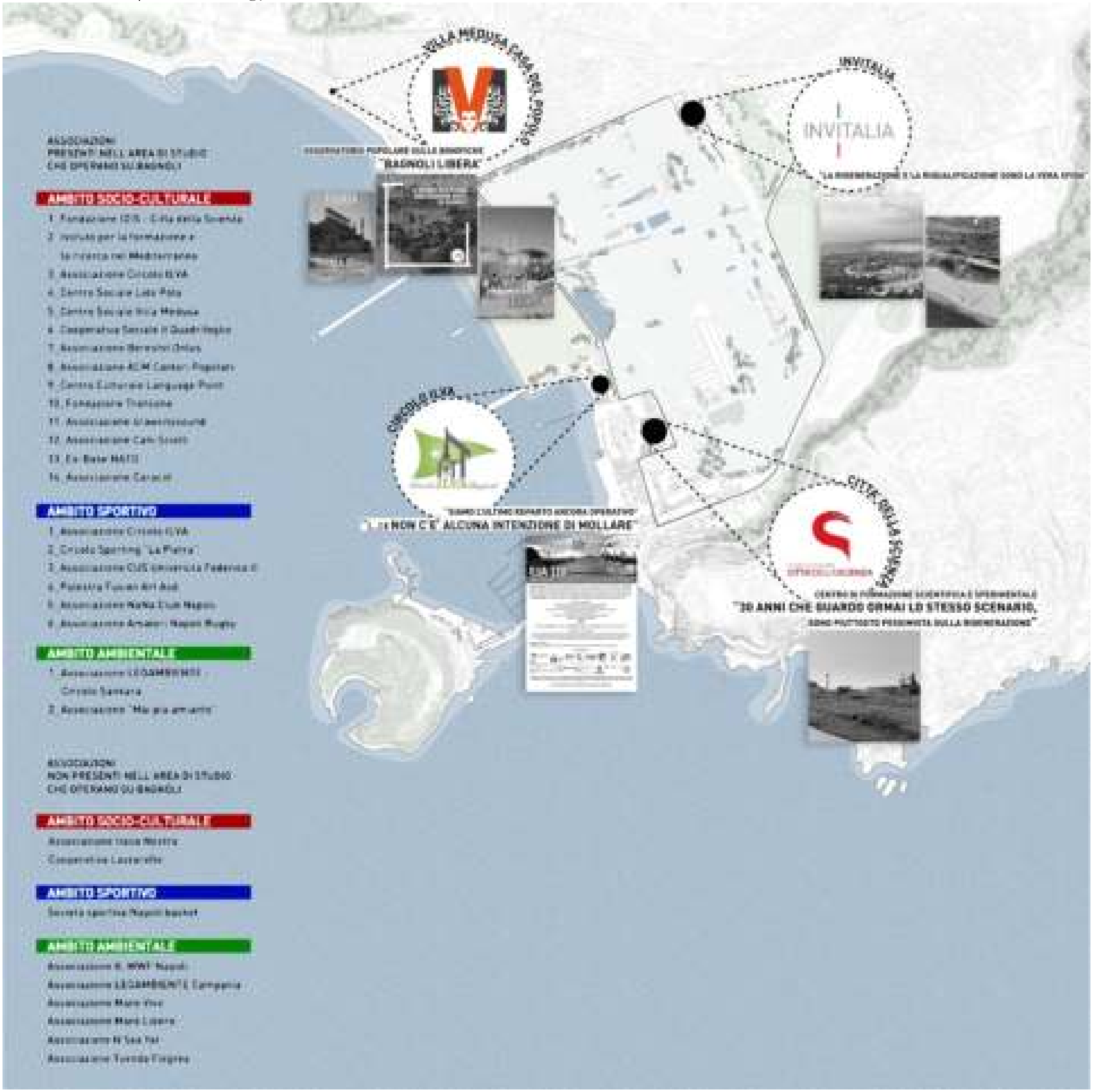


considering the transformation project as a series of discrete operations, inserted into the context to change its meaning, far from invasive actions. The history of the city is closely linked to the theme of production and the deindustrialization of recent decades, which has led to the decommissioning or reduction in use of entire urban and peri-urban compartments. The city of production is now a project element, no longer as a void, but as "one among those resources of immediate availability capable of activating not only reorganizational-functional processes of

Fig. 4. Axonometric diagram illustrating the integration of the proposed intermediate actions with the final implementation of the "Balneolis" project (drawing: A. Cherillo and C. Prezioso).

the territory, but also the social and economic development of our cities" (Sposito, 2012, p. 12).

In the outlined perspective, the case of the former steel center of Bagnoli - starting from its image of abandonment – the industry offers a possibility of rebirth based on its intrinsic characteristics, on the "waiting stones" present in the place, as stated by Daniele Vitale. This interpretation transcends the mere concept of "ruins", as there is a latent vitality waiting to be brought to light (Vitale, 1996, p. 41).

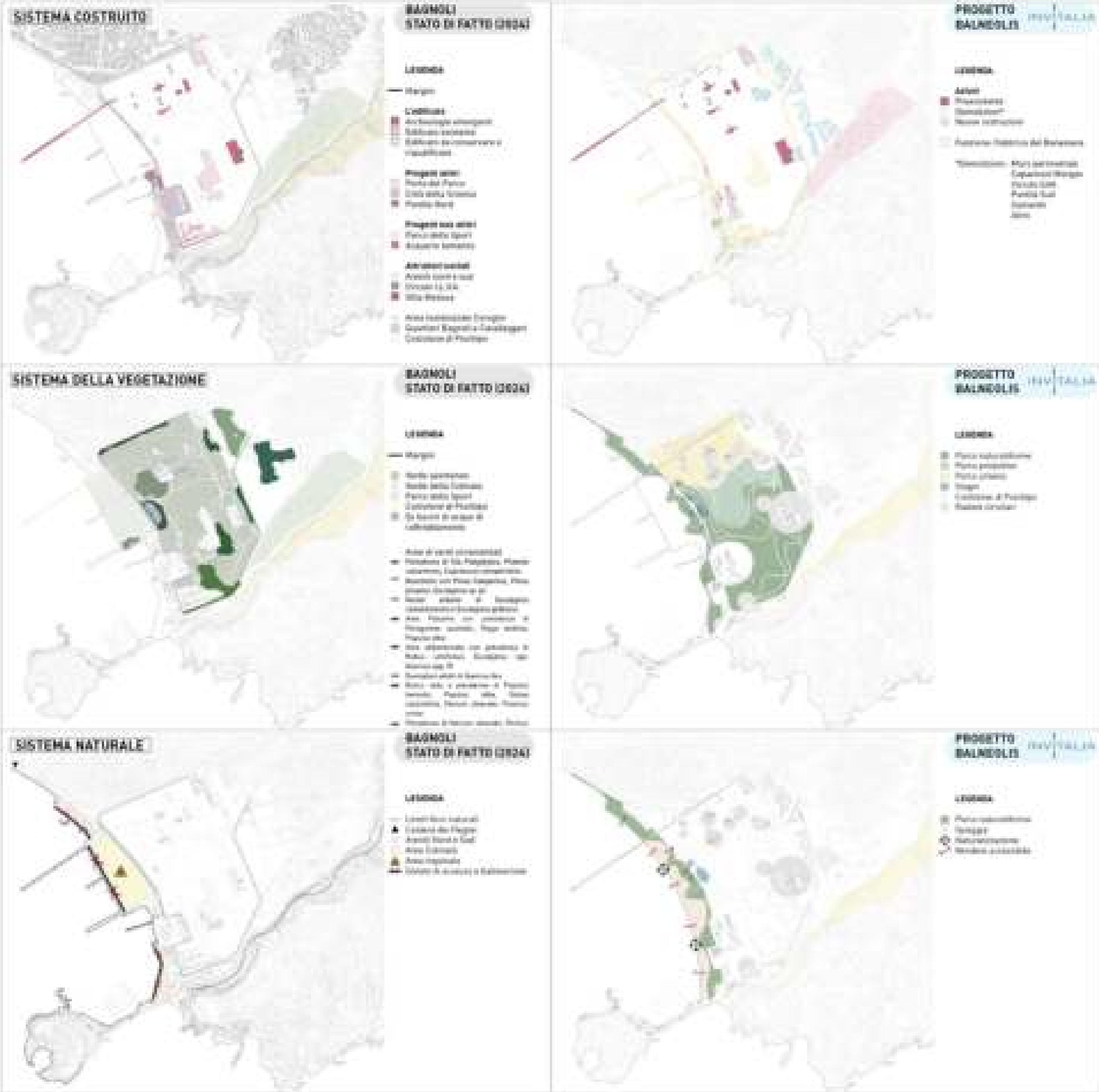

VILLA MEDUSA CASA DEL POPOLO
"BAGNOLI LIBERA"
INVITALIA
INVITALIA
CIRCOLO ILVA
"NON C'E' ALCUNA INTENZIONE DI MOLLARE"
CITTÀ DELLA SCIENZA
"30 ANNI CHE GUARDO ORMAI LO STESSO SCENARIO,
AMBITO SOCIO-CULTURALE
AMBITO SPORTIVO
AMBITO AMBIENTALE
AMBITO SOCIO-CULTURALE
AMBITO SPORTIVO
AMBITO AMBIENTALE

Thus, urban regeneration, associated with the reuse of abandoned industrial heritage, becomes a dynamic process that requires not only the preservation of existing values, but also the definition of innovative proposals capable of meet-ing various functional, social and cultural needs.
The research represents the most concrete testimony of the necessary and indispensable relationship between the university and the city, equal protagonists in a common development, where education becomes - as Mumford argues – "[...] the central nucleus of the new urban and cultural organization" (Mumford, 2007, p. 254). Therefore, the main objective has been the formulation of "possible visions", starting from an "academic social responsibility", which seeks synergistic and impactful solutions.
In order to encourage critical thinking, the research conducted by students has attempted to reconstruct the specific character of the place, through focused analyses conducted on thematic levels. The case of Bagnoli represents an emblematic example of how urban regeneration can be driven by the reuse of existing industrial heritage, turning it into an opportunity for the local community. The collaboration between the university and the city proves itself es-sential in this process, as it allows for the development of innovative solutions and the construction of a shared vision for the future of the area.

An incremental approach to analysis and design processes for industrial sites in disuse

From the transformation of the former industrial site as the "Nuova Italsider" and "Bagnolifutura", through "Ilva" and "Bagnoli S.p.a.", up to the "Balneolis e la nuova Stagione Felix" project [1], about 250 hectares - previously occupied by the steel plant - are now set to become an urban park. The goal is to create an ecological network linking the sea and the hillside, with a focus on enhancing the industrial heritage. However, the future of this place remains uncertain, an area suspended between "the no more and the not yet", with "the regret [...] of helplessly witnessing the continuous delays of the transformation works, while the inexo-rable

Fig. 5. The first "cognitive" phase guided the understanding of both the physical context through field visits in the extensive western suburb and the social context through dialogues with residents, local entrepreneurs and active associations in the area (drawing: A. Cherillo and C. Prezioso).


SISTEMA COSTRUITO
BAGNOLI
STATO DI FATTO (2026)
LEGENDA
PROGETTO
BALNEOLIS
LEGENDA
SISTEMA DELLA VEGETAZIONE
BAGNOLI
STATO DI FATTO (2026)
LEGENDA
PROGETTO
BALNEOLIS
LEGENDA
SISTEMA NATURALE
BAGNOLI
STATO DI FATTO (2026)
LEGENDA
PROGETTO
BALNEOLIS
LEGENDA

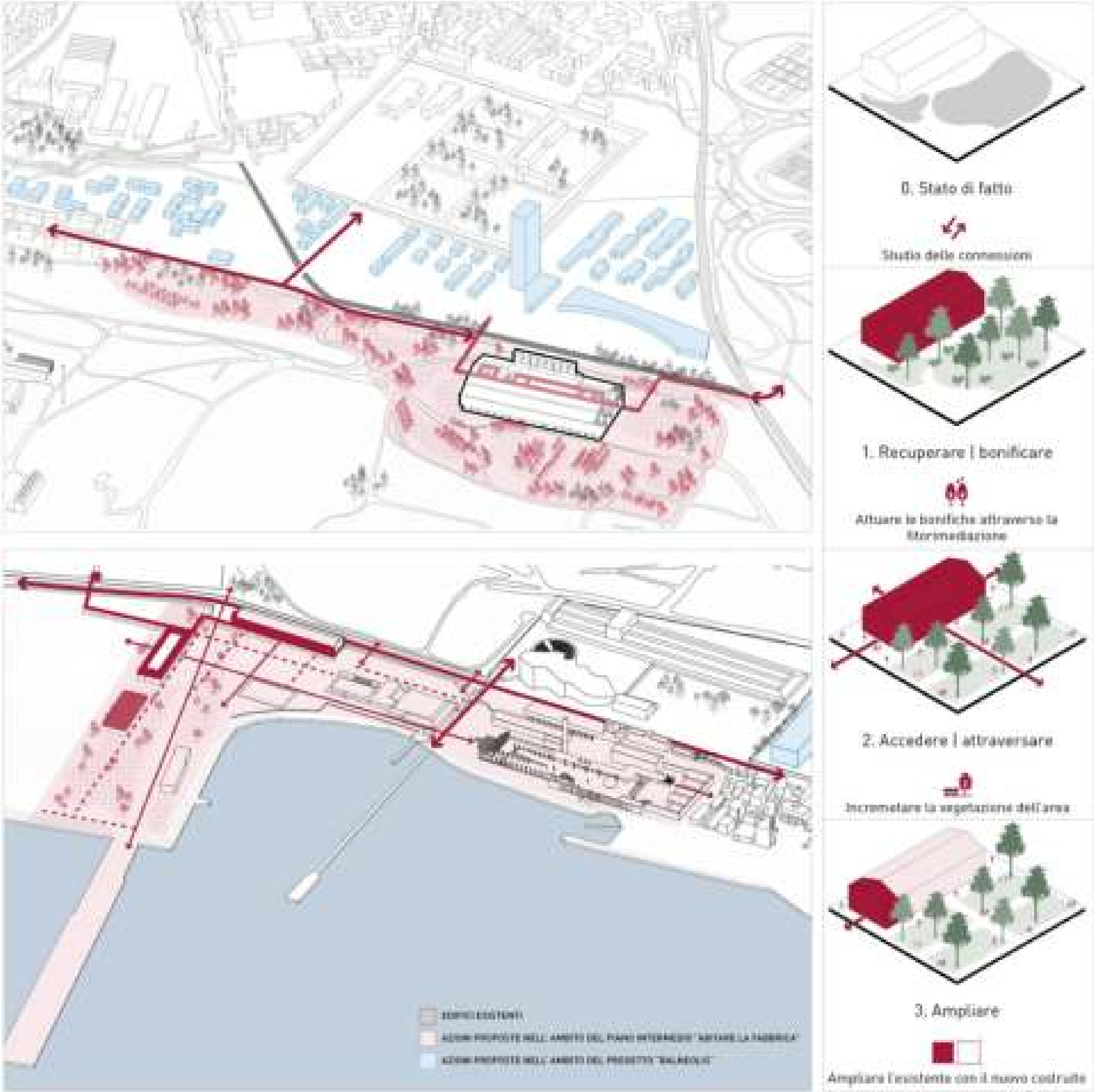
passage of time is now fading the memory of the factory" (Capasso, 2020, p. 131). To address this challenge, a new approach was undertaken in the thesis studio that aims at an alternative reading of the context and a site-oriented design. Rather than focusing on the inefficiency of the plans already proposed for these areas, an attempt was made to identify a model of project development as a form of "mediation", with the aim of initiating actions that can restore new ways of living for previously abandoned spaces.

The thesis research is characterized by its interdisciplinary approach, serving as a fundamental workspace for sharing reflections and perspectives from different disciplines. This context allows for the integration of a wide range of knowledge and skills, crucial for structuring a comprehensive and well-articulated project workflow. The aim is to create synergy among contributions from different fields, with the goal of formulating innovative and effective solu-tions. This gradual approach allows for the progressive tackling of challenges, adapting and optimizing intervention strategies based on the results obtained and the new knowledge acquired along the research journey. Moreover, the research's diverse phases have spurred reflections that have guided the architectural project. This includes exploring modes of collaboration with stakeholders representing varied interests, such as residents, third-sector organizations, academic institutions, entrepreneurs, and traders. Additionally, it entails examining the structure and nature of the ur-ban project, from urban and architectural strategies to landscape design, while considering the actions required to manage, maintain, and support regenerated spaces.

In this regard, the thesis studio has endeavored to provide a concrete response to the regeneration of the former in-dustrial area of Bagnoli, starting from the environmental remediation and urban regeneration program (P.R.A.R.U.) [2], promoted by Invitalia, and the subsequent international competition "UrbaNAture" [3], which became structuring elements for defining the research question.

The thesis has been structured in three phases where the understanding

Fig. 6. Comparison maps making explicit the current condition of Bagnoli and the directions of the winning project, produced during the discussion phase with Invitalia, the entity responsible for the revitalization program of the industrial area (drawing: A. Cherillo and C. Prezioso).


0. Stato di fatto
Studio delle connessioni
1. Recuperare | bonificare
Attuare le bonifiche attraverso la fitorimediazione
2. Accedere | attraversare
Incrementare la vegetazione dell'area
3. Ampliare
Ampliare l'esistente con il nuovo costruito

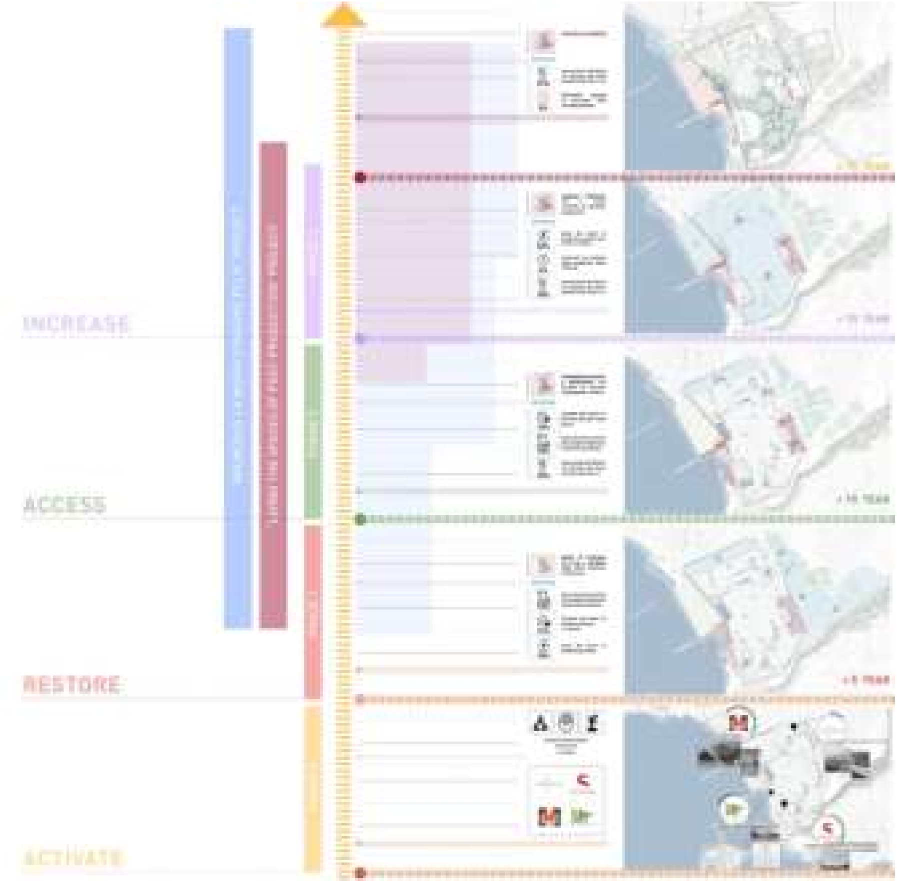


Fig. 8. Diagram of the intermediate temporal plan named "Living the spaces of post-production", structured in a progressive sequence of project actions - activating, regenerating, accessing, expanding - by combining the strategies of the winning project "Balneolis" (drawing: A. Cherillo and C. Prezioso).

of the territory was deepened to compre-hend the physical and socio-cultural conditions of the area; dialogue and engagement with various stakeholders were initiated, and finally, an operational intervention strategy was proposed. The first "cognitive" phase guided the under-standing of both the physical context through field visits in the extensive western periphery and the social fabric through dialogues with residents, local entrepreneurs, and active associations in the area [4].
In particular, interactions with the Circolo Ilva, which has long promoted

Fig. 7. The diagrams illustrate the two pilot areas to be activated to trigger the wider regeneration process and the proposed strategic program for incremental actions (drawing: A. Cherillo and C. Prezioso).

social inclusion and promotion actions, were of great source of knowledge (Fig. 5). The subsequent "engagement phase" was characterized by an active dialogue with Invitalia, the entity responsible for the remediation and revitalization program of the former industrial area of Bagnoli. This engagement was useful for understanding the status of the remediation efforts and the implementation of the winning project "Balneolis", identi-fying strategic directions and implementable criticalities (Fig. 6).
In the third phase, after identifying two potential areas of "urban reactivation" - the steelworks factory and the Circolo Ilva warehouses - an intervention strategy was developed, focused not on a defined project, but rather on a program defining the type of transformations, uses, and activities needed to support future regeneration (Fig. 7).
The research outcome is the intermediate temporal plan named "Living the spaces of post-production", structured in a progressive sequence of project actions - activating, regenerating, accessing, expanding - suggesting which actors to involve, which remediation interventions to implement, and what types of architectural and urban interventions can facilitate this transformation process. The aim is to combine the strategies of the winning project "Balneolis" with in-crementally implemented actions, allowing the community to "live" in spaces previously neglected or abandoned while the large urban park is being realized (Fig. 8).
After the initial activation, supported by participatory communication and engagement processes to involve interested actors, interventions are carried out to ensure the safety and recovery of disused buildings, simultaneously with the start of remediation works. At the end of the activation and regeneration phases, access will be possible through elevated and ground paths in areas ready for use. This operational sequence provides a basis for expansion actions through interventions on existing structures, thus offering the possibility of "Living the spaces of post-production".
The proposal aims to cooperate with the "Balneolis" project. In the new context, the Circolo Ilva contrary to the planned relocation of its spaces, will retain a central position, acting as a hinge between the waterfront

Fig. 9. The vast former Ilva area of Bagnoli from the hill of Posillipo (photographs: A. Cherillo and C. Prezioso).

and the large park, in continuity and installing an uninterrupted dialogue between the two landscapes. Consequently, actions are proposed to facilitate communication between the park and the sea, protecting and enhancing the spaces of the Circolo Ilva as a "space of social inclusion and knowledge", through the realization of the "Ilva Archive Museum of Bagnoli" and the enhancement of sports and social activities through the activation of agreements with territorial partners.

The proposed project for the former steel factory area represents an innovative approach aimed at reclaiming and en-hancing this important historical and industrial site. The approach is structured through a series of incremental phas-es, with the goal of transforming the area into an accessible and functional space for the community. Central to the project is the development of a modular construction system that can accommodate various urban functions. Using modular and flexible structures such as walkways, arcades, stairs, and alcoves, the project aims to adapt to the chang-ing needs of the community and offer opportunities for use.

One of the initial phases of the project involves creating an elevated

pathway to allow access to the interior of the former plant. This enables visitors to explore the area safely and admire the industrial monuments that characterize the urban landscape. Subsequently, the module is expanded to envision semi-public spaces that can be equipped for various urban activities and functions. The vertical configuration of the structures allows users to have a full awareness of the natural terrain, traversing different layers of uses and landscape, thus creating a harmonious blend between the industrial history of the site and the contemporary needs of the community.

To sum up, the thesis research has provided a valuable opportunity to reconsider intervention approaches in particularly fragile areas, offering a process that acknowledges the adaptability of transformations to the specific characteris-tics and timelines of the places. At the core of this process emerged the need to define programs that not only guide the execution of the transformations, but also support their management and long-term development. This incremen-tal project development model not only raises crucial questions but also opens up to a wide range of possible future scenarios. It invites further research to explore the various forms that architecture can take into consideration by ad-dressing the dynamics of transformation in contemporary cities.

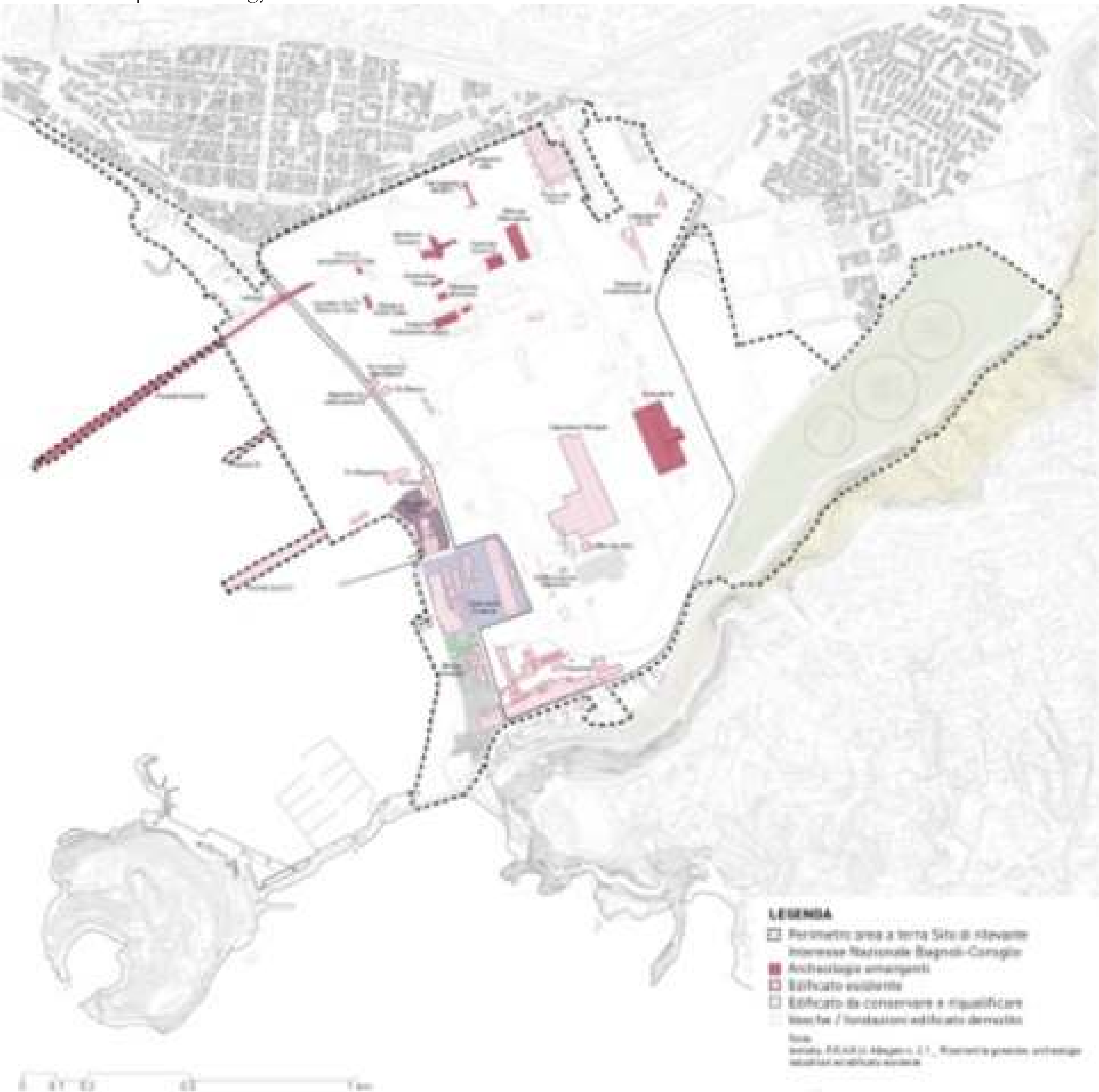
A deep understanding of these dynamics and their integration into design processes is essential to develop effective and sustainable solutions that meet the needs and challenges of modern urban communities.

The Industrial Heritage

Whoever looks today from the hill of Posillipo at the vast former Ilva area of Bagnoli cannot but notice the "remains" of the plant that has been disused for almost thirty years, alternating with vast uncultivated green areas (Fig. 9).

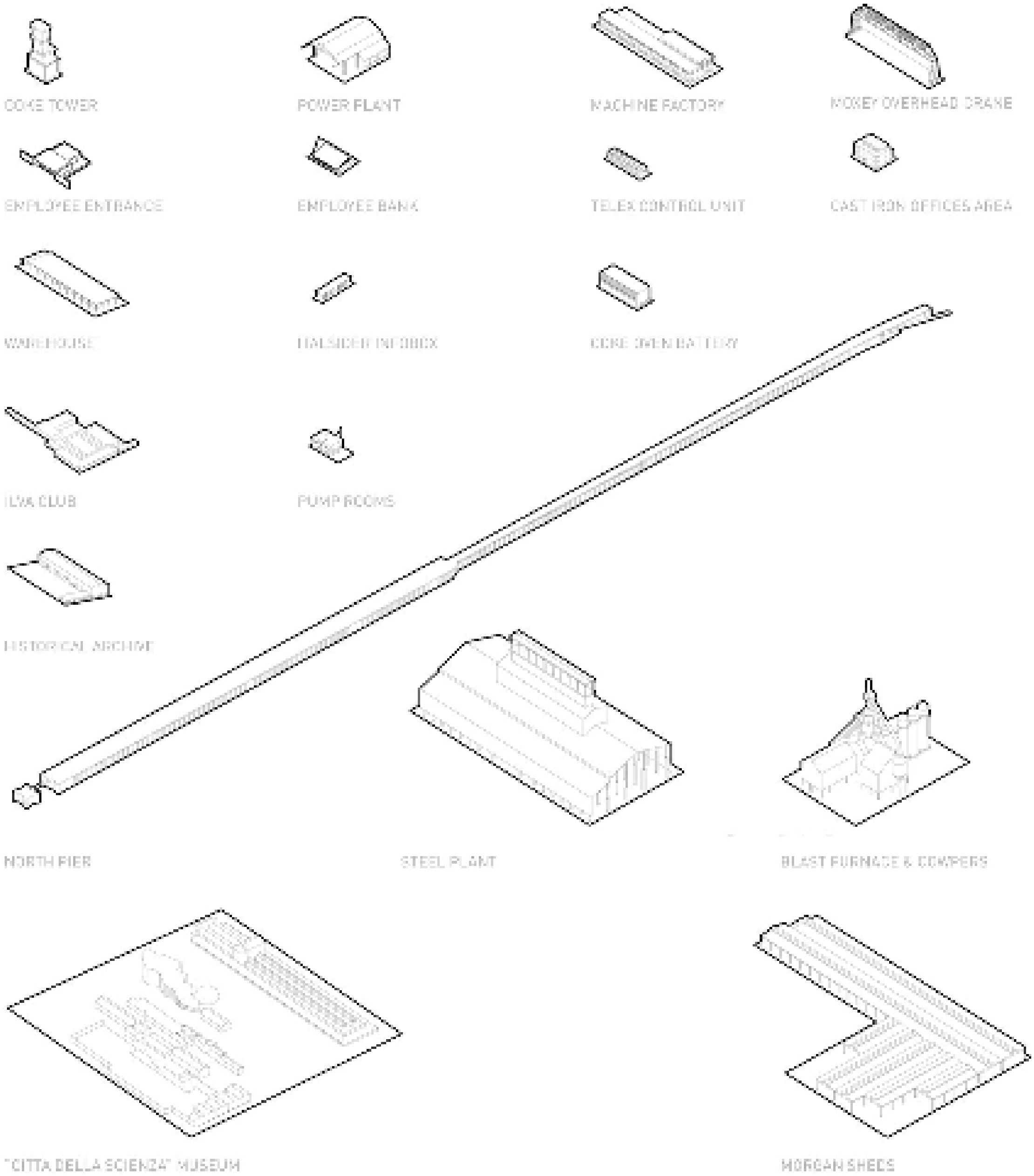
A sort of large archaeological park (belonging to a recent past) closed to the city by a wall, which the gaze cannot grasp except in relation to a landscape context. Within the large enclosure, the smokestacks, blast furnace and espe-cially the steel mill, an imposing monument of modern

Fig. 10. Some "remains" of industrial archaeology within the large enclosure (photographs: A. Cherillo and C. Prezioso).


LEGENDA
Perimetro area a terra Sito di rilevante
Interesse Nazionale Bagnoli-Coroglio
Archeologie emergenti
Edificato esistente
Edificato da conservare e riqualificare
Vasche / fondazioni edificato demolito

times, seemingly casually located. But no building has random type, shape, and location in a manufacturing plant (Fig. 10).
Not far from Ilva, set in the same scenery of the Phlegrean fields stands out the Olivetti factory in Pozzuoli, where Luigi Cosenza, interpreted in a completely innovative key the idea of the factory and its relationship with the envi-ronmental context inspired by the idea that the project takes on the rules of the place and then confers new ones. Reproposing such an exercise for the SIN area of Bagnoli, becomes a necessary, albeit somewhat complex, action. It means addressing the issue of regeneration from two questions: what are the "rules" to be incorporated? What are the "rules" to be assumed in the project?
In this specific case, bringing these aspects back to the way of approaching the topic of industrial archaeology, it is a must to remember that such "remains" were part of a system created with the precise purpose of making the factory work. No construction, from the blast furnace to the wharf, from the steel mill to the machine shop, is conceived independently of the other: each artifact played its own role in perfect relation to the others and in function with the development needs of the production process.
These are not stand-alone constructions but a system of architecture and infrastructure, placed according to a logic never divorced from the context, based on the phases and sequences of the industrial cycle. All starting with the im-posing presence of the North wharf that connects the complex with the sea, the starting point of the cycle, the place of arrival of raw materials then deposited next to it in the storage area, originally located within the enclosure between the boundary of Via Coroglio and Via Diocleziano, and later moved to the fill along the coast. With the decommissioning, dismantled the road and track infrastructure, the built-up area of the industrial era emerged, "remnants" not without value, coinciding with what the Nizhny Tagil charter defines as industrial heritage: "industrial heritage represents history, architecture and technology in different time and area, which needs to keep in good condition for next generations" (TiCCiH, 2003).

Fig. 11. General plan: industrial archaeology and existing buildings. Source: Invitalia, Program for environmental renovation and urban regeneration. Bagnoli - Coroglio site of relevant national interest. Update: March 2018 (drawing: A. Cherillo and C. Prezioso).


COKE TOWER
POWER PLANT
MACHINE FACTORY
MOXEY OVERHEAD CRANE
EMPLOYEE ENTRANCE
EMPLOYEE BANK
TELEX CONTROL UNIT
CAST IRON OFFICES AREA
WAREHOUSE
ITALSIDER INFOBOX
COKE OVEN BATTERY
ILVA CLUB
PUMP ROOMS
HISTORICAL ARCHIVE
NORTH PIER
STEEL PLANT
BLAST FURNACE & COWPERS
"CITTA DELLA SCIENZA" MUSEUM
MORGAN SHEDS

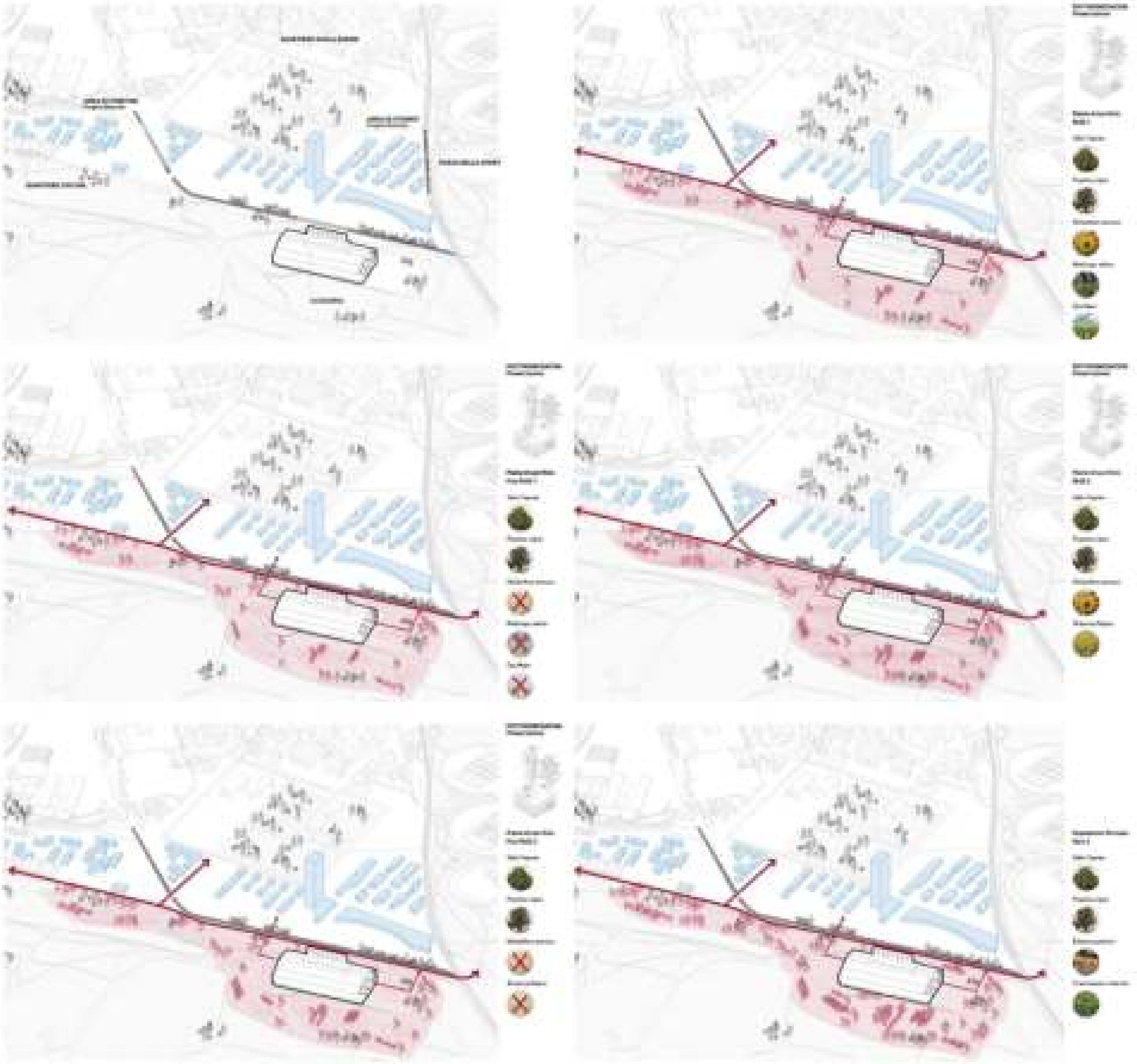
A heritage, this one, recognized as early as March 1999, when sixteen industrial artifacts were selected for relevance and state of preservation among those not yet demolished at the time, and in 2005 incorporated into the PUA with the aim of "restoring the extraordinary environmental conditions that were erased by the construction of the factory and, at the same time, preserving in non-superficial forms the memory of the recent productive past, especially for the significance it had in the formation of a labor culture in our city" (Figg. 11, 12).
The pre-existence must be thoroughly investigated in order to carp about its real possibilities for adaptation to strate-gies and plans of reconversion. Only if "vivisected and loaded with enough symbolism to bring out its characteristics as a shared good, and therefore susceptible to protection" (Zorgno, 1998) will the factory be able to show itself as a resource for the contemporary project.
While recognizing the value of the industrial site, today we have the right-duty to recover the environmental value of that area as well, restoring a balanced relationship between natural and industrial heritage. Hence the need to use an environmentally sustainable approach to the project. In this perspective, the building as such was not taken into consideration, rather the work aimed to focus on that " 'mechanics' of existential space which takes the form of the building of a harmonious fabric, encompassing both the natural and the artificial and responding to changing housing needs...in search of a new rootedness of things and man and nature, it being well understood, however, that the characteristic of the human species is the ability to modify na-ture, to make it more and more suitable for its own survival" (Vittoria, 1960).
In this perspective, the project starts from some paradigms of contemporary building dictated on the one hand by the need to rebuild a network of relationships between the built, itself understood as a resource and natural resources, in order to: principles of bioclimatic environmental design (partly already present in the types of industrial pavilions equipped with skylights designed to rationalize light and ventilation to the working environments); systems of energy production from renewable sources,

Fig. 12. Classification of industrial archaeologies. Source P.R.A.R.U. Annex no. 2.2. Urban Regeneration. Title: Industrial archaeology with description of the state of degradation. Update: March 2018 (drawing: A. Cherillo and C. Prezioso).

Fig. 13. The disused industrial area of Bagnoli as a valuable resource of naturalness and urban biodiversity (photograph: A. Cherillo and C. Prezioso).

in compliance with and beyond the thresholds provided by current regulations and protocols; as well as the principles of an architecture in the making, based on the uncertainty of construction and operating times, thus also providing for temporary, semi-permanent or permanent constructions, to provide for a progressive use of pre-existing volumes.
Regarding the latter aspect, the time factor was decisive in the choice of construction principles appropriate to what are the needs of the contemporary project, versatile for a variable and evolving demand, in

accordance with the stra-tegic objective defined by the Intermediate Time Plan within which the project proposal is placed. Hence the logic of operating from the perspective of landscapes "in transition", transforming pre-existing architectures into architectures "in the making" through the grafting of innovations, recovering peculiarities and implementing performance in terms of the environment and usability of spaces.
Within the timeframe required for remediation, in anticipation of time-varying uses, potential levels of transformabil-ity of the artifact need to be established, and the where and how of adding new volumes, components, technologies for water reclamation and energy production from renewable sources needs to be identified, with a view to "adaptive reuse" (Robiglio, 2017).
The choice obviously fell on systems and materials that meet the paradigms of reversibility, recyclability and the main environmental criteria aimed at making a project meet the goals of the Green Deal.
The proposal has focused on two among the existing volumes, different in type, structure, materials, location, but which in common have a high strategic value insisting on two edge areas close to two of the main axes that delimit the intervention area: the steel mill next to via Leonardi Cattolica, for which a semi-permanent construction is planned, and the shed of the former archive, destined to assume a permanent function whose side front insists on the sidewalk of via Coroglio, southwest towards the coast. The design hypotheses basically start from two assumptions. In the first case, that of the steel mill, interventions were considered that would allow the activation of functions even during the planned soil remediation activity using natural processes. Based on the logic of building in the built environment, a lightweight system with a structural steel cage and performance closure panels was assumed. The framed structure, an autonomous grid from the existing, allows the interior of the shed to be gained by accessing an intermediate elevation from the outside via a walkway to avoid contact with the soil at least until ecological regeneration processes restore the natural balance of the outdoor and covered areas.



In the second case, relating to the former Historical Archive destined also by its construction characteristics to last over time, special attention was given to technological and functional retrofit solutions, attentive to in-door wellbeing and energy saving. The retrofit actions therefore involved the entire shed, the external envelope and the construction of a new body leaning against the pre-existing one that allowed through the volume exposed to S-W to control and optimize environmental resources, filtering lighting and irradiation with a variable configuration façade system. In addition, on the large outdoor space, the semi-open volume intended as exhibition space, alternates ideal light and shade zones in a context facing the sea, characterized by the landscape design of sea dunes, mediates the indoor-outdoor relationship. The creation of shaded areas and the attention to the materials and color of the outdoor flooring, lowers the risk of generating heat islands, keeping the effects of the climate characterized in summer by the sea breeze con-stant.
When the Italsider (ex Ilva) in Bagnoli was decommissioned and the first demolitions began in Germany the RHUR had already become the Emscher Landschaftpark area, a reference of environmental regeneration and landscape de-sign. Today we are aware of how much damage has been done by abandoning the Ilva artifacts, turned into ruins, whose demolition would produce waste to the detriment not only of the identity of the building but of the habitat in which we live. The motivation that drives us to conserve the existing comes from this dual need, cultural and envi-ronmental, but we must not forget that the main purpose of the project is to return to those architectures born for other purposes, and in the past place of polluting productions, the role of mediation between natural resources and human needs for indoor and outdoor comfort, respecting the planet as a “common home”.

The Landscape Project

“Coping with post-industrial sites is a pressing issue throughout Europe and North America. One point of departure for their general rediscovery was the revitalisation by Latz + Partner in the early 1990s of an abandoned

Fig. 14. Planned phytoremediation process in the Acciaieria area, featuring sacrificial and permanent vegetation for environmental reclamation (drawing: A. Cherillo and C. Prezioso).

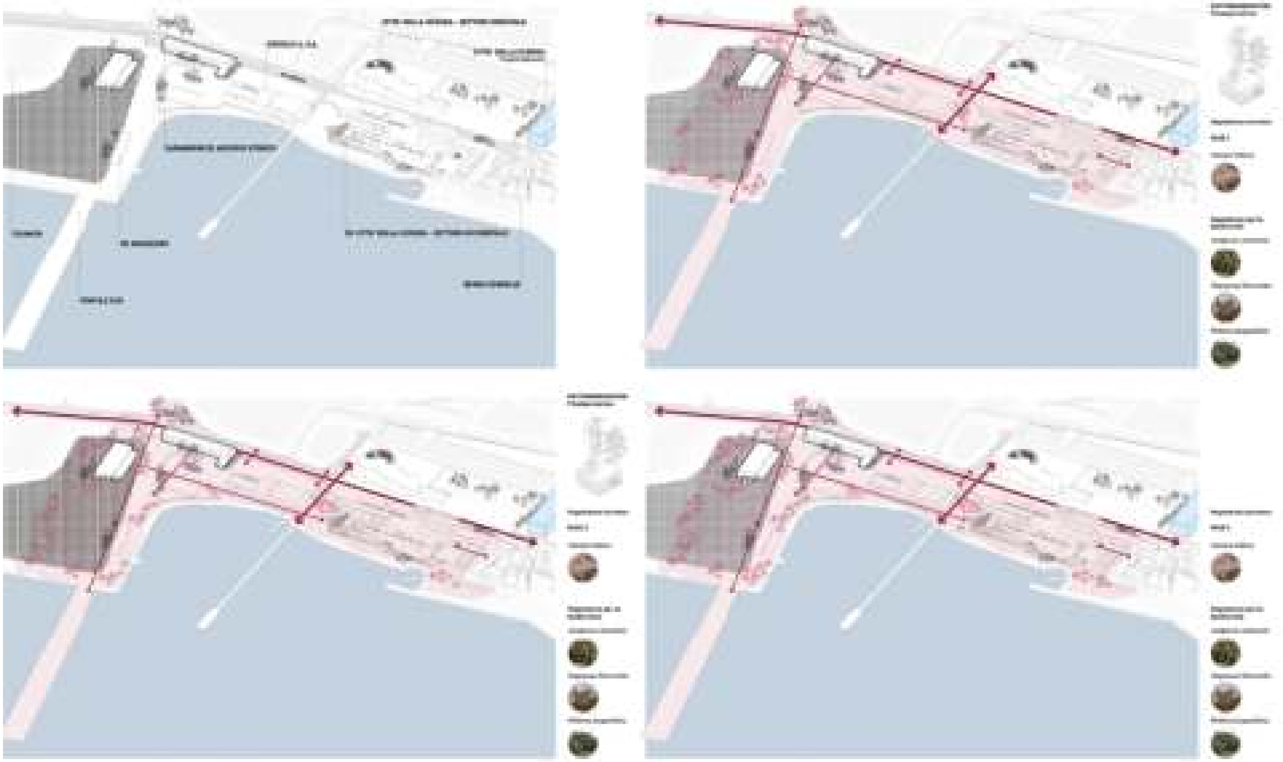


Fig. 15. Proposed Mediterranean dune landscape design for the Circolo Ilva area. Tamarisk trees (Tamaris gallica) and a variety of dune grasses and shrubs are strategically planted to enhance biodiversity and remediate polluted soils, while providing a picturesque backdrop for sports and recreational activities (drawing: A. Cherillo and C. Prezioso).

steelworks as Landschaftspark Duisburg-Nord; industrial relics were not demolished but seen as integral parts of the overall concept and imbued with new meanings and uses. Many more projects with a similar approach have since been executed, the most seminal such as Chemetoff's Île de Nantes, Parc del Clot in Barcelona, Hargreaves/PROAP's Parque do Tejo e Trancao in Lisbon and Michel Desvigne's Parc aux Angéliques in Bordeaux" (Braae, 2015).

The onset of the new millennium has raised the major issue of disused industrial areas reconversion These are those territories, the outcome of a post-industrial condition now widespread and consolidated, that underwent radical changes brought about by the rapid industrialization

processes of the nineteenth century, reaching their productive peak in the twentieth century, only to gradually cease their activities, leaving behind a huge number of abandoned areas with disused infrastructure and barren soils. Brownfields are part of that wide range of "latent landscapes" (Gioffrè, 2018) waiting to be discovered, interpreted, and restarted to a new life cycle, landscapes that constitute an untapped wealth of ecological and social resources for the contemporary city.
At the turn of the year 2000, coinciding with the evolution of the concept of landscape and the huge issue of brownfield redevelopment, novel approaches to landscape design with significant new works were born and spread internationally.
In Germany, where an ecological and environmentalist tradition is well established, there are some of the most significant experiences of a design culture that can be considered avant-garde in contemporary times. The histories and qualities of abandoned sites are reimagined in the transformed landscape to reveal the dramatic changes that have been made to these places in a short period of time. As part of the more general process of reclaiming the Rhur Valley, where one of the largest brownfield sites in Europe stood, Peter Latz created the famous Duisburg Park. The German landscape architect does not operate an erasure of the industrial pre-existences; on the contrary, he ennobles them by elevating them to the rank of real "ruins" of a recent modernity and defining overall a "sublime" post-industrial landscape (Latz, 2016).
Pylons, cisterns, and metal platforms dialogue with the vegetation inserted into the design that envelops and integrates them into a single context. The result is an overall design of the park that expresses an unprecedented aesthetic quality, a re-actualization in a contemporary key of the nineteenth-century style of the picturesque. Latz is also among the designers of the Dora Park in Turin, also built in a disused industrial area, where once again the design choice is to maintain some of the pre-existing structures that acquire, in the total resignification of the site, a new iconic value. The path opened by Latz, as supported by Braae in the quotation given at the opening of this text, has led today to the realization

of some particularly significant works. Latz's proposed approach, focused on rewriting brownfields while minimizing the demolition or erasure of pre-existing structures, has also been the central reference of this design research work for Bagnoli. The research project for the Ex-Italsider area, proposed here, defines an evolving landscape that is not structured on assertive and definitive configurations but, rather, on changing and transitional scenarios capable of accommodating further grafts and additions over time. The disused industrial area of Bagnoli, in fact, can be considered an emblematic example of a "third landscape" (Clément, 2014): it is already a valuable resource of naturalness and urban biodiversity not only for Bagnoli, but for the entire city of Naples, thanks to the ongoing process of spontaneous renaturalization.

The project in the Ex-Italsider of Bagnoli can only arise from the assignment of new qualities and new value to an area, emblematic of the complex and contradictory post-industrial condition of contemporaneity, accepting its distortions and contradictions, in order to define a new adaptive, ecological, shared and open landscape for the community of Bagnoli and Naples (Fig. 13). In fact, the time frame for the realization of "Balneolis and the New Felix Season", the first-place project in the in-ternational design competition promoted by Invitalia in 2021, will inevitably be very long.

The project drawn up by RTI Constituent S.B. Arch-Studio Bargone Architetti Associati proposes a monumental interven-tion with the cancellation of the current spontaneous nature forms and the total rewriting of the site. The project proposes, with an excess of formalism, the figurative reference to the circles of volcanic calderas and to the famous definition of campana felix given by the Romans for the fertile Campania countryside. It is therefore necessary to propose "landscapes in transition" that can gradually make parts of the disused industrial area of Bagnoli usable.

The landscape design proposed here is centered on two principles: the first is to carry out soil remediation through natural processes, thus using phyto-remediation and bio-remediation techniques whose effectiveness is widely demonstrated in similar cases; the second design principle involves the gradual and progressive opening of areas al-ready compatible with public use. Thus, the vegetation envisaged in the landscape design performs a dual function: that of an "ecological machine" for soil reclamation; and the aesthetic and perceptual function of a qualifying element of the entire area to define new spatial configurations that evolve with natural processes. In this design scenario, nature, with its ecological times and processes, returns to be the protagonist of the Bagnoli landscape.

In this hypothesis, the landscape project is generated by the landscape and not vice versa; the project is not a prepackaged abstract geometry that lands on the site colonizing it, but rather a sensitive reinterpretation of the existing that generates new forms and spaces.

The project proposes two thematic insights in two areas: the "Acciaieria", and the "Circolo Ilva". For Acciaieria area (Fig. 14), massive use of sacrificial vegetation, especially herbaceous and shrubby vegetation, is planned in the first phase to start the phytoremediation process. In a phase, when the remediation process is already underway, the progressive planting of permanent vegetation consisting of trees (Salix caprea and Populus nigra) and her-baceous perennials. After reclamation is completed, the Acciaieria landscape will be characterized by geometric poplar forests, widespread systems of willows, and dense meadows of perennials.

For the area surrounding the Circolo Ilva (Fig. 15), being near the sea, the intervention consists of building a Mediterra-nean dune landscape. The project includes the planting of tamarisk (Tamerix gallica), a tree typical of sandy coasts also in the Campania Region, which in addition to its aesthetic value also does an excellent job of cleaning up polluted soils. In addition, a collection of dune grasses and shrubs will be planted to increase biodiversity. The result is thus the defining of a Mediterranean landscape that can well accommodate the sports and recreational activities of the Circolo Ilva. The interventions proposed for both cases, the arboreal landscape of the Acciaieria and the dune landscape of the

Circolo Ilva, will also and above all make it possible to significantly increase the biodiversity of the site by attracting new plant and animal species.
The most avant-garde Landscape Architecture is today understood as a “therapeutic tool” (Jacob, 2009) capable of repairing the damage caused by the industrial development of the last two centuries; it is a specific approach that pro-vides responses to contemporary global crises, from environmental to social and health ones, with a design attitude that repositions Man’s relationship with the Nature of which he is part, according to principles of co-evolution: “Following the relational models also in the field of meaning of the landscape, it is possible to trace a path that brings us closer to the themes of co-evolution in the contemporary world (...) new interpretative references are involved in the change in meaning of three main terms constitutive of modern thought: nature, earth, evolution (Caravaggi, 2022).

Notes

[1] The project “Balneolis e la nuova Stagione Felix” was awarded First Prize at the Bagnoli UrbaNAture Competition (2021). It proposes the transformation of the site, a former industrial area characterized by decades of abuse and pollution, through a metamorphosis that returns to the ideal of “Campania FELIX”. This contemporary interpretation of the genius loci aims to highlight the natural, agricultural, chromatic, aesthetic, and well-being characteristics specific to this part of Campania, which the Romans considered both fertile and “felice”. The abbreviation “Balneolis” is used to refer to the project title within the text.

[2] See: https://www.invitalia.it/cosa-facciamo/rilanciamo-le-aree-di-crisi-industriale/rilancio-bagnoli/doc01---programmazione-e-pianificazione.

3] A project to transform the 250 hectares of Naples’ former industrial area into one of the largest urban parks on an international scale.
See https://bagnolicontest.invitalia.it/i-progetti.

[4] The involved associations - Villa Medusa, Lido Pola, Circolo ILVA Bagnoli, Fondazione Idis Città della Scienza - actively participated in the meetings, sharing the experiences and needs of the local community.

Acknowledgements
The four paragraphs are attributed as follows: the first to Giovanni Multari, the second to Margherita Maurea, the third to Paola Ascione, and the fourth to Vincenzo Gioffrè.

References

Braae, E. (2015). *Beauty Redeemed: Recycling Post-Industrial Landscapes*. Basilea: Birkhauser Architecture.

Capasso, G., & Pesce, G. (2020). *Bagnoli. L'ultimo casco giallo*. Casoria: Martin Eden, p. 131.

Caravaggi, L. (2022). Co-evolution. In *Ri-vista*, No. 20, pp. 5-25. <https://oaj.fupress.net/index.php/ri-vista/article/view/14310 (accesed 30 april 2024).

Clément, G. (2014). *Manifeste du tiers paysage*. Paris: Sens&Tonka.

Gioffrè, V. (2018). *Latent Landscape*. Siracusa: Letteraventidue.

Jacob, M. (2009). *Il paesaggio*. Bologna: Il Mulino Edizioni.

Latz, P. (2016). *Rust Red. Landscape Park Duisburg-Nord.* Monaco: Hirmer Publishers.

Mumford, L., et al. (2007). L*a cultura delle città*. Torino: Einaudi, p. 254.

Rea, E. (2002). *La dismissione.* Milano: Rizzoli, p. 184.

Robiglio, M. (2017). *RE-USA: 20 American stories of adaptive reuse, A toolkit for post-industrial cities*, Jovis Verlag GmbH.

Sposito, C. (2012). *Sul recupero delle aree industriali dismesse. Tecnologie materiali impianti ecosostenibili e innovativi.* Santarcangelo di Romagna: Maggioli Editore, p. 12.

The Nizhny Tagil Charter for the industrial Heritage, The international Committee for the Conservation of the industrial Heritage, TiCCiH, 2003.

Vitale, D. (1996). Le pietre d'attesa. In *Bollettino del Dipartimento di Progettazione Urbana Argomenti 2. La trasformazione delle aree dismesse nella esperienza europea.* Conference proceedings. Napoli, October 1996, p. 41.

Vittoria, E. (1960). Insegnare il design. In G. Guazzo (Ed.) (1995). *Eduardo Vittoria. Tutte le architetture*, pp. 143-144. Roma: Gangemi.

Zorgno, A. (1998). Editoriale. In *Docomomo italia giornale*, No 4, p. 1.

CHAPTER 2
European approaches
Mara Capone

One of the main objectives of the BIP program is to analyze different cultural and management approaches to disused industrial heritage. This is achieved through the presentation and analysis of emblematic case studies identified in Europe.
The contributions collected in this chapter provide valuable insights into the various methodologies and strategies employed and significantly help in structuring a comprehensive framework that addresses the various problems and perspectives associated with the protection and reuse of archaeological industrial heritage. This framework aims to define a coherent European approach by examining the similarities and differences across different countries. Distinct trends emerge from these case studies. Some interventions focus primarily on conservation, preserving the original structures and features to maintain their historical and cultural significance. Other approaches involve using parts of the industrial sites for iconic purposes, creating landmark attractions that draw attention and promote cultural tourism.
Finally, some cases involve the complete transformation and refunctionalization of the industrial heritage, repurposing the sites for new uses while integrating modern functionalities, and sometimes replacing them with new buildings, which can lead to the loss of historical memory. Through this comprehensive analysis and the sharing of best practices, the BIP program seeks to foster a collaborative and informed approach to industrial heritage conservation and reuse, promoting the sustainable development of these historically significant sites across Europe.

On side. Ex Corradini, industrial heritage. Photo by Maria Ferrara, taken during the Living Lab Inhabiting the City in Transition. Evolutionary Projects for the Reuse of Large Urban Containers (curated by Orfina Fatigato and Gianluigi Freda) included in the program of the Festival of Architecture, CA23 Campania Region Architecture in April 2023.


10

Parameters of transformation of industrial Heritage. Some European Case Studies

Lucas Fernández-Trapa

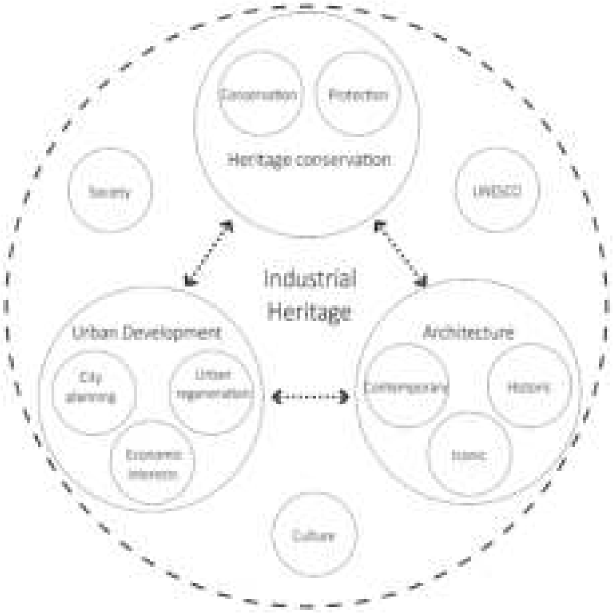
A changing world?

Industrial states grew formidably across Europe in the XIX. and beginnings of the XX. century; the textile revolution that started in England with the invention of the Spinning Jenny and the Water Frame ignited the mass production of thread and cloth. Figure 1 illustrates children working in a textile Mill in South Carolina, US, the so-called doffers (a doffer is someone who removes, or "doffs", bobbins or spindles that hold spun cotton or wool from a spinning frame, then replaces them with empty ones). This was a common sight for the last 200 years; although child work is officially banned in Europe since 1948 [1] it has been outsourced to developing countries, where children still produce a considerable amount of goods that are in turn sold in Europe [2].

The social structures typical of he XIX century have since changed substantially; Europe underwent a profound transformation from an agriculture-based society into an industrial and service oriented one. As an example, agriculture made 70% of employment in Finland in 1920, compared to a mere 4.2% in 2004 [3] a pattern that can be found across Europe. By the end of the XX. century many of the industrial states in Europe were abandoned as a result of deindustrialization and relocation of the means of production, although manufacturing output kept growing, manufacturing employment fell considerably, industrial facilities were dismantled, and the sites abandoned. The down of the XXI century has brought a shift in occupancy fuelled by the so called

Fig. 1. Young doffers in Mollahan Mills in Newberry, South Carolina, on December 3, 1908 (photo: Lewis W. Hine, re-framed).

Fig. 2. Stakeholders in the development process of Industrial Heritage.
After Clash of discourses, Mieg & Overmann 2015 (drawing: author).



fourth industrial revolution (Schwab, 2017); in Europe and the US employment in manufacturing keeps falling and new jobs can be found mainly in sectors related with data management and protection, software development and health care [4].

This change of the productive tissue of our society must be taken into account when dealing with the remains of our industrial heritage, for every reformatory process has to aim at a certain goal.

When dealing with the transformation of industrial sites, there are several factors and stakeholders that influence the development and the outcome, from local authorities and landlords to cultural associations and universities and heritage related initiatives. The interests of each group collide with each other (Mieg & Overmann, 2015) and there is no universal recipe one-size-fits-all.

Although every intervention should be considered ideally within their own constellation of stakeholders, as Mieg & Overmann state, we could

Fig. 3. Zeche Zollverein, Essen. UNESCO World Heritage since 2001 (image: Wikipedia).

distinguish between three main discourses: Heritage conservation, Urban Development and Architectural Production (Fig. 2).

1. Heritage conservation focuses mainly on the recovery and maintenance of the industrial facilities as well as the promotion of the immaterial cultural values associated with them. This approach is as little invasive as it can, just underscoring the built substance with punctual interventions; the results of this discourse are mainly for the museum purposes, but it can also yield goo results in for academic and teaching institutions. This could be the case of the Zeche Zollverein in Essen, or the Matadero de Madrid, which have embedded vibrant activities such as museums, libraries, academies, and multipurpose spaces in the industrial fabric.

2. Urban development's main drivers are not directly related with heritage conservation, they have more to do with city planning and economic and social development; This discourse will prime the feasibility and economic interests of the stakeholders, whether institutional or private.

An obvious conflict with existing industrial states will ensue, for these sites often find themselves in areas worth developing which cannot be fully exploited if the industrial heritage is to be preserved. The Falck Steel Mills in Sesto-San Giovanni is a good example of industrial sites which are planning to be redeveloped and intend to keep and reuse part of their remnant industrial heritage.

3. Architectural production can be seen as a branch of urban development, but it is focused on positioning "Star-architectures" in derelict areas with the intention of sparking initiatives which in turn will reverberate and complete the development. It also acts as a Laboratory for new forms of architecture that respond to new social issues, such as co-working spaces and adaptable housing solutions. This approach is somewhat down-to-top, in contrast to big masterplans being top-down, a good example of it being the Guggenheim in Bilbao, or the design-and gallery driven redevelopment of Hackney in London.

The UNESCO World Heritage Site Zollverein (Fig. 3) is probably an international best-practice model for the successful transformation of industrial sites. Since 1986, it has become a symbol of resilience as well as an extraordinary success story and a place symbolizing the bridge between heritage and future. It has successfully transitioned from smoking chimneys to an attractive cultural and economic hub, hosting a variety of uses ranging from museums and other cultural activities to university facilities.

German industrial and economic history was written in the the Zollverein region: In 1847, the entrepreneur and industrial pioneer Franz Haniel sank the first shaft in the northern part of Essen. Over the following 60 years, a total of eight shafts were built to exploit reserves of fat coal in the northern part of Essen. The last shaft complex of the Zollverein colliery was built between 1928 and 1932 against the backdrop of global efforts in mechanization and rationalization. When, on February 1, 1932, the wheels turned for the first time on the headframe above the new Shaft XII, an industrial high-performance complex with largely automated workflows came into operation, modelled on the principles of

Fordism, imported from America – thus, the assembly line production. The mine, centred around the 55-meter-high double headframe, was henceforth considered the largest and most powerful worldwide, above and below ground, up to 8,000 miners were employed in shift rotations, more than 600,000 people worked at Zollverein until its closure in 1986 [5]. Fritz Schupp (1896–1974) and Martin Kremmer (1894–1945) were tasked with designing the Zollverein Shaft XII colliery complex. The result was considered a technical and aesthetic masterpiece of modernity from the outset, achieved through close collaboration between engineers and architects. Additionally, Zollverein became a model colliery, meeting the representation needs of the owners, Vereinigte Stahlwerke AG, and attracting significant attention in the professional world from the outset. The architects articulated this aspiration in 1929: "We must recognize that industry, with its monumental buildings, is no longer a disruptive element in our urban landscape and countryside, but rather a symbol of work, a monument of the city, which every citizen should proudly show to strangers, just as they would their public buildings." (Brusis, 2000).

On December 16th, 1986, a week before closure, the unique ensemble of mining architecture was placed under monument protection, thus saving it from demolition. The preservation of Zollverein and other noteworthy monuments of the industrial era was part of the International Building Exhibition (IBA) Emscher Park, a ten-year (1989–1999) future program initiated by the state of North Rhine-Westphalia. The agenda included the transformation of large industrial areas in the northern Ruhr area, which had been dominated by coal and steel for almost 150 years: Zollverein became a flagship project. In 1989, the first phase of renovation for the repurposing of the halls and buildings began on Shaft XII, following the principle of "preservation through repurposing" (Hauser, 2001; Garcia, 2004; Miles, 2005). Among other developments, the former compressor hall was transformed into the Casino Zollverein in 1996, which still stands today as one of the most exceptional restaurant and event venues in the Ruhr area. In 1997, the Design Centre North Rhine-Westphalia moved into the former boiler house, which had been transformed by British

Fig. 4. Buildings of the Schacht XII, now Ruhr Museum, Zeche Zollverein Essen (picture: Brigida González, © Ruhr Museum).

architect Norman Foster into an extraordinary space for events and presentations. In 1999, Zollverein became the central anchor point of the newly created Route of Industrial Heritage – a 400-kilometer circular route that showcases the industrial heritage of the region for tourists.

Moreover, during this pioneer phase, it was primarily artists and creatives who discovered Zollverein as an inspiring place and occupied the first renovated halls. From 1992 to 1997, the sculptor Ulrich Rückriem used Hall 5 on Shaft XII as his studio and exhibition space. On the decommissioned mine site, he exhibited his works in 1992 as part of documenta IX, declaring the former colliery an external station of this world art exhibition – a novelty in the history of documenta. The designation of the decommissioned Zollverein colliery and coking plant as a UNESCO World Heritage Site in 2001 marked the beginning of further development of the entire site. Architect Rem Koolhaas, along with his Rotterdam-based Office for Metropolitan Architecture (OMA),

Fig. 5. Park Zeche Zollverein (https://www.die-planergruppe.de/project/der-zollverein-park/).

developed a master plan in 2002 for transforming the site into a vibrant cultural and economic hub. The conversion and expansion of the coal washing plant into an exhibition space for the Ruhr Museum and Ruhr Visitor Center (Fig. 4) in 2010 was the first significant transformation of the buildings.

By 2009, the number of visitors had gradually but steadily approached the million mark. In 2010, when the Ruhr area was the European Capital of Culture, the Zollverein World Heritage Site recorded a record number of visitors at 2.2 million guests [6]. Since then, 1.5 million tourists annually visit the Zollverein World Heritage Site (2011–2019). In addition to the growing number of visitors from other federal states and abroad – nearly two-thirds of visitors come from outside the region – the Zollverein World Heritage Site is also highly appreciated by residents of the Ruhr area as a destination: Zollverein has now become the most popular leisure destination in the entire region.

In 2017, the Zollverein Park took (Fig. 5) centre stage in the public eye, as the Zollverein World Heritage Site, alongside the Grugapark and Baldeneysee, was one of the three main venues of the "European Green Capital - Essen 2017." Through guided tours and events ranging from the Geo Day of Biodiversity to workshops and excursions, visitors learned about the transformation of the former industrial site into a roughly 70-hectare park with diverse industrial nature. Over 700 species of flora and fauna have been documented at Zollverein, including approximately 100 types of lichen, 40 bird species, and 20 different types of butterflies. Visitors have also been able to explore the unique features of the ecosystem at Zollverein through a free hiking map titled "Nature at Zollverein," which highlights twelve different stations.

The transformation of the Falck foundry, Milano Sesto San Giovanni

In 1906, Giorgio Enrico Falck founded his Società anonima Acciaierie e Ferriere Lombarde, and searched for a site to expand his business. The final choice fell on Sesto San Giovanni, a location that boasted several advantages: in addition to its proximity to Milan, it was crossed by an international railway line connected to the San Gottardo railway tunnel, allowing direct connections to France, Belgium, and Luxembourg, major centres for mining raw materials; it had abundant water sources necessary for iron production; and thanks to the connections provided by the Milan-Monza railway and the Milan-Monza tramway, it enjoyed good accessibility for labour. Furthermore, several other companies had already started production in Sesto San Giovanni, such as Breda, founded in 1886 and established in Sesto in 1903, Osva, founded in 1891, and Ercole Marelli, also founded in 1891 and established in Sesto San Giovanni in 1905 (Varini, 2006; Tedeschi & Trezzi, 2007; Trezzi 2007). The Unione plant is the first of Falck in the Lombard municipality, it was established in 1906 with the founding of the company and will always be the largest in the complex (Fig. 6). At its peak, the Unione plant covered 935,000 square meters.

Fig. 6. Ex acciaieria Falck Concordia, Sesto San Giovanni (https://commons.wikimedia.org/wiki/File:Ex_acciaieria_Falck_Concordia_01.jpg).

The Falck site is 1.5m sqm of brownfield, formerly a steel factory, covering approximately 13% of the whole municipal area. Despite its pollution and the heavy costs involved with land recovery, it occupies a strategic location within the north-east corridor of Milan-Monza as it sits in the midst of a dense urban area with connection to the northern and western ring highways. After the deindustrialization of the 1990s, large private corporations envisaged opportunities of residential and office development here. The area is also interesting for city government, as public returns from its development could increase supply of public services, social housing (1200 additional houses on a total existing stock of 2450 units), and scarce green spaces (Savini et al., 2015).
Since its closure in 1995, the redevelopment of the Falck industrial area has been subject to multiple initiatives for its development. As Fossa indicates (Fossa, 2015), there has been a cascade of developers offering masterplans, almost always signed by star-architects. In 1996 the Falck Family presented a Masterplan envisioned by Kenzo Tange, in 2001 the

Fig. 7. Masterplan of Sesto San Giovanni, Milan (image: © Foster & Partners and milanosesto).

developer Pasini bought the area and commissioned Mario Botta with a new planning, in 2005 the new ownership, Pasini & Coppola, asked Renzo Piano. In 2019 Hines commissioned Foster & Partners with the revision a development of a new concept for the Falck Area [7].
According to the developer [8], MilanoSesto, the largest urban regeneration project in Italy and one of the most ambitious in Europe, will transform an area of more than 1.5 million square meters into an efficient, sustainable, and inclusive urban centre. The masterplan designed by international architecture studio Foster + Partners (Fig. 7) foresees progressive development over the next few years with landscaping, multifamily residences for professionals and young families, new squares, retail and office spaces and, above all, places designed to connect people.

Fig. 8. The urban park in the Falck Area, as of 2019. The Masterplan from Renzo Piano is visible in the background (drawing: © milanosesto).

The area is well connected to the surrounding communities thanks to the new Sesto San Giovanni railway station (which work started in July 2021 and will take two years to complete), the subway station and the major trunk roads providing rapid access to the city centre, the toll ways and the rest of Lombardy. The area will also include a 45 hectare park (Fig. 8), an extensive green "lung" for the entire Milanese metropolitan area, integrated with the historic industrial buildings [9]. The large Urban Park of 2.5 hectares, together with the City of Health and Research Park and all the planned green areas and equipped public spaces, forms the heart of the emerging urban environment. The total extension of the green areas is over 50 hectares, with approximately 15 kilometers of cycling and walking paths and around 10,000 newly planted trees. The planned

Fig. 9. Proyecto de Ensanche de Bilbao, 1876. Alzola, Achúcarro & Hoffmeyer. Abandoibarra can be seen on the upper margin of the river Nervión (https://intranet.pogmacva.com/en/obras/49131#).

public areas occupy 75% of the total surface. The project involves the construction of a healthcare excellence hub, Città della Salute e della Ricerca (City of Health and Research), in addition to the new academic and hospital centre of the Vita-Salute San Raffaele University, and private spaces intended for residential facilities, offices, student residences, commercial space, and socio-cultural projects. The construction sites, opening at the start of 2022, are planned to close in 2032; in 2025 the first private lot (Union 0) and the City of Health and Research will be completed and put at the disposal of the community for use in 2025 [10]. A project of this scale and magnitude will generate impacts of a multiple nature for the local area. The investment planned for the construction of the first two lots - Union 0 and City of Health and Research will generate revenue of over 2.3 billion euros and over 5,300 jobs. At the end of

the works, with the completion of the City of Health and Research and the creation of the residential and occupational hub, the true potential of regeneration will be unfolded. From an economic impact standpoint: people who will be using the spaces, that is, resident families, the city users who will be staying at the hotel, neighbourhood workers, patients and their families, etc., will generate almost 190 million euros of additional usage, every year. The Municipality of Sesto San Giovanni will benefit from an additional 2.6 million euros – in IMU, TARI property taxes and additional IRPEF income tax - an amount corresponding to 6.2% of total Municipality tax revenue [11].
More than economic aspects: student residences and flats rented at agreed rentals will have important social repercussions in an area where the availability of student accommodation is dramatically insufficient (there is a shortage of 30,000 beds to bring the city into line with the European average) and where the cost of rents makes it difficult for young people and couples to find adequate housing solutions without excessively overstretching their income. Thanks to the flats available at agreed rentals, which will be equipped with valuable services (study spaces, smart working, baby-sitting and fitness, etc.), 30% more residents in the neighbouring areas will be able to access a home at sustainable prices which will have an average cost 50% lower than comparable solutions in the Municipality of Milan. The project responds to nine of the seventeen Sustainable Development Goals (SDGs) set by the United Nations.

The Guggenheim Museum and the transformation of Abandoibarra, Bilbao

Bilbao, located in the Atlantic coast in the Gulf of Biscay, north of Spain, was until the 1990´s a typical example of a small city which grew prosperous on the wake of the industrial revolution and therefore suffered the consequences of the deindustrialization of the 1980. Abandoibarra, as the riverside of the city extension of the XIX century is known (Fig. 9), was the birthplace of one of the busiest shipyards in Spain, the Astilleros Euskalduna. Founded in 1900 as the Compañía Euskalduna

Fig. 10. Guggenheim Museum, Bilbao. Arch. Frank Gehry, 1996 (https://de.wikipedia.org/wiki/Guggenheim-Museum_Bilbao#/media/Datei:Guggenheim-bilbao-jan05.jpg).

de Construcción y Reparación de Buques, the shipyard took over the former docks of the Dry-Dock Company od Bilbao established 1868 and expanded over an area of 90.000 m2 which saw the construction and repair of ships over almost 90 years (Odriozola, 2011).
The oil-crisis of 1973 and the competition in the international market increased, especially with Asian builders from Japan and South Korea, leading to a decline in orders at European shipyards. Private capital gradually withdrew from the industry, leaving companies in the hands of the state. Spain's entry into the European Economic Community (EEC) compelled the sector to adapt to EU regulations, gradually reduce public subsidies, and open the Spanish market to European competition. However, in the 1980s, with industrial restructuring, the shipyards became the scene of 'the battle of Euskalduna,' which lasted for five years, from the announcement of the company's closure in 1983 until its consummation in 1988. During that time, the people of Bilbao became accustomed to seeing – and even crossing – the Deusto bridge in flames, the smell of burning tires, and the burning buses, as well as the bearings and screws launched with the rubber bands used by practitioners to draw blood, the rocket launchers made from tubes, and the rubber bullets and tear gas fired by the National Police dressed in brown. Previously, the great flood

of 1983 had already started galvanizing the main urban stakeholders. The catastrophe brought together previously divided actors, whether from the city, the region, or the Spanish state (Crone, 2022). "The flood was Bilbao's Ground Zero," says Bernd Nitsch, architecture guide in the city and head of Guiding Architects Bilbao [12]. From then on, decision-makers agreed that the place needed more than just rebuilding; it needed a transformation. Under Ibon Areso, Bilbao's longtime chief planner, a master plan was developed in 1990. The core idea was to relocate the inner-city port in order to gain space in municipal ownership for the extensive redesign of the city centre. Public institutions established a development company, Bilbao Ría 2000, which still exists today, a public limited company constituted in equal parts by the State Administration, through companies dependent on it [13]. The active commitment of all the entities involved in BILBAO Ría 2000 has been maintained from the start of the company's activity and has allowed important urban transformation works to be carried out (Gonzalez, 2004). Between 1990 and 2000, the wasteland where once the shipyards stood has become a vibrant environment and the relationship between city and river has been re-established. Bilbao has undergone a period of radical change; it has a new metro system with sleek stations designed by Foster & Partners and two superb new library buildings. The city was completely rethinking its public spaces and a sophisticated contemporary culinary culture was emerging. Guggenheim Museum Bilbao opened in 1997 and has since been the symbol of the renaissance of Bilbao as well as its most visible face. Not only did the museum change the landscape of Bilbao by bringing millions of tourists from all over the world, but also gave name to the phenomenon known as the Bilbao Effect (Van Ryk, 2007), a term coined in the 2000's to describe the successful regeneration of cities. As Plaza puts it, the massive media attention generated by Frank Gehry's unique building, and the accumulation of news and images, repositioned the city of Bilbao globally (Plaza, 2006, 2022). The inclusion of an iconic building as a landmark within a Masterplan works wonders in the case of Bilbao, the appearance of the Guggenheim Museum (Fig. 10) with

Fig. 11. Liverpool, Piers Head. "The Three Graces". From left to right, Liverpool Pier Head, with the Royal Liver Building, Cunard Building and Port of Liverpool Building, and the Anglican cathedral in the background (https://en.wikipedia.org/wiki/Pier_Head#/media/File:Liverpool_Pier_Head.jpg).

its titanium sheeting and extravagant industrial forms symbolizes – partly representative, partly metaphorical – its bond with the tradition & heritage of the Euskalduna Shipyards (Haarich & Plaza, 2010). The museum is described in the academic literature as "one of the examples par excellence of an art museum originally conceived as part of an urban regeneration plan" (Baniotopoulou, 2001), and Bilbao becomes a "symbolic site of regeneration" (McNeill, 2000).

Bilbao has now become one of Spain's most captivating destinations for tourists and investors. The Guggenheim Museum's socio-economic impact more than met its objective of transforming the city's image, with calculations in 2017 suggesting that the museum generates around €400 million per year for the local economy [14]. A study of 2017 showed that since it opened in October 1997, the Guggenheim Museum has attracted some 7 million visitors, of whom 60 per cent are foreigners. It has contributed to the maintenance of approximately 4,500 jobs, principally in transport, hotels, restaurants, bars, coffee shops, and retail establishments; it has created added value amounting to more than €1.2 million, which has produced an increase in local fiscal capacity and tax revenues close to €200 million. Finally, the 'Guggenheim effect' has also been psychological: it has contributed to the recovery of civic pride. In

Fig. 12. Royal Albert Dock. Liverpool (https://en.wikipedia.org/wiki/Royal_Albert_Dock,_Liverpool#/media/File:Albert_Docks_Liverpool.jpg).

2022, the total demand generated as a result of the Museum's activity in the Basque Country was €448.8 million, and the contribution to the GDP was €393.4 million (with an additional income for the Basque Public Treasury of €60.9 million). The Museum's activity contributed to maintaining 8,410 jobs [15].

The case of Liverpool Maritime Mercantile City

Liverpool (Fig. 11) was in the XIX century the busiest port in England, and therefore the centre of trade of the British Empire, its activity and population grew strongly, from 100.000 in 1811 to nearly 850.000 in 1931 (9). By 1975, the population had almost decreased by 40%, to roughly 500.000 habitants. In 1981 the Toxteth Riots marked an inflexion pint in the history of Liverpool; similarly to Bilbao, high unemployment, and the misuse of "SUS" laws Vagrancy Act 1824 [16] had started riots in Brixton that quickly spread out to Toxteth in Liverpool (Jefferson, 1983). Then Secretary State of state Heseltine was named Secretary of the

Fig. 13. Liverpool Waters Development (image: © ARUP / Peel).

Merseyside launches regeneration initiatives for Liverpool, a heritage led campaign that started in 1983 with the refurbishment of the Royal Albert Docks (Fig. 12). These were built in 1846 as a fine example of innovation in the Dock Typology, with the warehouses constructed in Cast Iron and masonry all the way up to the Basin, so that the ships could be unloaded directly to the upper storeys (Jones, 2004). The restored buildings were opened to the public in 1988, now hosting a variety of uses such as the TATE Liverpool, Ground floor shops with office space on the mezzanine level and apartments on the remaining floors. The culture led development reached its peak in 2008, when it was chosen as European Capital of Culture, the Slogan "The World in one City" focused on the diversity and cultural traditions (music, literature, sports) of Liverpool.

In 2002, English Heritage announced the creation of the Historic Environment of Liverpool Project (HELP) in partnership with Liverpool City Council, the North West Development Agency, National Museums Liverpool, Liverpool Vision, and the Liverpool Culture Company. Among

Fig. 14. Liverpool Waters Development (drawing: © Chapman Taylor Architects).

its activities detailed studies of the city's built heritage and archaeology, as well as the design and implementation of a buildings-at-risk strategy, and a variety of educational and community projects, exhibitions, and publications could be found (Stonard, 2003; Rodwell, 2015).
The development of the nomination to UNESCO in 2002–2003, to which the HELP contributed substantively, formed a core part of the re-articulation of Liverpool as a world city for the 21st century. Liverpool Maritime Mercantile City was inscribed on the World Heritage List in 2004 under UNESCO criteria (ii), (iii), and (iv) [17]; the docks and their surviving urban landscape with the "Thee Graces" at the centre formed a 136 World Heritage Site with a 750 ha Buffer Zone around it. "They form a dramatic manifestation of Liverpool's historical significance ...[whose] vast scale... allows them to dominate the waterfront when approaching by ship" (Liverpool City Council, 2003a, 2003b). The pre-inscription 2004 ICOMOS advisory report described the nominated site as "a complete and integral urban landscape that provides coherent evidence of Liverpool's historic character and bears testament to its exceptional historical significance" (ICOMOS, 2004). By that time, the

planned construction of a "Fourth Grace" (as an attempt to replicate the Bilbao Effect) next to the iconic trio of buildings at the Pier Head and the development of Mann Island close to the Royal Albert Dock was already a source of heavy discussion. Given that the United Kingdom planning system is both primordially negotiable and permissive in the interests of development, conflict with the international conservation community was going to be inevitable (Rodwell, 2015).

The city's determination to build at this location was the primary prompt for the 2006 UNESCO–ICOMOS mission which was followed by another in 2011. It led to the adoption of a new standard-setting instrument, the Recommendation on the Historic Urban Landscape (UNESCO, 2011b). The 2012 decision to place Liverpool on the List of World Heritage in Danger was founded upon the "soft law" of this 2011 Recommendation, which was not available previously. Key to this 2011 Recommendation is its definition: "The historic urban landscape is the urban area understood as the result of a historic layering of cultural and natural values and attributes, extending beyond the notion of a 'historic centre' or 'ensemble' to include the broader urban context and its geographical setting".

After the Museum of Liverpool and the Development of Mann Island were complete (winning Awards for the ugliest buildings in Britain), the site was inscribed on the List of World Heritage in Danger due to the proposed construction of Liverpool Waters project (Figs. 13,14). This is an aggressive development of the Waterfront north of the protected area but well into the Buffer Zone, which planned the construction of a 60 ha new district including Skyscrapers and a new Stadium for FC Everton. The eventual site is expected to contain a mix of residential, commercial, retail and sport facilities (Peel L&P, 2022).

The proposed plans are by no means fixed as they have been repeatedly redesigned over the years with a range of promotional images used to depict the hypothetical development. Like most large-scale developments, it is impossible to predict their final form as they undergo constant revision and adjustments depending on the success of each subsequent phase of the project along with more general factors such as the general performance of the economy or the developers themselves.

In 2021 the World Heritage Committee, holding its 44th session in Fuzhou and online, decided to delete the property "Liverpool – Maritime Mercantile City" (UK) from the World Heritage List, due to the irreversible loss of attributes conveying the outstanding universal value of the property (UNESCO, 2021).

This case is of special interest not because of its success, which it had some, but for its conflict of interests and its clash with the UNESCO. There were some failures and some misunderstandings, It could be argued that the original UNESCO failed to represent clearly the implications of the Buffer Zone and that the reports of the ICOMOS Missions did not acknowledge directly the danger to the World Heritage Status deriving from the initial developments in Pier Head and Mann Island. According to Rodwell (2015), the conflict emerged in part from the initial state party's nomination referring to the value of the urban landscape but was clearly fueled by developers and politicians who had little interest in preserving the World Heritage Status. Instead of a heritage-led regeneration of the Docks north of Pier Head, which could have drawn in the identity of Liverpool and its unique characteristics, the Liverpool City Council and the Liverpool Waters development chose to transform the Waterfront into a speculative commercial mix of mid and high buildings that could be found anywhere else.

Notes

[1] European Charter of Fundamental Rights, 1948.

[2] As of April 2024, an agreement on banning forced labour products has benn reached in the EU, it is stilll pending approval by a full plenary of the European Parliament and the Council of member states. It is estimated that in 2021, almost 28 million people worldwide were in forced labour – 3 million more than in 2016. https://www.socialistsanddemocrats.eu/newsroom/agreement-reached-banning-forced-labour-products-eu-market-sds-flagship-proposal - seen on 24.April.2024.

[3] Statistics Finland (2007). From slash-and-burn fields to post-industrial society - 90 years of change in industrial structure, Statistics Finland https://www.stat.fi/tup/suomi90/helmikuu_en.html. – seen 24.April.2024.

[4] US Buro of statistics, 2024 . https://www.bls.gov/ooh/fastest-growing.htm - seen on 24.04.2024.

[5] Zollverein, https://www.zollverein.de/ueber-zollverein/geschichte - accessed 20.04.2024.

[6] Ibid.

[7] Milanosesto at the 2021 meeting in Rimini, https://www.milanosesto.it/assets/media/press/Press_release_MilanoSesto_Rimini_Meeting_2021_ENG.pdf - accessed 27.04.2024.

[8] https://ilgiornaledellarchitettura.com/2023/12/03/ex-falck-a-sesto-san-giovanni-la-patata-bollente-2/.

[9] Milanosesto: la rigenerazione urbana delle aree ex Falck. Attuazione della Variante al PII".

[10] Comune di Sesto San Giovanni e da Milanosesto SpA. https://sestosg.net/wp-content/uploads/2020/01/6484-attach104.04.2019_Rigenerazione_Aree_ex20Falck_Lamiranda.pdf - accessed 27.04.2024.

[11] https://www.milanosesto.it/assets/media/press/Press_release_The_European_House_Ambrosetti.pdf.

[12] Ibid.

[13] https://www.bauwelt.de/rubriken/bauten/Die-Langzeitwirkung-des-Bilbao-Effekts-Guggenheim-Frank-Gehry-Baskenland-3850331.html - accessed 27.04.2024.

[14] SEPES- Public Business Land Entity-, Port Authority of Bilbao and ADIF, as well as by the Basque Administrations (Basque Government, Provincial Council of Bizkaia, Bilbao City Council and Barakaldo Town Council).
https://www.bilbaoria2000.org/en/bilbao-ria-2000/what-is-bilbao-ria-2000/ - accessed 27.04.2024.

[15] https://www.apollo-magazine.com/is-the-bilbao-effect-over-guggenheim/ - accessed 27.04.2024.

[16] Memoria de actividad 2022. Museo Guggenheim Bilbao. https://cms.guggenheim-bilbao.eus/uploads/2023/06/MEMORIA-de-actividad-2022.pdf - accessed 26.04.2024.

[17] Every suspected person or reputed thief, frequenting any river, canal, or navigable stream, dock, or basin, or any quay, wharf, or warehouse near or adjoining thereto, or any street, highway, or avenue leading thereto, or any place of public resort, or any

avenue leading thereto, or any street, or any highway or any place adjacent to a street or highway; with intent to commit an arrestable offence [...] shall be deemed a rogue and vagabond[.] —section 4, Vagrancy Act 1824.

[18] Criterion (ii): Liverpool was a major centre generating innovative technologies and methods in dock construction and port management in the 18th and 19th centuries. It thus contributed to the building up of the international mercantile systems throughout the British Commonwealth.

[19] Criterion (iii): the city and the port of Liverpool are an exceptional testimony to the development of maritime mercantile culture in the 18th and 19th centuries, contributing to the building up of the British Empire. It was a centre for the slave trade, until its abolition in 1807, and to emigration from northern Europe to America.

[20] Criterion (iv): Liverpool is an outstanding example of a world mercantile port city, which represents the early development of global trading and cultural connections throughout the British Empire.

References

Alzola, P., Achúcarro, S., & Hoffmeyer, E. (1876). *Memoria del Proyecto de ensanche de Bilbao, 1876*. (Introducción de Javier Cenicacelaya e Iñigo Saloña). Bilbao: Colegio de Arquitectos Vasco-Navarro, 1988.

Baniotopoulou, E. (2001). Art for whose sake? Modern art museums and their role in transforming societies: the case of the Guggenheim Bilbao. In J*ournal of Conservation and Museum Studies*, No. 7, pp. 1-15.

Beascoechea Gangoiti, J. M. (2007). Abando, el lugar del nuevo Bilbao. In F. Martinez Rueda (Ed.). B*ilbao y sus barrios: una mirada desde la historia*, Vol. I, pp. 47-65. Bilbao: Ayuntamiento de Bilbao / BilbaokoUdala.

Brusis, I. (2000). Industriedenkmale - Landmarken auf dem Weg in die Zukunft. In *Industriedenkmalpflege und Geschichtskultur Heft,* No. 1, pp. 22-24.

Cenicacelaya, J. (1999). El ensanche de Bilbao de Alyola, Achúcarro y Hofmeyer de 1876. In *Ciudad y Territorio. Estudios Territoriales*, Vol. XXXI(119-120), pp. 307-316. Ministerio de Fomento, Madrid.

Crone, B. (2022). Die Langzeitwirkung des Bilbao-Effekts. In *Bauwelt*, No. 235, pp. 66-69. Bauverlag BV GmbH, Berlin.

Finkenzeller, K. (2007). Mal Guggen, Die Zeit, 04.10.2007 Nr. 41. <https://www.zeit.de/2007/41/Bilbao/komplettansicht > (accessed 27 april 2024).

Garcia, B. (2004). Cultural policy and urban regeneration in Western European cities:

lessons from experience, prospects for the future. In *Local Economy*, No. 19.4, pp. 312-326.

Gonzalez, S (2004). The role of the Guggenheim Bilbao Museum in the development of urban entrepreneurial practices in Bilbao. In *International Journal of Iberian Studies*.

ICOMOS (2004). *Advisory body evaluation: Nomination of Liverpool – Maritime Mercantile City*. Paris: ICOMOS.

Haarich, S., & Plaza B. (2010). Das Guggenheim-Museum von Bilbao als Symbol für erfolgreichen Wandel – Legende und Wirklichkeit. In U. Altrock, S. Huning, T. Kuder, H. Nuissl, D. Peters (Eds.). *Symbolische Orte. Planerische (De-)Konstruktionen. Reihe Planungsrundschau 19*. Berlin.

Hauser, S. (2001). *Metamorphosen des Abfalls: Konzepte für alte Industrieareale*. Frankfurt : Campus Verlag.

Ibañez, I. (23.12.2023). El Puente de deusto en llamas: 40 años de la batalla de astilleros Euskalduna. *El correo* <https://www.elcorreo.com/bizkaia/puente-deusto-llamas-anos-batalla-astilleros-euskalduna-20231203013342-nt.html> (accessed 27 april 2024).

Jefferson, M. (1983). The Toxteh Riots: a selected bibliography. Liverpool Law Rev, 5, pp. 203-218.

Jones, R. (2004). *The Albert Dock, Liverpool*. RJ Associates Ltd.

Liverpool City Council. (2003a). *Nomination of Liverpool – Maritime Mercantile City for inscription on the World Heritage List*. Liverpool: Liverpool City Council.

Liverpool City Council. (2003b). *Liverpool – Maritime Mercantile City: Management plan*. Liverpool: Liverpool City Council.

McNeill, D. (2000). McGuggenisation? National identity and globalisation in the Basque country. In *Political Geography*, No. 19, pp. 473-494.

Mezzi, P. (2023). Ex Falck a Sesto San Giovanni, la patata bollente. <https://ilgiornaledellarchitettura.com/2023/12/12/ex-falck-a-sesto-san-giovanni-la-patata-bollente-3/> (accessed 27 april 2024).

Mieg, H. A., & Overmann, H. (2015). *Clash of discourses*. Routlegde: Cambridge Mass.

Miles, S. (2005). 'Our Tyne': iconic regeneration and the revitalisation of identity in Newcastle-Gateshead. In *Urban Studies*, No. 42.5–6, pp. 913–26.

Moro, A. (2016). *Ex Area Falck. Idee e progetti nel tempo*. Milan: Mimesis.

Nieva, A. M. (18 January 2018). Ellegado portuario, presente en la transformación de

Bilbao. PORTUS the online magazine. <https://portusonline.org/el-legado-portuario-presente-en-la-transformacion-de-bilbao/> (accessed 27 april 2024).

Odriozola Oyarbide, L. (2011). La Compañía Euskalduna de Construcción y Reparación de Buques. <www.euskomedia.org.> (accessed 27 april 2024).

Peel, L&P. (2022). The Neighbourhoods. <https://liverpoolwaters.co.uk/about/> (accessed 2 september 2022).

Plaza, B. (2006). The return on investment of the Guggenheim Museum Bilbao. In *International Journal of Urban and Regional Research*, Vol. 30, No. 2, pp. 452-467.

Rodwell, D. (2015). Liverpool: Heritage and Development—Bridging the Gap?. In M. Overmann (Ed). *Clash of discourses*, pp. 29-46. Routlegde: Cambridge Mass.

Savini, F., Majoor, S., & Salet, W. (2015). Urban peripheries: reflecting on politics and projects in Amsterdam, Milan, and Paris. In *Environment and planning C: Government & policy*, Vol. 33, No. 3, pp. 457-474.

Schwab, K. (2017). *The fourth industrial revolution*. London: Penguin.

Tedeschi, P., & Trezzi, L. (2007). *L'opera condivisa, La città delle fabbriche, Sesto San Giovanni (1903–1952). La società*. Milano: Franco Angeli.

Trezzi, L.(2007). *Sesto San Giovanni (1953–1973). Economia e società: equilibrio e mutamento*. Milano: Skira.

UNESCO (2021). Summary Record of 44th session of the World Heritage Committee Fuzhou (China) WHC/21/44.COM/INF.19.< https://whc.unesco.org/archive/2021/whc-21-44com-inf19-Summary-Records.pdf> (accessed 27 april 2024).

UNESCO (2011b). *Recommendation on the historic urban landscape*. Paris: UNESCO.

Van Ryk, N. (6 october 2007). The Bilbao-Effekt. Welt Print. <https://www.welt.de/welt_print/article1239862/Der-Bilbao-Effekt.html> (accessed 27 april 2024).

Vanstiphout, W. (6 January 2012). What's wrong with managed decline?. Building Design, No. 9. < https://www.bdonline.co.uk/opinion/whats-wrong-with-managed-decline/5029986.article> (accessed 27 april 2024).

Varini, V. (2006). *L'opera condivisa, La città delle fabbriche, Sesto San Giovanni (1903–1952), L'industri*a. Milano: Franco Angeli.

Inhabiting the Industrial Heritage. Rehabilitation of Industrial Areas into Collective Housing

Noelia Cervero Sánchez, Aurelio Vallespín Muniesa, Javier Domingo Ballestín

Introduction

Industrial heritage has acquired a meaning that exceeds the aesthetic or testimonial to become a temporal and spatial framework in the memory of place. The contemporary interpretation of the concept of "heritage" recognizes the need to define traditions and identities and makes necessary a professional and institutional system of conservation with an urban dimension (Bandarin & Van Oers, 2012, p. 15). The Italian architect and urban planner Gustavo Giovannoni (Zucconi, 1997), who in the 1930s laid the foundations for the conservation of urban heritage, by proposing the protection not only of the monument but also of its surroundings, integrating contextual needs under a global vision, is a precursor of this meaning of the term. The landscape values of the industrial traces, the urban heritage and the needs of the city and the population, join the values of each work in a continuous space, which conditions its conservation and use in a second life.

Since the 1960s there has been a growing interest in industrial archaeology, first in Great Britain and the rest of Europe, and later in countries on other continents. It is a utilitarian architecture, sometimes influenced by the dominant neoclassical trends in the first half of the nineteenth century, which determines the appearance of decorative elements. Initially they were built with the available materials, which conditioned the design, essentially affected by the energy used, and new materials were introduced, such as cast iron in structural elements. Indeed, the evolution

Fig. 0. Alliance Building at the Gasworks, Dublin, Ireland. O'Mahony Pike Architects. Housing Project, 2006 (source: O'Mahony Pike 2006, p. 71).

of industrial buildings is strongly influenced by technical progress, the availability of materials, stylistic change in architecture and the demands of production cycles, specific to each industry (Capel, 1996, p. 25).

The technological obsolescence of installations has led to a loss of the primitive function of industrial facilities, and, from the production point of view, the modern city has undergone a series of important changes in its organization. The processes of industrial reconversion and restructuring, linked to the crisis of the 1970s and the global displacement of industrial employment from traditional regions to new ones, have led to the abandonment of industrial land in strategic urban areas of European cities, leaving a large number of production spaces outdated and unused. In parallel, there has been a growing phenomenon of tertiarization of the so-called post-industrial city, which has conditioned the reuse of industrial buildings to accommodate other uses (Biel Ibáñez, 2016, p. 159).

There is a wide range of approaches and criteria that have been adopted in the reuse of industrial architecture, after its late identification as heritage to be preserved. The disappearance of unique works such as Les Halles in Paris (Victor Baltard, 1852-1870), demolished between 1971 and 1973, led to the inventorying and cataloguing of this type of architectural ensembles, which began to be recognized and protected (Hernández, 2013, pp. 29-30). Parallel to this awareness, the first interventions were carried out on this functionally obsolete architecture, which needed a new use, as a means to guarantee its survival.

This chapter focuses on industrial heritage reuse processes in which collective housing projects are carried out. They find their precedent in pioneering examples such as: The Blue Warehouse, Copenhagen, Denmark (Hertz & Ramsgaard Thomsen, 1979); Water Toren Wej, Rotterdam, The Netherlands (Wytze Patijn, 1982); Riverhead Granaries, Humberside, England (MacCormack and Jamieson, 1979); Buchanan Wharf, Bristol, England (Halliday Meecham, 1988); Bryant & May match factory, London, England (ORMS Architects, 1988); or Spillers & Bakers warehouse, Cardiff, Wales (MWT Architects, 1988).

The paper presents various contemporary European cases and experiences in the conversion of industrial heritage into residential complexes, which allow us to analyze how these actions affect the architecture and its surroundings, depending on the diversity of areas that affect each strategy: factors such as artistic value, symbolic character, municipal requirements, neighborhood initiatives, the sensitivity of the intervening agents and the possibilities offered by their reuse.
This selection of case studies has been structured according to the building typology of industrial, agricultural, and port constructions, depending on whether they are:
- Warehouses, with linear porticoed structure.
- Silos, with wall structure by aggregation of modules.
- Gasometers, with circular perimeter wall or lattice structure.

These are operations with central or peripheral locations, in which social, student or luxury housing projects are carried out, but in any case, they are archetypes of regions with remarkable traces of the industrial revolution, which serve to illustrate the limits and possibilities of their reconversion into urban residential complexes.

Warehouses

Jernstøberiet, Roskilde, Denmark. Jan Gudmand-Høyer and Jes Edvars Architects. Co-housing Project, 1980

Jernstøberiet in Roskilde, Denmark, is a cohousing community designed by Jan Gudmand-Høyer and Jes Edvars in 1980, in a former iron foundry. Located in the Himmelev neighborhood, in an environment of traditional single-family houses, the factory was reconverted, after a long process of rehabilitation, into a housing complex with common uses that favored the social interaction of the residents. According to Jan V. Hansen, this is the Third Generation community with the most radical and innovative approach so far (Gudmand-Høyer & Edvars 1984, p. 234).
The factory consisted of a large production nave with a gable roof and a maximum height of 8 m., and adjoining naves with a pitched roof and side skylights. Jernstøberiet took up a project from 1968, structured

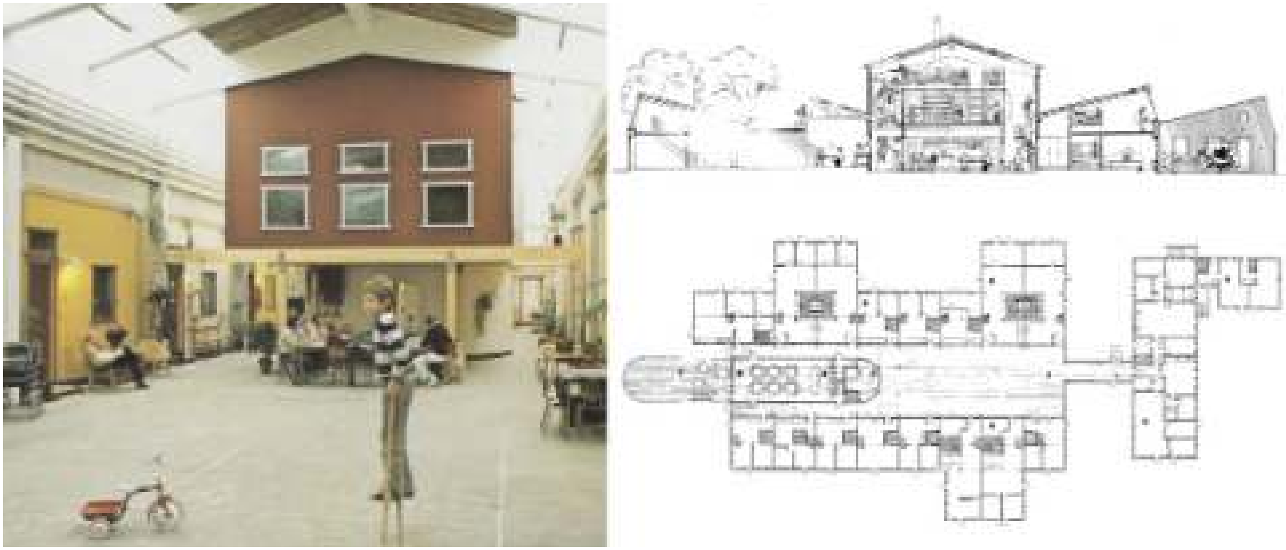


Fig. 1. Jernstøberiet, Roskilde, Denmark. Jan Gudmand-Høyer and Jes Edvars Architects. Co-housing Project, 1980 (source: Gudmand-Hoyer and Edvars 1984, pp. 236, 237).

around a glazed central street. The central nave took on the character of a covered outdoor space and an entrance hall for 20 apartments located in the side naves and in an annexed volume. This common area is the physical center of the community, providing a place for informal gatherings and children's games, and acting as a climate buffer (Fig. 1). At one extreme, a community center with shared kitchen, dining room, lounges, workshops, etc., was set up with more intensive treatment. The dwellings of between 33 and 127 square meters for singles and families, involve the segmentation of the warehouses with a single module and the use of the section with mezzanines and light entrances on the roof, which compensate for the great depth of the bays. They are open to the environment with small individual gardens, and large outdoor spaces with playgrounds, fields, and orchards. The rehabilitation of the original architecture was approached with minimal modifications and criteria of economy and self-construction by the residents, through the reuse of the roofs and the enclosure, which was covered with wood planking and corrugated iron, thus guaranteeing the viability of the project.

Torpedo Boat Workshop, Copenhagen, Denmark. Vandkunsten Architects. Housing Project, 2003

The old Torpedo Boat Workshop located in the port of Copenhagen, Denmark, currently accommodates a housing complex designed by Vandkunsten architects in 2003. The building was built in 1954 for the repair and maintenance of Navy vessels, in Holmen, the Royal Naval Shipyard, an area of important natural and architectural value, selected after its abandonment in the 1990s for the urban development of the city. In the renovation, the gigantic 160x32x15 m. structure of reinforced concrete porticoes every five meters and steel trusses was preserved, in memory of the building's unique architecture, and took on a new meaning. Under the trusses, a public passageway open to the sky runs longitudinally through the building, extending the street to provide access to the dwellings, facilitate relations between residents and, ultimately, integrate the complex into the city. One end rises up to the second floor, above a communal parking lot that facilitates vehicular access, and the other end goes into the canal, allowing access from the water. This dynamic and vibrant interior street is bordered and crossed in height by light footbridges and terraces of the dwellings, recalling the activity of the old shipyard hall (Fig. 2).

The 67 bright and flexible loft apartments of 75 to 275 square meters, on one or two floors, open with large windows and terraces to the interior street and to the surroundings, leaving the slender trusses on the penthouses visible (Keiding, 2003, pp. 234-241). Its self-supporting modular system is integrated into the fabric of the structure, set back 40 centimeters from it, to maintain its independence and prominence.

Massó i Carol - Vapor Llull Factory, Barcelona, Spain. Cristian Cirici and Carles Basó Architects. Housing Project, 1997

The Massó i Carol - Vapor Llull chemical factory located in Barcelona, Spain, was rehabilitated with a private residential project by Cristian Cirici and Carles Basó architects in 1997. The factory, inaugurated in 1902 and in service until the end of the 1990s, is located in Poble Nou, a traditionally

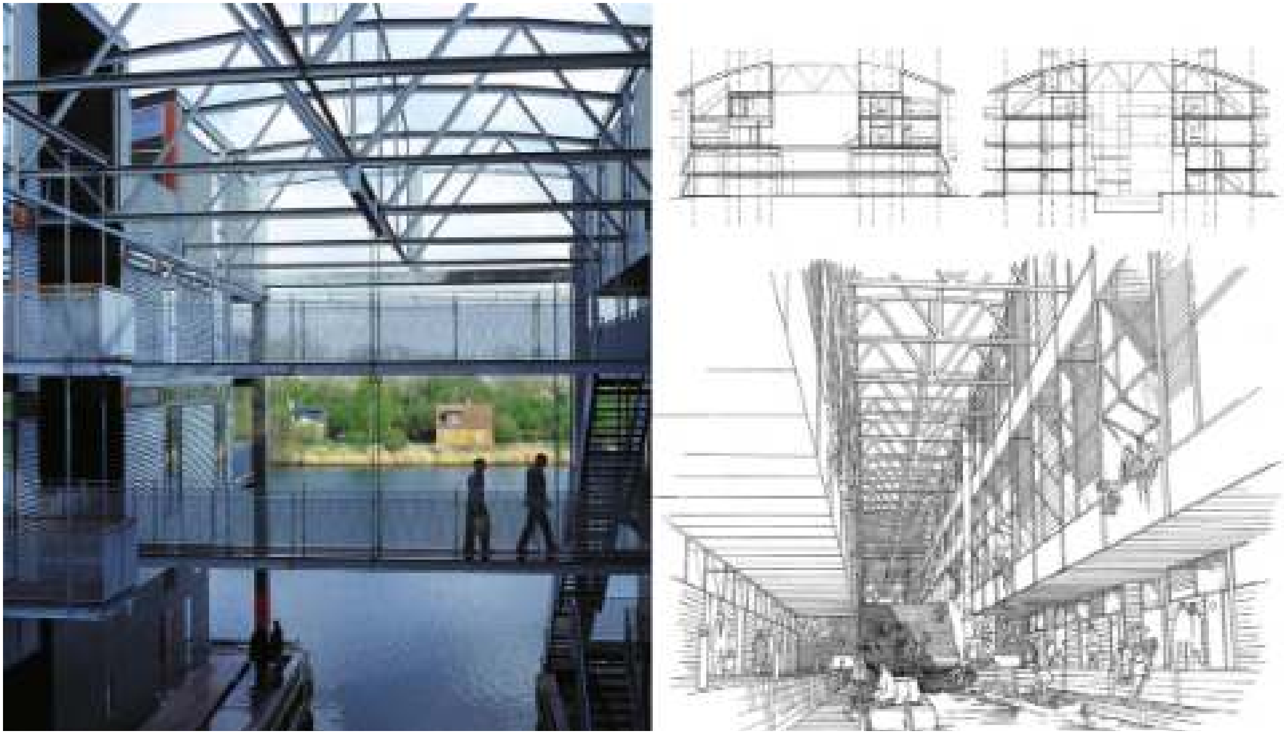


Fig. 2. Torpedo Boat Workshop, Copenhagen, Denmark. Vandkunsten Architects. Housing Project, 2003 (source: Keiding 2003, pp. 235, 237).

industrial neighborhood, which protected this type of building through a Special Plan for its progressive reconversion and integration into the city (López, 2011).

It is a complex that houses a main longitudinal nave with three floors, different auxiliary buildings, and a 32 m. high solid ceramic brick chimney, which was preserved. The building maintained its original structure with three floors, solid brick load-bearing perimeter walls, intermediate pillars and cast-iron beams, ceramic vaulting and a gabled roof with wooden trusses. In the intervention, the building was subdivided with vertical partitions of exposed brick into 18 independent and double oriented modules of about 90 square meters, intended for workshops, offices, studios, and housing (Martí et al., 2000, p. 4). The free height on the

ground and second floors allowed the incorporation of an intermediate slab, and each unit was left unfinished so that users could adapt it to their preferences and needs.
Three vertical cores with stairs and elevator were added to the existing building, which were supported on the envelope, signifying the exterior with volumes of sheet metal and glass. Together with the color treatment on the façades based on silicate paint that replaced the pre-existing plaster (Broto & Mostaedi, 2006), these light volumes contributed to change the original image, signifying the accesses from a communal garden space in which a parking lot is integrated in an independent volume (Fig. 3).

Passatge del Sucre Factory, Barcelona, Spain. Garcés - De Seta-Bonet Architects. Housing Project, 2009
Located in the same neighborhood of Poble Nou in Barcelona, Spain, Passatge del Sucre is a former alcohol distillery rehabilitated with a collective housing project by Garcés - De Seta - Bonet architects in 2009. It was covered by a new typology of municipal ordinances, called "unconventional housing" which, as happened in the 1960s in New York, allowed transforming industrial buildings with architectural, historical or artistic interest into "lofts" (Dot Jutgla & Pallares-Barbera, 2015).
This old industrial complex of 1916 consisted of three warehouses with a gable roof and two blocks in height, arranged in an L-shape and structured by a central access passage (Garcés et al., 2015). The three naves had load-bearing façades of facing brick, cast iron pillars and beams, intermediate slab of ceramic vault and gable roof, with metal and wood trusses. Given the limited natural ventilation surface and the difficult access to the two naves perpendicular to the passageway, a corridor was opened with the partial demolition of one of them, maintaining the metal trusses that recall the original volume (Fig. 4). Taking advantage of the clear heights, in one of the bays the original floor slab was replaced by two new ones, and in the others, it was maintained, with occasional interventions and mezzanines on the upper level. In the blocks, the cast iron pillar structure was preserved or reinforced with concrete pillars, incorporating an

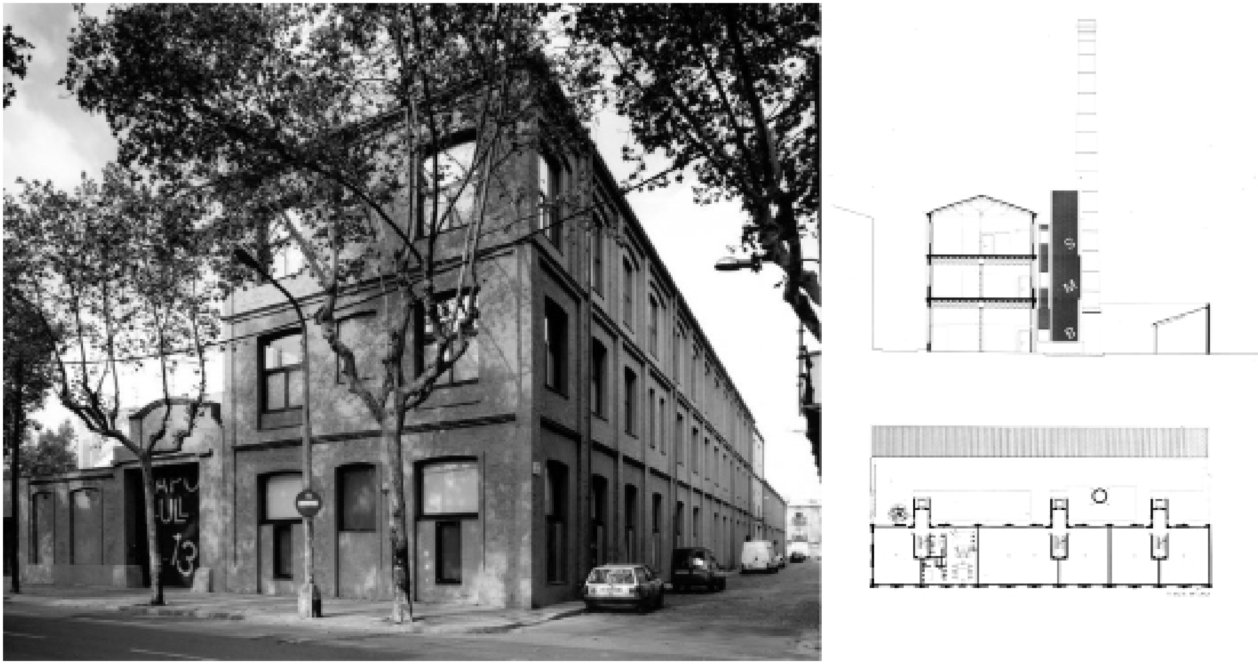


Fig. 3. Massó i Carol - Vapor Llull Factory, Barcelona, Spain. Cristian Cirici and Carles Basó Architects. Housing Project, 1997 (source: Broto and Mostaedi 2006, p. 45).

intermediate slab and favoring the connection with the street by emptying the ground floor. The complex houses 29 dwellings with very different typologies and surfaces, which, due to the characteristics of the building, are unique and exclusive (Laudy, 2011, pp. 27-29).
The project included important variations in the façade, maintaining some windows and opening others with metal lintels. The differentiation of the facings, completed with a new type of brick, allows us to guess the original composition, in a collage of overlappings.

Fabra & Coats, Barcelona, Spain. Roldán and Berengué Architects. Social Housing for Young People Project, 2005

Fabra & Coats is a former textile industrial site of about five hectares, founded in 1837 in the district of Sant Andreu in Barcelona, Spain, which after its closure in 2005 was acquired and protected by the City Council to

reconvert it into facilities for the city. One of the yarn storage warehouses, built in 1905, was converted by Roldán and Berengué architects into social housing for young people under municipal management.

The building measures 100x15x11m. with a solid brick façade and 25 bays with steel structure and trusses on the roof, and an intermediate concrete slab. With the intervention, the longitudinal dimension is emphasized, by making a central emptying of the building, where the access and the itineraries are concentrated by double diagonal ascending stairs. This cascading community space functions as an interior plaza, which physically and visually communicates all levels (Fig. 5). The 46 housing modules of about 60 square meters, built with timber framing, are inserted into the original structure, which makes it possible to generate two intermediate floors, increasing from two to four, without the need for reinforcements, given the lightness of the material. They are separated from the roof and both façades with intermediate spaces that, in addition to functioning as

Fig. 4. Passatge del Sucre Factory, Barcelona, Spain. Garcés - De Seta - Bonet Architects. Housing Project, 2009 (source: Garcés 2015, pp. 233, 235).

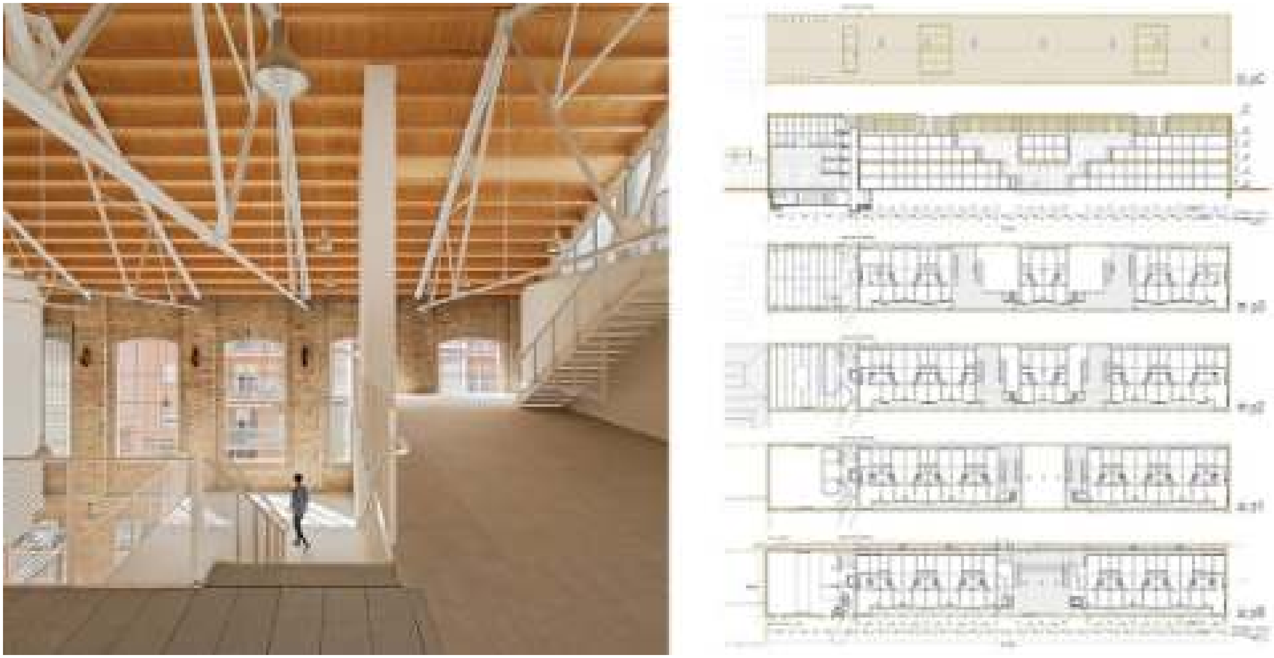


Fig. 5. Fabra & Coats, Barcelona, Spain. Roldán and Berengué Architects. Social Housing for Young People Project, 2005 (source: Roldán and Berengué 2020a, pp. 162, 165).

a thermal buffer, optimized by the inertia of the original construction, allow the organization of accesses and terraces.

The new construction, by its nature and assembly, can be mounted and dismounted, so it is "reversible", allowing the nave to be returned to its original state if necessary. The project is based on "activating all the elements of the original building for the new program", as well as reusing its physical, spatial, and historical qualities, to make the new construction more efficient and reinforce the nature of the original building (Roldán & Berengué, 2020a, 2020b).

Silos

Grain Silo in Grünerløkka, Oslo, Norway. HRTB Architects. Student Housing Project, 2002

In the Grünerløkka district of Oslo, Norway, a grain silo next to the

Aker River was transformed into a student residence by Ola Mowé, Ketil Moe, Kjell Beite and Harald Lone architects (HRTB) in 2002 as part of a larger-scale urban regeneration program. The riverbed, an engine of the city's industrial development since the 18th century, was declared a nature park in the 1990s, with rezoning of the industrial buildings to residential, university and artistic use (HRTB 2002, 2003, 2004).

The grain deposit, erected in 1953, was the first Norwegian building constructed in reinforced concrete with sliding formwork, which formed 21 cylindrical hoppers. The adaptation to the new use follows the criterion of reducing the construction effort and preserving the singular character of the building, respecting its rounded geometry. Slabs are inserted on 16 floors and a distribution corridor is generated by perforating the central hoppers. The 226 units occupy segments of a circle, circular main spaces and interstices between the hoppers, where the bathrooms are located (Fig. 6). On the upper floor, there are common spaces and services and a rooftop viewpoint.

The structure is perforated with more than a thousand vertically proportioned openings. Inside, the concrete is exposed and dialogues with a color code designed by Lykke Frydenlund, which extends to the glass sills of the balcony windows and the furniture adapted to the curvatures. To the exterior, a layer of thermal insulation is projected, protected by a crude rendering, to maintain the original roughness. The transformed building stands as a monument and icon of the urban landscape and of the surrounding redevelopment (Burnham, 2018, pp. 71-73).

Frøsilo, Copenhagen, Denmark. MVRDV Architects. Housing Project, 2005

The Frøsilo is a radical housing project for the conversion of two identical cylindrical silos, almost next to each other, located in the old harbor of Copenhagen, Denmark, realized by Winy Maas, Jacob van Rijs and Nathalie de Vries architects (MVRDV) in 2005. The intervention in these old silos of bare reinforced concrete and incomplete appearance was based on their main limitation, the difficulty of drilling their continuous structure.

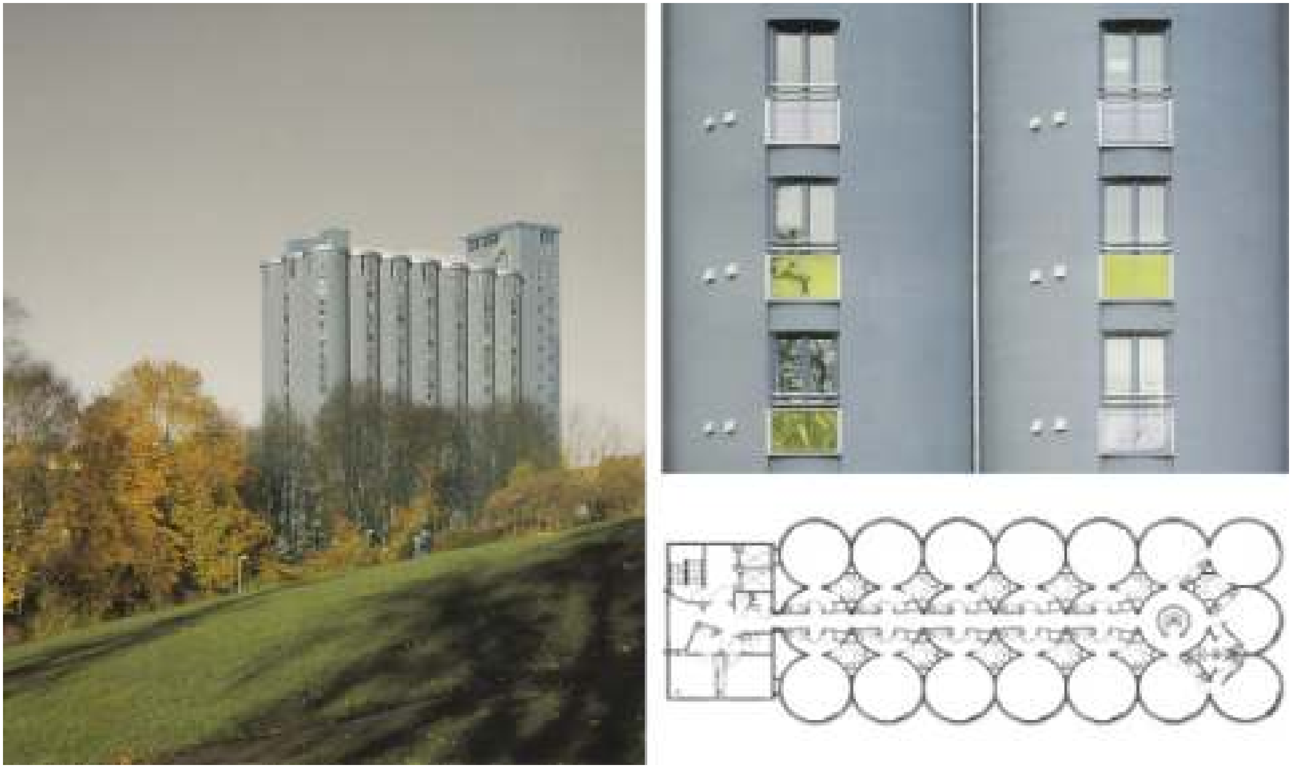


Fig. 6. Grain Silo, Grünerløkka, Oslo, Norway. HRTB Architects. Student Housing Project, 2002 (source: HRTB 2002, pp. 111, 113).

Given their nature, in the concrete cylinders it was only possible to make restricted openings of complicated execution, which was an excessive constraint to locate the dwellings inside. On the other hand, it would mean losing the most attractive aspect of their original state, the quality of emptiness. Thus, the silos literally form the new cores of the project, with perimeter distribution rings on each floor, which allow access to the apartments through punctual holes in the structure, stairs in flight, which go into the void, and elevators and ducts, which turn them into server shafts. Both cores are covered and protected with a transparent plastic membrane roof that allows a glimpse of the sky, giving rise to a futuristic lobby that shows the movement of the users (Fig. 7).

To the outside of the silos, 8 floors are suspended with 84 apartments made up of continuous curved spaces, which make it possible to dispense with intermediate walls, providing maximum flexibility. The cylinders are enveloped in a light and transparent glass skin, bordered by wide continuous terraces, which allow to enjoy the privileged panoramic views over the port and achieve a total transformation of the original infrastructures (MVRDV, 2005).

Grain Silo, Copenhagen, Denmark. COBE Architects. Urban Facilities and Housing Project, 2017

The Silo in Copenhagen, Denmark is a former port grain container redeveloped by COBE architects with a luxury urban facilities and housing project of private initiative in 2017. It is located in the Nordhavn district, where the 19th century docks have been immersed since 2009 in a process of transition to a modern residential neighborhood for 40,000 people, with the preservation of its identity and industrial heritage (Lindhardt Weiss, 2018).

The silo, built at the end of 1950 with rigorous criteria of functionality and economy, was a slender block formed by 27 concrete square-shaped tubes, which constituted a focal point in the port due to its great visibility. It had a structural mismatch, as it was slightly twisted, so it had to be calibrated with a careful process. To open up and articulate its thick exterior walls, a façade was designed to relate to the original structure. Galvanized steel caissons were attached, enveloping the building with a new faceted shell. The shape of these high-precision prefabricated modules allows balconies to be sheltered and drafts to be deflected to make the ground floor habitable, and they form an efficient sculptural "cladding" that flickers and shimmers in the light (Fig. 8).

Inside, the concrete remained exposed, even showing its cross-section in the openings between rooms. It contains 39 exclusive apartments of one or more levels and 73 to 305 square meters, which were adapted to the heights of the existing floors up to 8 m. Both the first floor and the upper level are publicly accessible, with a gallery that generates activity

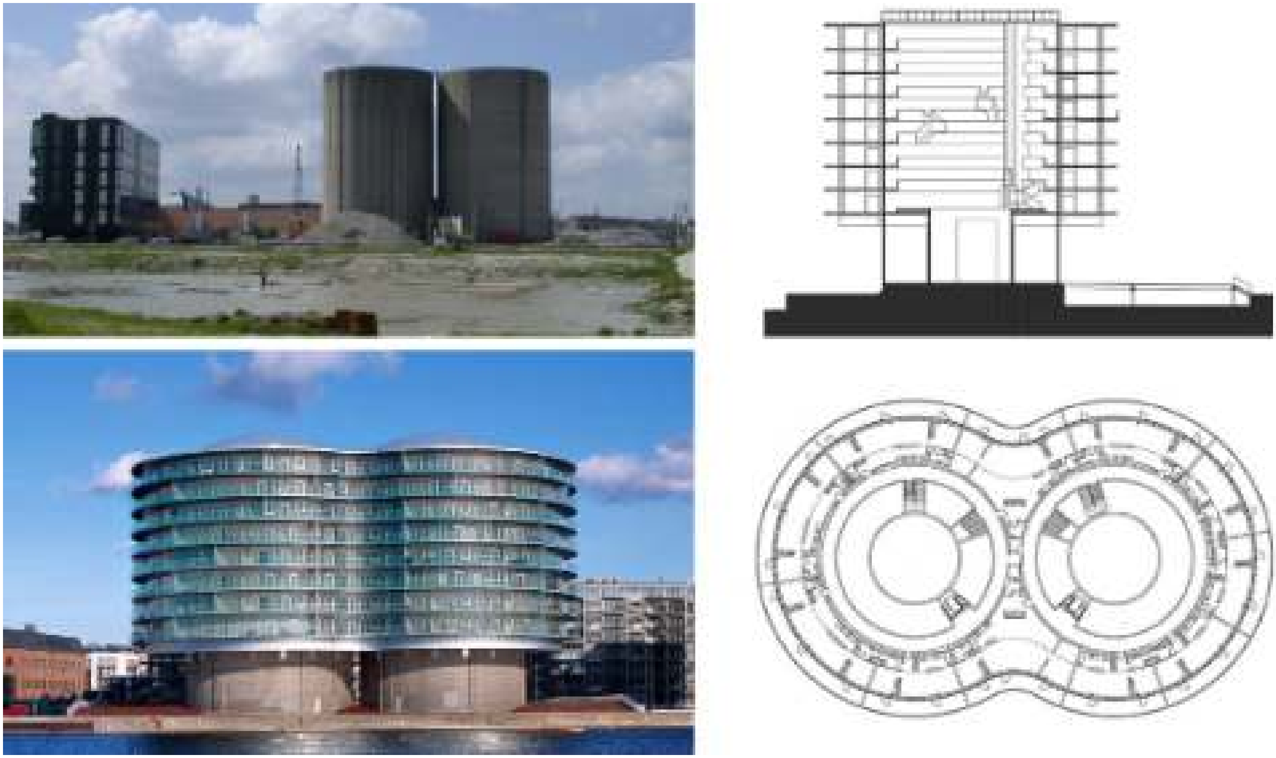


Fig. 7. Frøsilo, Copenhagen, Denmark. MVRDV Architects. Housing Project, 2005 (source: MVRDV 2005, p. 14).

towards the street and a restaurant wrapped in a glass skin, which finishes the silo with a luminous halo. The Silo aims to preserve the monolithic spirit of the old building, derived from the materiality and tactility of its construction, by simply covering it with a new cladding (COBE 2017, 2019).

Gasometers

Gasometers in Simmering, Viena, Austria. Jean Nouvel, Coop Himmelb(l)au, Manfred Wedhorn and Wilhelm Holzbauer Architects. Urban Facilities and Housing Project, 2001

The transformation of four gasometers located in the industrial district of Simmering in Vienna, Austria, responds to the initiative in 1995

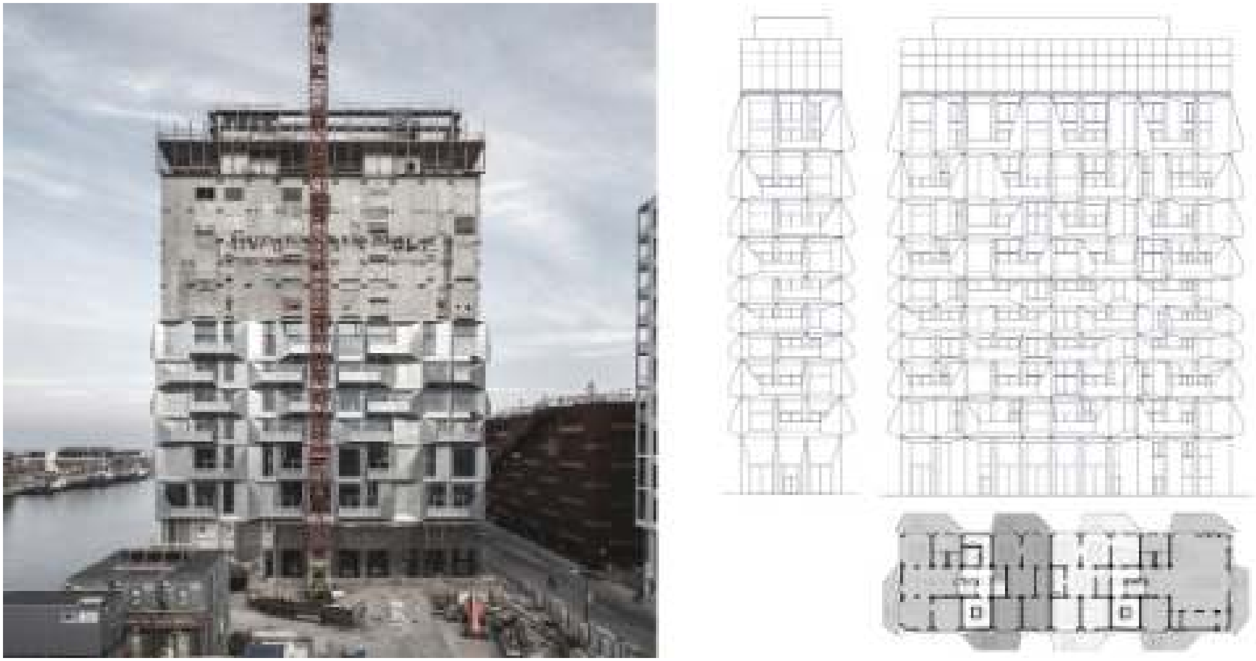


Fig. 8. Grain Silo, Copenhagen, Denmark. COBE Architects. Urban Facilities and Housing Project, 2017 (source: Lindhardt Weiss 2018, pp. 152, 158).

to preserve their heritage value by holding a competition for a mixed program. In 2001, the project by Jean Nouvel, Coop Himmelb(l)au, Manfred Wedhorn and Wilhelm Holzbauer architects for the conversion of the deposits into housing and offices was completed with a common base with a shopping center, cinemas, and concert hall, designed by Rudiger Lainer, which facilitated their integration into the surroundings (Wehdorn, 2002, pp. 86-89).

The gas factory, built between 1896 and 1899, was the largest complex in Europe, responsible for supplying the city until 1970. The four preserved tanks, 72 m. high and 64 m. in diameter, are of telescopic type and brick masonry with classic style openings, stiffened on the outside with large pilasters. The introduction of apartments and offices in each of these structures was based on the existing geometric order, with the premise of preserving them, reinforced with concrete pillars and rings, integrating

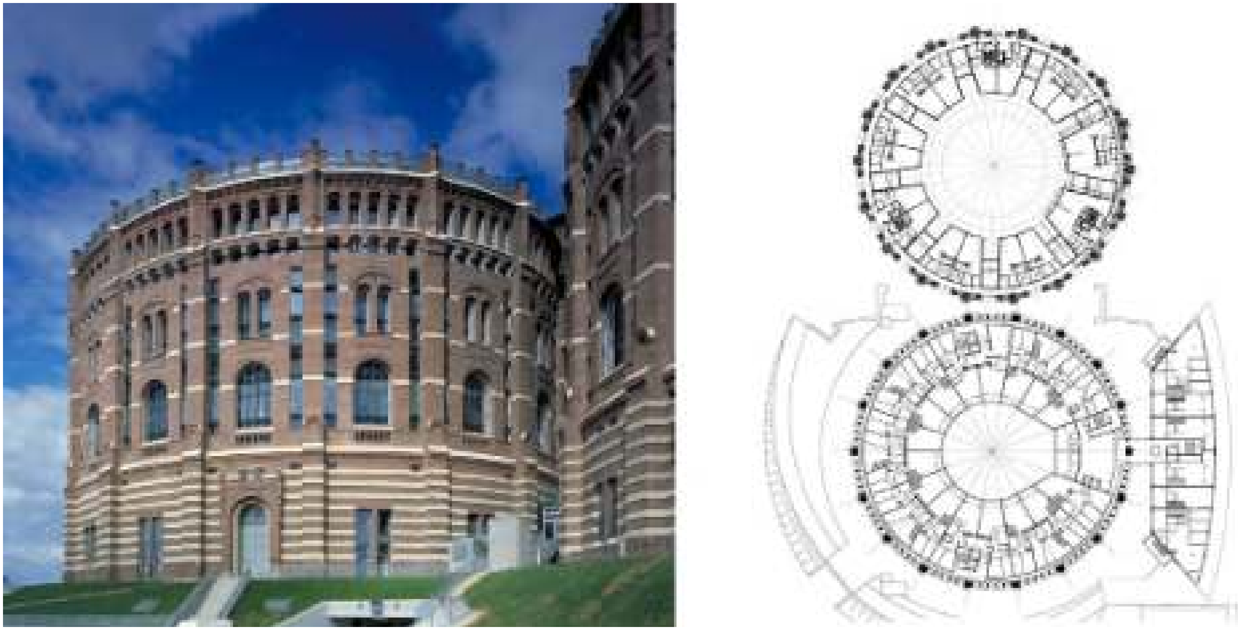


Fig. 9. Gasometers in Simmering, Viena, Austria. Jean Nouvel and Coop. Himmelb(l)au Architects. Urban Facilities and Housing Project, 2001(source: Nouvel, 2001, p. 48; Wehdorn 2002, p. 86).

new materials and styles. Jean Nouvel divided the gasometer A into nine segments located on the perimeter with 200 housing units, separated from each other and independent of the envelope by an exterior corridor. These volumes, clad in stainless steel, allow a view of the ceramic wall and reflect light, contributing to the luminosity of the central courtyard (Nouvel, 2001, pp. 48-51) (Fig. 9).

Coop Himmelb(l)au incorporated in Gasometer B two light-finished volumes with a total of 330 apartments and student residence: an interior one independent of the pre-existing ceramic structure with radial distribution and central courtyard, and an exterior one with sinuous forms and punctual connections (Fig. 9).

Manfred Wedhorn housed in the gasometer C a volume with 92 apartments staggered and white towards the central courtyard. Finally, in gasometer D, Wilhelm Holzbauer occupied the center with a core and three housing volumes, which delimited three courtyards with the preserved brick envelope (Wehdorn, 2002, pp. 90-111; CoopHimmerb(l)au, et al. 2002, pp. 71-79).

Alliance Building at the Gasworks, Dublin, Ireland. O'Mahony Pike Architects. Housing Project, 2006

The Alliance Building is a former gas deposit, located in Dublin, Ireland, rehabilitated with a housing project carried out by O'Mahony Pike architects in 2006. It is located in the port area of the city center, an industrial site since the 1870s, which in recent years has undergone a rapid and intense process of urban regeneration with the introduction of residential, commercial and office uses.

It is the only gasometer with a cast iron lattice structure preserved in the area and considered after its cataloguing and protection an important industrial archaeological monument. The 62 m. diameter frame, manufactured in London in 1885 by S. Cutler and Sons, is made up of 24 masts joined on two levels with metal frames and braced with tie rods. Fully restored, its interior houses an independent glazed structure with 240 apartments distributed over nine floors, a circular landscaped courtyard in the center and four vertical cores around it (Figg. 0, 10). The transparency of its façade makes it a privileged observation point and its location and entity, an icon and landmark in the landscape (O'Mahony Pike, 2006).

Fig. 10. Alliance Building at the Gasworks, Dublin, Ireland. O'Mahony Pike Architects. Housing Project, 2006 (source: O'Mahony Pike 2006, p. 71).

Gasometer in Stade, Germany. Gerhard Buttge Architect. Housing Project, 2015

The project to transform a gasometer located in the harbor of the city of Stade, Germany, into a residential building by architect Gerhard Buttge in 2015 furthered the regeneration of the urban area Harschenflether Vorstadt, formally designated in 2013 with a Master Plan to develop a mixed-use neighborhood.

The 29 m. diameter gasometer, built in 1955, consists of a cast-iron framework made up of 12 lightweight pillars joined on three levels and braced with triangulations. Its rehabilitation entails the incorporation of

Fig. 11. Gasometer in Stade, Germany. Gerhard Buttge Architect. Housing Project, 2015 (source: Buttge Architects website).

this structure to a unitary base of sheet metal with parking on several levels, and its union through intermediate slabs, which contain 36 dwellings distributed over six floors with a central core and a transparent aluminum and glass façade, which provides wide views and different orientations (Fig. 11). The project, in accordance with the status of protected monument, ease of use and affordability, results in a unitary building, in which the historical framework shapes the façade, adding a new order (Buttge Architects website).

Gasometers in King's Cross, London, England. Wilkinson Eyre Architects. Housing Project, 2018

The rehabilitation of three gasometers in King's Cross, London, England, to accommodate three residential buildings with Wilkinson Eyre's 2018 project, is part of an extensive program of urban redevelopment with

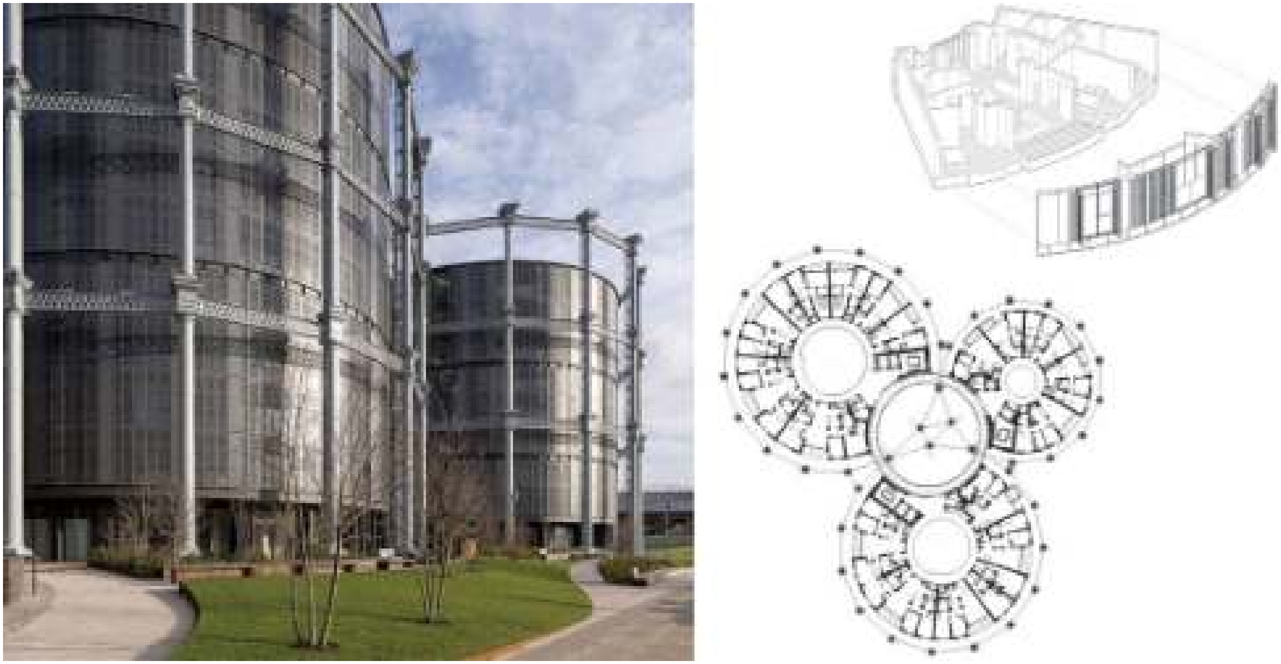


Fig. 12. Gasometers in King's Cross, London, England. Wilkinson Eyre Architects. Housing Project, 2018 (source: Wilkinson Eyre, 2018a, pp. 18-20).

preservation of industrial heritage. It consists of three cast-iron guide frames of different diameters - the largest, 45 m. - tangent to each other, built in 1867 and dismantled in 2001, which were subsequently listed for the great heritage value of their monumental columns joined on three levels. The project proposed three cylindrical housing containers separated from the cast iron trusses and of different heights, to suggest the movement of the original gasometers.

A fourth virtual drum, located in the intersection of the three structures, forms a central landscaped courtyard that concentrates the accesses (Fig. 12). The project includes 145 apartments with common facilities of gym, spa, lounges, dining rooms and bar. In each volume, access to the apartments is provided through a circular, glass-roofed central atrium, with walkways around it on each floor, where light is reflected in a water fountain. The radial configuration gives rise to diaphanous apartments, which take advantage of the natural light on the perimeter. The roofs were conceived as gardens that naturalize this re-inhabited urban landscape, and the façades as transparent planes of modular steel and glass panels protected by perforated sheet metal panels to provide shade and privacy for the occupants. All of this creates a dynamic counterpoint between the old and the new, which maintain the autonomy of heavy industrial aesthetics and the delicate refinement of new materials (Wilkinson Eyre, 2018a, 2018b, 2019).

Final Reflections

The historical industrial heritage has acquired different degrees of protection that have allowed it to be preserved, interpreted, and enhanced. In this chapter we have reviewed different strategies for the conversion of warehouses, silos, and gasometers into residential complexes. The great diversity of forms of intervention, which emphasize or conceal, preserve, or modify, link or make independent, etc. the most characteristic elements of the buildings, highlights the need to define transversal policies for safeguarding and rehabilitating these infrastructures, with universal conservation criteria.

In relation to the viability of the intervention, the regeneration of these obsolete industrial areas depends mainly on factors such as: economic considerations, which prioritize balance with the benefit to the community or the environment; urban diversity, optimizing the mix of uses; the ability to solve current problems from the indispensable historical reference; the potential to find signs of collective cultural identity, which compensate for strictly utilitarian aspects; and the richness of the urban landscape, to contribute to the complexity and cohesion of the city.

When considering the element to be preserved, in addition to the values of the building itself, it is necessary to take into account historical, cultural and educational qualities, related to the historical memory of the forms of economic activity carried out in the past, and external spatial values, linked to its urban-landscape contribution. Awareness of the physical context's importance in the process of conservation and rehabilitation of industrial heritage is a fundamental active part of the responsible management of cities in order, as indicated in the Aalborg Charter (1994, pp. 97-98), to undertake interventions in an integrated, holistic, and sustainable approach.

Hence the importance of knowing the origin and contribution of each work to architecture and the current way of life, in order to reach a global awareness that, linked to the concept of historic urban heritage, triggers a broadening of regulations capable of implementing criteria for intervention. Kevin Lynch (1960, p. 119) alluded that we need an environment, not only well organized, but also poetic and symbolic, that addresses individuals and their complex society, their aspirations and historical tradition, the natural setting and the complex movements and functions of the urban world. The city provides a basis for clustering and organizing these meanings and associations, highlighting human activity, and encouraging the formation of memory traces.

The articulation of industrial heritage with history and the city opens new lines of reflection, necessary to define its conservation principles and practices. The state of revision to which this discipline is subjected, responds to a flexible way of understanding heritage as part of a living and dynamic city, in constant need of adaptation to change, and open to new objectives with a focus more integrated and linked to the territory.

Acknowledgements
This research has been carried out in Grupo de Representación Arquitectónica del Patrimonio Histórico y Contemporáneo (GRAPHyC). Ref.: H32_23R. University of Zaragoza.

References

Bandarin, F., & Van Oers, R. (2012). *The historic urban landscape: managing heritage in an urban century*. Chichester: Wiley-Blackwell.

Biel Ibáñez, M.P. (2016). El patrimonio industrial en el siglo XXI y su relación con la ciudad posindustrial. In A. Hernández Martínez (Ed.) *Conservando el pasado, proyectando el futuro: tendencias en la restauración monumental en el siglo XXI*, pp. 157-176. Zaragoza: Institución Fernando el Católico.

Broto, C., & Mostaedi, A. (2006). *Rehabilitación: Nuevos conceptos*. Barcelona: Structure.

Burnham, S. (2018). *Reprogramming the City: Doing more with what we have*. London: VRMNTR.

Buttge Architects website <https://www.architekt-buttge.de/projekte/gasometer> (accessed 28 April 2024).

Capel Sáez, H. (1996). La rehabilitación y el uso del patrimonio histórico industrial. In *Documents d'anàlisi geogràfica*, No. 29, pp. 19-50.

COBE (2017). Suiting the silo. In *Architectural review*, Vol. 242, No. 1444, pp. 58-65.

COBE (2019). Reconversion of a silo. In *Arquitectura viva,* No. 213, pp. 22-27.

Nouvel, J., Wehdorn, M., & Holzbauer, W. (2002). Apartment building Gasometer, Vienna. In *GA document,* No. 69, pp. 68-79.

European Cities & Towns Towards Sustainability (1994). *Charter of Aalborg*. European Conference on Sustainable Cities & Towns. Aalborg, Denmark, 27 May 1994. <http://www.sustainablecities.eu/the-aalborg-charter/> (accessed 28 May 2024).

Garcés, J., de Seta, D., Bonet, A., & Rovira, B. (2015). Viviendas no convencionales en el Passatge del Sucre. Barcelona, Spain. In *ON diseño*, No. 352, pp. 232-245.

Gudmand-Høyer, J., & Edvars, J. (1984). Jernstøberiet, bofællesskab i Himmelev ved Roskilde. In *Arkitektur DK*, Vol. 28, No. 6, pp. 234-238.

Hernández Martínez, A. (2013). El reciclaje de la arquitectura industrial. In M.P. Biel Ibáñez (Ed.). *Patrimonio industrial y la obra pública*. Conference proceedings. Zaragoza, 16-18 April 2007. Coord. Zaragoza: Gobierno de Aragón, 2007, pp. 29-52.

HRTB (2002). Residencia de estudiantes en un silo de 1953, Oslo. In *AV Monografías*, No. 98, pp. 110-113.

HRTB (2003). Student housing, Oslo. In *Architektur Wettbewerbe*, No. 195, pp. 26-29.

HRTB, & Mowe, O. (2004). Student residence, Oslo. In *Architecture interieure cree*, No. 313, pp. 54-55.

Dot Jutgla, E., & Pallares-Barbera, M. (2015). Patrimonio industrial, revitalización económica y compacidad urbana en el Poblenou-22@Barcelona ¿Un nuevo modelo Barcelona? In *Boletín de la Asociación de Geógrafos Españoles,* No. 69, pp. 9-35.

Keiding, M. (2003). Housing in the Torpedo Boat Hall (Tegnestuen Vandkunsten). In *Arkitektur DK - Nyt i gammelt [New in old]*, Vol. 47, No. 4, pp. 234-241.

Laudy, S. (2011). Conversion of a factory, Barcelona; Architect: Jordi Garcés. In *A10,* No. 38, pp. 27-29.

Lynch, K. (1960). *The image of the city*. Cambridge, MA: MIT Press.

Lindhardt Weiss, K. (2018). *The Silo - COBE. Ny Dansk Arkitektur*, Vol 2. Copenhague: Strandberg Publishing.

López Corduente, A. (2011). *22@ Barcelona: 10 anys de renovació urbana*. Barcelona: l'Ajuntament.

Martí Checa, N.A., Claver, N., Fernández Delkader, M., Fernández Valentí, R., Güell, A., Gatnau, M.J., & Llobet, X. (2000). *Poblenou i la reconversió de les fabriques*. Barcelona: Arxiu Historic del Poblenou.

MVRDV (2005). From silo to loft apartments: MVRDV's building in Copenhagen. In *Baumeister*, Vol. 102, No. 11, p. 14.

Nouvel, J. (2001). Gasometer A, Gasbehalter Simmering, Vienna. In *Arquitectura Viva*, No. 81, pp. 48-51.

O'Mahony, P. (2006). Docklands revival - a converted gas holder forms the centrepiece of a mixed-use scheme in Dublin's docks. In *Architecture today,* No. 167, p. 71.

Roldán, J.M, & Berengué, M. (2020a). 46 VPO en la nave de Fabra & Coats, Barcelona. In *AV Monografías*, No. 223/224, pp. 160-167.

Roldán, J.M, & Berengué, M. (2020b). Viviendas en la nave de Fabra & Coats. In *Arquitectura Viva*, No. 226, pp. 20-29.

Wehdorn, M. (2002). Gasometer projects, Vienna, Austria. In *A&U,* Vol. 5, No. 380, pp. 84-111.

Wilkinson E., & Tuckey, J. (2018a). Circles of life. In *Architecture today,* No. 286, pp. 14-23.

CHAPTER 2

Wilkinson Eyre & Tuckey, J. (2018b). Steely can. In *Architectural record,* vol. 206, n. 4, April, p. 74.

Wilkinson E. (2019). Gasholders in London, UK. *Architectural review*, vol. 245, n. 1458, February, p. 109.

Zucconi, G. (1997). *Gustavo Giovannoni, del capitello alla città*. Milan: Jaca Book.

The Mercado del Progreso of Oviedo. Analysis and urban evolution

Marta Alonso Rodriguez, Noelia Galván Desvaux

Introduction

The city of Oviedo, capital of the Principality of Asturias, has been an important centre of trade and commerce since its beginnings. Its strategic location in the north of Spain, at a crossroads between the Cantabrian coast and the centre of the peninsula, has favoured the development of a dynamic commercial activity over the centuries. However, it was not until the 19th century that this activity was significantly boosted by industrialisation and the consequent demographic and urban growth. In this context, the construction of covered markets became an imperative need to meet the growing demand for fresh and manufactured products, while contributing to the organisation and modernisation of urban space.

Background to the covered markets in Oviedo

The first manifestations of trade in Oviedo date back to medieval times, when the city established itself as an important centre of pilgrimage to Santiago de Compostela. Small street stalls were set up around the Cathedral and the main access roads, where local products and those from other regions were sold. However, the lack of adequate infrastructures and the absence of sanitary control over food products made it difficult to develop an orderly commercial activity. Generally, these activities were located in areas where streets converged or near the convents that were distributed on the outskirts of the city. One of the places where street trading first took place was none other than the current Trascorrales square, which at least from the year 1498, became home to the butcher's and fishmonger's shop, and would certainly also be the place chosen for the purchase and sale of other products brought into the city.The current Plaza de la Escandalera was also an enclave destined for a spontaneous market, a place where the peasants would go to sell their produce, and it was the first market outside the city walls. Until then, Trascorrales and Cimadevilla were the places where most of the commercial area was concentrated, and the latter square in particular needed to be relieved of this function in order to be able to host other public events. This was solved with the construction of the Plaza del Fontán. In order to give the area a more appropriate place for the sale of goods, an arcaded square was planned. The initial construction of the Fontán arcaded square was carried out between 1792 and 1794, under the direction of the municipal architect Francisco Pruneda y Cañal. This project, approved by the Oviedo City Council on 11 June 1792, responded to the need to provide the city with a covered space for commerce, replacing the traditional open-air markets that were held in the area.

Pruneda y Cañal conceived the square as a rectangle opened by four passages, with shops and businesses on the ground floor and dwellings on the upper floors. The original design also included corner towers to enhance the presence of the complex. However, the Fontán arcaded square underwent significant modifications during the 19th century. The merchants requested that the attics of the shops be extended to be used as dwellings, which affected the original proportion of the square. Shaped like a rectangle with a ground plan of some 65 by 30 metres, it would be used to house shops and businesses on the ground floor, with the upper part for storage and towers on the corners for housing (Ruiz-Tilve Arias, 1994, p. 24). As a result, the side streets, which initially had an appropriate proportion between the width of the street and the height of the buildings, were affected by the increase in the latter. The opening of Fruela and Uría streets around 1880, ended up transferring the commercial activity to this new expansion area. The market was thus reduced to the sale of products from the rural outskirts, to which the locals went on Thursdays to stock up on foodstuffs, flowers and to stroll around surrounded by such a grand landscape.

The 19th century and the construction of covered markets

Although industrialisation in Asturias is considered to have begun with the opening of the Trubia factory at the end of the 18th century [1], this process actually took a long time, not becoming effective until the second half of the 19th century. It was from 1850 onwards, coinciding with the reopening of this arms factory, the mechanisation of the mining industry and the creation of iron and steel companies, that the industry saw a notable increase in its development and began its period of splendour. Asturias possessed two of the basic materials for the production of machinery: coal and iron. Due to the greater abundance of the former, development was centred mainly on the extraction of this mineral, including all the additions involved in its transport. The transformation that this fact meant for Asturian cities was evident, influencing not only the new areas of growth, arising from the need to accommodate the new working population that was arriving, but also affecting the historic centres which, not resigning themselves to abandoning their supremacy over other areas of the city, found their new settlers in the new industrial bourgeoisie.

Among the urban reforms carried out in the city of Oviedo during the 19th century, the demolition of the medieval fence that surrounded the oldest part of the city is worth mentioning, as can be seen from the large number of files relating to it that can be found in the archives. The main reasons for this, as can be seen in some of these files, were the poor communication that existed between the interior and exterior through the arches of the fence, due to its narrowness, and the new hygienic and health considerations, which found these areas unhealthy.

If the previous centuries were known as those of the illustrious palace constructions and private residences, this new century was the one that brought with it the great endowment constructions, with the appearance of theatres, markets, and other institutional buildings, as a complement to the improvements that were beginning to be made in the infrastructures. In addition, we should add the growth of the industrial sector in the city, with the centralisation in 1856 of the workshops of the arms factory in the grounds of the former convent of La Vega and the appearance of the tobacco factory.

Added to this, we find the densification of the capital, with an increase in population, which went from less than 10,000 inhabitants at the beginning of the century to almost 50,000 in a hundred years (Ansón Calvo, 1990, p. 36) [2]. At the same time as industrial growth was taking hold in Asturias, the railway appeared, both symbols of the city's development. On the other hand, the city experienced a more bitter side, produced to a large extent by the above, and which consisted in the demolition of a large number of emblematic and singular buildings in the city centre. To all this must be added the growth of the tertiary sector, which increased with the establishment of the city as the administrative capital, political and service centre, which led to the appearance of public bodies such as the provincial council, the provincial hospital, or the political government, developing a great deal of commercial and financial activity.

The widening of the Uría road and the spatial growth of the capital towards this new area was managed by private hands. The city council refused to present an urban planning plan for the widening sector for economic reasons, and so streets were opened at the request of neighbours, motivated by private interests (Tomé, 1988, pp. 71-73). The scarcity of economic resources was the perfect excuse for not providing the city with a widening plan, although the new street was almost a kilometre long and, with its 16-metre width, it was an easily amortisable place. The new city grew parallel to the old one, providing the population with new facilities, such as the Fontán and Progreso markets, the Banco Asturiano, the General Hospital, the new Model Prison on the slopes of Naranco, the Seminary and the Cemetery. In 1845, the walls of the Convent of Santa Clara were demolished and the land occupied by its gardens was made available to the city, which also allowed rapid building growth in this area, on the site of which the city's theatre, the Campoamor, was built between

Fig. 1. Plan of the surroundings of the Marcado del Progreso building (yellow), circa 1900 (drawing: authors).

1883 and 1892 by J. López Salaberry and Siro Borrajo Montenegro [3] and the new covered market designed by J.M. de la Guardia, popularly known as the Placina, at the confluence of Calle Pelayo and Paseo de Santa Clara (Fig. 1).

This expansion was the place chosen not only by the wealthy classes but was soon to be occupied by the commercial sector and also by several congregations, who opted to open their convents in the vicinity, such as the Salesas, the Siervas de Jesús de la Caridad or the congregation of

Fig. 2. Plan drawn up by Joaquín maría Fernández and the modern part added by Javier Aguirre (drawing: AMO).

the Esclavas in calle Toreno. The Church of San Juan el Real, located in Calle Doctor Casal, in the Estancos neighbourhood, was built between 1902 and 1909, at a time when the new buildings of the bourgeoisie were still coexisting with the small pre-industrial buildings that had been installed beforehand. It was built as the new parish church of the Uría district with the pretensions of a large and magnificent temple for the new bourgeoisie.

It can be seen in the 1885 plan of the city (Fig. 2), how most of the proposed infrastructures were centred in this area of connection between the old and the new city, around the park of San Francisco, which acted as a place for recreation and strolling for the new bourgeoisie after its disentailment. Thus we find adjacent to this area the project for the new Campoamor theatre (1892) and the merado del Progreso (1887), both built on the grounds of the former convent of the Poor Clares, the Don Santos passageway (1892), which joined the streets of Uría and Pelayo and was occupied by various shops, the palace of the Provincial Council (1910) or the project that was never built to cover Calle Principado with an iron and glass roof.

In addition to all the buildings corresponding to institutions, new powers and services that were built, including markets, barracks, hotels, courthouses, and theatres, we must add the reforms that were carried out in the streets of the city with the arrival of electricity and lighting, which incorporated elements such as streetlamps and the electric tram into the street furniture.

During the 19th century, Oviedo experienced significant economic and social growth, which was reflected in the vitality of its markets. These commercial spaces were not only centres for the exchange of products, but also meeting and socialising places for the population. Although the location of the railway stations was a determining factor in the growth of the city of Oviedo, so was the location proposed for the markets that began to appear in the city, in response to the need to create covered spaces to replace the old open-air markets.

In some cases, such as the 19 de Octubre market, the location responds to an internal restructuring of the city, seeking to improve both the place where it is located, the Plaza del Fontán, and its immediate surroundings, with the idea of giving a new life to this somewhat forgotten sector of the old city (Molina & Morillón, 1994, p. 48). The same is true of the market planned for Trascorrales, whose construction provides a roof and better sanitary conditions for a practice that had been taking place in these areas for a long time (Fig. 3).

Around 1882, the construction of two markets in the city of Oviedo was proposed, and the places chosen were the Plaza del 19 de Octubre (next to the town hall square) and the space occupied by the former market gardens of the convent of Santa Clara, which had already been

Fig. 3. Plan of the Trascorrales market, 1862 (image: AMO).

Fig.4. Plan of the streets of Uría and Fruela, made by the engineer Don Salustiano Regueral, at the start of the construction project in 1868 (image: AMO).

disentailed. Both spaces were strategically located close to Calle Uría, a new artery of the city that connected the historic centre with the train station (Fig. 4).

The city's most emblematic market was the first of those mentioned. Its origins date back to the Middle Ages, but it was in the 19th century that it experienced its greatest boom. The current market building, in the Art Nouveau style, was built between 1882 and 1885 (Fig. 5). This building, designed by Javier Aguirre in wrought iron, is still standing today and is a notable example of nineteenth-century architecture in Oviedo.

The mercado del Progreso

The mercado del Progreso known among the people of Oviedo as la placina was located on the site of the Santa Clara vegetable gardens, next to the Campoamor theatre, on the block where the Jirafa building, and post office are today. Until the disentailment in 1845, this place was usually used for markets and was known as Campo de la Lana and was enclosed by the convent wall. The project, by J. Aguirre, was drawn up in

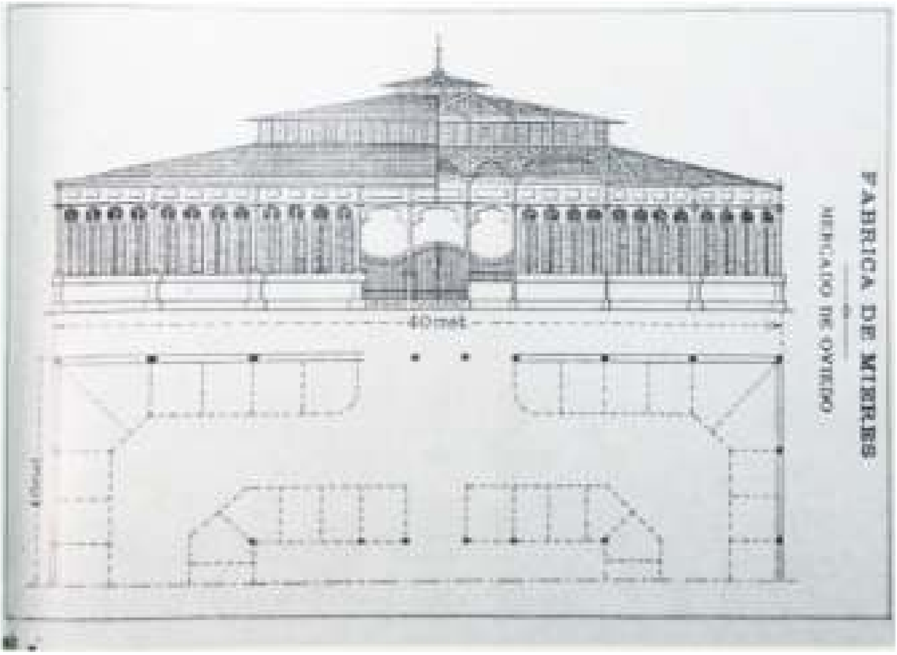


Fig. 5. Plan, façade and section of the 19 de Octubre market, 1907 (drawing: Fábrica de Mieres product catalogue).

1882, although the one that was finally carried out corresponds to J.M. de la Guardia. Its exact date is unknown, the work being completed around 1887 (Molina & Morillón, 1994, pp. 118-120). Formed by two naves arranged in a T-shape, it occupies a triangular site, one of the arms being the largest, which was also the one that gave access to the building from its ends. A third door was located in the centre of the long nave. As for the façade, it was built on a stone plinth made of iron and glass (Fig. 6).

J. Aguirre's initial project was not finally carried out, although the reasons for this are unknown, and the main difference with the one that was finally built was in its layout, as Aguirre proposed the total occupation of the triangular site, whereas the one that was finally built would have been T-shaped.

The mercado del Progreso had a metal structure made in the Mieres factory and a tile roof. It had two main halls and several smaller stalls. The

Fig. 6. Image of the interior of the market. Archivo de Rodríguez Curieses (https://www.facebook.com/650302524990009/photos/a.650313011655627/976368712383387/?type=3.)

main façade, facing Pelayo Street, was decorated with horseshoe arches and ceramic elements. The Mercado del Progreso was a representative example of Asturian neo-Mudejar architecture, characterised by the use of local materials, such as limestone, and by the incorporation of decorative elements typical of the region, such as noble coats of arms.

The neo-Mudejar style of the Mercado del Progreso was not only an aesthetic element, but also reflected the interest in Spanish history and culture that existed at the time (Fig. 7). Moreover, this style contributed to creating an identity of its own for the city of Oviedo. The structure of the market was made of metal, but this was integrated into the design of the building through the use of decorative metal elements, such as railings and balustrades. Colourful tiles with geometric or floral motifs were used to decorate the façade, friezes and pillars. Its metal structure, innovative for the time, was harmoniously integrated into the design of the building, combining functionality with aesthetics. It was a lattice structure, made up of wrought iron beams and pillars. This type of structure was very strong and made it possible to create large, open spaces, ideal for a market. The

Fig. 7. Oviedo. Pelayo Street and marcado del Progreso, 1933. Museum of the Asturian People. Collection: Celso Gómez Argüelles (Author: Gómez Argüelles, Celso. (https://fondos.gijon.es/fotoweb/archives/5021-Fondos-fotogr%C3%A1ficos/MPAFondos%20fotogr%C3%A1ficos/G%C3%B3mez%20Arg%C3%BCelles%2C%20Celso/CGA-341%20FF045220.tif.info).

metal elements were combined with other materials, such as brick and stone, creating an effect of contrast and visual richness. The long hall was 66 metres long and faced Pelayo Street, while the short hall, forming the shape of a T, was 22 metres long. Both were 14 metres wide (Fig. 8). The design included three doors: two on each side of the long nave and one in the centre. Since the terrain was not completely flat, the alignment of the Campoamor theatre was maintained and the differences in level were solved with steps (Fig. 9).

However, like many other structures in the city, it suffered the ravages

Fig. 8. View of the Progreso market in Pelayo Street, ca. 1930 (https://twitter.com/Histoviedo/status/1324287981616771074/photo/2Iron, from the Fábrica de Mieres, was the main material used, together with glass, complemented by a plinth of exposed brick and stonework).

of war and never again recovered its original function as a market. For a period, the space was dedicated to sporting activities, being used as a bowling alley in El Progreso and for basketball in Santa Clara. Unfortunately, the Mercado del Progreso was demolished between 1950 and 1953. The bus station was located on the block of the old mercado del Progreso, close to Calle de Uría, which facilitated communication with the city centre. Later (Molina & Morillón, 1994, p.118), it was replaced by the building that would soon be known as 'La Jirafa'.

The causes of its demolition were diverse, including the deterioration of

Fig. 9. View of San Francisco Park, Escandalera and Pelayo, in 1920. In the front, the building known as Casa del Conde In the background on the right, the old progress market in Pelayo Street (picture: RIDEA-Royal Institute of Asturian Studies).

Fig. 10. Virtual reconstruction of the mercado del Progreso building. Image of the current Jirafa building that was built on the site (editing: authors).

the building and the urban planning of the time. The construction of the La Jirafa building was completed in 1957 (Fig. 10). The original project, designed by architects Gabriel de la Torriente, Fernando Cabanilles and Joaquín Suárez Pérez-Fonseca, envisaged a multi-purpose conference centre with a hotel, offices, post office, post office and shops. However, the building was finally used for offices and commercial premises (Nanclare & Ruiz, 2014).

Conclusions

The mercado del Progreso, located in the heart of the new Oviedo, next to the Campoamor theatre, played an important social role as a place for strolling, revitalising the surrounding commerce that was promoted as being close to El Progreso. Despite its initial success, the market experienced a gradual decline throughout the 20th century. The emergence of new supermarkets and shopping centres on the periphery of the city, together with changes in consumer habits, eroded the importance of the traditional market.

The disappearance of this market was an irreparable loss to the architectural and historical heritage of the city. Its demolition represented the end of an era and a break with a space that had been a witness and protagonist of Oviedo's urban and social evolution for more than half a century.

Notes

[1] In 1794 it was decided to move the arms factory, which until then had been located in Navarre, to Asturias, due to the attacks it had received from the French revolutionaries, in an attempt to move it away from the border of the French Pyrenees, locating it in a very closed valley that was easy to defend. http://es.wikipedia.org/wiki/F%C3%A1brica_de_armas_de_Trubia.

[2] According to the 1787 census, the population of Oviedo had 6257 inhabitants on that date. Floridablanca Census (Carlos III).

[3] Municipal Archive Inventory Catalogue. Urban Police. AMO Files organised by streets 2334-2434. Campoamor Theatre.

References

Ansón Calvo, M. C. (1990). *La ciudad de Oviedo en el siglo XVIII: Estudio informático*. Oviedo, España: Fundación de Cultura, Ayuntamiento de Oviedo.

Molina, F. J. R., & Morillón, G. J. (1994). *La arquitectura del hierro en Asturias. 13 mercados y otros edificios urbanos*. Oviedo, España: Colegio Oficial de Arquitectos de Asturias.

Nanclares, F., & Ruiz, N. (2014). *Lo moderno de nuevo: Arquitectura en Asturias, 1950-1965*. Oviedo: LaMicro.

Ruiz-Tilve Arias, C. (1994). *El Fontán: Guía para nostálgicos*. Oviedo: Ediciones KRK.

Tomé Fernández, S. (1988). *Oviedo: La formación de la ciudad burguesa (1850-1950)*. Colegio Oficial de Arquitectos de Asturias.

"La fabrica" or how to inhabit a ruin.
Riccardo Bofill's pioneer experience with Industrial Heritage

Raquel Álvarez Arce, Sara Peña Fernández

Introduction

In the 1960s, an international and multidisciplinary team called *Taller de Arquitectura* (Architecture Workshop) was created in Barcelona around the figure of Ricardo Bofill. The team was formed by the set designer and architect of Uzbek origin Manuel Núñez Yanowski, the English architect Peter Hodkingson, the writers Jose Agustín Goytisolo and Salvador Clotas, and the Italian actress Serena Vergano, among others. The team focused its work during the 1960s on the geometric generation of collective housing and community living.

In 1970, after a failed attempt to build his proposed spatial city in Madrid, Ricardo Bofill looks for a place in the metropolitan area of Barcelona where to build the city in the space of *Taller de Arquitectura*. In his search he finds a space on the outskirts of Sant Just Desvern, where the cement factory known as "*La Sansón*" was being dismantled. Bofill describes the encounter with the place as an inspiring moment:

"Instead of being Madrid it was Barcelona, we made it weigh, and instead of being so crazy we said: we will define the project, we will define it ourselves and we will do it. I went to look for land. I lived in Barcelona, I took the car and I said: well, I'll look in the countryside because Barcelona is a closed place and you cannot do any experience. I get here and then they were destroying this factory. I go to talk to the doorman, I remember him very well, and I say "Will you let me in? and he says NO! Come on, let me in, how about a tip? The universe was fantastic, I remembered the most childish things, the factories, the grottoes, the tunnels, all this. And in the afternoon, I'm going

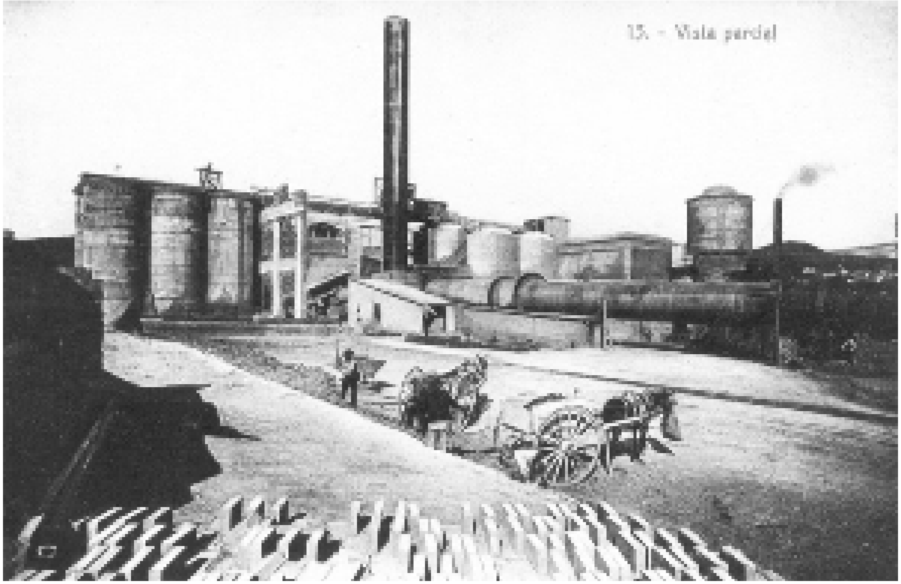


Fig. 1. Photograph of the Sanson Factory in 1921. Source: Arxiu Històric de l'Ajuntament de Sant Just Desvern [AHSJD], Colleccions. Fàbrica de Ciment La Auxiliar de la construcción SA, Sansón 1920-1968 (photo: Caja 8/Albúm Sr. Vila Casas, 1921).

to sign with "La Sanson" for 108 million bucks, and I didn't have a penny; besides they just gave me a lawsuit, I paid one million bucks, and 107 in letters." [1].
Thus began the project, on the land occupied by the old cement factory, taking up the formalization of this *city in space*. And it would be name as Walden 7 in honor of the homonymous science fiction book by Skinner [2]. A utopian work, as it would be, that in order to be carried out needed the financing of the *Banco Industrial de Cataluña* (BIC), through the mediation of Jordi Pujol from the Banca Catalana.

The sansòn

The demolition that Bofill finds are the remains of a factory of the company *La Auxiliar de la Comunicación* (LACSA), a corporate founded in January 1917 that already owned other facilities in the area. The plant started operations on June 12, 1920 as a support factory for some of the company's other factories (Fig. 1). And so, the new facility will produce artificial Portland cement under the name *Sansón*. The layout of the new

Fig. 2. Areal view of the factory in the 1960s. Source: Cartoteca del Instituto Cartográfico de Cataluña (http://patrimoniminerdecatalunya.blogspot.com/2014/06/fabrica-de-ciment-de-sant-just.html).

plant was devised by its director, Joaquim Molins, after traveling around Europe and the United States visiting buildings and industrial complexes from which to learn new production processes. Thanks to this previous study, the cement plant, compared to the artisanal processes of the time, stood out because of its automation and modernity.

A few years later, in 1924, an important reform was carried out inside the factory, the construction of a large chimney 102 meters high that still marks the profile of the town of Sant Just Desvern. The project increased cement production to 110.,000 tons of cement per year. In the 1945 aerial photos, we can see how the *Sanson* was located in a rural setting, far from the urban center of Sant Just Desvern, and surrounded by fields of crops. However, the photographs already show the outlines of the future arteries that currently organize the area (Fig. 2).

During the Spanish Civil War, *Sansón* was considered a war industry, in order to guarantee the production of cement needed for defensive buildings. Surprisingly, the factory was not bombed, so the modern facilities quickly resumed production after the conflict.

The increase in production, which coincided with the country's years of economic expansion, required extensions to the plant (Fig. 3). In 1950 a refrigerator was built, and in 1951 an underground water line, a new kiln for the production of natural cement and a thermal power plant for the production of energy [3]. In addition, during this period, in 1949 and 1955, the LACSA company built a small settlement with some housing for its workers [4], closer to the factory than the urban core.

This growth in production, which coincided with the years of economic expansion in the country, was going to generate waste and pollution with the consequent inconvenience among the local population, which caused neighborhood protests that were consolidated day by day. On April 6, 1964, the plenary session of the Sant Just Desvern council, taking note of the protests, decided to classify the activity of the cement plant as "annoying, unhealthy and harmful" (Solé & Amigó, 1988, p. 54) putting the factory's future in doubt. In 1965, when the construction assistant proposed to the city council to expand the facilities and the production of the *Sansón*, the city council did not authorize the works [5], forcing the cement company to consider closing it and moving it to the neighboring town of Sant Feliu.

In view of this situation, the head of the cement plant, Mr. Calderón, suggested to the city council the possibility of reclassifying the land from industrial to residential use. The mayor, Josep Lluis Surroca, resolves to agree to the change (Solé & Amigó, 1998), although the facility continued to operate until 1967. From that date, LACSA will progressively abandon the *Sansón* facilities in favor of the Sant Feliu plant, until the definitive sale of the land to Ricardo Bofill.

What to do with the ruin

The cement company's facilities occupied practically all the land that Bofill had acquired with his partner [6]. For this reason, on January 22,

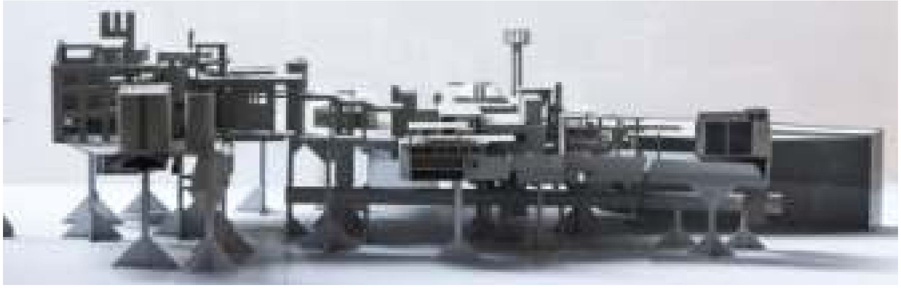


Fig. 3. Photograph of the model of the cement plant made by Taller de Arquitectura to show the elements of the cement plant that they wanted to preserve as a sculptural ruin (photo: Ricardo Bofill Archive).

1971, a request for permission to carry out a complex task of cleaning and architectural suture would be presented to the Sant Just Desvern city council:

"License to carry out some work to prepare the land for the future construction, as well as the demolition of the old existing constructions of the cement factory and remodeling, cleaning and treatment as sculptural work of the singular elements, especially the silos, chimney etc... that will be used as part of the common services of the later new buildings." [7].

The work, as Joan Malagarriga tells us, began with an attempt at a graphic survey of the factory, both of the industrial part and of the offices and workers' housing (Ibid, p.40). This documentation was either never produced or has disappeared, since in the application registered on February 1, 1971 at the city council of Sant Just Desvern, for the levelling and preparation of the land, no plan appears:

"The complexity of representation in plans the demolition, discourages its presentation accompanying this letter, however, a scale model of the singular elements that will compose the sculpture is available to the technical services." ([AHSJD], Obres i urbanisme (1875-1994) Box 694).

The sculpture cited in the application referred to the set of elements that the architects intended to preserve from the old cement plant. Photographs of the model and this one are preserved in the Bofill archive, and although the city council document explains that it is a scale model of the elements that will make up the project, the three-dimensional prototype shows considerably more pieces than would

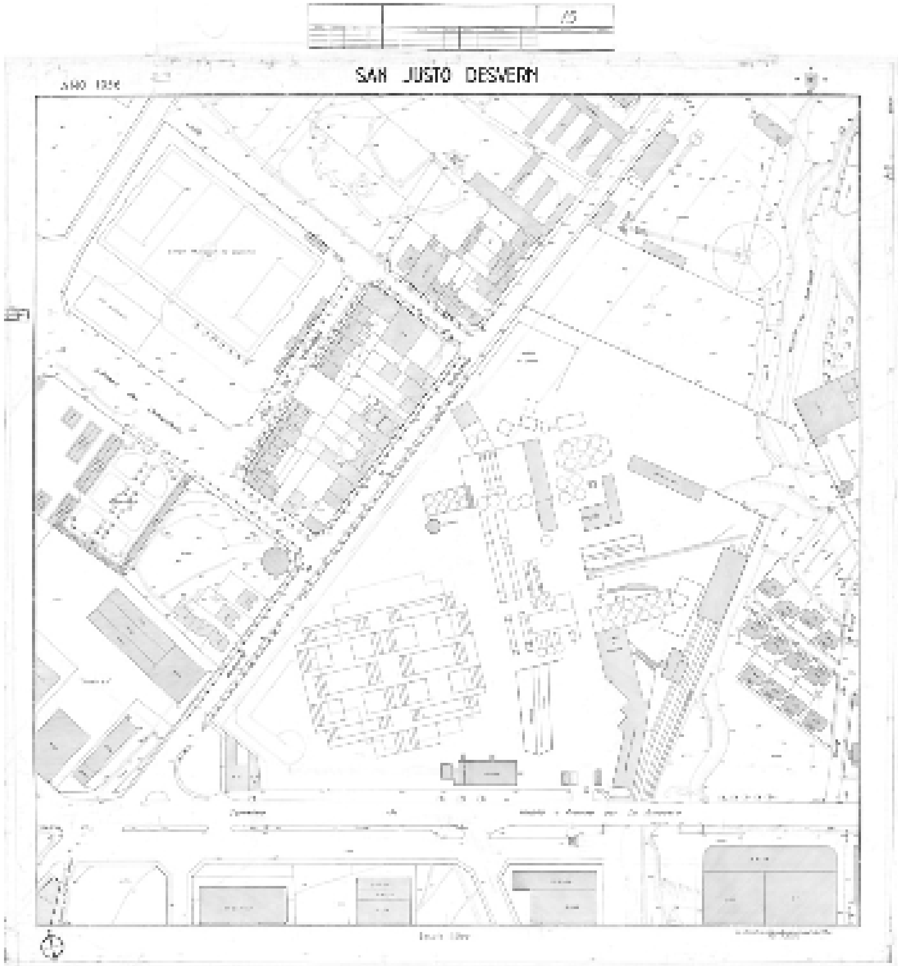


Fig. 4. Plan made by the topographer hired by the city council of Sant Just Desvern in 1956. Source: [AHSJD] (drawing: Colleccions. Fàbrica de Ciment La Auxiliar de la construcción SA, Sansón 1920-1968).

eventually be preserved. Although the planimetry was not delivered to the city council, its archive contains a series of topographic plans made in 1956, commissioned by the city council itself, in which the *Sansón* appears [8]. These plans are very relevant because, as opposed to the aerial photos in which the factory is reduced to roofs, the surveyor's survey shows the silos, pipelines, and warehouses with which the studio will work. The plan also shows an initial version of the Walden 7 building on the site, probably the result of the recycling of plans (Fig. 4).

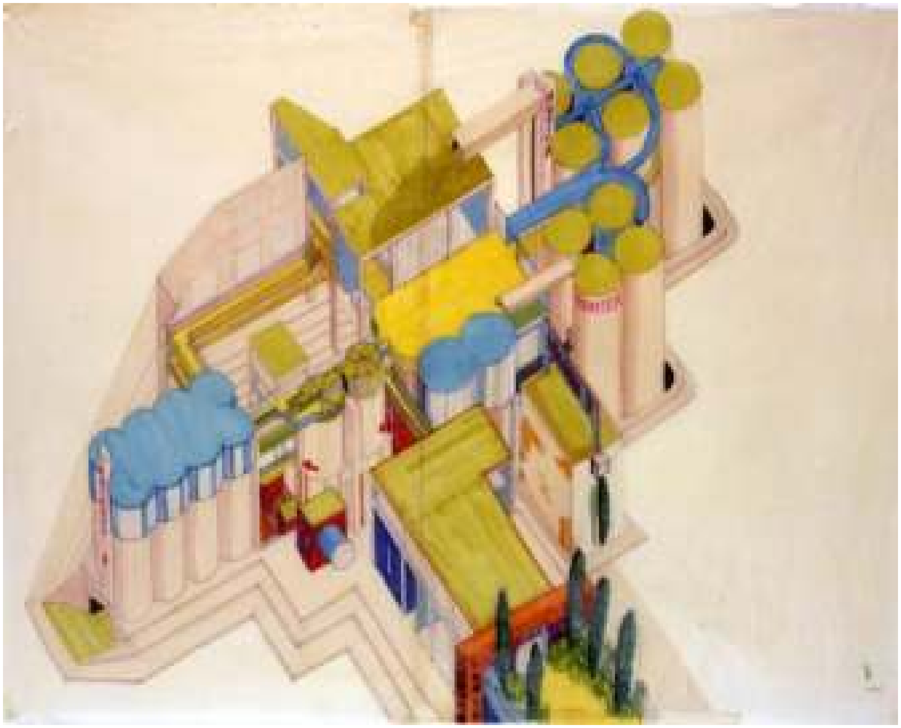
The project process of Walden Island, understood as the different buildings that will coexist on the site of the old cement plant, will be subject to the different vicissitudes through which the work will pass. And perhaps, the proposed use for the ruins of the industry will be the one that will vary the most during the development of the industry.

In the project delivered in 1971 to the city council, the area occupied by the remains of the factory that the *Taller* wants to preserve is marked with a plot in which the legend indicates that *“The exterior surface of the elements of the duly remodeled old cement factory will be used as a green area”* [9]. This agrees with what Ramón Collado also narrates: *“The garden that was created in the center, with the vegetation invading everything, changed a landscape of gray cement dust dunes for dunes of green, transforming an industrial, suburban, aggressive landscape into a pleasant landscape, a romantic garden.”* (Solé & Amigó 1998, p. 36).

In the approved project that the *Taller* delivered to the city council in August 1972, the remains of the cement plant became buildings for public use by the tenants of Walden Island. In the detailed plans [10] of the old production spaces, communal areas are proposed, occupying the decks with swimming pools. The *Taller* proposes “*a program to reuse the factory as a nerve center, center of interest and play center, a bit like the brain of Walden*” (Solé & Amigo, 1998, p.41). This focus of activity, which housed nightclubs, cinemas, and even spaces for fashion catwalks (Ibidem), also had to house experimental laboratories dedicated to the social study of the individual [11]. This idea of community center is clearly shown in a color axonometry, close to *pop art*, in which the remains of the *Sansón* appear labeled with signs that already denote these new uses (Fig. 5). No planimetries of the communal center are preserved beyond this image, but thanks to this axonometric perspective, we can clearly understand the architects’ work strategy in terms of preserving the existing elements, such as the different sets of silos or the hoppers.

Despite the fact that in May 1974 the execution project was delivered

Fig. 5. Sketch showing the remains of the cemetery converted into a community center for the Walden (drawing: Ricardo Bofill Archive).



to start the second phase, it was never carried out. The reasons for the failure of this initiative were weighted between purely economic issues and those of a social nature, motivated by the complaints of the residents of Sant Just Desvern, who looked with antipathy at the construction of the rest of the project.

Thus, when the BIC (Banca Industrial Catalana) finally signed the promotion agreement with the *Taller*, the construction of the Walden Tower began (Solé & Amigo, 1998), and it is here when the fate of the Sansón's remains changes and becomes, in a certain way, governed by economic issues. Nuñez Yanowski reports that when the bank joined the development, the ruins of the cement plant ceased to be a social space for the Walden neighbours [12]. We can understand that Ricardo Bofill's will to conserve the remains of the cement factory, which are part of the payment of the fees of the *Taller* [13], transforming the *Sansón* finally into *La Fábrica*, the architect's house-studio.

The transformation in la fàbrica

The work to convert the old cement plant into Ricardo Bofill's house-studio was carried out in three stages: cleaning, delimitation and redefinition. The beginning of this transformation, probably in parallel to the change of use of the remains of the cement plant, was carried out, according to Malagarriga, as part of the remodeling of the factory (Solé & Amigo 1998). As it appears in the city council registry, the *Taller* requested to begin consolidation work on the remains, while the municipal permit was being obtained to begin work on Walden 7:

"It is advisable, until the referred municipal permit is obtained, to carry out some work that allows the preparation of the land for the future construction, as well as the demolition of the old existing constructions of the cement factory and remodeling, cleaning, and treatment as sculptural work of the singular elements, especially silos, chimney, etc., that will be used as part of the common services of the later new buildings." ([AHSJD, Obres i urbanisme (1875-1994) Leg.288 doc. 71.1972)

This first phase was carried out, according to Bofill, with "*dinamite and drilling machines*", cleaning and trying to "*reveal hidden forms and revalue certain spaces*" (D'Huart, 1984, p.81), a job for the architect comparable to that of a sculptor. During this part of the process, the *Taller* makes use of black and white photographs of the remains of the factory on which, with colored markers, they mark the elements to be removed. An operation carried out almost as a game [14], where the members of the *Taller* worked with the remains of the cement plant as if it were a large model from which to cut out and reveal elements (Fig. 6).

After this first surgery process, everything indicates that *La Fábrica* project becomes a personal work of Bofill [15], who will begin to work with the forms hidden in the *Sansón*. These elements that emerged after the cleaning corresponded to the different silos, elevated tanks and hoppers of the cement plant, as well as a series of large frames with their

Fig. 6. Photographs on which Taller de Arquitectura planned the transformations of La Fábrica with colored markers (image: Ricardo Bofill Archive).

floor slabs and a large perforated wall with different rectangular section openings. Spaces that make Bofill feel, in his own words, overwhelmed by the experience of discovering this industrial space. Spaces that inspired both Le Corbusier and futurist architects such as Sant'Elia, whose proposals sought the forms of large North American industrial buildings. The aesthetic references were present and at hand, Bofill only had to take them and turn them into what was to become his workshop home. After the cleanup, the remains of the cement factory emerged from the rubble and Bofill had to face the transformation of the old factory into a new architecture, an issue that he approached in very different ways depending on the nature of the remains. The hoppers and some elements such as metal turrets will be maintained as sculptural forms, incorporated in one way or another into the project. The silos, which are grouped in sets of 6, 4 and 2 elements, will house different functions depending on their relationship with what we could call the main volume. Bofill called this volume, defined by the large frames that supported the nave, *The Cathedral*, the space that would eventually house the architect's residence. The mechanism used by Bofill to assign new functions to the spaces of the cement plant has to do with the dimensions and characteristics of the pre-existing elements, causing spatial changes that make it possible to adapt the spaces to the new functional needs proposed. Bofill names each area according to its own aesthetic characteristics that derive from the dreamlike universe he seeks to create -*The Cathedral, the Garden of Delights, the Silos of Knowledge or the Catacombs*- and that would be translated into a *specific vocabulary* [16] able to articulate the new architecture. In this way, the *Silos of Knowledge*, the set of 6 of the 10 silos that were preserved from the old industrial plant, form the *Taller de Arquitectura* studio; *The Cathedral*, becomes Bofill's residence, *the Catacombs* were used for archiving, and the remaining four silos were used as guest apartments (Fig. 7).

After the first cleaning and cutting process, the *coller* phase continues, gluing and suturing where needed. This mechanism seems to respond to another project strategy, that of wrapping the remains of the cement factory in order to delimit the entire complex of *La Fábrica,* understanding, as Norberg Schulz states, that by establishing this limit the new architecture takes presence (Schulz, 1998). Thus, the architect placed a new facade that delimits the perimeter of the large frames of the industry, in which we find the characteristic set of arches that will give a new image to the whole, and that will influence the new spatiality of the complex.
Through an almost continuous envelope, Bofill encloses the space of *The Cathedral*, leaving out the elements that can work autonomously, such as the silos. We could say that, like Kahn and Venturi, he makes "ruins that envelop buildings", understanding this as a use of architectural elements behind or within others (Rodell, 2008). Ricardo Bofill wraps one ruin with another by means of the wall perforated by windows outlined with semicircular arches, but does not seek to generate a façade [17], but to delimit a space. This decision seems to be related to the symbolism

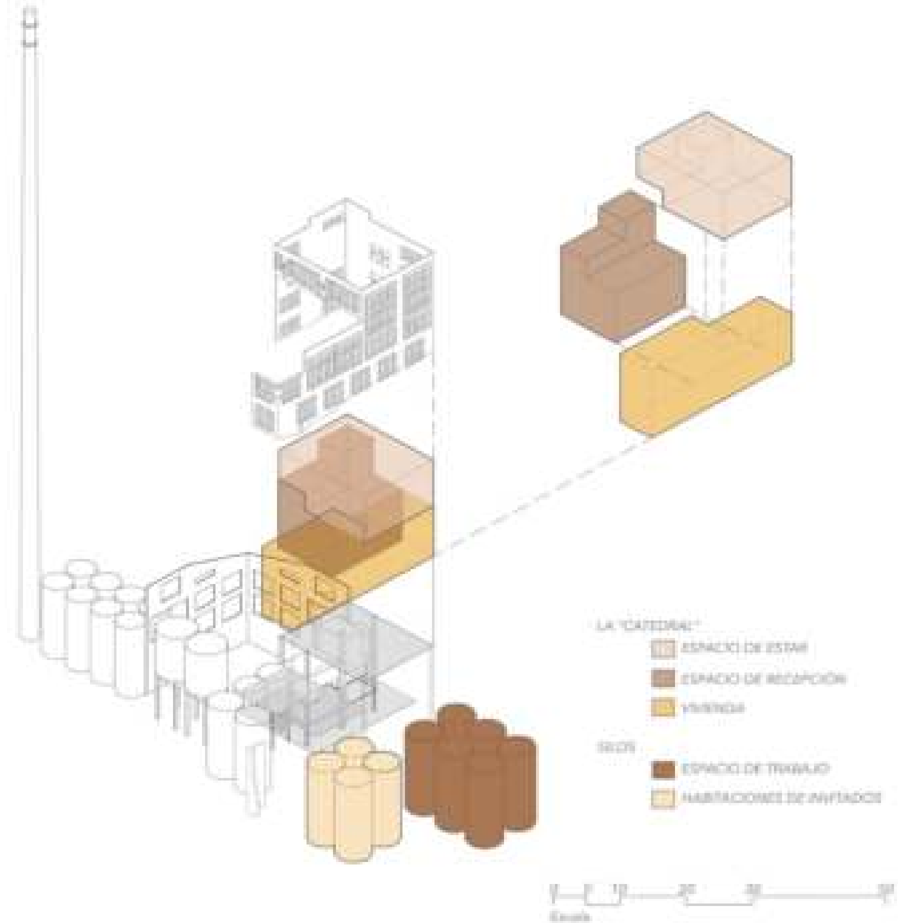


Fig. 7. Exploited axonometry of La Fábrica. On the first level, the pre-existences preserved by the Taller. The second level defines the spaces formed by delimiting the ruin and the last level defines the envelope that articulates the complex (drawing: authors).

present in the architecture of the 1970s, and to the ironic incorporation of historicist elements that had been abandoned by modernity. Bofill seems to take this path, echoing the surreal character that, according to him, he finds in the factory on his first visit [18]. The arches together

Fig. 8. Photograph showing the process of opening the windows in the cement silos, as well as the construction of the envelope (photo: Ricardo Bofill Archive).

with the industrial elements, the stairs that lead nowhere and the large chimney are reminiscent of the metaphysical paintings of Giorgio de Chirico. The disproportion of the arches brings the image of *La Fábrica* even closer to the paintings of the Italian artist's metaphysical period, where the industrial architecture, represented by the chimneys in the background, contrasts with facades of what could be an urban street with an arcaded gallery with arches. One of the challenges of this reconversion will be the transformation of the silos, which are made up of cylinders with a diameter of nearly 5 meters and built in pure concrete. Both the warehouses dedicated to the *Taller* and the guest rooms have the same modifications and readjustments. The first is the union of these by a central space that links them and allows access to the different rooms. The second, its division in height, creating different floors which are accessed from one of the cylinders, inside which a helical staircase is developed, delimited in its interior by the same arches that envelop *The Cathedral*.

Fig. 9. Ricardo Bofill walking among the remains of the cement factory (photo from Ricardo Bofill Archive).

But in order to be able to inhabit these spaces, it will be necessary to continue this process of "deconstruction", demolishing in order to build. In the style of Matta Clark, the *Taller* produces cuts and openings in the silos, to open windows that are highlighted with elements typical of the Gothic Quarter of Barcelona (Fig. 8), in what seems to be an ironic play by Bofill in incorporating historical elements in this factory space.

Tanks and silos are left clean, untreated, showing the reinforced concrete with which they were erected. The interior surfaces allow us to appreciate the original materiality of the cement factory, showing the different concrete layers, like a sedimentary rock whose texture responds to the old wooden formwork.

The surfaces of the new spaces also take up the precepts of the whole, maintaining its archaic character and delving into the sensual materiality that evokes the ruin. The interior face of the enclosures reveals the brick that makes it up, uncovered, showing the way in which the slender arch of windows is traced on the wall, almost as if in homage to Louis Kahn when he rhetorically asked the brick what it wanted to be. With this set of finishes, it seems that Bofill also wanted to tell us, not only the story of the construction of *La Fábrica*, but also its transformation, only possible thanks to the work of the catalan craftsmen. (D'Huart, 1984).

A pioneering attitude

The transformation of the *Sansón* cement factory into *La Fábrica* is a pioneering project in the recovery and reconversion of an industrial building, especially at a time when these were not considered spaces to be rethought, since most of the industries were operating at full capacity. We can only refer to the photographic series that, in the 1960s, Bernd and Hilla Becher took, establishing what today is known as industrial landscape photography and calling attention to the heritage of the facilities present in Germany at the time.

Bofill's intervention, parallel to that of the Germans, represents a before and after in the national panorama in terms of the recovery of factory complexes of little heritage value, revaluing a piece that could not have been preserved from the architectural point of view (Solé & Amigo, 1998). The project, far from any idea related to heritage conservation, plays with a series of pre-existing elements and seeks a balanced association between the previous, the new and the expanded, placing the remains of the cement plant in a contemporary discourse, whose common thread is the use of existing structures with no apparent value. If we add to this the use for which it was intended, that of a house-workshop, the building will be the first work in which the task of establishing human habitation in a factory space is radically addressed. A difficult design challenge that sought domesticity between hoppers and silos.

Notes

[1] Ricardo Bofill in Solé & Amigó, 1998 p. 17. Translation by the authors.

[2] In Skinner's book, the protagonist visits Walden 2 on an assignment to investigate this new community that lived outside the American society of the time. At one point in the story, visitors appear from Walden 6, the last community that was beginning to be created after the third, fourth and fifth experiences. The name of the Taller de Arquitectura building, therefore, is a clear reference to Skinner's book and its communal society, alien to the country in which it is located.

[3] Arxiu Històric of l'Ajuntament de Sant Just Desvern [AHSJD], Obres i urbanisme (1875-1994), Leg.77, doc. 32, 1949; Leg 78, doc. 34, 1950; Leg. 79, doc.67, 1951; Leg. 80, doc. 82-1, 195.

[4] [AHSJD], Obres i urbanisme (1875-1994), Leg. 77, doc.53, 1949; Leg.83, doc 3, 1955.

[5] In the historical archive of Sant Just Desvern, the record of the non-authorization to build a new concrete power plant is preserved. ([AHSJD], Obres i urbanisme (1875-1994) Leg. 107, doc. s/n, 1962. "Obres no autoritzades").

[6] To purchase the land and carry out the housing development, Ricardo Bofill partners with Carlos Ruiz de la Prada.

[7] Document found in the Historical Archive of Sant Just Desvern. Due to the volume of the project, the documents related to the demolition of the site are archived separately.

[8] Curiously, the plan preserved in the archive has undergone modifications, showing in the 1956 plan one of the first proposals of Walden, surely the result of a process of reuse of plans.

[9] [AHSJD], Obres i urbanisme (1875-1994) Box 694.

[10] [AHSJD], Obres i urbanisme (1875-1994) Box 691.

[11] Comment by Manuel Nuñez Yanowski in an interview conducted by the authors on January 19, 2021.

[12] Comment by Manuel Nuñez Yanowski in an interview conducted by the authors on January 19, 2021.

[13] "Part of the Taller's professional fees were paid for with pieces of the old factory. Thus, the current Taller de Arquitectura was started after Walden." (Malagarriga in Solé & Amigó 1998, p.40) Translation by the authors.

[14] "Va a ser un treball molt interessant, encara que no sabias gaire el que feies ni perqué ho feie "; "It's going to be a very interesting job, although you didn't know much

about what you were doing or how you were doing it" (Malagarriga in Solé & Amigo, 1998, p.41) Translation by the authors.

[15] This is the opinion of Dr. Antonio Millán Gómez, Professor of Architectural Representation at the School of Architecture of the Polytechnic University of Catalonia, in a brief interview conducted by the authors with the architect about La Fábrica project. This theory is also confirmed by Manuel Nuñez Yanowski, when in the interview conducted by the authors on January 19, 2021, he confirms that this was a more personal project by Bofill, with the collaboration of the young architect Joan Malagarriaga.

[16] "Later, we had to mark the new constructions with a specific vocabulary, integrating the "vocabularies" of the history of architecture, a cultural vocabulary opposed to that of vernacular architecture." (Bofill in D'Huart 1982, p.81).

[17] "I wanted the vegetation to eat the building and cover it. I didn't like to do a facade here. Not for me. If you walk around here you won't see any of this building, it's covered by the gardens, and it's covered by the gardens for two reasons. First because, from these windows here, I didn't want to see anything going on outside, I want a round world. And it's also covered because I wanted this building not to have a composite façade." (Bofill in VVAA 2016 p.73).

[18] "SURREALISM: Paradox of the stairs that lead nowhere. Absurdity of certain elements hanging in the void, powerful and useless spaces at the same time, of strange proportions that their tension and disproportion turn them into magic". (Bofill in D'Huart 1984 p.81).

References

Aa.Vv. (2016). *Ricardo Bofill a Taylor made world*. Barcelona, España: Random House Incorporated.

Architectural Design (1975). *Taller de Arquitectura*. Vol. XLV.

Baldellou, M. A., & Capitel, A. (1995). *Summa Artis. Historia General del Arte Vol. XL Arquitectura Española del Siglo XX*. Madrid, España: Espasa-Calpe, SA.

Bofill, R. (1989). *Espaces d'une vie*. Francia: Odile Jacob.

Bofill, R., et al. (1968). *Hacia una formalización de la ciudad en el espacio Barcelona*. España: Blume.

Bofill, R. et al. (1985). *Ricardo Bofill: taller de arquitectura*. Tokyo: A.D.A.

D'Huart, A. (Ed.) (1984). *Ricardo Bofill. Taller de Arquitectura. El dibujo de la ciudad. Industria y clasicismo*. Barcelona, España: Editorial Gustavo Gili SA.

CHAPTER 2

James, W. A. (1988). *Ricardo Bofill. Taller de Arquitectura. Edificios y proyectos 1960-1985*. Barcelona, España: Editorial Gustavo Gili SA.

Muntañola i Thornberg, J. (1988). Bofill 'classic': un templo profano. Nueva Figuración. In *Arquitectura Viva*, No. 2, pp. 14-16.

Norberg-Schulz, C. (1998). *Intenciones en arquitectura*. Barcelona, España: Gustavo Gili.

Postiglione, G., & Acerboni, F. (2004). *One Hundred Houses for One Hundred Architects*. Köln: Taschen.

Prost A., et al. (1991). *Historia de la vida privada. 9, La vida privada en el siglo XX*. Madrid, España: Taurus.

Rodell, S. (2008). *The influence of Robert Venturi on Louis Kahn*. Master of Science (MS) thesis in Architecture. Degree Supervisor Prof. D. Wang. Washington State University.

Solé I Ubeda, J.L, & Amigò, J. (1998). *Walden 7 i mig*. Barcelona, España: Ajuntament de Sant Just Desvern.

Interventions in the old municipal slaughterhouse of Valladolid: dialogues and socialisation

Alberto Grijalba Bengoetxea

In 1874, the Valladolid City Council decided to relocate the city's slaughterhouse, located in a large house on the right bank of the Esgueva in a place called Las Carnecerías and later Calle del Rastro (González, 1901). In 1894, a new slaughterhouse designed by Ruiz Serra was inaugurated in the vicinity of the provincial hospital. It was soon rendered obsolete by the increase in demand and the demands of new hygienic conditions required by society, which, for example, were reflected in Sanz Egaña's publication, *El matadero público (The Public Slaughterhouse),* in 1921.

In 1925, the municipal council debated whether to extend and renovate the existing building or to build a new one on a different site. After agreeing that the most convenient solution would be to build a *new one*, it was decided to promote a design competition for a modern facility. According to the agreement, the new facility should not be far from the city, but close to the river Pisuerga. At the same time, it was decided that it should be located downstream and with a sufficient flow to be able to carry out the washing and cleaning tasks described in all the hygiene manuals.

The 1925 competition

On 11 December 1925, the terms and conditions of the competition were published. In June of the following year the decision was made public, and the winner was the industrial engineer Alberto Colomina y Botí. Among the members of the jury, Modesto López Otero, director

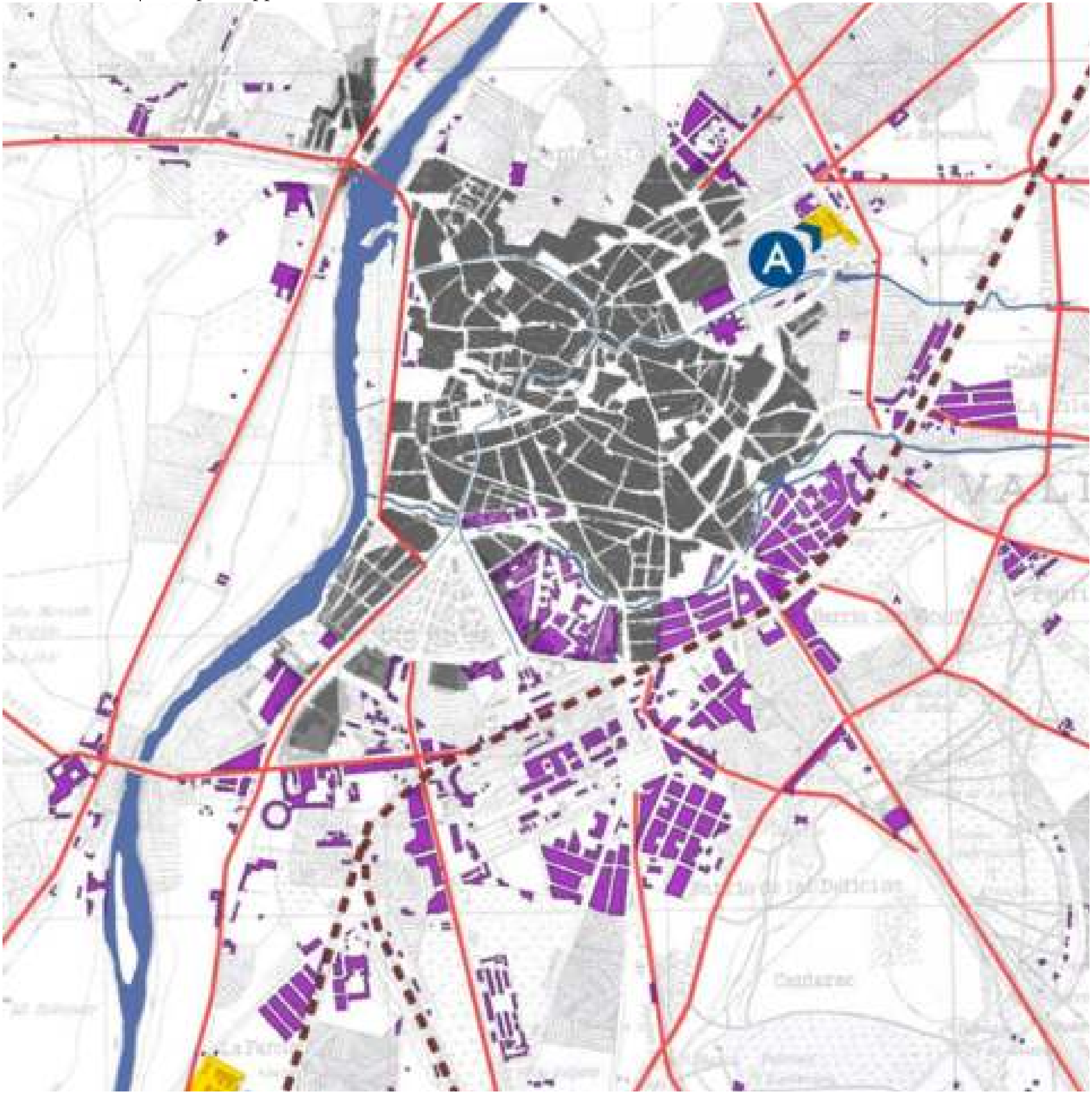

A

Fig. 2. Slaughterhouse of Valladolid. Project elevation 1925 (image: Colomina and Botí).

of the Madrid School of Architecture, explicitly defended the so-called rationalist currents, exemplified in another of the projects submitted to the competition, that of Blein and Hidalgo. According to the minutes, this defence of industrialism was also endorsed by the municipal architect Juan Agapito y Revilla. These two members of the jury valued Blein and Hidalgo's proposal positively for the rationality of the approach to the circulations in relation to the uses, exemplified in the materials chosen and in the structural coherence of the complex. Their reports also highlighted the application of the hygienist criteria of the beginning of the century linked to the presence of natural light, ventilation, easy cleaning, durability, and non-combustibility: "The structural system chosen. Reinforced concrete with large bays; simple choice, sober walls without useless things... modern and beautiful" (Virgili, 1979).

However, in the end, Colomina and Botí's project was chosen for its industrial study, the appropriate arrangement of its parts and its resolution as a factory container, rather than for its architectural design solution. Let us not forget that Colomina was not an architect. In the reports and minutes, the winning project is described as having an antiquated image, with unnecessary elements and a bad appearance. Of the panels presented in the competition, the project still adheres to the eclectic taste of the 19th century and therefore refers to the factory architecture of the end of the previous century. In the project finally built in 1932, all this seems to have changed. Colomina considered all the jury's recommendations,

Fig. 1. Map of the layout of the city of Valladolid showing the location of the old slaughterhouses (drawing: Linazasoro, Grijalba, Grijalba, Carazo and Gil).

Fig. 3. Slaughterhouse of Valladolid. 1930 (image: Colomina and Botí).

while maintaining the characteristics of factory organisation that were so highly valued for his first prize. The project is transformed into an industrial building stripped of the useless and antiquated elements denounced by López Otero. The management of the project lasted from 1925 to 1931. In the various documents in the Municipal Archive, cited by María Antonia Virgili, the delay in the management until its construction is attributed to the reduction in size of each of the elements and the suppression of a livestock market that accompanied the initial project. Undoubtedly, all these changes meant that some forty years later, the facilities were insufficient for a growing city like Valladolid. The original model vision proposed by the organisers of the competition was weighed down by administrative decisions. A facility that claimed to speak of the future would prove to be insufficient in the last third of the 20th century.

The project built in 1931

There are undoubtedly two driving forces behind the change that led Colomina y Botí to introduce a new epithelial aspect to the ensemble. Firstly,

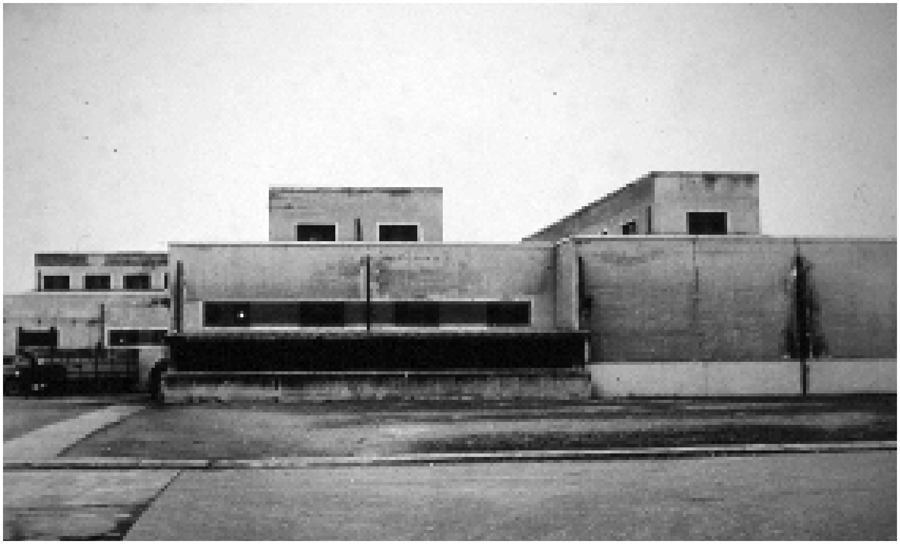


Fig. 4. Slaughterhouse of Valladolid. State 1996 (image: Colomina and Botí).

the dissemination of the *International Exhibition of Industrial Decorative Arts* held in Paris in 1925. It specifically called for the construction of a new modernity associated with a new inspiration and a new originality. In this respect, the decisive influence of the *L'Esprit Nouveau Pavilion* presented by Le Corbusier should be remembered.

Secondly, modernity in Spain had had its first manifestations coinciding with the same years. In 1929, Aizpurúa y Labayen's Club Náutico de San Sebastián was inaugurated. In 1932, this building was part of the exhibition *The International Style* at the MoMA, curated by Johnson and Hichcock. GATEPAC, on the other hand, was founded in October 1930 as the Spanish branch of C.I.A.M. From 1931, as part of the diffusion of modernism in Spain, the group published the influential magazine *A. C. Documentos de Actividad Contemporánea*. In 1925, Le Corbusier in his book *L'art décoratif d'áujourd'hui* introduced his well-known theory of the white wall, which is presented as a method of redefining the identity of architecture itself from its approach to its fundamentally visual attributes. The main argument culminates in the chapter entitled "A whitewash of

Fig. 5. Slaughterhouse in Valladolid. Amalgam of additions, 1996 (image: Colomina and Botí).

lime: Ripolin's law"; however, to the visual condition of the white, charged with attributes of honesty, sincerity and purity, another no less important one is added: "stopped" time. White in opposition to the passage of time. A virtue that allows it to escape from Chronos and seek the eternity associated with the absence of change. Thus, the colour white is a symbol of the perennial, the universal in space and the eternal in time. Following these principles, the built project of the Slaughterhouse assumes a condition of dematerialisation and of stopped time, abandoning the exposed brick used until then in factory constructions in favour of a certain epithelial rationalism of the white.

However, the complex had arrived at the end of the 20th century as a disorganised amalgam of buildings of varying quality, the product of numerous disorderly interventions that altered the spirit of the complex. Nevertheless, it still retained the essential elements of the original project of the early 20th century. These elements can be exemplified in two ways:

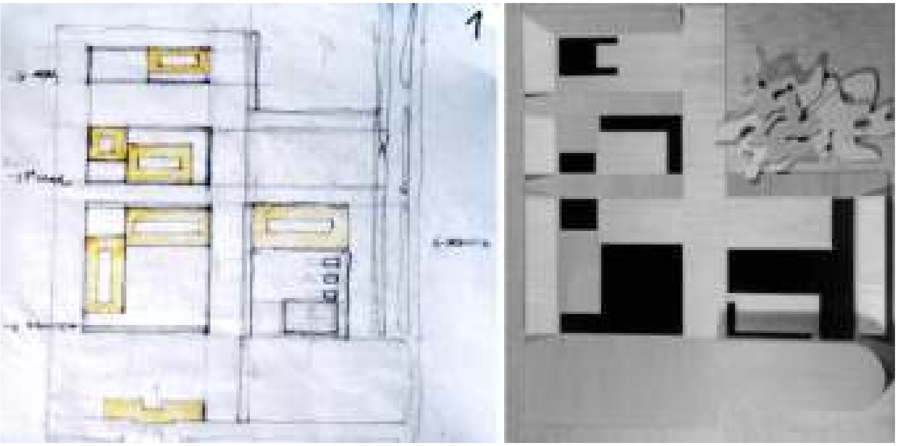


Fig. 6. Slaughterhouse of Valladolid. Sketch and model, 1996 (drawings: Linazasoro, Grijalba, Grijalba, Carazo, and Gil).

the idea of an enclosed enclosure, for security reasons, and the use of basilica-type structures that housed the main functions.

The 1996 contest. Time is a strange country

In 1996, the Valladolid City Council announced a new National Architecture Competition aimed at transforming the large block that made up the area occupied by the disused Industrial Slaughterhouse, which was to be converted into an Integrated Services and Equipment Centre. The freedom granted by the City Council in establishing the terms of the competition led to a wide variety of proposals, most of which included the complete demolition of the complex, which meant the disappearance of the memory. In our case, we opted for a mixed approach that orbited around the conservation of the most singular elements of the original constructions, which were none other than those of the basilica type that housed the main functions, and the dialogue with the new constructions incorporated that completed new interior blocks, with which the enclosure sutured the edges and opened to the city. Our proposal was the winner. The project was presented as authors by José Ignacio Linazasoro, Julio Grijalba, Alberto Grijalba, Eduardo Carazo, and Paloma Gil. At all times our intention was to reflect on time and the contemporary. The apparent

Fig. 7. Antique tea bowl repaired using the kintsugui technique (https://www.inran.it/wp-content/uploads/2022/12/kintsugi-3.jpg).

doctrinal irrelevance of the past, in the contemporary present, heir to modernity, is a widespread phenomenon but one that has had a particular impact on architectural thought. David Lowenthal (1998) refers to this explicitly in his essay *The Past is a Strange Country*. In it one can trace the three fundamental arguments for the generalised exclusion of the past, and by extension of time, in our current thinking. The first is the abrupt rupture between past and present, the second is the distancing from the past, and the third is the homogenisation of the past.

Procedure 1. The gold carpentry

In 15th century Japan, a powerful Shogun named Ashikaga Yoshimasa saw two antique tea bowls from his favourite collection smashed to pieces. Disgusted by the situation, he thought of a way to repair them. He sent them to China, home of famous porcelain ceramists, but the result was not to his liking. The bowls came back repaired with rude metal staples that made them unpleasant and did not respect the intrinsic value of the original ceramics, nor their sense of time, their lived time, which he ultimately wanted to preserve. He sought out Japanese craftsmen capable of restoring the lost splendour to a few shards of pottery. The key was not to try to recover the already fragmented unity, but to accept its condition. He ultimately found what he was looking for in *kintsugi* or gold carpentry. The technique consists of marking the break lines, stopping his time and filling the cracks with gold dust and varnish. Our project, first, eliminates the additions and fragments of unknown or altered origin. By eliminating these fragments, the joints are revealed and recovered, creating new empty territories that must be stitched together with new elements. These new fragments are not intended to compete with the inherited structures to be conserved, but their function is to complete a narrative, appropriating the voids generated in the same way as gold carpentry does, to stitch together and cohere the whole. From a voluntary formal and material restriction, the additions, like the *kintsugi*, accept their condition of uniting, but not from mimesis or simulation, but from specialisation and differentiation. For this reason, the blocks are

Fig. 8. Valladolid Slaughterhouse, 2010 (image: Linazasoro, Grijalba, Grijalba, Carazo and Gil).

completed with canopy buildings of exposed concrete and natural stone slats. Ultimately, it is a question of recovering and continuing the guiding task present in the reformulated 1931 project.

Procedure 2. Type persistence

As Leibinz states, time, as a universal order of transformation and change, is an order of successions and brings us closer to the knowledge that we attain through time series. Its importance is given to the dating or representation of time, as developed by Focillon and Kubler in their studies linked to the history of art. In this way, they both proposed the configuration of architectural series throughout history that allow us to define time according to their belonging to each one of them. Finally, they explore the relationship between object and subject in reference to the model, as a lesson of a "continuum" in architecture, or, in other words, the continuity of the guiding tasks of the project over time. Important contributions are known, but always from a fragmentary, non-inclusive point of view. These include Choisy, Sedlmayr, Jantzen and George Kubler's influential work *La configuración del tiempo*. More recently, we can highlight the contributions of José Ignacio Linazasoro in *Escrito en el tiempo. Thinking architecture*. The central discourse in all of them is oriented around the idea of belonging to an uninterrupted chain of series in history, and therefore to the architectural project as a *continuum over*

Fig. 9. Slaughterhouse of Valladolid. Interior of the building, 2010 (image: Linazasoro, Grijalba, Grijalba, Carazo and Gil).

time. The fundamental difference is what goes from the *morphé* in the former to the Albertian *eidos* of the latter. Thus, Linazasoro proposes the overcoming of the stylistic from a new orientation between subject and object that modifies the more pure-formal approaches, associated with the unity of the architectural object, in favour of a sequential vision of integration, where there is also room for a mental play of references.

The guiding idea of the 1996 project is to recover all the buildings that correspond to the basilica type. To this end, from the first sketches of the project, these take on an essential role in the configuration of the

Fig. 10. Slaughterhouse of Valladolid. Interior fragment, 2005 (image: Linazasoro, Grijalba, Grijalba, Carazo and Gil).

new open area. The relevance in our project of the original type and its preservation was based on two characteristics: its functional adaptability over time and its imprint on the volumetric perception of the complex now converted into a new institution.

Procedure 3. Palimpsest

By palimpsest we mean a manuscript that still preserves traces of the previous writing on the same surface, but expressly erased to make room for the one that now exists. Cardinal Angelo Mai, custodian of the Biblioteca Ambrosiana and chief supervisor of the Vatican Library, at the beginning of the 19th century managed to ensure that this superimposition of times was reflected simultaneously in a single present time. It is the representation of the paradox of time in constellation, the observation of different times perceived from the same position.

"*Burnt Norton" is the first of T.S. Eliot's Four Quarters, published in 1936. There, we found the following statement: "The present time and the past time are perhaps both contained... the present in the future time... and the future time in the past time. If all time is eternally present all time is retrievable*".

Our project echoes this passage from Eliot. It attempts to reconcile the different times, past, present, and future. The past is represented by recovering the essence of a project from almost a century ago that attempted to adhere, albeit epithelially, to the attributes of the desired modernity linked to dematerialisation and the suspension of time. The present, already distant since 1996, when we won first prize in the national competition, was evoked by incorporating new fragments from a voluntary attitude in which silence became the subject of the project. The present as a reflection on the meaning of completing what has been inherited. Finally, the future, making it possible to embrace a narrative of the diverse in the unitary, to which the dialogue between movable and immovable elements is no stranger.

Conclusions. Fragments

For Borges, every place is archaeological; if we subject it to excavation, we will find in it the ruins of ancient constructions, fragments of the thoughts of those who have preceded us. These sediments are displaced and mutilated words or the words of others. They form the basis of culture as an ultra-personal fact, as something that has value precisely because it belongs to no one. As if it were a Borges tale, the preservation of fragments constructs a new time in which the meaning of architecture no longer refers to a single great story. It is necessary to express oneself through a plurality of more discrete stories that intertwine and propose a polyhedral way of seeing our condition of belonging to a collective memory, which ultimately derives from the lost order. The past thus understood is a material that presents infinite plasticity, capable of receiving the most diverse forms, very different from the somehow irreparable past that a discipline such as history investigates, and which would come to be the authentic one.

Extracted from the project report

Below is a fragment of the original memorandum of intentions of the 1996 competition, which in our opinion has not lost its validity and is allowing us to complete fragments of the project over time, reaching up to the present day, as we are currently drafting the project of what is perhaps the last of the fragments.

Character: it is a question of intervening in a group of buildings of an industrial nature. Therefore, dignifying the complex and adapting it to a new cultural and recreational use means, on the one hand, restoring it and, on the other, finding an architecture that responds to this without destroying the character of the pre-existing buildings.

Rationale: the intervention is only justified based on the preservation, if not total, at least most of the buildings of the Old Slaughterhouse.

Economy: the two criteria set out above also express an essentially economic approach, both because of the desire to make the most of as much of what already exists as possible, and because they propose a unitary intervention, based on criteria of simplicity and constructive repetition.

An urban proposal: to understand the Slaughterhouse space, made up of free-standing pavilions, as an urban area to be promoted as such, incorporated into the city.

To this end, an urban grid is proposed, delimiting the buildings by means of streets and squares. The new buildings consist of the existing pavilions and the new additions.

A normalised and unitary construction: based on a prefabricated structure for all the added buildings, as well as continuous façades for all of them, which reinforces its own image as an addition and its industrial character.

An opening to the city: removing the existing fences and making the complex permeable to the immediate surroundings through the new interior grid of streets and pedestrian routes.
A clear and simple language: based on a repeated constructive resolution for the whole ensemble, whereby the new can be distinguished from the pre-existing without destroying the unity of the ensemble, but rather creating a new unity based on this contrast and superimposition.

References

Eliot, T. S. (2021). *Four quartets*. Madrid: Alianza.

García Grinda, E., & Solá Morales, I. (1998). *Josè Ignacio Linazasoro Contemporary Spanish Artists Collection*. Madrid: Argentaria Foundation.

González, C. (1901). *Valladolid sus recuerdos y sus grandezas (Valladolid, its memories and its greatness), Vol. II*. Valladolid: Rodríguez Hernando.

Le Corbusier (1925). *L'Art décoratif d'aujourd'hui*. Paris: Editions Crès.

Linazasoro, J. (2009) *Written in time. Thinking architecture*. Buenos Aires: Nobuko.

Linazasoro, J. I., Grijalba, J., Grijalba, A., Carazo, E., & Gil, P. (1998). Centro Integrado de Equipamientos. In *Arquitectos,* No. 146, pp. 66-69.

Linazasoro, J. I., Grijalba, J., Grijalba, A., Carazo, E., & Gil, P. (1998). Centro Integrado de equipamientos. In *Arquitectura Viva,* No. 59, p. 11.

Lowenthal, D. (1998). *The past is a strange country*. Madrid: Akal.

Quintans, C. (2009). *Catalogue IV Enor Architecture Award*. Vigo: Enor.

Sanz Egaña, C. (1921). *The public slaughterhouse. Construction. Installation. Government*. Barcelona: Revista veterinaria de España.

Virgili, M. A. (1979). *Urban and architectural development of Valladolid (1851-1936)*. Valladolid: Ayuntamiento de Valladolid.

Analysis for the intervention, rehabilitation and reuse of buildings of patrimonial value of industrial origin. The case of the Giesa Factory in Zaragoza

Luis Agustín-Hernández, José Ángel Gil-Bordás, Marta Quintilla Castán

Introduction

Industrialization in Spain, somewhat delayed compared to England, Northern France, Southern Germany, and Northern Italy, began with an incipient industry during the 19th century, mainly derived from the transformation of agricultural products and mining, except for the scarce textile experiences in the Barcelona area, the blast furnaces near Bilbao, and the vicinity of Valencia with the blast furnaces of Sagunto, Zaragoza will not be oblivious to the national reality and will have abundant flour mills, sugar mills, and industries for the transformation of basic products, textiles, leather, and footwear. This development, although slow and steady, reaches the 20th century with numerous projects and product diversification. However, this process will be interrupted by General Franco's military uprising, which, despite taking the city with little resistance, will plunge the local industry into self-sufficiency, lack of materials, and limited export possibilities. After autarky and with the support of the United States, Spain joined most of the international organizations: the UN (1955) and probably the most important for the national industry, the General Agreement on Tariffs and Trade (1963), which had been founded in 1947 under the auspices of the UN and which would be the germ of the World Trade Organization. The international situation and the entrepreneurship of bussinessmen from the city and the surrounding area will make a new industry flourish, fundamentally oriented to the transformation of metal, mechanics, electrical products, the transformation of consumer products, a large logistics industry and a strong chemical industry. In this environment, in 1947 the G.I.E.S.A. factory, Guiral Industrias Eléctricas, S.A., was created in honour of its founder, which was dedicated to the construction of electric motors and essentially to the manufacture of lifts.

Architectural Survey in Industrial Heritage

For any intervention in a pre-existing building, it is essential to have geometric and constructive knowledge, as well as the materials that make it up and an exhaustive detail of its style and background, which is achieved through previous documentation and study. The geometric shape at the moment of making the survey and the deterioration suffered by the passage of time provides an accurate record of the current moment, which, using constructive and compositional criteria, leads us to the intervention on the building. This exact replica, with millimetric or even sub-millimetric values, is highly valued and a great tool for work in the intervention of heritage buildings in general. However, when it comes to industrial buildings, it can be more of a problem than a solution, because excessive precision can lead to errors. The virtual model that will be generated, as indicated by architect Luis Franco-Lahoz, must take into account that there are plans drafted by an architect. Although the details may be very concise or nonexistent, there is a general planning, a series of modules or construction guidelines that repeat with the technology available at the time of construction. It is also important to consider that there are multiple elements, generally structural, that are standardized, such as metal profiles, panels, etc. This will be necessary to create a correct architectural model exportable to Hbim technology, which can simulate the mechanical characteristics of the structure and the thermal or acoustic properties of its envelope.

To carry out the survey, the research group decides to combine both terrestrial and aerial photogrammetry technology with laser scanner technology for precise point capture. Subsequently, a digital twin will be created using Hbim technology.

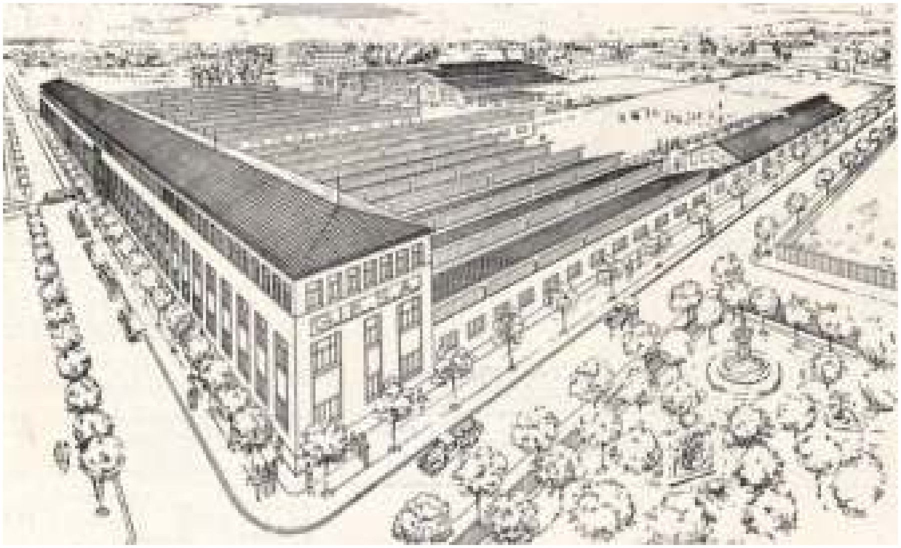


Fig. 1. Overview of Giesa (source: Revista Nacional de Arquitectura, nº 30, 1944).

There is little bibliography on surveys of industrial heritage buildings, but they address the use of multiple techniques to achieve satisfactory geometric and colorimetric results in buildings with highly variable lighting. This is indicated in the article: Graphic survey of active industrial heritage: Nueva Cerámica de Orio. Therefore, it has been considered necessary to test modern techniques for massive point capture and geometric registration using different tools that allow for the creation of a three-dimensional model; specifically, the use of street-level and aerial photogrammetry (assisted by drones), and 3D laser scanning (Senderos, 2019).

The history of the Giesa factory and previous documentation

Joaquin Guiral, a technical engineer from Huesca, acquired in 1942 land on which to build the Guiral Industrias Eléctricas, S.A. factory known by its acronym: "G.I.E.S.A." which had been founded in 1940, with the idea of building a factory dedicated to the development of electromechanical projects, although it finally specialized in the vertical transportation of

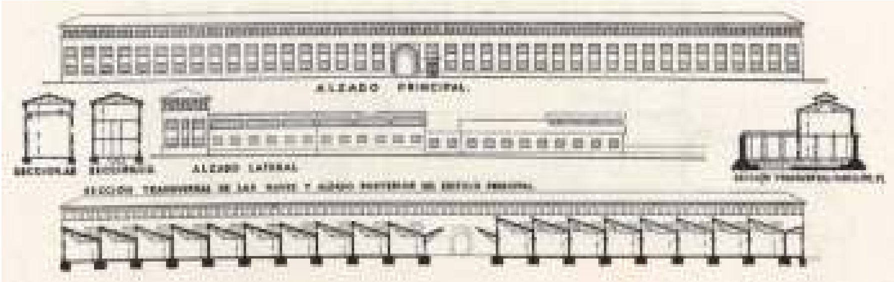


Fig. 2. Elevations and sections Giesa (source: Revista Nacional de Arquitectura, nº 30, 1944).

people in buildings, focusing on the elevator sector, being a national reference. The lands were located next to the national Zaragoza-Castellón highway, in the well-known neighborhood of Las Fuentes, and come from the sale of the property known as Villa Asunción. These had an area of almost eleven hectares and corresponded to the estate called Villa Asunción, which included the palace built by the shipowner Miguel de Larrinaga in 1901 (Mendoza, 2020). The construction project of the new factory was entrusted to architects Miguel Ángel Navarro Pérez and José Luis Navarro Anguela, who were responsible for the design and construction. Although it was initially planned in three phases, ultimately more architects participated in its completion. Fortunately, in 1944, Miguel Ángel Navarro Pérez, architect, and co-author of the project, published an article in the National Architecture Journal (ISSN 0211-3376, No 30, 1944, p 225) about the GIESA project, with abundant graphic documentation that captures the intervention. The project included the factory itself, located between San Joaquín streets, two newly opened roads, and an urban intervention dedicated to housing for the workers' homes, following the German or Catalan models of workers' colonies.

Regarding the industrial complex, it occupied 32,000 m^2 of surface area with a reserved zone for future expansions. It was surrounded by 12-meter-wide streets and had direct access from the highway, as well as an axial connection through another 16-meter-wide street. Additionally, it had railway sidings (Biel, 2003). Part of this property was designated for residential development. In fact, the plot included a reserve for building

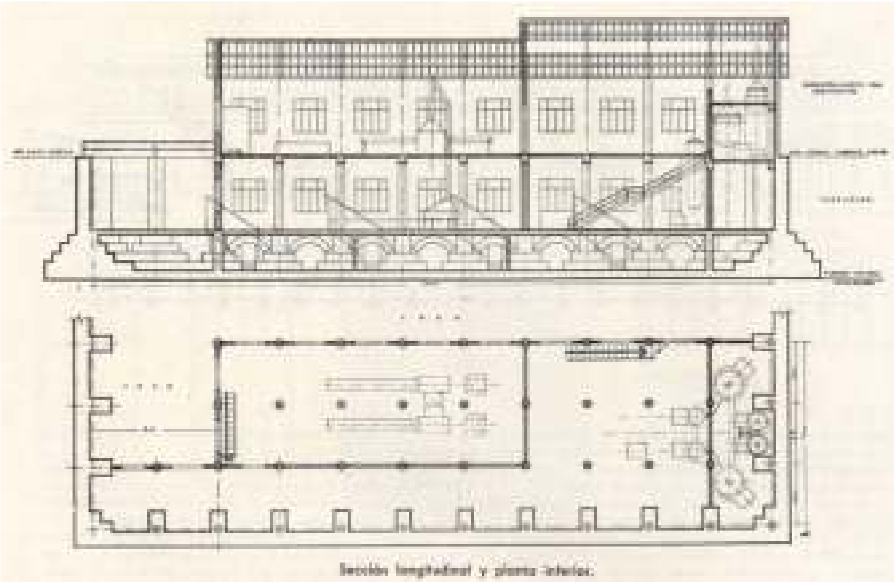


Fig. 3. Plan view and section. Main building Giesa (source: Revista Nacional de Arquitectura, nº 30, 1944).

1,000 worker housing units under the reduced rent regime, protected by the National Housing Institute (Mendoza, 2020). However, the housing project was never carried out due to lack of municipal involvement in the intervention. The eminently rationalist project articulates the spaces in BUS, hanging from a main building constructed with reinforced concrete for the vertical load-bearing structure and foundations, using one-way slabs in a 7-meter module for the upper floors, and covering the building with a lightweight structure made of metal trusses. This building houses the production plant on the ground floors, resembling a railway terminal where the product travels along the line until it reaches the end where it is finished. In the central area, there is a large hall with an overhead crane for moving heavy goods, and this hall is accessed through the main door, the corporate goods entrance. Additionally, the building on San Joaquín Street also includes offices, management, and the technical office, as well as other minor dependencies. The complex also features an air raid shelter, reflecting the time when it was constructed.

The façades are made of brick, partly exposed and partly covered, vaguely reminiscent of traditional Aragonese and Zaragozan architecture. From this main building with two floors, the workspaces hang linearly on one side, predominantly open-plan buildings with metal pillars and trusses in a sawtooth roof shape, facing south to allow good lighting in the work areas. Although the choice of such traditional construction systems and that certain picturesque popular bias may be more related to the scarcity of modern materials, characteristic of a period of self-sufficiency and maximum isolation (Mendoza, 2020). During one of the final phases of construction, a 6-story tower was built, which added character and identity to the complex. Inside, there was an elevator testing tower, further emphasizing the technological aspect of the company. "The relationship that the Swiss multinational Schindler established with GIESA will be particularly significant, as the latter began manufacturing under the Group's license starting in 1946. Joaquín Guiral passed away in 1950, leaving behind a solid trajectory visible in the company he had created in 1940, which was ultimately merged with the Schindler multinational in 1986. In 2005, an agreement with the City Council led to the relocation of the factory from its initial location to the Empresarium Industrial Park in La Cartuja Baja, Zaragoza, where modern facilities were inaugurated a year later. The old factory was acquired by a developer with the intention of building 334 housing units, while also preserving the architecturally significant area for eventual public use by the City Council". (Mendoza, 2020).

Municipal objectives

After the transfer of the Architectural Heritage Asset of the GIESA factory to the Zaragoza City Council, the council intends to rehabilitate the building and change its use to create a community facility for the Las Fuentes neighborhood, establishing a new hub area in the former GIESA factory building. Zaragoza City Council under the name of the action: "Re-Use of Giesa and participation actions associated with the urban environment. Sociocultural and Socio-Technical Center for Hybrid

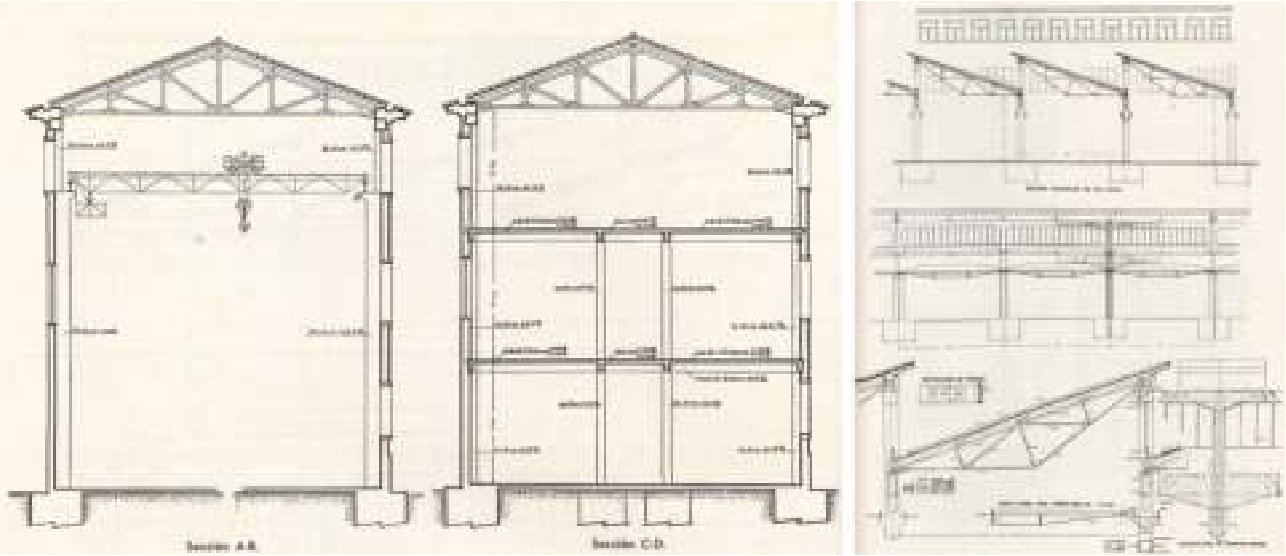


Fig. 4. Constructive sections. Giesa (soruce: Revista Nacional de Arquitectura, nº 30, 1944).

Uses. Barrio de Las Fuentes (Zaragoza). A building currently in disuse", carries out a process of citizen participation and, with the support of European funds, proposes a master plan for the reuse of the building where the most relevant actions are associated with energy efficiency processes, through the implementation of improvements in the thermal envelope and in the facilities system. It is proposed that the overall approach will mean that the New Giesa will be transformed into six large areas: a neighbourhood house, a socio-cultural centre, an open and digital square, multipurpose spaces, a co-working space, a residence for athletes and a high-performance centre that will serve as a sports facility for the neighbourhood. On the one hand, a Casa del Barrio (3,173 m2) has been designed at the front of the building that overlooks Calle de San Joaquín, in the area next to Calle de Padre Chaminade, which will have space for exhibitions, workshops and multipurpose rooms. The rest of the main building, towards Calle de Yolanda de Bar, will be the Casa de la Ciudad (2,412 m2), with exhibition halls, a multipurpose space, a large assembly hall divisible as an auditorium and storage for equipment.

Fig. 5. Director plan. Giesa (source: Zaragoza City Council).

The entire building on Calle de Yolanda de Bar will be used for the Co-Living area (2,016 m^2), which will have shared rooms and spaces, co-working areas and shared housing as a residence for athletes. That is the key to another of the great attractions of the project, given that a 3,495 m^2 High Performance Centre (CAR) will be built in the warehouses on Padre Chaminade Street, with regulation courts, a 25-metre swimming pool, gymnasium, changing rooms, classrooms and workshops. But it is also proposed as a facility for shared uses with the district, thus providing a solution to one of the great demands of the neighbourhood: a sports facility or pavilion open to the neighbourhood. The rest of the project will be created on Francisco Rodrigo Street, next to the pedestrian area behind the main building. There, on one side, the Digital Agora (1,495 m2) is proposed, a new construction dedicated to a media library, digital laboratory, multipurpose spaces, cafeteria, dining area, and administration area. And, next to it, the Natural Agora (3,953 m^2), or public square, with sports areas for adults and children's playgrounds. This specific area has already been executed.

The graphic documentation process of Giesa

Prior to conducting fieldwork, research and the search for existing graphic information about the building were carried out. In order to understand the building and create an appropriate documentary record, it is essential to conduct a preliminary study that provides the necessary knowledge to formally interpret the different construction stages that formed the architectural ensemble, and thus identify the aspects that need

Fig. 6. Plan director. Giesa (source: Zaragoza City Council).

to be addressed in the record. Firstly, the project drafted by architects Miguel Ángel Navarro Pérez and José Luis Navarro Anguela, approved by the College of Architects, was located. This project contains the original project's plans subject to protection. Additionally, the Zaragoza City Council provided plans for the drafting of the master plan for the building's reuse, which was submitted for European Next Generation funds within the Recovery, Transformation, and Resilience Plan (PRTR). This documentation, carried out by the City Council technicians through on-site measurements using a distance meter, reflects the successive additions of industrial structures made later on. While the original project documentation holds significant value, it does not accurately depict the current reality of the factory, unlike the competition plans, despite the detected precision errors. Fieldwork continued the work initiated during the previous phase of information source research. To collect data, it was necessary to take into account the formal characteristics of the building and its immediate surroundings, with the aim of anticipating any potential disruptions during the capture and recording process. One notable factor that hindered the survey was the size. The complex has

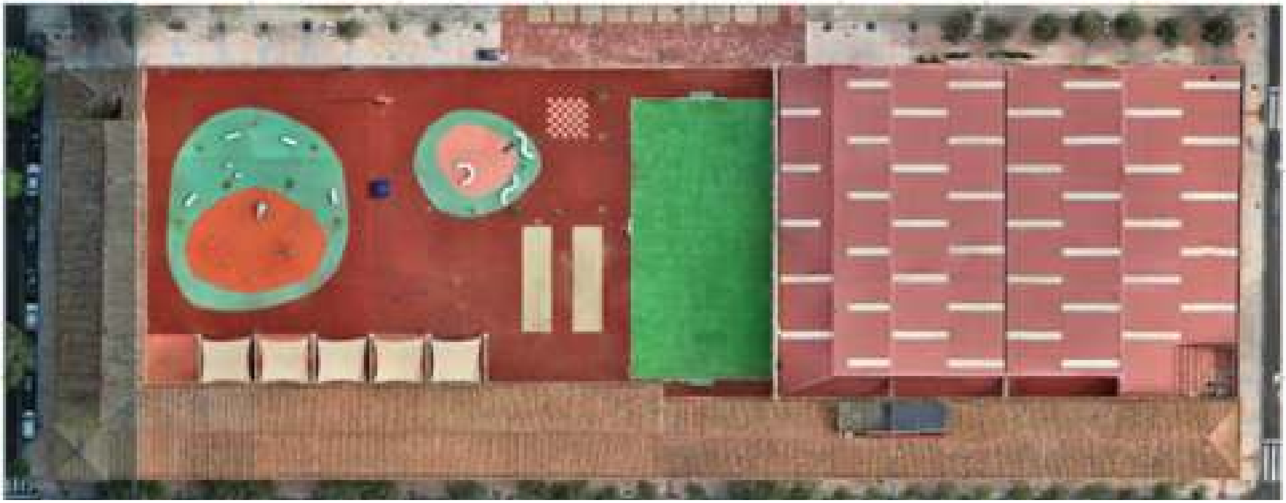


Fig. 7. Aerial view -Restored. Giesa (source: the authors).

an approximate area of 5,600 m², with open, empty, elongated floors and a significant amount of façade surface. Most of these areas lack interior lighting, as the windows are boarded up for security reasons. Additionally, some spaces have triple heights, which complicates their recording. On the exterior, both the main façade and the side facades are limited by narrow streets with large trees closely located. This complexity has affected the selection of appropriate tools for data collection, as well as other criteria such as scope, level of detail, time, and economy. Considering the formal characteristics of building typology, data capture included exterior elevations of walls, as well as roofs and the tower. Inside the building, information on spatial organization and structure was necessary, with lattice work difficult to record due to the height of the spaces. Before determining the techniques used in the survey, several factors were taken into consideration, such as the level of detail required, the skills and experience available in different recording methods, the definition of the time frame, and the desired outcomes. The scope of the project was designed to balance all these factors with the constraints of available time and economic resources (Lo Brutto et al., 2014; Achille

Fig. 8. San Joaquín Street elevation. restored. Giesa (source: the authors).

Fig. 9. Complete section. Giesa (source: the authors).

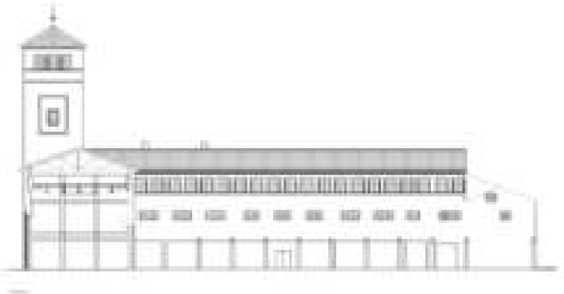


Fig. 10. Constructive section. Giesa (source: the authors).

et al., 2015; Fatta et al., 2017). The definition of the desired level of detail and precision for the resulting graphic information was crucial in the selection of methods and tools to be used. In the specific case of the GIESA factory, given its particular characteristics, the need to achieve a high level of detail was deemed necessary. An approximate precision of ±2 mm for construction details and between ±10 mm and 25 mm for the construction planimetry was established as the objective. These parameters were fundamental in guiding the selection of the most appropriate survey techniques and ensuring the acquisition of accurate and complete data. For a comprehensive survey of the buildings, both their exteriors and interiors, a combination of acquisition techniques was employed, such as photogrammetry and laser scanning, carried out in

Fig. 11. Orthophotography - restored. Giesa (source: the authors).

three stages. The choice of survey method was based on considerations such as limited accessibility near the buildings and specific architectural features that require a high level of detail (Barba et al., 2019; Diara & Roggero, 2022).

Initially, in the first stage, a Faro 3D_HW_LS_Focus M 70 laser scanner was used to capture additional data. This scanner allows for the acquisition of photorealistic textures and mappings with a precision of ±3 mm and a range from 0,6m up to 70 m, making it ideal for short-range measurements and applications in confined areas. The Faro 3D_HW_LS_Focus M 70 has a wavelength of 1550 nm, a color resolution of up to 165 megapixels, and a wide field of view of 300º vertical and 360º horizontal. Additionally, it is equipped with a dual-axis compensator with a precision of 19 arcseconds within a ±2º margin, as well as a height sensor using electronic barometer, compass, and integrated GNSS with GPS and GLONASS. A total of 234 scans were carried out, including 177 indoors, 3 in the transition zone between interior and exterior (next to the door threshold), and 54 outdoors. It took several weeks to complete enough scans to capture the entire building. Due to the building's characteristics, spheres were used to facilitate the alignment of the scans later using Faro's Scene software. The point cloud density obtained was 5 mm, and information was captured not only in volumetric terms but also in terms of color, in order to accurately record data from both the interior and all façades of the building.

As a complement to the laser scanner, in a second stage, photogrammetric surveying of the roofs was carried out using an Unmanned Aerial Vehicle (UAV) in order to complete the three-dimensional registration of the buildings. 1734 photographs were taken at 5280 x 3956 pixels, allowing for comprehensive capture not only of the roof but also of the facades, in this case, unlike the scanner, from a high altitude. The model used is the DJI Inspire2, a device that offers great agility, capable of reaching speeds from 0 to 80 km/h in just 5 seconds, with a maximum speed of 94 km/h and a maximum descent speed of 9 m/s. In addition to its ability to operate in low-temperature environments, the DJI Inspire2 is equipped with a collision protection system in two directions and can transmit live video from both its onboard FPV camera and its main camera simultaneously. The proximity to neighboring buildings and the atmospheric conditions of the authorized flight day did not allow for obtaining photographs with sufficient oblique angle to capture the front and side façades in their entirety. Therefore, it was necessary to complete the survey using terrestrial photogrammetry. In a third stage of work, the registration process was complemented with terrestrial photogrammetry of the exterior of the building at street level. It was necessary to take 761 photographs at 4272 x 2848 pixels, mainly of the main and side façades, since they were obstructed by trees and the narrow streets, preventing the drone from capturing sufficient angles of the lower part of the façades. To complete this information, data was collected using a Nikon D5600 camera equipped with a large DX format image sensor of 242 megapixels, paired with an AF-P DX 18-55mm VR lens.

Results

The integration of data collected from both the interior and exterior of buildings through photogrammetry and laser scanning results in a complete three-dimensional geometric model, providing a detailed representation of the buildings' geometry and shape. The acquirement of the three-dimensional model began with the combination of information recorded through both terrestrial and aerial photogrammetry. The process was carried out using Agisoft's Metashape software. The information provided by the photographs facilitated the creation of a textured three-dimensional model from which realistic orthophotos of elevations and roofs with metric quality were obtained.

The process of point cloud model generation involves the integration of photogrammetric and laser scanning data, which are combined and processed using Faro's Scene software. First, all parking lot scans were loaded into the software and aligned using common reference points. Subsequently, coordinates for various points in the model were obtained and assigned to corresponding points in the photogrammetric cloud, generated from ground and aerial photographs using Metashape. This process allowed us to align and scale the photogrammetric model precisely with the information obtained from laser scanning. Finally, this point cloud was imported into the Scene software, where it was merged with the rest of the scanned data, achieving a seamless overlap between all point clouds. The result is a high-density point cloud that provides accurate information about the geometry and color of the buildings, with a resolution of up to 5 mm. Additionally, the three-dimensional model allows for the creation of a CAD planimetry in order to geometrically define the overall assembly at a representation scale of 1:100. In this case, the Autocad program was used to obtain the desired views by applying rectangular cuts to the point cloud.

Conclusions

The graphic documentation of industrial architectural heritage has special characteristics due to the repeated elements, the quantity and diversity of materials used, such as brick, concrete, and plaster, for which a low point cloud density is required. For some materials like laminated steel, which is very thin, a denser point cloud is necessary for precision. Given the age and varying lighting conditions of these buildings, it is important to find chromatic values close to reality. Sometimes artificial lighting is needed to achieve these values, which can reveal traces or pathologies affecting the building or its structure. In conclusion, satisfactory results have been obtained from the integration of terrestrial photogrammetry, aerial technology, and laser scanning, by adjusting point density in different areas and using proper lighting. The work for the writing of this paper has been carried out in “Grupo de Representación Arquitectónica del Patrimonio Histórico y Contemporáneo. GRAPHyC“, Ref: H32_23R. University of Zaragoza.

References

Achille, C., Adami, A., Chiarini, S., Cremonesi, S., Fassi, F., Fregonese, L., & Taffurelli, L. (2015). UAV-based photogrammetry and integrated technologies for architectural applications – Methodological strategies for the after-quake survey of vertical structures in Mantua (Italy). In *Sensors*, Vol. 15, No. 5, pp. 15520-15539.

Barba, S., Barbarella, M., Di Benedetto, A., Fiani, M., & Limongiello, M. (2019). Comparison of UAVs performance for a roman amphitheatre survey: the case of Avella (Italy). In *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, Vol. XLII-2(W11), pp. 179-186.

Biel Ibañez, M.P. (2003) Autarquía y Arquitectura industrial en Zaragoza. In *Artigrama*, No. 18, pp. 527-548.

Diara, F., & Roggero, M. (2022). Quality Assessment of DJI Zenmuse L1 and P1 LiDAR and Photogrammetric Systems: Metric and Statistics Analysis with the Integration of Trimble SX10 Data. In *Geomatics*, No. 2, pp. 254-281.

Fatta, F., Bassetta, M., & Manti, A. (2017). Survey Methodologies, Research and Technological Innovation for a Case of Medieval Archaeology: Torre Melissa in the province of Crotone. In *Disegnarecon*, Vol. 10, No. 19, pp. 6.1-6.17.

Lo Brutto, M., Garraffa, A., & Meli, P. (2014). UAV platforms for cultural heritage survey: first results. In *ISPRS Ann. Photogramm. Remote Sens. Spatial Inf. Sci.*, Vol. II-5, pp. 227-234.

Mendoza, R. I. (2020). Las cubiertas de dientes de sierra. Escasos pero representativos ejemplos industriales en la Revista Nacional de Arquitectura 1941-1950. In P. Arza Garaloces, Jo. M. Pozo Municio (Eds.). *Los edificios de la Industria: icono y espacio de progreso para la arquitectura en el arranque de la modernidad*. Conference roceedings. Pamplona, 25-27 marzo 2020, pp. 361-368.

Senderos, L. M., Leon Cascante, I., & Pérez Martínez, J. J. (2019). Graphic survey of industrial heritage in activity: Nueva cerámica de Orio. In *EGA Expresión Gráfica Arquitectónica*, Vol. 24, No. 36, pp. 92-105.

Ombù: an innovative example of industrial building reuse project in Madrid by Foster + Partners

Gianluigi Freda

An abandoned industrial site is not an archaeological site, but an opportunity for a new urban development

For many years, in the cultural language code concerned with Architecture and urban heritage studies, the term "industrial archaeology" has been used when referring to abandoned industrial artifacts that retain architectural and stylistic features of a certain value. In reality, the use of the expression "industrial archaeology" becomes inappropriate when one focuses on the temporality to which the archaeological condition refers (Casamonti, 2022). The ancient or archaic time that permeates the existence of archaeological remains has nothing to do with industry and its production apparatus, which are essentially a modern legacy. Nor is the mystical aura glimpsed among the ruins of a classical temple comparable to the rust that invades the many industrial residues, rendered unproductive just a few decades ago and destined for a degradation that appears increasingly irrecoverable.

However, many of these abandoned buildings still possess spatial qualities and formal characteristics that are very valuable to the contemporary city. Moreover, they belong to collective memory and to the history of places, and reintegrating them into a new cycle of life appears to be a solution that aligns well with the contemporary sensitivity that the culture of architecture design is demonstrating towards the concept of urban circular reuse. The transformative approach, which represents its theoretical and practical foundation and is applied to the revitalization of

Fig. 1. Exterior view of building. Originally built in 1905 by the architect Luis de Landecho, the building once supplied energy to the surrounding areas. It later fell into disuse until ACCIONA acquired it in 2017, saving it from demolition, a fate that other similar structures in the area had experienced in recent years (image: © Nigel Young / Foster+Partners).

abandoned industrial sites, replaces the traditional linear model of "take, produce, dispose" with a regenerative system that seeks to minimize waste and maximize the value of resources. Within this approach, abandoned industrial sites, once unproductive and sterile, become the new hubs of a dynamic ecosystem of material flows, energy exchanges, and resource utilization.

Adaptive reuse and regeneration of industrial sites also make urban renewal efforts more effective in terms of environmental sustainability and

Fig. 2. Historic industrial building built in 1905 by Luis de Landecho (image: © Rubén Pérez Bescos / Foster + Partners).

cultural heritage preservation, using innovative design strategies through the intrinsic qualities of existing structures to minimize environmental impact and maximize the potential for social and economic revitalization. The reuse of abandoned industrial buildings, which exhibit conditions favorable to balancing the energy expended in their reactivation with the actual benefits for residents and the city in economic, functional, and environmental terms, is a design action that goes beyond mere physical transformation. It becomes an operation of high symbolic value,

Fig. 3. The lightweight structure inserted inside the space is made from sustainably sourced timber from local forests and allows for spatial flexibility (image: © Nigel Young / Foster+Partners).

especially when the buildings to be reactivated are located in marginal areas. These containers resurrected to new life trigger a process of revitalization for the entire neighborhood, generating new forms of productivity aggregation, especially of cultural origin.

The need to promote regenerative processes in architecture also contributes to the preservation of urban identity and represents a response sensitive to environmental issues. The reuse of industrial structures, adapted to new functions, indeed provides a sustainable solution to the excessive

use of land and the progressive and unstoppable depletion of resources. For many years now, international urban policies have promoted the development and sustainable use of resources. Europe is particularly sensitive to this issue, given the potential of reusing the many industrial buildings scattered throughout the territory in terms of safeguarding and saving land in historic centers. There are many documents produced by the EU that focus on deepening this topic. Among these, the Sustainable & Circular Reuse of Spaces & Buildings Handbook emphasizes that:
"As the available land is often scarce in cities and the urban sprawl is burdensome and costly, re-using existing buildings emerges as an alternative. Promoting re-use practices will help to ensure more sustainable urbanisation, with multiple benefits not only for managing authorities, but also for all citizens" (Urban Agenda for the UE, 2019, p. 12).
In light of this political approach, sensitive to environmental and urban issues, which materializes in the reuse of disused industrial heritage, there are many architectural project experiences moving in this direction in Europe. Some of these experiences have been carried out by internationally renowned firms that have also been able to interpret the theme of reuse in an innovative and exemplary manner for future projects. One of fhe most significant in this regard was the redevelopment of an industrial building in Madrid, elaborated by Foster+Partners Office in 2022.

Ombù: an Ark of innovation and environmental sensitivity

Not far from Madrid's Atocha Station, along Calle del Ombù, stands the majestic brick building stretching about a hundred meters in length, built in 1905 by the Basque architect Luis de Landecho on behalf of the Sociedad Gasificadora Industrial (Fig. 1). The large structure, characterized by neo-Gothic decorations, was intended to house the engine room, which, along with other industrial buildings in the area owned by the same company, provided power to part of the city.
Fallen into disuse and destined for demolition, in 2017 it was acquired by the Spanish infrastructure company ACCIONA, which commissioned Foster+Partners studio to transform the large empty shell with steel

Fig. 7. Exterior view of building. One of the most sustainable projects by Foster + Partners, the project was presented at COP26 in Glasgow as a case study for the World Green Building Council. Its environmental impact is compatible with the original 2°C aim of the Paris Agreement and its carbon footprint has been carefully measured and controlled. (image: © Nigel Young / Foster+Partners).

trusses into its office headquarters.

As stated by the studio, the retrofit operation aims to reintegrate a disused industrial building into the city's life and productivity cycle, preserving its historical and cultural identity.

At the core of the design intervention is the intention to preserve the integrity of the facades and to intervene only internally without modifying the layout volumetrically. Additionally, the project utilizes the existing load-bearing structure that supports the inclined steel trusses. The large interior space (Fig. 2), that seems to be a reminiscent of a cathedral nave, is cleared and restored, and within it, a large three-story wooden structure (Fig. 3) is placed to house the functions required by the client. Similar to an ark, containing precious objects, this structure is made from timber sourced from sustainably managed forests in northern Spain, providing spatial flexibility and integrating lighting, ventilation, and other services. The structure is supported by wooden pillars that free up space on the ground floor, allowing for unrestricted circulation

Fig. 4. The lightweight structure inserted inside the space is made from sustainably sourced timber from local forests and allows for spatial flexibility, while also integrating lighting, ventilation and other services (image: © Nigel Young / Foster+Partners).

Fig. 5. Interior view of building. The lightweight structure inserted inside the space is made from sustainably sourced timber from local forests and allows for spatial flexibility (image: © Nigel Young / Foster+Partners).

Fig. 6. The lightweight structure inserted inside the space is made from sustainably sourced timber from local forests and allows for spatial flexibility, while also integrating lighting, ventilation and other services. The timber structure will save more than 1,600 tonnes of CO2 and is recyclable and demountable. A central skylight brings natural light to the interior, reducing the need for artificial lighting, while the glazing incorporates photovoltaic technologies that generate electricity (image: © Nigel Young / Foster+Partners).

Fig. 8. Courtyard adjoining the building. Taking advantage of Madrid's temperate climate, the new courtyard offers the option to comfortably work outdoors (image: © Nigel Young / Foster+Partners).

(Figg. 4, 5), while existing windows in the envelope and a skylight in the pitched roof provide natural lighting and ventilation, ensuring great comfort during office hours.
The reuse and redevelopment operation, which finds its strongest symbol in the wooden structure placed inside (Fig. 6), also has a significant impact on the external areas, treated as a large surface in continuity with ACCIONA company's workspaces (Fig. 7). Carefully selected local flora minimizes water usage, drawn from nearby water basins. Therefore, the design of the outdoor space allows for extending the workspace outdoors, considering that for much of the year, Madrid's climate allows for pleasant outdoor stays. For the large 12,400 square meter park with 350 trees, only local species have been selected to reduce water consumption, sourced from local reservoirs (Fig. 8).
The park (Fig. 9) not only aims to increase comfort and enhance the quality of the workspace but also serves as an intermediate space between the building and the city, creating a continuity that had been denied until now

Fig. 9. Section sketch by Norman Foster. The building connects to a large 12,400 square-metre park with 350 trees featuring outdoor working spaces and areas for informal meetings sheltered by a green canopy of trees (image: © Norman Foster).

and allowing the community to have another large green and sustainable space at its disposal.
The project actions guided by a strong environmental ethic, supported by Foster+Partners studio, which has always been sensitive and at the forefront of this issue, can serve as a model and guide for future projects involving the reuse of disused industrial sites. In fact, the decision to preserve the industrial building, besides safeguarding the historical identity of the place, is the first action in environmental protection, as it allowed for the preservation, and therefore not dispersing into the environment, of over 10,000 tons of original bricks, thus immediately reducing the environmental impact (Fig. 10). The entire project aims to mitigate the environmental footprint, that is, the impact of human activities on the ecosystem. In addition to those previously mentioned, there are many design actions that ensure the offices designed by Foster+Partners have a very high quality in terms of safeguarding environmental resources, which can become an operational model for future reuse projects, not only for abandoned industrial buildings but also for the many disused urban containers present in the urban areas of many European cities.
It is estimated that the wooden structure located in the center of the space of the large industrial building, recyclable and dismantlable, will save more than 1,600 tons of CO_2. Additionally, the central skylight,

Fig. 10. Interior view of building. The historic building envelope has been retained to conserve over 10,000 tonnes of original brick and mitigate the environmental impact. The lightweight structure inserted inside the space is made from sustainably sourced timber from local forests and allows for spatial flexibility (image: © Nigel Young / Foster+Partners).

bringing natural light inside, reduces the need for artificial lighting. Furthermore, the windows incorporate photovoltaic technologies that generate electricity.
As the studio itself declares, Ombù is one of Foster+Partners' most sustainable projects and has already become, despite its short existence, a virtuous case study for the World Green Building Council. To the benefit of project initiatives for reusing existing buildings, as an alternative to the desire to produce new volumes where not strictly necessary, the London-based studio estimated that the Ombù project is capable of reducing carbon production by 25% compared to a new construction for the entire duration of the project, also taking into account future renovations. Additionally, it has been revealed that operational energy is actually 35% lower than normal expectations [1].

Voids are resources for the culture of Architecture design and for the protection of the environment

As often happens with great works, Ombù holds not only the value of being a prestigious piece of architecture but also the significance of generating a new awareness towards methods of reusing abandoned buildings. Foster+Partners' project, by bringing back to life a disused building, ensures the recovery of the area in which it stands, reactivates the involvement of the local community, and ultimately establishes a new paradigm for sustainable urban development. In this way, Ombù sets a model for an interpretation of architectural design that will increasingly appear necessary for the cities of the future.
Along this path of development and taking renowned experiences like those conducted by the London-based studio as a model, Architecture Schools can also propose and experiment with the exploration of innovative concepts and approaches for the revitalization of disused industrial heritage. Within universities, educators guide students through interdisciplinary collaboration and research-driven inquiry to develop new visions for adaptive reuse and regeneration of abandoned sites, aiming to provide a sustainable future for the historical heritage of cities.

Moreover, architecture schools serve as a connection point between the academic world and the professional realm, offering students the opportunity to directly engage with real-world issues and stakeholders. Through internships, workshops, and community partnerships, future architects gain practical experience and delve into the complexities of a design-sensitive topic such as the regeneration of disused sites, learning to navigate the political, economic, and social dynamics that are essential aspects of industrial sites redevelopment.
This cultural horizon tied to the project of disused heritage also aims to foster a new sense of responsibility and ethical management in the new generation of architects, promoting attention to principles of sustainability, resilience, and social equity.
This design approach is even more significant when observed from the perspective of Mediterranean areas, where the legacy of industrialization intersects with the rich cultural heritage of the region and its diverse economic landscapes. In these areas, the adaptive reuse of disused buildings takes on additional significance: the Mediterranean basin has always been characterized by the presence of port cities, as well as vast inland areas with abundant resources that have historically generated substantial industrial dynamics. However, changes in economic dynamics, evolving industries, and ongoing transformations in industrial management policies have emptied places that for decades were symbols of productivity, economic progress, and urban and social development. This has not only left these big architectures to their solitary fate but also left communities grappling with unemployment and the urban decay that has inevitably enveloped these abandoned places.
In this context of economic transition and the need to develop a new environmental sensitivity in the field of architectural design, the reuse of abandoned industrial buildings emerges as a promise of a new development model for Mediterranean areas.
As already happened in some Mediterranean cities, repurposing these structures for new uses, such as artisan workshops, professional studios, cultural venues, or as in the case of Foster+Partners' project, offices

for private companies that look towards collective development, allows the Mediterranean region to draw upon its rich cultural heritage and millennia-old entrepreneurial spirit to create new opportunities for employment and economic growth. This contributes to broader goals of sustainable development and environmental conservation by minimizing the environmental impact of urban development and promoting efficient use of resources.

Finally, the revitalization of industrial sites can breathe new life into neglected urban neighborhoods, fostering social cohesion and the reconstruction of a collective identity for the places where communities can continue to recognize themselves.

Notes

[1] https://www.fosterandpartners.com/projects/ombu> (accessed 12 May 2024).

References

Casamonti, M. (2022). Industrial Reuse: Introduction. In *Area. Rivista internazionale di architettura e arti del progetto*, No. 184, p. 2.

Urban Agenda for the UE (2019). *Sustainable & Circular re-use of Spaces & Buildings Handbook*, p. 12. <https://ec.europa.eu/futurium/en/circular-economy/handbook-sustainable-and-circular-re-use-spaces-and-buildings.html> (accessed 12 May 2024).

The regenerative potential of Point of Interest (POIs) in urban renewal: the Pietrarsa Railway Museum for the coast of San Giovanni a Teduccio

Massimiliano Campi

Urban regeneration is a crucial theme for many Italian cities, especially those with a rich historical and cultural heritage like Naples. Among various redevelopment projects, the renewed Pietrarsa Railway Museum stands as a significant example of the transformative potential that historical and cultural landmarks can have on the surrounding urban fabric, particularly for the coast of San Giovanni a Teduccio.
Urban regeneration involves the revitalization of urban areas that have experienced decline, aiming to improve the physical, economic, and social aspects of the environment. In new planning methodologies to try to rehabilitate this kind of areas, Points of Interest (POIs) play a critical role in this process, acting as catalysts for economic growth, community engagement, and cultural development.
A Point of Interest (POI) in the context of urban planning and development refers to a specific location within a city that attracts people due to its cultural, historical, recreational, or aesthetic value. POIs can range from museums, parks, and historical landmarks to entertainment venues, shopping districts, and public art installations. These sites play a pivotal role in defining the character and appeal of urban areas. Urban regeneration involves revitalizing parts of a city that have fallen into decline, with the goal of improving physical, economic, and social conditions. POIs are essential in this process for several reasons.
The eastern coast of Naples, particularly the areas encompassing San Giovanni a Teduccio, Barra, and Ponticelli, has faced a range of urbanistic

Fig. 1. 'Museo Nazionale Ferroviario di Pietrarsa', panoramic view (source: https://www.ferrovie.it/portale/articoli/15060).

problems over the years. These challenges are a result of historical industrialization, socio-economic disparities, environmental degradation, and inadequate infrastructure. This part of the territory was historically an industrial hub with factories, refineries, and shipyards. The decline of these industries has left behind numerous abandoned and contaminated sites, known as brownfields. These industrial sites have contributed to significant soil, air, and water pollution, posing health risks to local residents and hindering redevelopment efforts.

The decline of traditional productions has resulted in high unemployment rates, particularly among the youth. This economic hardship has exacerbated social problems such as poverty, crime, and educational underachievement. The area has suffered from a lack of public and private investment, leading to deteriorating infrastructure, inadequate public services, and poor housing conditions.

Despite some improvements, the eastern coast still struggles with inadequate public transportation options. This limits mobility for residents and restricts economic opportunities. Roads, bridges, and public facilities are often in poor condition, requiring substantial investment for repairs and modernization. Many residential and commercial buildings in this area are in a state of disrepair. The lack of maintenance and investment has led to unsafe living conditions and unattractive urban landscapes. As consequence of years of decay there are numerous vacant

Fig. 2. 'Museo Nazionale Ferroviario di Pietrarsa', aerial view, detail (source: https://cefisrl.it/pietrarsa/).

and abandoned properties that contribute to urban blight and discourage new development.

The eastern districts often feel disconnected from the economic and cultural life of central Naples. This social isolation is reinforced by physical barriers such as railways and industrial zones. The lack of community spaces and cultural amenities further isolates residents, reducing opportunities for social interaction and community-building. Socio-economic difficulties have contributed to higher crime rates in the eastern coast areas of Naples. This includes both petty crime and organized crime, which can deter investment and development. Residents often face safety concerns related to both crime and the physical condition of their environment, including unsafe buildings and poorly lit streets. POIs can often embody the historical and cultural essence of a community. They provide a sense of identity and pride for residents, fostering a connection to their city's heritage. This sense of pride can inspire community involvement in preservation and enhancement efforts, contributing to the overall success of urban regeneration projects. These

peculiar places contribute to the cultural identity of a city, or a part of it, preserving its history and traditions while also promoting contemporary cultural expression. They help build a unique character for urban areas, making them more attractive and livable.
There are many case histories in the world that demonstrate how the recovery of the pride of identity of a site was the cooperative engine for starting and promoting effective regeneration processes, as in the case of some neighborhoods in New York or - to cite examples that are better known and experienced by the author - the city Barcelona, which was able to exploit events of global importance such as the 1993 Olympic Games, to give a new life to the entire city, with a recovery that has not stopped and which has made the Spanish city one of the most admired cities in Europe.

The Role of Points of Interest (POIs) in Urban Regeneration and Pietrarsa Museum as epicenter of a new potential renewal
POIs play a significant role in revitalizing urban areas by driving tourism, generating revenue, creating jobs, and fostering social and cultural benefits. Here's how they contribute in terms of Tourism and Revenue Generation. In fact, Points of Interest such as museums, historical sites, parks, and entertainment venues are key attractions for tourists. Their presence leads to an increase in visitors, which in turn boosts the local economy. Tourists spend money in local businesses like restaurants, shops, and hotels, bringing in much-needed revenue. This influx of money can be reinvested into urban improvements, sparking a positive cycle of development and growth within the city.
Furthermore, the establishment and upkeep of POIs can generate a wide range of employment opportunities. Sectors such as construction, hospitality, retail, and transportation benefit directly from the development of these sites. Additionally, the ongoing operations of POIs require staff for roles in administration, marketing, and daily management, providing long-term job prospects for residents. This not only supports the economy but also helps reduce unemployment in the community.

Besides this, POIs offer significant social and cultural advantages that enhance the quality of life for residents, such as brand-new educational opportunities. It is known that Museums, galleries, and historical sites are valuable educational resources. They offer programs and workshops that benefit local schools and the broader community, stimulating interest in local history and culture. These educational initiatives help foster a deeper appreciation of the area's heritage. POIs like heritages, but even parks and plazas, serve as vital gathering places. They offer spaces for social interaction, recreation, and community events, promoting social cohesion. These areas provide venues for festivals, public celebrations, and physical activities, which contribute to improved public health and a sense of community, that is a feeling that has been tested as fundamental to make people find a new participating identity, which represents the first step of a wishful renaissance for every declined historical territory.
There are many cases of interest in the world that demonstrate how POIs can activate a generative process of urban redevelopment. Some of them are very worthy to be shortly mentioned as the High Line, New York City, where the transformation of an abandoned elevated railway into a linear park has revitalized the surrounding neighborhoods. The High Line has become a major tourist attraction, spurring economic development and real estate investment in the area. It provides a unique green space for residents and visitors, enhancing the quality of urban life.
Another preeminent case history is the Tate Modern, London, which with the conversion of the former Bankside Power Station into the Tate Modern art museum has significantly boosted the South Bank area. It attracts millions of visitors annually, generating substantial economic benefits and fostering a vibrant cultural scene. The museum also hosts community events and educational programs, contributing to the area's regeneration.
As previously said, the renovation of the Pietrarsa Museum historical site has the potential to transform the San Giovanni a Teduccio coastline. By attracting tourists and stimulating local businesses, the museum can play a key role in the economic and social revitalization of the area, promoting

Fig. 3. The Museum amphitheatre (source: https://www.genteeterritorio.it/binario-rosa-a-pietrarsa/).

sustainable development and cultural engagement. In conclusion, POIs are crucial for urban regeneration. They not only drive economic growth through tourism and job creation but also enhance social and cultural vitality, making cities more vibrant and sustainable places to live.

Contemporary trends to requalify disused coastal area

From a scientific perspective, contemporary trends in the regenerative rehabilitation of disused coastal and former industrial areas focus on a holistic and sustainable approach. These trends encompass various architectural and social strategies aimed at transforming neglected spaces into vibrant, functional, and environmentally friendly urban areas.

One major trend is taking old industrial buildings and giving them new life by repurposing them for modern uses while keeping their historical and architectural charm intact. This helps to maintain the character of the area. There is a strong focus on reducing energy consumption by incorporating systems like solar panels, green roofs, and insulation in renovated structures. These measures significantly cut down the carbon footprint. Using sustainable building materials that are less harmful to the environment is another important aspect. This includes materials that are recycled or have minimal environmental impact. Another huge aspect to care of is water management. The Blue-Green Infrastructure involves creating systems that handle stormwater efficiently, reduce the risk of flooding, and improve the health of coastal and marine ecosystems. Constructing natural barriers such as wetlands and oyster reefs helps to prevent erosion and supports biodiversity. These natural elements not only protect the shorelines but also enhance the local environment.

Among other aspects to be considered fundamental in an urban regeneration process is activating social inclusion mechanisms, as forms of participatory planning capable to engage local communities in the planning and decision-making process is crucial. This ensures that redevelopment projects reflect the needs and cultural heritage of the residents.

Including affordable housing options is essential to prevent the displacement of long-term residents and to promote social equity, making sure everyone benefits from the redevelopment.

Designing areas that combine residential, commercial, and recreational uses creates lively neighborhoods that are active around the clock. Providing amenities like parks, playgrounds, and cultural centers encourages community interaction and enhances the quality of life for residents.

Incorporating advanced technology like the Internet of Things (IoT) is a key aspect of smart cities, helping to manage resources more efficiently. This includes implementing smart lighting, waste management systems, and traffic control. Additionally, using data analytics to guide urban design and monitor the success of regeneration projects ensures that these efforts are effective and based on reliable information. Developing small, localized energy grids that use renewable sources such as wind, solar, and tidal energy is a significant trend in urban regeneration. These microgrids help power regenerated areas sustainably. Promoting the use of electric vehicles, bicycles, and public transport through well-planned infrastructure also reduces environmental impact and improves connectivity. Maintaining and restoring historic industrial buildings preserves the cultural heritage and identity of an area. Creating museums, galleries, and information panels educates visitors about the industrial history and transformation of the area, making this heritage accessible and engaging. Commissioning public art installations that reflect the community's history and aspirations adds cultural value and visual interest. Hosting events, festivals, and performances celebrates local culture and attracts visitors, adding vibrancy to the area.

Reintroducing native plants and fauna to create balanced ecosystems improves the natural environment through habitat restoration. Establishing green belts and buffer zones protects sensitive habitats from urban development and enhances the ecological health of the area. Techniques like phytoremediation, which use plants to remove contaminants from soil and water, improve environmental quality. Increasing vegetation cover helps absorb pollutants, leading to cleaner air and a healthier urban environment.

Creating incubators and support systems for local entrepreneurs stimulates economic growth and innovation. Establishing markets and commercial spaces allows local artisans and vendors to thrive, creating a vibrant local economy. Promoting sustainable tourism that highlights the natural and cultural assets of regenerated areas attracts visitors while preserving the environment. Developing walking and cycling routes that connect key points of interest encourages exploration and supports local businesses.

Three places in coastal areas which are worthy to be mentioned as good practices of urban renewal methodologies are unconditionally Copenhagen's Nordhavn area, Bilbao's Abandoibarra and, last but not least, Sydney's Barangaroo. The first one, once an industrial port, Nordhavn has been transformed into a sustainable urban district with green buildings, renewable energy sources, and vibrant public spaces, showcasing how industrial areas can be reimagined. The Abandoibarra area, featuring the Guggenheim Museum, has been revitalized into a cultural and economic hub with public parks and mixed-use developments,

breathing new life into the city's old docklands. The redevelopment of a former container terminal known with the name of as Barangaroo into a dynamic waterfront precinct with residential, commercial, and recreational facilities highlights the importance of sustainability and public access in urban regeneration.
These trends and examples illustrate how thoughtful design and community engagement can transform disused industrial areas into thriving, sustainable urban spaces. By integrating these trends, the regenerative rehabilitation of disused coastal and former industrial areas can create resilient, inclusive, and thriving urban environments that honor their past while looking forward to a sustainable future.

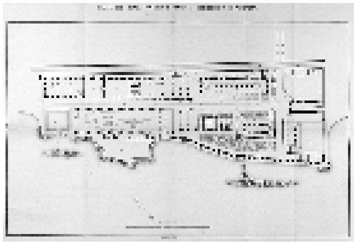


Fig. 4. On the lelt, Royal Mechanical and Pyrotechnical Factory of Pietrarsa, planimetry, 1861 (source: http://www.san.beniculturali.it/web/san/dettaglio-oggetto-digitale?pid=san.dl.SAN:IMG-00002949).

A part of the history

The concept of building a railway in the Kingdom of the Two Sicilies, which encompassed much of southern Italy, including Naples, was initially proposed by French engineer Armand Bayard de la Vingtrie. He presented his plan to Ferdinand II of Bourbon, the reigning monarch, who saw the potential benefits of rail transport for economic and strategic purposes. The king granted approval for the project in 1836. The construction of the railway was overseen by Bayard and a team of engineers and workers, including both local laborers and skilled technicians from abroad.
The chosen route for the railway was between Naples and Portici, a distance of approximately 7.25 kilometers (about 4.5 miles). This line was strategically selected to connect Naples, the capital and largest city in the kingdom, with Portici, a nearby town with a royal palace and coastal access, elected as summer site by the royal family.
The construction faced several challenges, including difficult terrain and the need to build infrastructure such as bridges and tunnels. Despite these obstacles, the work progressed steadily.
The Naples-Portici railway was officially inaugurated on October 3, 1839. The event was marked by great fanfare, with Ferdinand II himself participating in the inaugural journey. The king, along with his court, boarded the train for its maiden voyage from Naples to Portici,

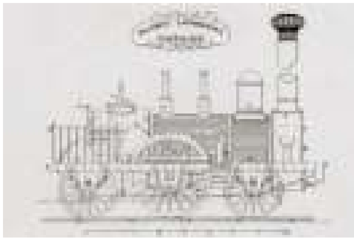


Fig. 5. On the right, drawing of the Bayard locomotive, one of the first used on the Napoli Portici (source: http://www.lestradeferrate.it/mono28.htm).

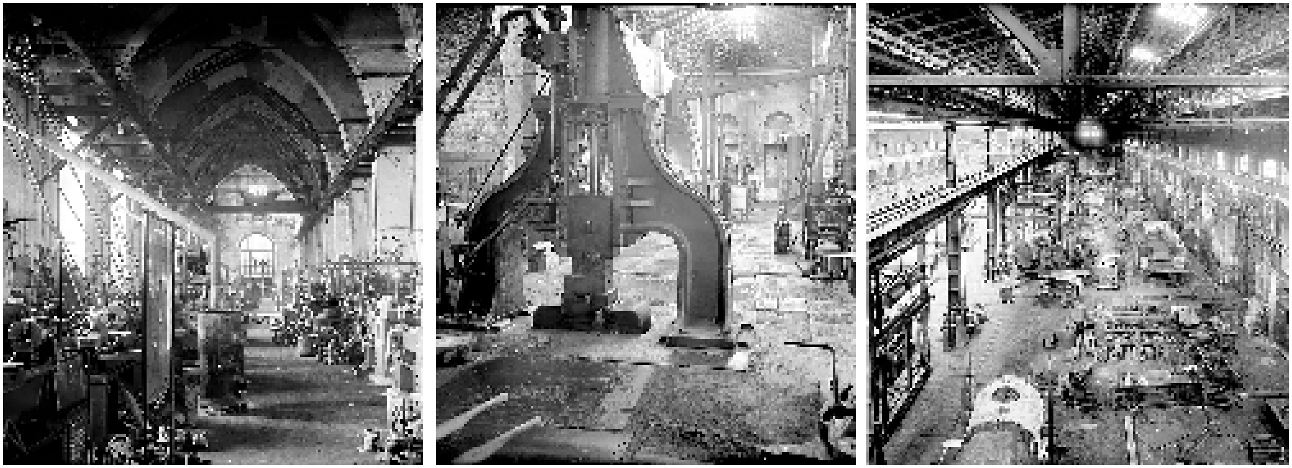


Fig. 6. Historical images of the pavilions of the Royal Mechanical, Pyrotechnic and Locomotive Factory (source: https://www.fondazionefs.it/content/fondazionefs/it/esplora-il-museo/visita-pietrarsa/la-storia.html).

showcasing the success of this pioneering project. The railway featured tracks of standard gauge, and the trains were initially powered by steam locomotives imported from England. The first locomotive to operate on the line was the "Vesuvio," built by the English firm Longridge and Company.

The railway facilitated faster and more efficient movement of people and goods between Naples and Portici, spurring economic activity in both areas. It demonstrated the potential of rail transport to enhance trade, industry, and mobility.

As the first railway in Italy, the Naples-Portici line symbolized a major technological advancement and marked the beginning of the railway era in the country. It paved the way for the expansion of the railway network throughout the country. The railway had a significant cultural impact, introducing modern transportation technology to the region and contributing to the spread of industrialization. It also influenced urban development and the growth of new industries along its route. Following the success of the Naples-Portici railway, additional lines were constructed, extending the network further into the Kingdom of the Two Sicilies and beyond. This expansion continued after the unification

of Italy in 1861, integrating the southern railway network with the rest of the country, which subsequently developed.
The legacy of the Naples-Portici railway is preserved and celebrated at the Pietrarsa Railway Museum, located near the original route. The museum houses historical locomotives, carriages, and exhibits related to the early history of Italian railways.
Today, the Naples-Portici line is part of the larger railway network, which serves the metropolitan area of Naples and the surrounding region. The original route remains a symbol of Italy's industrial heritage and its early embrace of railway technology. We can definitely say that the Naples-Portici railway holds a special place in Italian history as the nation's first railway line. Its successful construction and operation in 1839 marked the beginning of a transformative era in transportation, industry, and urban development. The railway not only revolutionized travel and commerce in the Kingdom of the Two Sicilies but also set the stage for the expansion of rail networks across Italy, contributing significantly to the entire country's economic and social progress.

A Significant Cultural Hub
The Pietrarsa Railway Museum, located along the eastern coast of Naples, tells the story of Italian railways, hosting a unique collection of historic locomotives and vintage carriages. Recently renovated, the museum not only celebrates the country's industrial heritage but - as said before - also serves as an interesting tourist and cultural attraction. This renewal has expanded the museum's capacity to host events, temporary exhibitions, and educational activities, increasing the flow of visitors.
The Pietrarsa Railway Museum is located in the former Officine di Pietrarsa, a major railway workshop established by Ferdinand II of Bourbon in 1840. This site is situated in the San Giovanni a Teduccio district of Naples. In a stubborn search for economic and political independence of Naples, the policy of the Bourbon king was in fact very driven towards technological innovations to build a plant never seen before in Italy: the Royal Bourbon Opificio of Pietrarsa, the place where

Fig. 7. Images of the interior of the Museum (source: https://www.napolike.it/museo-ferroviario-di-pietrarsa-ingresso-in-offerta-a-2-euro-per-4-giorni).

Naples could have built and repair their own locomotives without having to rely on English and French factories which, at the time, were the only industries capable of managing the new travel technologies.

The workshops were officially inaugurated on October 3, 1845, and were among the first industrial complexes dedicated to railway construction and maintenance in Kingdom of the Two Sicilies. The name "Pietrarsa" derives from "pietra arsa," meaning "burnt stone," referring to the volcanic rocks from nearby Mount Vesuvius used in the construction of the original buildings. Initially, Pietrarsa focused on building steam engines, carriages, and manufacturing parts for the burgeoning railway network in the Kingdom. The first locomotive constructed at Pietrarsa, the "Vesuvio," was completed in 1845. Over time, the site expanded to include facilities for casting, forging, and assembling railway components. Pietrarsa became one of the largest and most important railway workshops in Europe during the mid-19th century.

After the unification of Italy in 1861, Pietrarsa continued to play a critical role in the development of the national railway system. However, competition from other industrial centers and technological changes gradually reduced its prominence. By the mid-20th century, the workshops' activities had significantly diminished. The facility officially ceased operations in 1975, ending a long era of industrial production. Recognizing the historical significance of the site, efforts were made to preserve its legacy. In 1989, the Italian State Railways (Ferrovie dello Stato) inaugurated the Pietrarsa Railway Museum, transforming the former industrial complex into a cultural institution. The museum houses an extensive collection of historical locomotives, carriages, and railway memorabilia, showcasing the evolution of railway technology and the history of Italian railways. Key exhibits include the "Bayard," one of the earliest locomotives to operate in Italy, and various steam, diesel, and electric engines.

The museum underwent significant renovations in recent years to improve its facilities and expand its exhibition spaces. These efforts have enhanced its role as a cultural and educational center. Today, the Pietrarsa Railway Museum serves not only as a repository of railway history but also as a venue for events, exhibitions, and educational activities. It attracts visitors from around the world, contributing to the cultural and economic revitalization of the San Giovanni a Teduccio area.

Recently, the Municipality of Portici has also initiated the development of a dock in the Pietrarsa area to serve the Museum Hub. This infrastructure aims to enhance urban resilience and obtain proposals for completing the new waterfront layout, making it functional for the area's strategic redevelopment needs. This initiative originated from a series of Agreements and Memorandums of Understanding starting in 2008. These involved various stakeholders, including the Ministry of Cultural Heritage and Activities and Tourism, the Campania Region, the Municipality of Portici, the Municipality of Naples, and several companies within the Italian State Railways Group. This collaboration has created a synergy of intentions with clear objectives regarding the redevelopment of areas and assets within the municipal territory of Portici. The focus is on enhancing mobility, intermodality, and accessibility to the Granatello Port, the Pietrarsa Museum, and the entire coastal strip between the municipal borders of Naples and Ercolano through a series of targeted strategic interventions.

Specifically, the Memorandum of Understanding between the Municipality of Portici and the Italian State Railways Group companies outlines the following strategic objectives: improving access to the Pietrarsa Museum by both sea and land; creating an intermodal hub in the Granatello area, integrating all railway, maritime, and road transport to establish a sustainable and functional system that connects the area's architectural and monumental highlights. Additionally, the same protocol includes other premises and considerations, stating the intention of the Italian State Railways to enhance the Pietrarsa Museum Hub, which it owns, and improve its maritime connections through the creation of a dock.

Moreover, it should be noted that the area around the Pietrarsa Museum is included in the Strategic Plan for the development of areas within the management plan of the UNESCO site titled "Archaeological Areas of Pompeii, Herculaneum, and Torre Annunziata," adopted on March 20, 2018.

The Strategic Plan aims to define an open masterplan for creating an integrated cultural tourism system as an opportunity for the economic development of the territory. This includes rationalizing accessibility and transport networks, enhancing the usability of the Royal Palace complex and other significant architectural sites, restoring the natural and landscape aspects of the coastal strip, and converting disused areas, former industrial sites, and abandoned railway sections to improve the cultural and tourist offer. The open masterplan characteristic of this Plan allows for the strategic tool to be implemented with proposals from various involved entities and administrations.

It is necessary to remind that the territory of the Municipality of Portici falls within the "buffer zone" identified by the Plan for the realization of strategic interventions to achieve the set objectives. The main areas of transformation identified are the sea-Vesuvius axis as a privileged access to the National Park and as an intermodal tourist interchange point, and the waterfront in its entirety to achieve the goal of unified landscape redevelopment of the Vesuvius municipalities' coast.

This strategic framework is coherently integrated into the new municipal urban plan of Portici adopted in 2017, which includes the intention to create a new dock in the Pietrarsa area for the development of an intermodal exchange hub in non-operational railway areas owned by the Italian State Railways Group. The new infrastructure is proposed to enhance the Pietrarsa Museum Hub and strengthen its role in the tourism and economic dynamics of the Vesuvius municipalities' area. Additionally, the project offers the opportunity to transform and redevelop this section of the coast, defining a new identity for it. This new infrastructure is intended to boost the Pietrarsa Museum Hub and enhance its significance in the tourism and economic activities of the Vesuvius municipalities. Furthermore, the project provides an opportunity to transform and revitalize this section of the coastline, giving it a new identity.

Effects and impacts on Urban Regeneration

The renewed Pietrarsa Railway Museum has the potential to transform into a major draw for tourists and history enthusiasts, increasing tourist traffic to the San Giovanni a Teduccio area. This increase in visitors can stimulate the local economy, creating new job opportunities and encouraging the opening of businesses such as restaurants, cafes, souvenir shops, and tourist services.

The presence of a such prominent POIs can attract investment from both public and private sectors. Investors are more likely to fund projects in areas with established attractions that draw visitors and locals alike. This can lead to the development of additional amenities and infrastructure, further enhancing the area's appeal and functionality. High-profile POIs can draw both public and private investment, funding further urban development projects and infrastructure improvements.

The presence of a significant cultural institution like the Pietrarsa Railway Museum can catalyze investments in local infrastructure. Improvements in public transportation, road networks, urban signage, and safety can make the area more accessible and attractive not only to tourists but also to residents. Infrastructure improvements can also support the recovery and enhancement of historic buildings and public spaces, creating a more livable and welcoming urban environment. The museum's renovation and the surrounding areas can serve as a model for further interventions to recover historical and environmental heritage along the coast of San Giovanni a Teduccio. Projects to redevelop port areas, restore historic buildings, and create green spaces can help return a high-quality urban space to the local community, promoting greater awareness and appreciation of local heritage.

The Pietrarsa Railway Museum can become a reference point for the local community, fostering social cohesion and strengthening cultural identity. Through educational activities, workshops, and cultural events, the museum can engage residents, especially young people, in initiatives that promote knowledge of local history and active participation in community life. The eastern coastline is subject to erosion and other environmental pressures that threaten both the natural environment and built infrastructure. Continued industrial activities, although reduced, still contribute to environmental pollution. Additionally, illegal dumping and inadequate waste management exacerbate the problem. Incorporating sustainable practices in the development and maintenance of POIs can set a standard for urban regeneration projects. Utilizing renewable energy sources, implementing water conservation measures, and promoting eco-friendly transportation options can make these sites models of sustainability, encouraging broader environmental responsibility within the community. Integrating sustainability practices into the development of POIs can set an example for the wider community. Using renewable energy, promoting eco-friendly transportation, and incorporating green design principles help make urban regeneration projects more environmentally friendly.

Finally, the redevelopment process can integrate principles of environmental sustainability and innovation. Using ecological technologies for the museum's energy management, promoting sustainable mobility, and creating green spaces can contribute to sustainable urban development. Moreover, innovation can play a key role in attracting investments and talents, transforming the area into a center of excellence for culture and innovation. POIs like Pietrarsa museum could offer parks and nature reserves contribute to the creation and preservation of green spaces

within urban environments. These areas enhance biodiversity, provide habitats for wildlife, and contribute to the ecological health of cities. Green spaces also offer residents and visitors respite from the urban hustle, improving mental and physical well-being.
Parks and nature reserves serve as vital green lungs for cities, improving air quality, providing recreational opportunities, and enhancing the overall aesthetic appeal of urban environments.

Strategies for addressing a sustainable rehabilitation of the urban coastline

At this point it is necessary to try to summarize for specific points the possible actions to be implemented for the recovery and rebirth of the eastern coast of Naples, starting precisely from those which are already renewed points of interest and from which adequate urban redevelopment can be stimulated , as in the case of the Pietrarsa Railway Museum, which presents itself as a positive epicenter for a regenerative wave for the entire adjacent territory.
Transforming abandoned industrial sites into new residential, commercial, or green spaces can revitalize the area. This includes thorough environmental remediation.
Upgrading roads, public transportation, and utilities is crucial for improving connectivity and quality of life. Then, encouraging new industries, including technology and service sectors, can provide employment opportunities and offering tax incentives and grants to attract businesses and investors to the area.
To improve skills and employability, it is essential to offer education and vocational training programs. These initiatives can significantly boost individuals' capabilities, making them more competitive in the job market. In addition, developing community centers and public spaces is crucial for fostering social interaction and community engagement. Such spaces provide residents with venues to connect, collaborate, and build stronger social networks. Creating parks and green areas is another vital component, as these enhance the environmental quality and offer

Fig. 8. An event at the Pietrarsa Museum (source: https://www.ilmattino.it/napolismart/tendenze/napoli_museo_pietrarsa_aperitivo_musica_visita-7493239.html).

recreational opportunities for all. Parks serve as vital green lungs in urban settings, promoting physical activity and well-being.
Moreover, promoting sustainable urban planning practices is key to long-term urban health. This includes incorporating renewable energy sources and improving waste management systems, ensuring cities grow in a sustainable, eco-friendly manner. These efforts collectively contribute to building more resilient and vibrant communities.

Conclusion

The Neapolitan east coast faces significant urbanistic challenges rooted in its industrial past and compounded by socio-economic and environmental issues. Addressing these problems requires a comprehensive and multi-faceted approach, integrating urban regeneration, economic development, social programs, and environmental sustainability. By leveraging the area's historical and cultural assets, and with targeted investments and community engagement, the eastern coast of Naples can be transformed into a vibrant and sustainable urban area.
Points of Interest are vital components of urban regeneration, offering economic, social, cultural, and environmental benefits. By attracting visitors, fostering community pride, and setting examples of sustainable development, POIs can drive the revitalization of urban areas, transforming them into vibrant, dynamic, and sustainable communities. Effective urban regeneration strategies should leverage the potential of POIs to create lasting, positive impacts on cities and their residents.
POIs often include facilities such as playgrounds, sports areas, and cultural venues, which improve the quality of life for residents. They provide spaces for leisure and relaxation, contributing to better physical and mental health. The regeneration of areas surrounding POIs can lead to improved housing, better infrastructure, and upgraded public services. This holistic approach ensures that the benefits of urban regeneration are widely distributed across the community.
The renewed Pietrarsa Railway Museum represents a significant opportunity for the urban regeneration of the coast of San Giovanni a

Teduccio. Through an integrated approach that values cultural heritage, improves infrastructure, and promotes sustainability, the museum can become a catalyst for positive transformation, enhancing the quality of life for residents and making the area a significant tourist and cultural attraction. The challenge and potential are great, but with a shared vision and targeted investments, the future of San Giovanni a Teduccio can be bright and prosperous.

The Pietrarsa Railway Museum is surely a testament to Italy's rich industrial heritage and its pivotal role in the development of the national railway system. From its origins as a major railway workshop to its transformation into a huge modern museum, Pietrarsa continues to be a symbol of technological progress and cultural preservation, so much to have still the potential to renovate itself once again in its ongoing contributions to urban regeneration, which definitely highlight the enduring significance of historical sites in contemporary urban landscapes.

Acknowledgements
Special thanks go to Gian Piero Torquelli and Aida Irostri for them help in researching bibliographic materials and for the support given to the elaboration of this text. Thank you for your contributions given spending evenings chatting about these topics and sharing ideas.

References

Gehl, J. (2010). *Cities for People*. Island Press.

Whyte, W. H. (1980). *The Social Life of Small Urban Spaces*. Project for Public Spaces Inc.

Lynch, K. (1960). *The Image of the City*. MIT Press.

Jacobs, J. (1961). *The Death and Life of Great American Cities*. Random House.

Montgomery, C. (2013). *Happy City: Transforming Our Lives Through Urban Design*. Farrar, Straus and Giroux.

Carr, S., Francis, M., Rivlin, L. G., & Stone, A. M. (1992). *Public Space*. Cambridge University Press.

Florida, R. (2002). *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community, and Everyday Life*. Basic Books.

CHAPTER 2

Carmona, M., Heath, T., Oc, T., & Tiesdell, S. (2003). *Public Places Urban Spaces: The Dimensions of Urban Design*. Architectural Press.

Oldenburg, R. (1989). *The Great Good Place: Cafes, Coffee Shops, Bookstores, Bars, Hair Salons and Other Hangouts at the Heart of a Community*. Paragon House.

Project for Public Spaces (2000). *How to Turn a Place Around: A Handbook for Creating Successful Public Spaces.*

UN-Habitat. (2013). *Streets as Public Spaces and Drivers of Urban Prosperity*. United Nations Human Settlements Programme. (Report)

World Bank. (2009). *Reshaping Economic Geography.* (Report).

European Commission. (2011). *Cities of Tomorrow: Challenges, Visions, Ways Forward* (Report).

Marcus, C. C., & Francis, C (1997). *People Places: Design Guidelines for Urban Open Space*. John Wiley & Sons.

Punter, J. V. (1991). *Design Guidelines in American Cities: A Review of Design Policies and Guidance in Five West Coast Cities.* University of California Press.

Bohigas, O. (1963). *Barcelona Entre el Pla Cerdà i el Barraquisme*. Edicions 62.

Bohigas, O. (1985). *Reconstrucció de Barcelona*. Edicions 62.

Bohigas, O. (2004). *Contra la incontinencia urbana: reconsideración moral de la arquitectura y la ciudad*. Edicions 62.

Bohigas, O. (2009). *Arquitectura y crítica*. Edicions 62.

Bohigas, O. (2011). *Barcelona: arquitectura, urbanismo y historia*. Edicions 62.

Project for Public Spaces (PPS) - [www.pps.org] (https://www.pps.org).

Urban Land Institute (ULI) - [www.uli.org] (https://www.uli.org).

Gehl Institute - www.gehlpeople.com.

American Planning Association (APA) - [www.planning.org] (https://www.planning.org).

The second life of architecture

Pasquale Miano

The presented project concerns the Laveria, a building-machinery linked to a mining activity that developed over a period of time from the end of the 19th century to the 1960s in Sardinia, at Argentiera (Sassari, northern area of Sardinia): for many years the activities were completely interrupted, and the structures completely abandoned (Fig. 1).
The 'first life' of these buildings, with all the happenings, the more or less major transformations, unequivocally ended around 1960, leaving room for new possibilities of life, which have only been grasped, to a very partial extent. The pictures of the situation on the site before the project show the abandoned building in ruins. Laveria, a huge architectural ruin, almost suddenly presented itself to the view of anyone driving along the winding access road to Argentiera in the municipality of Sassari. Only when approaching the building could one discern the presence of other blocks and wall foundations, which made the general composition of the complex very articulate. In this place, a very peculiar condition had been determined: the ruins of the large production machine had now become part of the landscape, playing an absolutely dominant role and determining a condition that made it difficult to separate it from the morphology, vegetation and all the other elements of identity of the settlement site (Fig. 2).
At Argentiera, the naturalised ruins of the Laveria were therefore not isolated elements, but, despite their particular condition, they weaved a close dialogue with pieces of nature (rocky ridges, esplanades) that

Fig. 1. Panoramic photo of the intervention area (photograph: P. Miano).

Fig. 2. The Laveria complex before the intervention (photograph: P. Miano).

had been altered and partly cemented. Between the naturalised ruins and the 'alienated' natural elements were the 'rationalist architectures' of the workers' village (the cinema, the post office, the office building, the church), in some respects also out of place, but such as to reflect, due to their particular position, the morphological conditions of this interesting and isolated Sardinian coastal area. At Argentiera, a very particular declination of the factory/village theme has been realised over time, one that is certainly very interesting as a whole, a declination that is inseparably linked to mining production activity (Fig. 3).
Preceded by inspections by Balzac and La Marmora, at Argentiera the reopening of an ancient mining activity, probably dating back to Roman and medieval times, formally took place in 1867, with the enterprise to the Marquise Pola di San Saturnino of a permit for the extraction of argentiferous lead and zinc minerals. In 1870, the concession passed to the Societé Anonyme Minière et Metallurgique Sardo-Belge: it was during this period that Quintino Sella visited the site, analysing the two strands that characterised the deposit that had been explored until then. Subsequently, the first Laveria plant was built, which allowed the materials to be separated by washing, exploiting the difference in specific weight of the minerals compared to the slag. The construction and plant history of the 'Laveria' and their evolution over time constitutes a chapter of fundamental importance in the mining history of Sardinia: in this sense, the comparison with the Laveria di Monteponi in the Iglesiente area is interesting, from which it can be understood that the position of the mines and the relationship with the access roads, including the sea in the case of Argentiera, is of fundamental importance (Fig. 4).
At the end of the 19th century, favourable conditions for the development of mining activities matured, and at the beginning of the 20th century, there was a very significant growth of Sardinian mines; as Giuseppe Cavallere argued in a 1903 report. Observing one after the other "the noisy laverie, the other chimneys, the colossal machinery, the steep inclined planes, the spectacular aerial tractions, the incandescent bottoms, the basins, the hundreds of wagons", it no longer even seemed as if we

Fig. 3. The ruins of the old machine-building (photograph: P. Miano).

were in Sardinia. During the twentieth century, with the development of mining activities, we witnessed the gradual formation of the township, with the new workers' quarter, church and school. "Formed by seven buildings arranged in a chessboard pattern for a total of 28 dwellings, the village of Cala Onano was planted on a raised hill, north-east of the mining centre, one kilometre from the laveria. The construction typology of the dwellings, all made of sandstone blocks from the nearby Porta Palmas quarry, differs from that of the old mine chambers similar to the traditional cuili, indeed it seems to be inspired by non-local models"[1]. This is where the interesting situation of the assimilation of the Laveria's temporary architecture to the sandstone-built village is determined. In 1929, the important reconstruction of the Laveria was carried out, adopting the flotation system, which allows excellent results in the processing of blinde (zinc).

Fig. 4. Historical photo of the industrial complex in operation (postcard from the 1910s).

The Second World War brought about a phase of crisis in mining activity, both due to the lack of labour and because the deposit was now impoverished. After a phase of progressive downsizing of mining activities, the mine's life cycle came to an end in 1963. These few particular aspects I want to point out in the context of a very particular historical event, which we have documented in detail, in order to fully understand the reasons for the current configuration and condition of the laveria. To summarise, the current configuration of the architectural complex of the laveria and the mechanical and electrical workshops, part of a more articulated building aggregate, which extends as far as the beach, is the result of a series of interventions that took place over a century (1864-1963), responding to different logics and phases of development in the mining sector in Sardinia. We are moving within the world of mining, as described by Giorgio Peghin, who emphasises that this world "offers itself as a powerful device of form and analogy capable of provoking a

Fig. 5. The interior spaces of the abandoned machine-building (photograph: P. Miano).

sense of history and the memory of the past and the image of a great architectural machine whose gears, blocks, generate a sort of suspension of its figure and its momentary blurring. Indeed, functional aspects are not enough to describe and represent the disused mining landscape. We are faced with extraordinary artificial geographical constructions, architecture of earth and in the earth, which present themselves as unknown and difficult to decipher, having lost the original datum that had determined their formal condition" (Peghin, 2019, p. 121).

The identity of the Argentiera, encapsulated in the relationship between the mine and the village, the worker and the landscape, was the basis for the project to recover the artefacts and the proposal to reuse them with the insertion of new functions. The project's task was therefore to induce a 'second life' and this seems to me a very interesting condition for reasoning, also in more general terms, on the recovery of industrial archaeology. The Laveria reclamation project was therefore defined on

Fig. 6. General plan of the intervention area (drawing: Pasquale Miano Studio).

Fig. 7. Project cross-section (drawing: Pasquale Miano Studio).

the basis of the dual instance of conservation and a new compatible function, using the surviving structures without adding anything.
From this point of view, the questions of design approach were tackled in an open manner, outside of any pre-established position and solution,

Fig. 8. Project rendering (image: Pasquale Miano Studio).

in a condition of great variability and effective breadth of interpretative possibilities, according to an attitude that Giorgio Grassi has well outlined, when he states that "the artefact that has fallen into ruin, reduced to fragments, shows precisely in this last stage a recovered incompleteness, like a new availability" (Grassi, 1990). But recovery, incompleteness and availability are not unambiguously defined terms, and above all it was necessary to understand how far to push them in order not to lose the trace of that first life, from which the second originated. To briefly illustrate these aspects, it is useful to quote an interesting consideration by Giuseppe Galasso, regarding the logic with which the researcher selects the causes of a historical event, working "with the criterion of creativity, originality, innovation of each present with respect to each past. Every action fits into the past and is temporally a continuation of it; but it is also a break in the past [...] a fracture in the chain of what happens.

Fig. 9. Project floor-plan (drawing: Pasquale Miano Studio).

And it is this fracture that differentiates the present from the past, the unknown to which one arrives from the known, the choice that is not only the selection of the alternatives in play but is at the same time the modification of those alternatives in the very act of selection" (Galasso 1995, p. 431). This is the criterion we have tried to follow.
The new life of this building-machine, i.e. the architectural project of its second life, draws its origin from the pre-existing building, but it is not simply a restoration: it is an intervention that is difficult to define in synthetic terms; it is a matter of introducing new functions, while respecting the need for conservation, but even this is by no means sufficient to define the intervention to be carried out (Fig. 5). In the description of Gardella and Rossi's reconstruction project for the Carlo Felice Theatre in Genoa, Vittorio Savi used a very interesting and precise definition: "to establish the genre of this operation, no entry in the current architectural-urban dictionary is suitable [...] if anything, the word deducible from Alberti's De Re Aedificatoria, the term instauratio, is needed. Take the corpse of architecture, recompose, reintegrate (with critical and fabricative integrations), put the organism back on its feet,

Fig. 10. Project rendering of library spaces (image: Pasquale Miano Studio).

insufflate life" (Savi, 1990). But how to insufflate life into this productive machine that is now non-functional and instead responds in its construction and development to practical purposes? How to insert new functions into this machine, through which, to use a succinct expression by Andrea Branzi, "the city of the future is realised in the interior spaces of the contemporary city?" (Branzi, 2006, p. 117). It is on this basis that design reflection has begun.

But this situation hinges on knowledge of the state of affairs. With the construction of the factory, located downstream from the entrance to the mines, some fundamental characteristics of the Argentiera territory and landscape changed profoundly. Despite the simplicity of its architectural elements, the building-production complex is very articulated due to its particular position at the foot and along the hillside. The structure grew and changed slowly over time, assuming its own stable configuration in

Fig. 11. Overall axonometry (image: Pasquale Miano Studio).

the landscape, like the workers' village. In the building-machine there are very characterised spaces, more than fragments of its former life, and it is in this deciphering of the spatial dynamics of this machine that the most interesting part of the design work lies. In fact, Laveria is composed of spaces at various heights, according to a very tight concatenation, a real interwoven sequence of spaces of different natures, from which the detached bodies of the workshops stand out, more regular and ordinary (Fig. 7).
The Laveria reflects two structural concepts and the use of materials: the masonry parts reflect the idea of buildings with a longitudinal

Fig. 12. Project elevation (drawing: Pasquale Miano Studio).

plan, while the wooden parts (beams, trusses, planking) respond to the logic of a provisional structure, suitable for creating large overlapping spaces. In the Laveria, what counts is the course of the ground, well represented by vertical sections (always different), which 'cut' the hill and the building through levels, platforms, machinery, in continuous movement. The materials of the mine travel from top to bottom and when they are discarded they determine and modify the ground, they give it a very significant imprint, so that, at least in part, the Laveria takes on the connotations of an 'architecture of the earth', which significantly enters into the composition of the machine, which adapts in its basement parts to the course of the ground.

Also of great importance in the Laveria are the cross-sections of the rooms at the various heights clinging to the hillside and 'descending' to the sea: each cross-section is different from the other, resulting in a situation of extreme variability, both in the full-empty ratio and in the correlations between the various planes, which are often connected with great difficulty.

Actually, for the Argentiera complex, it's not possible to speak about one single building or of a sum of buildings, but it is more appropriate to interpret the very particular architectural system that has been determined over time as a unitary structure, a machine hinged on an articulated relationship between spaces of different natures and characters, a protuberance of the hill, a machine endowed with spatiality, a spatiality that is not ordinary, not usual, at least in some parts.

For the second life of the building, starting from the methodological principle that the survey and description of the state of the places are an essential part of the project, we worked on the identification of some significant 'cutaways' of the spatial organisation of the mining production structure: cutaways capable of 'telling' the articulated story of the production machines understood as units that are difficult to separate into elements. Thus, the plans of the seven 'significant' levels of the Laveria and many sections were drawn, which constituted very important cognitive material for the purposes of the design layout.

What did we plan to do to bring these structures back to life and in what way did we introduce the new functions? 'The introduction of the new' took the form on the one hand of a scaffolding, another architecture which served to facilitate the reading of the previous architecture, but which also performed the precise task of involving the previous spaces in a new spatial organisation. Not the past on one side and the present on the other, but a concatenation, as Francesco Venezia argues when he emphasises that "there is no authentic novelty without reference to the chain of efforts that preceded us" (Venezia, 2011, p. 22). In this way, it is as if the previous building is 'rewritten', in a logic of 'superimposition', aiming to create a 'multiple palimpsest'. The pre-existing architecture is read as a script on which to superimpose new phrases, new systems, so that the introduction of a different constitutive logic with respect to the existing is inevitable, a logic that moves by points, by measured fragments, that does not aspire to its own total continuity. The previous elements have not been decontextualised, but have been reinterpreted in the new architectural machine, which certainly has continuity with the

Fig. 13. Interior spaces after design and restoration work ((photograph: Pasquale Miano Studio).

previous one. However, it is not possible to achieve coherence in general terms, but rather to emphasise the pieces of the original mechanism, which denote a new capacity to function. The main design objective is that of the internal coherence of the result. In this sense, the pre-existing pieces are configured as the structuring elements of the new composition, which does not assume a definitive configuration, but is open to new interpretations and interventions. And this already seems to be an exceptionally contemporary feature, deriving from the particular condition of the disused industrial ruin (Fig. 8).

In the design solution elaborated for the building-machine, the superimposed scaffolding, reduced to a minimum, takes on the characteristics of a sequence, of a path, which brings into play the pieces of the pre-existing machine, suitably recomposed (Miano, 2013). The aim is to induce a new interpretation of space, or in other words

Fig. 14. The machines used in ancient Laveria (photograph: P. Miano).

to make possible a double, or multiple, spatial configuration, starting from the precise idea that “a project, today, must have the capacity to make an ancient building current, so that it effectively corresponds to our questions” (Venezia, 2011, p. 22). For the Laveria, the project was defined on the basis of certain precise building-machine considerations. In the first place, the Argentiera complex was reread as a potential museum of itself, a document of that very special production process that started from the mines, located at the highest elevations, and continued all the way to the sea, according to a mechanism that can be reconstructed in precise terms, even if over time, it has undergone continuous modifications and updates, which make it difficult to read immediately. At the same time, travelling through the structure in the opposite direction, and this possibility emerges from the first vision of the buildings in their current articulation, it was thought to create a sort of 'adventure' of knowledge, in which nothing is taken for granted, in which wonder, and surprise prevail, that is to say, those characterisations that are increasingly demanded of contemporary architecture. From bottom to top going up the car. This choice to walk along the machine in the opposite direction allows, the moment one enters this artefact, to activate a particular cognitive mechanism that does not follow the ordinary way in which a museum tour is realised. This is just to say that the building itself is of exceptional modernity and this aspect has been adequately considered in the project. The idea of the double path is made even more interesting by the fact that the building is made of masonry and wood: it is characterised by very traditional masonry parts, basement parts, to which in some cases the wooden structural system is leaning, at other times it is flanked (Fig. 9).

The project tries to resolve and synthesise these contrasts, working on a case-by-case basis and not making any modifications or forcing on the pre-existing structure, but interacting with light grafts that are configured more like an installation than a lasting architectural intervention: a single lift connecting the various elevations, some reconstructed staircases, some protective parapets and a few elements of exhibition design, necessary to emphasise important aspects of the previous machine. These installations dialogue with the forms and masses of the machinery to be recovered left in their original position, around which small concentrated services can be created, assigning new tasks to significant areas of the complex

Fig. 15. The machines used in ancient Laveria (photograph: P. Miano).

(bar, reading room, etc.), without in any way extrapolating them from the continuity of the spaces that characterise the entire complex (Fig. 10).
In the two parallel bodies of the mechanical and electrical workshops, outside the Laveria, the most demanding functions (conference hall, restaurant, guest quarters) have been located and realised. In this sense, the project takes on in a precise way some of the logics that characterise exhibition design, as Franco Purini points out: "in museums, exhibition design loses one of its main characteristics, a character that is written in its etymology - to set up contains the idea of swift, quick, quick like Mercury - to become a stable arrangement, a conformation of elements, walls, lights, paths - no longer ephemeral, but called to an existence that can be long, as the famous installations by Carlo Scarpa, BBPR and Franco Albini have been for a long time. However, it is precisely in being normally a fast-consuming system that the installation seems to correspond exemplarily to the futurist proposal of an architecture no longer projected on the long term, but projected in search of the instantaneous, of brevity, an architecture made of lightning-fast and extreme trajectories" (Purini, 2002, p. 61) (Fig. 11).

There are many issues that were addressed in the drafting of the project, and which should be illustrated and explored in depth at this point, but perhaps at least one can be taken into consideration as an example, which is of greater interest with respect to the theme of the recovery of industrial archaeology. From this point of view, one can firstly consider the issues of the Laveria's 'plugging' elements: the phase in which the structure was closed with wooden panels was followed by the phase of abandonment, in which the wooden skeletons were partially unplugged. In addition to these two pre-existing conditions, the project introduced the further possibility of working with large infill windows, which allow the fullness of the panel to be reconstructed, but at the same time offer the possibility of creating a closed structure (Fig. 12). Each of these hypotheses led to a different interpretation of the entire Laveria system. Preserving the machine in the state of ruins would have imposed an entire open wooden structure, but this would not have allowed for a functional museum, and it would also have been very difficult to guarantee the preservation of the interior spaces attacked by the sea and pigeons. So the other two solutions emerged as more concrete answers, but one could opt for either glass or wood with good alternative motivations: it was important, however, not to interpret this opposition in a rigidly alternative way, thinking to reach a unified and fixed conclusion. Either solution, perfectly accomplished and fully realised in an exclusive manner (all wood or all glass), would be a betrayal of the open interpretation of the building, on which much thought has gone into. This is very clear in the case of the choice of glass as the character of the building-machine would be completely altered, although a very significant result could be achieved in terms of functionality and the possibility of opening up suggestive views of the Argentiera landscape. Great doubts also arose when adopting the solution of a total wooden infill, which would not only give the building a blocky configuration but would also deprive museum visitors of the splendid view of the Argentiera coastline. Slowly, almost working piece by piece, a more articulated solution was arrived at: partly open, without infill, much of it in wood and some of it in glass. It is not a mediating solution but an attempt to give a coherent answer, an answer that can guarantee a balance, taking into account the multiple factors at play. In the project, the Laveria was not ultimately interpreted as a static element, so there is no past that dialogues with the present, but there is a past that advances together with the present, recomposing a fracture that had occurred (Fig. 13).

A final aspect concerns, once again, the need for an open solution: in the project some interior spaces, now uncovered but once built elements, have been left in their current condition. Some interior spaces, appropriately cleaned up, have therefore become decisive exterior spaces in the new compositional balance of the building-machine (Fig. 14). The interiors that become exteriors take on a very important role as they synthesise the idea of an articulated narrative: these spaces can become other things, such as internal gardens, pieces that begin to dialogue in a different way with the other parts of the pre-existing machine. In any case, each space, whether walkable or usable for parking, may be treated with care so that its original function is always evident, emphasising the presence of all the surviving machinery and the path of the materials at the different levels. The works carried out do not exhaust the project's forecasts, although they do offer a complete idea of the imagined result. In order to give the Laveria complex its due prominence, the Municipality of Sassari would need to provide further answers. The design programme could thus be extended to the immediately contiguous areas, fully enhancing the relationship between the buildings and the spaces, already used for processing, that connect and relate the different parts of the Laveria (Fig. 15). In this way, the museum intervention could be given a landscape imprint, involving other spaces and places of the Argentiera. In the most recent studies on the mining landscapes of Sardinia, these aspects, highlighted on an experimental basis for Argentiera, are becoming increasingly clear, as Giorgio Peghin has well pointed out when he emphasises that "the project cannot, therefore, concern only the single artefact, but must include the profound and critical relationships between the buildings, the environmental dimensions and the toxic residues, signs of a fragility of this system and at the same time of its strong resilience that constitute a unique landscape identity of great beauty" (Peghin, 2019, p. 9).

Notes

[1] The two quotations by Giuseppe Cavaliere are taken from the project report, written as part of the drafting of the project for the construction of the Mining Museum in the Laveria building in the Argentiera locality, years 2003-2012.

References

Branzi, A. (2006). *Modernità debole diffusa. Il mondo del progetto all'inizio del XXI secolo*. Milano: Skira.

Galasso, G. (1995). Filosofia e storiografia. In P. Rossi (Ed.). *La filosofia*, vol. II, p. 431. Torino: Utet.

Grassi, G. (1990). Un parere sul restauro. In *Phalaris*, Vol. II, No. 6, pp. 11-14.

Miano, P. (2013). *Armature tematiche e progetti*. Napoli: Clean.

Peghin, G. (2019). *L' architettura delle miniere. Paesaggio, suolo, sottosuolo, terra*. Melfi: Libria.

Peghin, G. (2019). *Re-Mine. Architettura e modificazione nei territori minerari deindustrializzati*. Melfi: Libria.

Savi, V. (1990). Il nuovo Teatro Carlo Felice. In *domus*, No. 719, pp. 33-49.

Purini, F. (2002). Allestire. In *Lotus*, No. 115, pp. 60-62.

Venezia, F. (2011). Nature. Doppio per riflesso. In A. D'Onofrio, C. Felci (Eds.). *Francesco Venezia. Nature 01/04*, p. 22. Roma: MAXXI B.A.S.E.

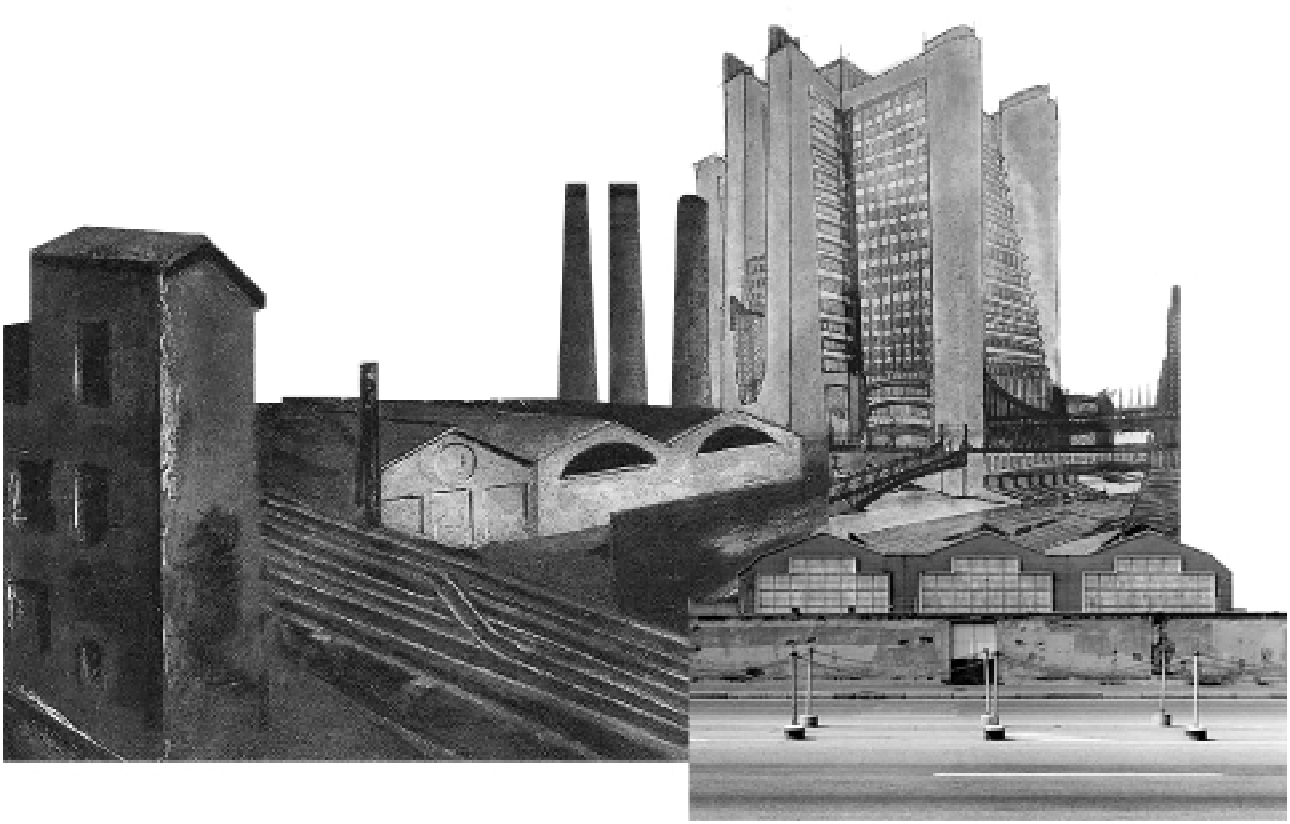
Industrial ruins and architectural design

Bruna Di Palma

"On Easter Sunday, 1978, the city hung in a magical, luminous suspension. Map in hand, I wandered from area to area. My exploration led me to zone 14, nestled between Via Ripamonti and Via Ortles. Here, industrial buildings dominated the landscape. There, for the first time, I truly saw the streets. The factory facades, silhouetted sharply and distinctly against the unexpectedly blue sky, seemed isolated. The usual view had become strangely unusual. It was as if I'd never seen it before: a slice of the city stripped bare of its daily movement, devoid of parked cars, people, and noise. The architecture stood repurposed, filtered by light, transformed into something scenic and monumental" (Basilico, 1981).

The former industrial areas of cities are the bearers of a vision of space that predominantly concerns the so-called urban peripheries, a nostalgic and inspirational ground, suggestion and experimentation for exponents of different disciplines related to architecture such as art and photography, which in the monumentality of large disused manufacturing spaces have read a metaphysical imagery made of abstraction, isolation and absence, strongly linked to a suspended time inhabitable only minimally by man and connoted by the presence of ruined architecture and discarded spaces.

"A large number of derelict production places and artefacts, which were inadequate to accommodate the innovation of production processes or new product transportation and distribution methods, have for some decades now determined the geographical dissemination throughout the country of a variety of "rejected sites" as well as "ruins", which can be seen in "archaeological" terms as being important resources for the



territory, if included in appropriate redevelopment and regeneration strategies" (Vanore, 2012, p. 2).

Following the inspiration of Antonio Sant'Elia's "Perspectives of the Futurist City," other artistic explorations tackled similar themes. Mario Sironi's "Urban Landscapes with Factories, Buildings and Streets" drew inspiration from 1920s Milan, while Gabriele Basilico's groundbreaking "Portraits of Factories" catalog documented the Milanese industrial landscape for the first time in the late 1970s (Fig. 1). These artistic expressions, imbued with a sense of "ghost dimension," emerged alongside a burgeoning movement in Milan. This movement focused on revitalizing the city's decaying industrial areas, the very spaces that had so strongly shaped its identity as a center of production and working-class community.

The Solari-Tortona neighborhood, southwest of Milan, exemplifies this urban evolution. Originally a rural area, it was transformed by the arrival of the railroad. This infrastructure spurred the creation of a new neighborhood, filled with factories and housing for the workers who powered them. These workers also became central figures in artistic documentaries, like Ermanno Olmi's piece on Officine Riva. Such films highlight not only the beauty of industrial architecture but also the social cohesion built around industrial production and labor. As Olmi himself suggests, "When a project becomes a real object, there is in it the work of man, the sweat, the hours it took to make it. Even if made by machine, in the end it remains a product of human hands. There was still, at that time, the pride of belonging to a company, to a group, to a people, to a human entity that produces a historical transformation. After all, it is a choral experience of work that is still felt today: the workers [...] celebrate a work done together and that gratifies not only the foreman or the director, but also the apprentice who carries the cables" (Olmi, 2008, p. 77). The neighborhood's industries have been decommissioned since the 1970s, in connection with the transformations of the production system and after the energy crises, leaving immense buildings and courtyards available for new uses. The process began with the dismemberment of

Fig. 1. Representations of industrial architecture in art and photography (collage: B. Di Palma and E. De Felice).

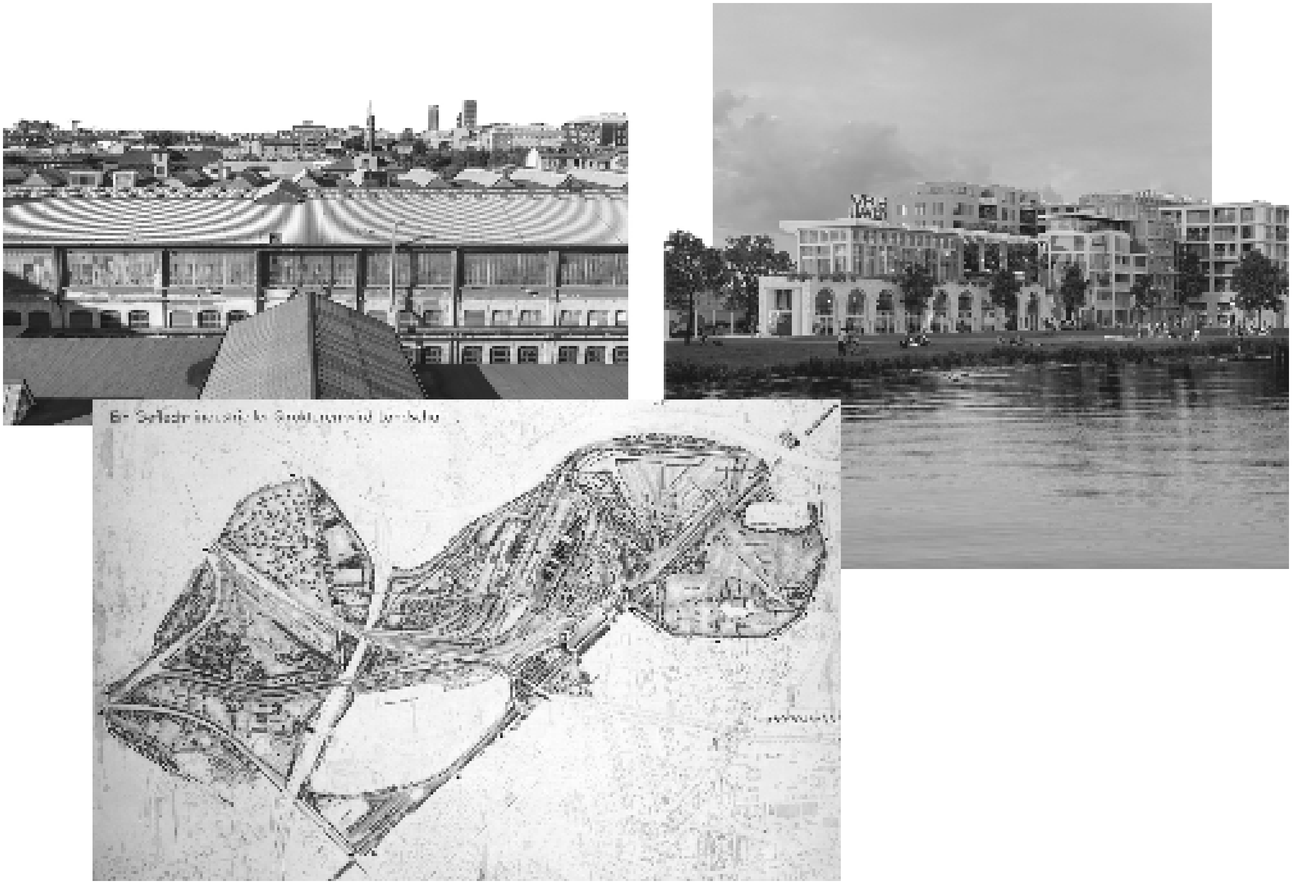


Fig. 2. European landscapes involved in the rehabilitation of industrial ruins (collage: B. Di Palma and E. De Felice).

Ansaldo, which was followed by the divestment of other factories, and saw designers such as Tadao Ando and David Chipperfield, to name but a few, as protagonists in the renewal process. Other areas of Milan have also seen major renovations of industrial ruins such as the headquarters of the Prada Foundation designed by OMA in a distillery dating back to 1910.

If Milan plays a representative role in the Italian panorama of industrial heritage design, at the European level certainly the reconversion of the

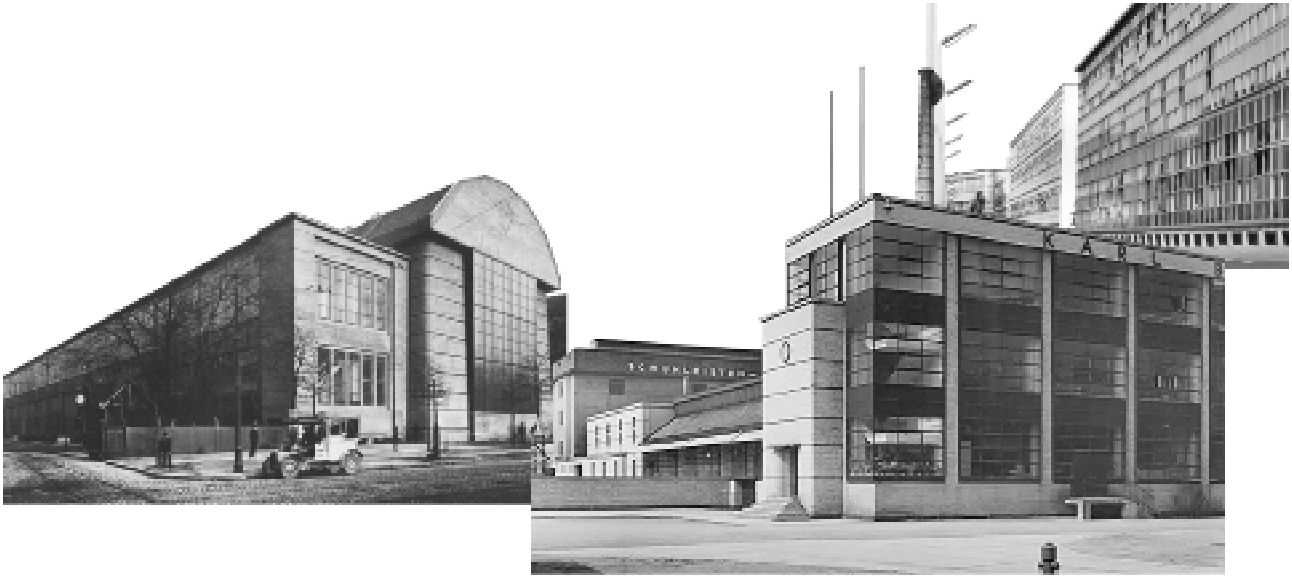


Fig. 3. Representative buildings of modern industrial architecture (collage: B. Di Palma and E. De Felice).

Ruhr region in Germany into a cultural district with large green areas is an emblematic case of the renewal of an area characterized, starting in the nineteenth century, by a strong development in the mining and metallurgical sectors, which then saw the closure of the coal mines in the 1990s and then the beginning of an industrial decline of which the project managed to subvert the progressive deterioration. This theme is confirmed to be of interest in contemporary times as evidenced by the recent competition for the design of the Havenstraat district, a well-known suburban area in the Dutch capital: the Powerhouse Company studio won the competition, the area will be remodeled as a "creative district", offering – according to the call for proposals – space for experimentation, opening up to local businesses, creatives and makers to refine its character (Fig. 2).
In addressing the issues related to the transformation of these areas, we talk about the many lives of the industrial heritage precisely in relation to the possibility that these ruins offer to host a second destination, to be

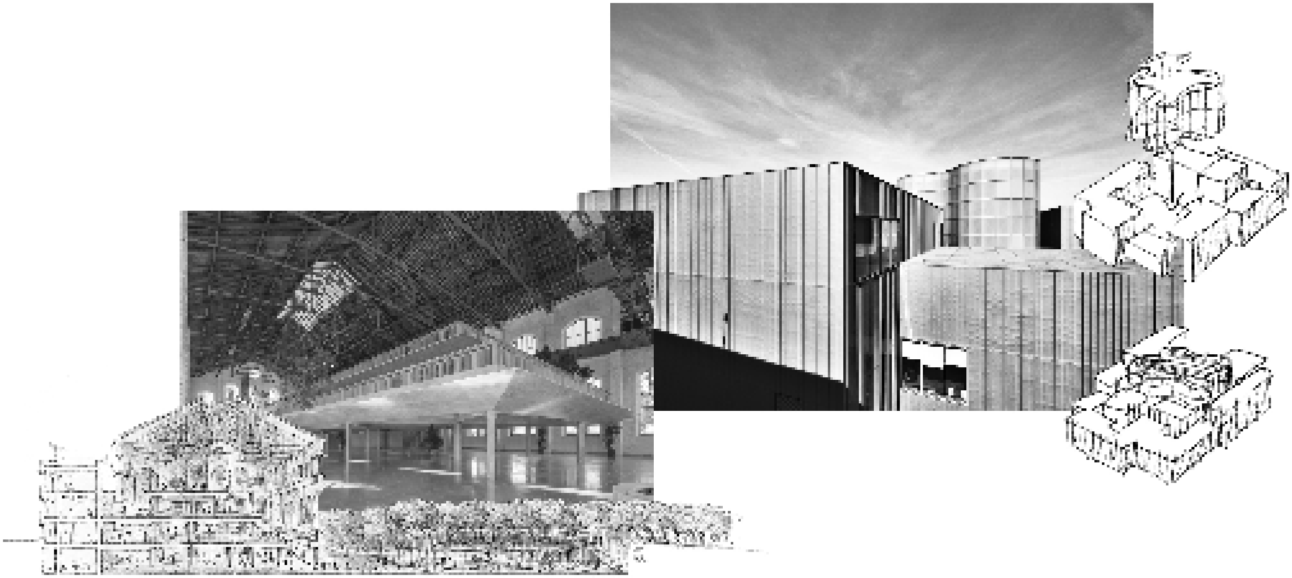


Fig. 4. Examples of architectural projects on the theme of "building within" (Ombù offices in Madrid by Norman Foster, Spain 2022, and Museo delle Culture in Milan by David Chipperfield, Italy 2015) (collage: B. Di Palma and E. De Felice).

reactivated in a contemporary key through the project, precisely starting from the meaning of the term ruin, which in this case takes on a particular meaning since it represents the state of interruption and deterioration of buildings designed to host material production processes and which, once this use is over, also cease to have a role as producers of intangible values related to the dynamism of work, progress and development of cities and communities. This is an affair that began on British territory: "Seventy years have not yet passed since the term "industrial archaeology" first appeared in Britain. It was 1955 and an architectural historian, Michael Rix, coined this expression – an oxymoron apparently – to title an article in which he denounced the state of neglect of the extensive industrial remains on British soil. [...] Seventy years after the issue's origins, however, the process of recognizing industrial heritage and defining its fate certainly cannot be said to be over. This is especially so in the face of an increasing extent of disused industrial landscapes, which have increased in recent decades in proportion to the development of the ongoing Fourth Industrial Revolution, which will be further enhanced by the long-term effects of the Covid-19 pandemic" (Pane, 2021, p. 23). The interpretation of decommissioned industrial heritage as a ruin then takes on an important meaning: if it can be said that "in the ruin is the magical moment of beginning" (Gily, 2006, p. 264) and that "ruins exist through the gaze that is placed on them" (Augè, 2003, p. 41), that of the architect is a designing gaze that projects the interrupted life of industrial ruins forward, through the architectural design it is possible to identify a future for this heritage. In this sense, it is interesting to address the issue of the relationship between destruction and design for industrial ruins, as the architect's gaze traces a second life among the fractures and collapses of destruction, defining "disaster situations [...] as laboratories for conceiving and experimenting" (Emery, 2011, p. 11).

The many experiences and experiments that have taken place in the field of designing for industrial ruins confirm how fertile this terrain has been in delineating certain prevailing approaches that emerge from the interventions carried out internationally such as: "building within", the possibility of redefining the interior space through work on the rearticulation of the original plan and section layout; "adding next to" through experiments involving the addition of new architectural blocks in proximity to the original ones; and "opening up" to the city by considering the ruined space as available for the definition of open spaces in continuity with the meshes of neighboring urban fabric.

However, before exploring the connotations of the new configurations, it is useful to reiterate the principles that make industrial buildings a particularly recognizable segment within the framework of architectural heritage that the contemporary era has inherited. Certainly we can speak of an architecture designed specifically for industry after the Industrial Revolution, as a consequence of the renewal of work processes and in relation to the "Full satisfaction of internal needs sincerely expressed externally, abolition of everything that through simulation or superimposition could distort the essence of construction, tendency to simplicity and economy of expressive means, search for effect no longer

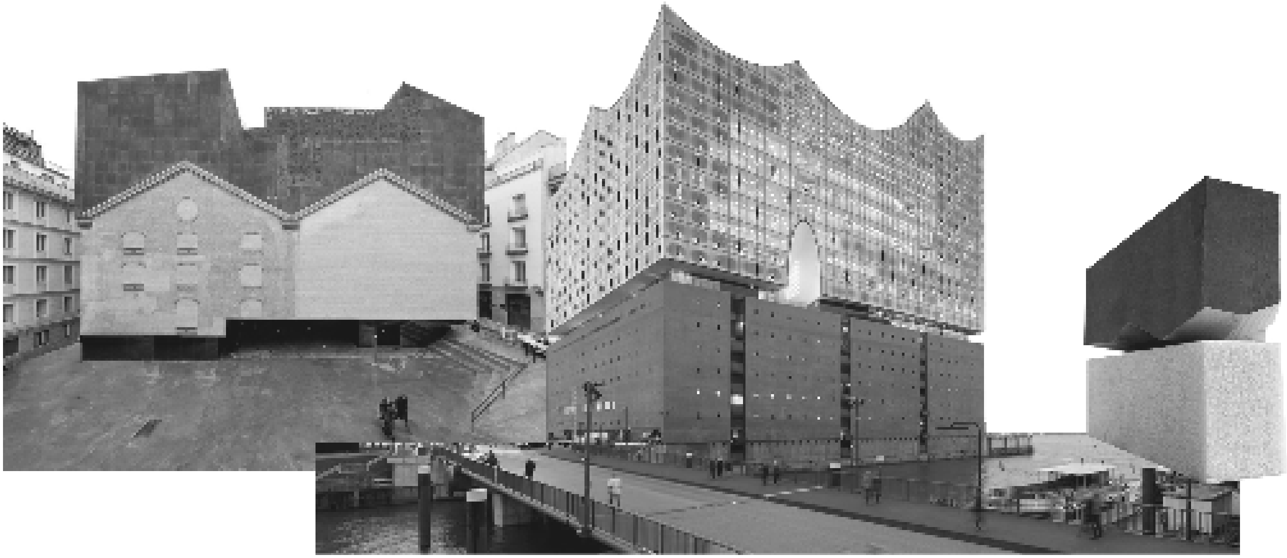


Fig. 5. Examples of architectural projects on the theme of "building within" (CaixaForum in Madrid and Elbphilharmonie in Hamburg by Herzog & De Meuron, Spain 2008 and Germany 2017) (collage: B. Di Palma and E. De Felice).

in the decorative detail but in the rhythm of repeated forms or in the violent contrast of volumes, mass architecture always increasing tendency to the study of the whole of the buildings inherent in the same industry" (Marino, 2024). These may be some of the general characteristics clearly recognizable in industrial architecture. From a typological point of view, industrial architecture, on the other hand, is difficult to define since it contemplates numerous variables related to the diversity of plants, processes and functions with special attention paid to the technological tools supporting the methods of production, in a disenchanted and functionalist perspective that nevertheless has produced numerous examples of particular expressiveness intended also as occasions within which to experiment with daring solutions even from a technical and engineering point of view. "Not infrequently, the industrial building is a kind of laboratory for the study of new solutions, and it is significant, for example, that the use of metal and then reinforced concrete structures first passes through the building-factory, as does the experimentation

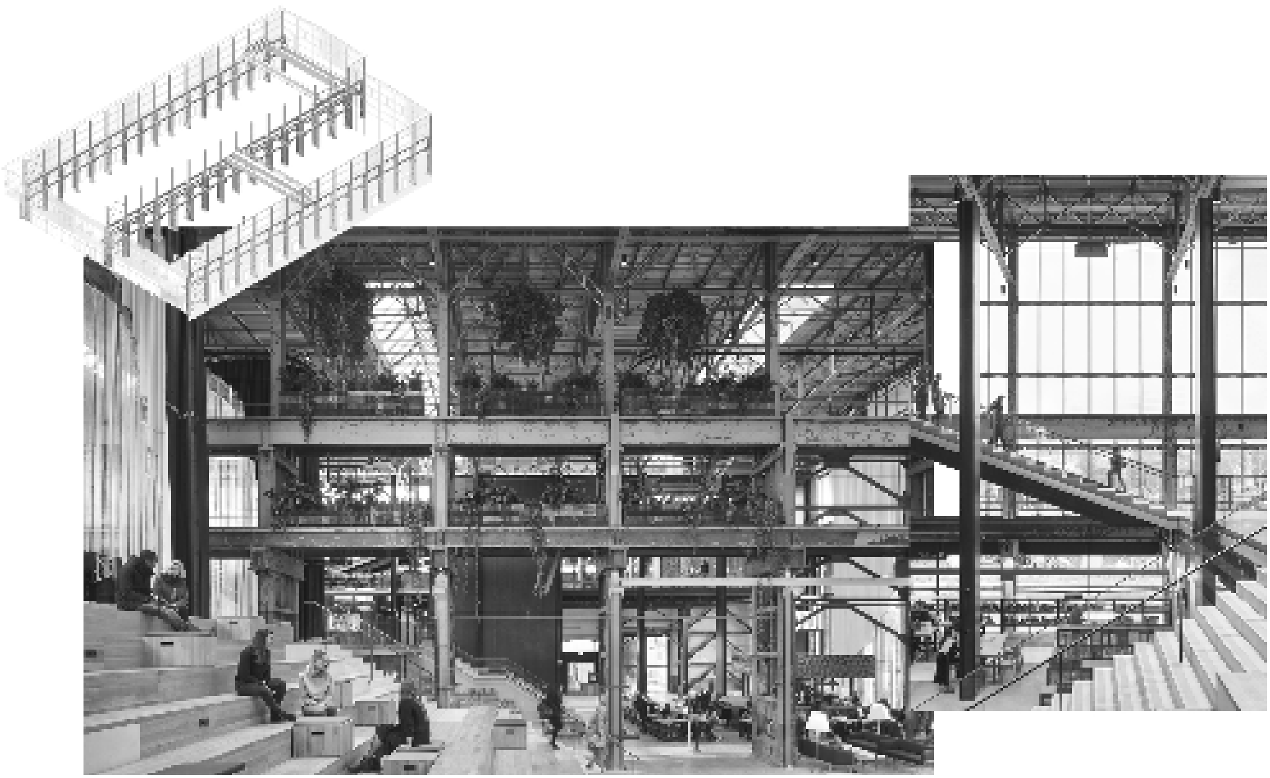


Fig. 6. LocHal public library in Tilburg (CIVIC architects, Braaksma & Roos architectenbureau, Inside Outside and Mecanoo, Netherlands 2018) (collage: B. Di Palma and E. De Felice).

and application of ideas for environmental control and comfort. [...] The industry identifies a thought of rationalization and optimization of materials and products, of processes and applications; the use of iron, steel, and reinforced concrete structures frees the interior space and opens it to light coming from large windows based on significant alliances between architecture and the principles of hygiene. According to Heinrich Albrecht, author in the late nineteenth century of a *Practical Treatise on Industrial Hygiene*, the modern factory needs "light, air, order and rationality": these are "key concepts" that can be considered in tune with the instances of the Modern Movement, not coincidentally capable of transmigrating from the industrial to the architectural tout court. The

Fig. 7. LocHal public library in Tilburg (CIVIC architects, Braaksma & Roos architectenbureau, Inside Outside and Mecanoo, Netherlands 2018) (collage: B. Di Palma and E. De Felice).

interest of modern architects has been revealed in a great many cases, among which I mention only the very famous examples of Behrens' AEG turbine factory or Gropius' Fagus factory: two cornerstones of modern architecture prior to World War I, whose most proclaimed features are precisely, in addition to new structural materials, large glass walls and the almost ethical revelation of the workspace" (Selvafolta, 2018, pp. 8-10) (Fig. 3).

From the perspective of contemporary architectural design solutions, "building within" certainly represents an established modality with respect to the possible dialogue between pre-existence and new architectural intervention. Even in projects for the renovation of industrial archaeology, this approach has been applied in numerous experiments with declinations that mainly concern an action all aimed at the reorganization of the interior space as evidenced, for example, by the interventions for Ombù offices in a former gas plant building in Madrid (Norman Foster, Spain 2022) and by the LocHal public library

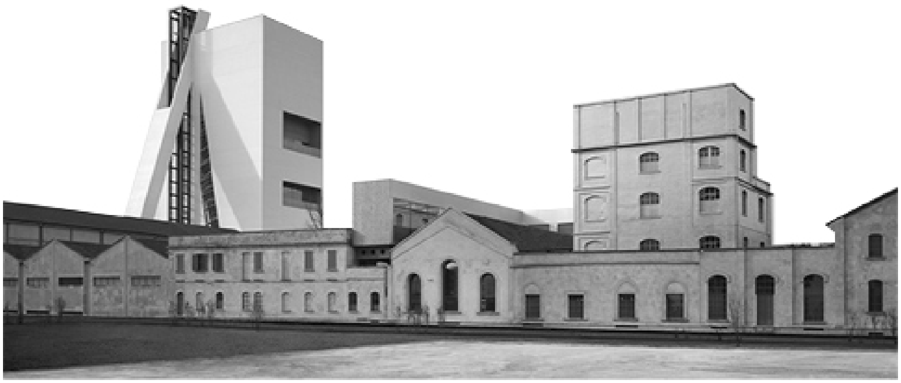


Fig. 8. Example of architectural project on the theme of "Adding next to" (SESC Pompeia in São Paulo by Lina Bo Bardi, Brazil 1986) (editing: B. Di Palma and E. De Felice).

in a former locomotive shed and workshop in Tilburg (CIVIC architects, Braaksma & Roos architectenbureau, Inside Outside and Mecanoo, Netherlands 2018), in which the articulation of the volumetric layout is unchanged; or an action that not only rearticulates the interior space but also reconfigures the development of the volumetric system, often without alteration of the external planimetric layout, as in the cases of the Museo delle Culture in the former Ansaldo area in Milan (David Chipperfield, Italy 2015) (Fig. 4), in the interventions for the CaixaForum in Madrid and the Elbphilharmonie in Hamburg (Herzog & De Meuron, Spain 2008 and Germany 2017), to name a few (Fig. 5).
The LocHal public library is a particularly representative case for aspects related to the dialogue between spatial layout of the existing building and its potential in terms of orienting contemporary design needs understood as an opportunity to renew established structural arrangements.
The intervention desired by the Tilburg administration and designed and implemented by CIVIC architects, Braaksma & Roos architectenbureau, Inside Outside, and Mecanoo aims at the conversion of a large industrial shed built in 1932, which was the site of a busy activity in the construction and repair of railway carriages and locomotives until 2009, when it was decommissioned after the introduction of a new power grid. Since then and until the reuse initiative was launched in 2014, the building had

Fig. 9. Example of architectural project on the theme of "Adding next to" (Prada Foundation tower in Milan by OMA, Italy 2018) (editing: B. Di Palma and E. De Felice).

remained intact but unused. Unlike many other industrial artifacts in the Netherlands, which have been stripped of their history, the building stood intact: therefore, the Tillburg administration decided to transform it into an urban space with which to celebrate the collective memory of a workplace known to many of its inhabitants.
The intention was primarily to create one large covered urban square, an interior space that could represent the spirit of the town as a whole, including in terms of its further development in the future (Fig. 6).

Architecturally, each intervention and addition is independent of the existing structure while respecting its overall character. The design consists of the definition of a large, open interior space overlooked by a series of multi-level perimeter paths designed in continuity with the outer edge of the building and along which is articulated a sequence of spaces that follows the measures and rhythm dictated by the scanning of the existing structure. The perimeter space does not separate the interior from the exterior of the building. On the contrary, a strong and continuous permeability on the ground floor is preserved and implemented with the definition of articulated spatial sequences that define a more compressed space, an annular threshold on the edge and a central dilation corresponding with the great hall in continuity therefore with the outer space of the building. The hall is overlooked by the distribution paths of the first level that connect with the highest level of the staircases that articulate the central space. It is organized flexibly with the possibility of articulating the space into micro-environments, with small rooms defined by light textile borders for the work of groups consisting of a few members, or in the macro-rooms, with large spaces defined by stairways on which events and activities can be organized formally or informally. Old tracks remain visible in the concrete floor and are used to move three large "train tables" on wheels. In fact, the functional program is complex and flexible, intended to define a laboratory for knowledge creation and includes three hundred co-working spaces, an art space with exhibition space, a restaurant, reading areas, an event hall, and a library. The interior space, thus conceived as multiple and becomes representative of an urban landscape that is a reflection of a city in which squares and streets, alleys and houses, objectively closed, but open in a figurative sense, are articulated on different levels and whose visual perception is interconnected (Fig. 7).

The different spaces introduced through the configuration of areas of different sizes and the use of different materials, induces a spatial and temporal dialogue that transcends the boundaries defined by one phase or another of the building, actively preserving the material traces still

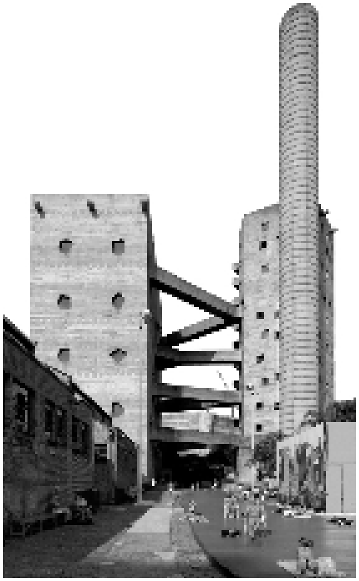


Fig. 10. Expansion of the Tate Modern in London (Herzog & De Meuron, UK 2016). External view (collage: B. Di Palma and E. De Felice).

Fig. 11. Expansion of the Tate Modern in London (Herzog & De Meuron, UK 2016). Internal view (editing: B. Di Palma and E. De Felice).

present and renewing their expressive and use potential.

"Adding next to" is a further possibility of the project, which involves a new building intervention that adds to the architectural plant of industrial origin whose characters it reinterprets and renews in ways that can vary from mimesis to antithesis. A well-established case is certainly the intervention of for the SESC Pompeia in São Paulo (Lina Bo Bardi, Brazil 1986) (Fig. 8); more recently, this approach is developed in the interventions for the Switch House, the completion of the Tate Modern in London (Herzog & De Meuron, UK 2016) and for the Prada Foundation tower built in Milan (OMA, Italy 2018), just to name a few (Fig. 9). These projects include one intervention involving the industrial building and another involving a new addition, almost always connected to the pre-existing building.

The expansion of the Tate Modern certainly represents an emblematic

case in terms of the continuity and at the same time the variations affecting the design of the new addition from the pre-existing building and the first intervention on its interior space. About four years after the inauguration of the first Tate Modern – the museum venue designed, from 1994 to 2000, by Herzog & de Meuron within the industrial shell of the former thermoelectric power station in the Bankside district –, given the international success aroused by the museum of British modern and contemporary art collection that had also triggered a process of local regeneration by creating a new urban landmark on the Thames, the path of expansion was set in motion, with the same architectural firm grappling with an intervention to complete their previous work.
The first intervention involved the Boiler House (referring to the former power plant's mighty boilers) of the power plant, which was transformed into galleries, teaching studios, and social spaces, while Turbine Hall was transformed into a huge open space for special events. 2016 marks the next phase in Tate Modern's evolution, with the addition and opening of a new 10-story building south of Turbine Hall, on the site of the power plant's former Switch House. About the new addition, the two Swiss designers said they wanted to create as unified a volume as possible, rather than one in which the various design phases can be read distinctly; moreover, in their vision, the new museum should offer visitors a variety of interior spaces and "atmospheres", such as gallery types that differ in size, lighting, and circulation.
The Turbine Hall, – a gallery of about 3,300 m2 and 150 m long, located on the east-west axis, used for large-scale art installations and contemporary exhibitions – is the connecting area between the previously built wing and the new addition. The connection between the two museum "wings" is made at different levels by means of vast bridges crossing the scenic space of the Turbine Hall. The new building, with its strong vertical development, is rooted in the underground cylindrical tanks that form the physical foundation of the Switch House and its conceptual starting point, offering new kinds of spaces for a new kind of museum (Fig. 10). The addition takes the form of a truncated pyramidal tower that recalls

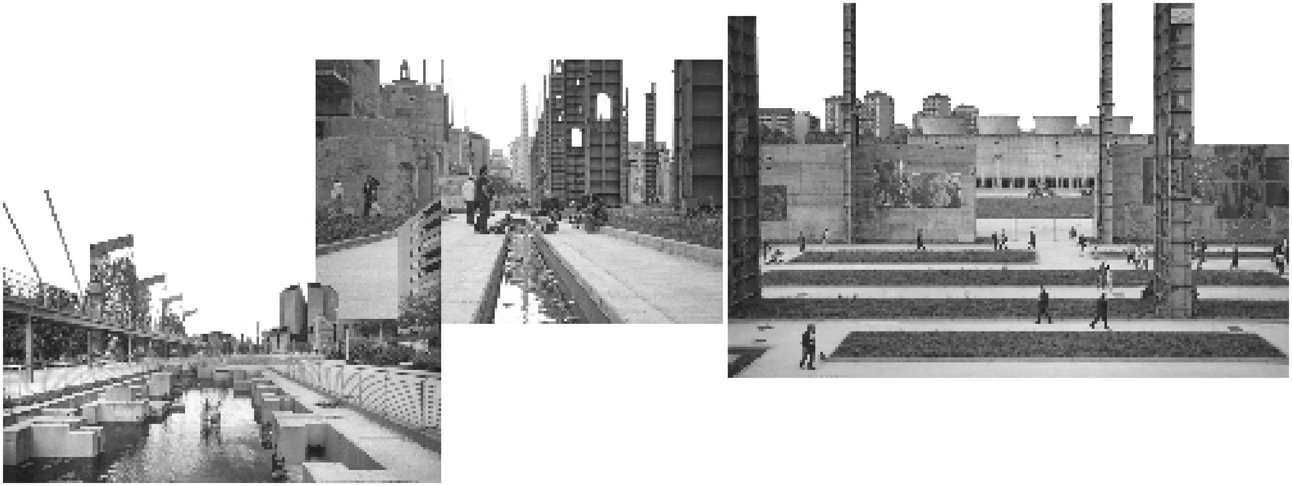


Fig. 12. Example of architectural project on the theme of "Opening up" to the city (Dora Park in Turin by Latz and Partners, Italy 2011) (collage: B. Di Palma and E. De Felice).

the London skyline on the Thames in opposition to the horizontality of the building it abuts and counterbalances. It reinterprets the masonry of the power station in a radically new way: the concrete skeleton is clad in a perforated lattice of bricks that allows light to filter through and is punctuated by thin windows that simultaneously allow visitors to look out over the surrounding landscape (Fig. 11). The resulting exterior creates both an iconic addition to the skyline and a "unified Tate Modern".

"Opening up" to the city is finally an approach that concerns the possibility of acting through subtractions with interventions that deal with open space and that interpret the mutilations of the ruin as a potential that reverses the original relationships between outdoor and indoor spaces to find a deeper relationship between architecture and the surrounding city, in opposition to the traditional enclosure of industrial blocks whose position, however, was often dictated by positional values connected with the more efficient functioning of the production process. "During the twentieth century - in fact - the factory defined a series of enclaves in the urban fabric firmly linked to the territory on which they

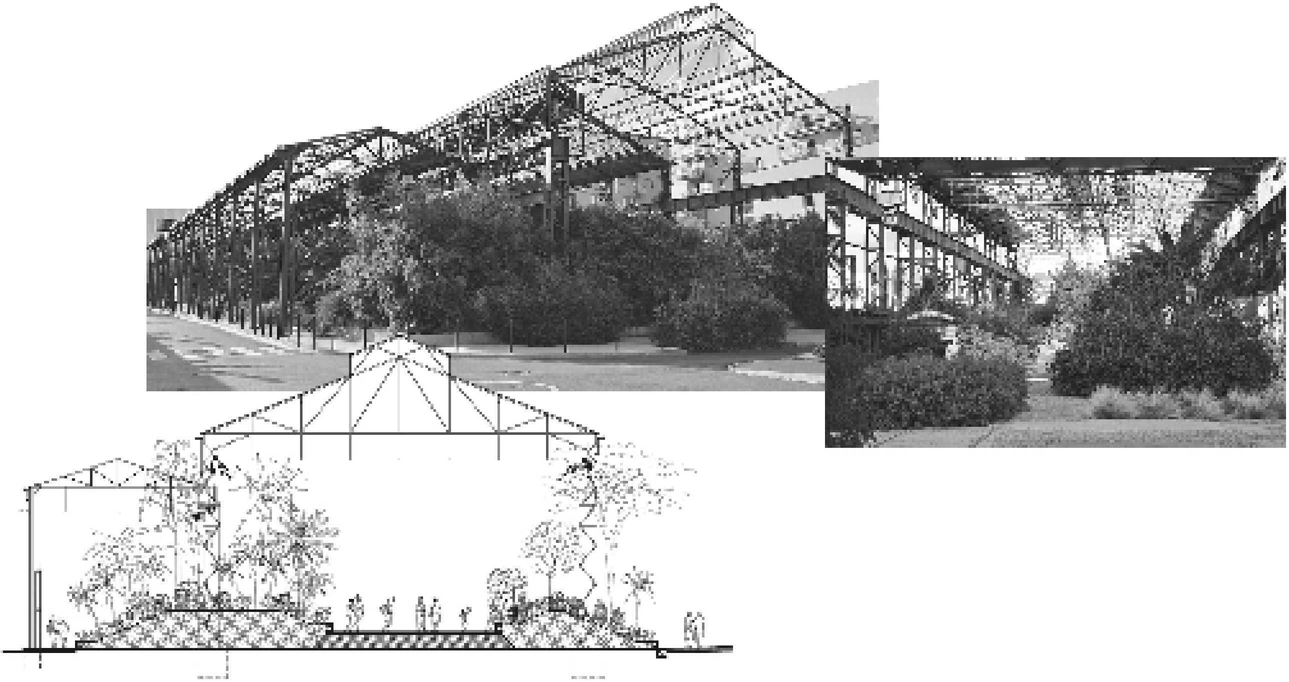


Fig. 13. Example of architectural project on the theme of "Opening up" to the city (Foundries' Garden by Doazan and Hirschberger, France 2009) (collage: B. Di Palma and E. De Felice).

settled, examples of which are the FIAT plants at Lingotto in Turin or the Olivetti complex in Ivrea" (Setti, Corriere). The Dora Park in Turin (Latz and Partners, Italy 2011) (Fig. 12), the Landscape Park in Duisburg North (Latz and Partners, Germany 2002) and the Foundries' Garden (Doazan and Hirschberger, France 2009) are just a few of the projects that testify to how design for industrial ruins can help strengthen the system of public green spaces in cities (Fig. 13).
The Landscape Park in Duisburg North (Latz and Partners, Germany 2002) is certainly the project in which an interest in the old Romantic myth of the attraction to ruin is most apparent, as Peter Latz himself points out in the interview with Udo Weilacher: "[...] the imagination, when is it most stimulated? In a state of harmony or in a state of disharmony? Disharmony, perhaps, produces a different balance, a different harmony,

Fig. 14. Landscape Park in Duisburg North (Latz and Partners, Germany 2002) (editing: B. Di Palma and E. De Felice).

a different reconciliation. [...] These devastated places offer many more possibilities for action, not only for landscape architects, but also for visitors. [...] That is why many people feel attracted to these places [...]. You can be fascinated by a technological landscape and recognize it as a typical landscape segment. This might have been totally uninteresting twenty years ago, but today it is very exciting. There are fascinating and accessible areas to discover right in the center of our cities. We just need to look at them a little closer" (Latz, 2008, p. 134). This is perhaps the most interesting aspect underlying the project carried out in the vast area of a former pig iron and steel production plant in the Ruhr district of Germany, one of the most important contemporary examples of conversion of a disused industrial area into a public park. The project addresses several issues such as: the reinterpretation of the pre-existing industrial structures

(buildings and workshops, gigantic raw ore warehouses, smokestacks, furnaces, bridges, cranes, rails, railroad yards, and more), the purification of the heavily contaminated watercourse and soil, and the need to create a place for recreation, education, and suitable for hosting a variety of social events (Fig. 14). The design attitude that the designers adopted for the design of the park, was not to attempt a fusion of the present elements by combining them into a single homogeneous and uniform landscape arrangement; aware of the strong fragmentation and spatial discontinuity that characterized the site, the designers sought rather, new interpretations of the existing structures, renewing their function and enhancing the context, through the overlapping and coexistence of a series of physical and sense levels characterized by different spatial and functional conformations (Fig. 15).
The traces are not hidden but enhanced; they narrate how industrial artifice can be interpreted in the natural context through the new meanings attributed to these large structures by the design choices. The different levels that make up Duisburg-North Park, while maintaining among themselves a strong independence and autonomous personality, are firmly connected to each other by numerous elements of a physical nature, such as: ramps, stairs, terraces, raised walkways, bridges, etc.; at other times the connection is functional and, at other times, purely symbolic, supported by perspective visual links.
The design experiments described are only a part of the panorama of interventions related to the future of industrial ruins; however, they are sufficient to frame the field of broad possibilities and approaches related to the second life of these architectures and represent an important wealth of examples and best practices to further direct future design opportunities. They also allow for a further reflection that concerns the role of memory in architecture, a theme that is substantiated in design reasoning around the future of industrial ruins: "a memory understood as an active tool in the mental processes of architects. And only this use of memory as a tool, as the material of the project, can make it possible to overcome the traditional opposition between old and new, between

Fig. 15. Landscape Park in Duisburg North (Latz and Partners, Germany 2002) (collage: B. Di Palma and E. De Felice).

preservation and innovation, between conservation and design, in order to claim an architecture of durability that corresponds to this other tradition of modernity: a tradition according to which the innovative languages of modernity and the established languages of history are blended, come into resonance and become complementary" (Croset, 2007, p. 58).

References

Augè, M. (2003). *Rovine e macerie. Il senso del tempo*. Torino: Bollati Boringhieri.

Basilico, G. (1981). *Milano Ritratti di fabbriche*. Milano: SugarCo.

Croset, P. A. (2007). La lezione di Rafael Moneo. In M. Bonino (Ed.). *Rafael Moneo. Costruire nel costruito*, pp. 53-60. Torino: Umeberto Allemandi & C.

Emery, N. (2011). *Distruzione e progetto. L'architettura promessa*. Milano: Christian Marinotti Edizioni.

Gily, C. (2006). Pedagogia dei beni culturali. Educare all'immagine. In G. Tortora (Ed.). *Semantica delle rovine*, pp. 259-270. Roma: manifestolibri.

Latz, P. (2008). Parco Dora, Turin. In U. Weilacher (Ed.). *Syntax of Landscape. The Landscape Architecture of Peter Latz and Partners*, pp. 134-147. Basilea: Birkhäuser Basel.

Marino, R. (2024). Archeologia industriale. <https://www.treccani.it/enciclopedia/architettura-industriale_(Enciclopedia-Italiana)/> (accessed 15 May 2024).

Olmi, E. (2008). Costruzioni Meccaniche Riva. In B. Tobagi (Ed.). *I volti e le mani - Il cinema di Ermanno Olmi*, p. 77. Milano: Feltrinelli.

Pane, A. (2021). The many lives of the industrial heritage. In *Compasses*, No. 37, pp. 22-23.

Selvafolta, O. (2018). Fabbrica e modernità: architettura, funzione, imagine. In *Le sfide dell'architettura. Edifici industriali*, pp. 8-10. Annex to Corriere della Sera n. 16 del 4/8/2018.

Vanore, M. (2012). Project, Heritage, and Landscapes of Production. In *IUAV giornale dell'università, Architecture and Archaeology of the production landscape*, No. 119, pp. 2-3.

CHAPTER 3

Case study: the San Giovanni district and the ex Corradini

Mara Capone

Selecting the former Corradini factory as a case study within the complex context of San Giovanni a Teduccio district was pivotal for highlighting the challenges and opportunities of this peripheral district. The goal is to explore the connections between the abandoned industrial site and the local community, proposing concepts that can promote urban regeneration processes.

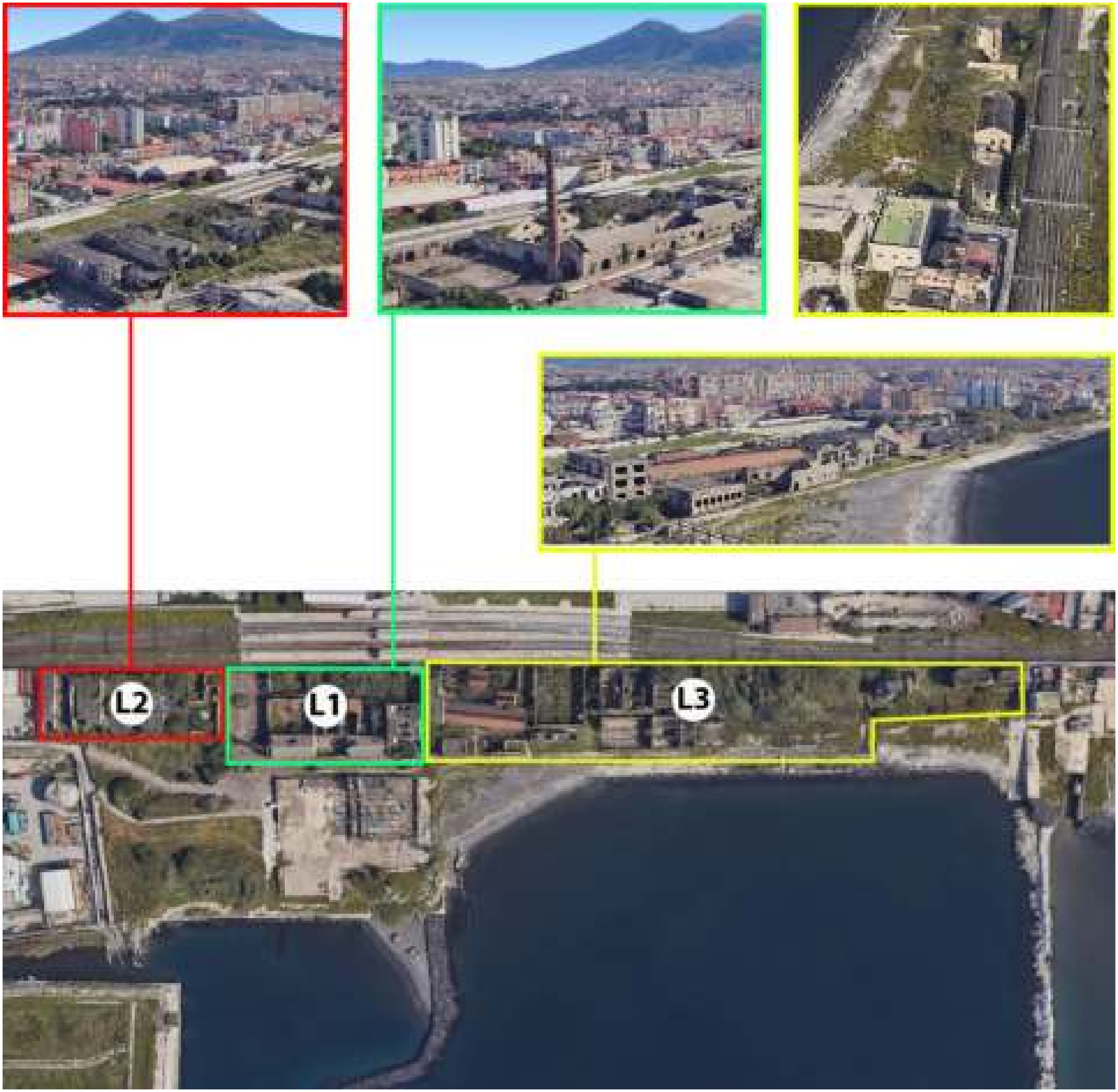
In this chapter we collected some papers that deal with the ex Corradini and S. Giovanni District in order to define a knowledge framework in relation to what has been done and what we can do.

San Giovanni a Teduccio is a former industrial district characterized by large urban voids. It has long been the focus of a regeneration process that has started but is currently stalled. Starting with the former Corradini factory, a strategic location between the railway and the sea, our goal is to work on its limitations and potential to define replicable approaches for restarting urban regeneration processes.

Currently, the S. Giovanni district is in a state of decline, lacking essential services and characterized by numerous abandoned industrial sites. Deindustrialization has significantly contributed to the deterioration of this area, which, although close to the historic center of Naples, is considered peripheral. While the railway provides good connectivity to the city center, it also poses a major limitation by acting as a barrier to accessing the sea.

The surrounding areas include a system of large infrastructures and

Fig. 1. Ex Corradini, industrial heritage. Photo by Maria Ferrara, taken during the Living Lab Inhabiting the City in Transition. Evolutionary Projects for the Reuse of Large Urban Containers (curated by Orfina Fatigato and Gianluigi Freda) included in the program of the Festival of Architecture, CA23 Campania Region Architecture in April 2023.


L2
L1
L3

containers that await new functional and spatial definitions. Some of these have been converted to new uses such as, for example, the former ex Manifattura Tabacchi, in via Galileo Ferraris for which the construction of the Agritech Center is planned or the former Cirio di San Giovanni, not far from the former Corradini, where the today the new research, technological and social innovation center of the Federico II University of Naples which, together with the Apple Academy Developer and other ICT companies, is the expression of a new model of reconversion and development for the east area of Naples.
This regeneration process is also demonstrated by the presence of numerous non-profit associations in the area and by the cultural awareness actions activated by street art such as Jorit's murals which have turned the spotlight on one of the most degraded district, Taverna del Ferro, known as "the bronx". Now it is a point of interest for many curious tourists.
The San Giovanni district is therefore the center of a recovery process also in many programs of the Region and the Municipality of Naples.
The Region Campania is planning the recovery of the eastern seafront, currently denied to citizens, while the Municipality of Naples has acquired the ex Corradini which is part of coast characterized by other large ex industrial buildings of the last century that are also mainly abandoned today, such as the complex of the Pietrarsa railway factories, that has been transformed in railway museum, and the ex-Cirio buildings. Along the coastline we still find the Vigliena power plant and East Naples purifier, which is no longer in use today.
The former Corradini area has seen extensive focus and development efforts aimed at urban regeneration and recovery over recent years. This site, marked by its industrial past, has been the subject of multiple studies and proposals aligned with the broader objectives of urban planning and regeneration as outlined in the General Urban Plan (PRG) and "Piano città per la rigenerazione delle aree urbane degradate". The PRG provided a foundational framework guiding the redevelopment of urban spaces, emphasizing sustainable development, improved liability, and economic revitalization. The "Piano città per la rigenerazione delle

Fig. 2. Ex Corradini. Municipality of Naples division (image edited by Mara Capone).

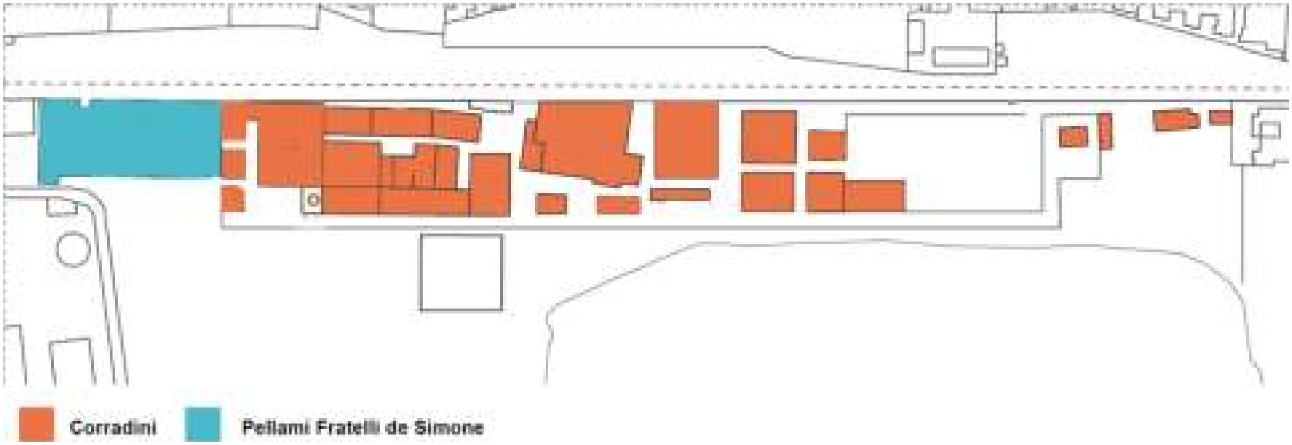


Fig. 3. Funtional division: "De Simone" and "Corradini" (image edited by Mara Capone).

aree urbane degradate", specific to Corradini, included tailored strategies aimed at transforming the area into a functional part of the city, focusing on mixed-use development, green spaces, and community facilities.
The analyzes and reports of these projects of the Municipality of Naples are one of the main sources to study and define a cognitive framework of the ex-Corradini.
These are some of these key topics for define the proposals that we can use as guideline:
Environmental cleanup: One of the main steps involves thorough cleanup and decontamination of the site, addressing soil and water pollution to create a safe environment for future development.
Accessibility: the railway makes the ex-Corradini difficult to access from the urban context
Mixed-use development: Proposals often highlight the importance of creating mixed-use space, combining residential, commercial and recreational facilities to foster a dynamic community environment.
Green spaces: incorporate parks, green belts and pedestrian areas to improve urban aesthetics and provide recreational opportunities for residents.
Community involvement: Involving local communities in the planning

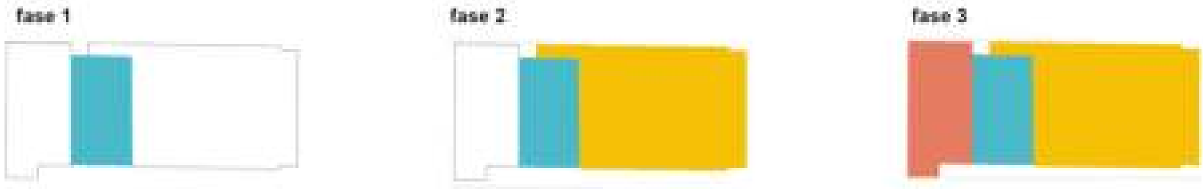


Fig. 4. Pellami De Simone: evolution (image edited by Mara Capone).

process ensured that developments met the needs and aspirations of existing residents, promoting inclusion and social cohesion.
In conclusion, the regeneration of the former Corradini area exemplifies a multifaceted approach to urban renewal, incorporating environmental, social, and economic dimensions to transform a historically degraded site into a key part of the urban fabric. Through strategic planning, community involvement, and sustained investment, the area could achieve significant positive change.
The complex of the ex-Corradini, subject to restrictions pursuant to law 1089/39 (upgrade by Codice dei Beni Culturali, D. Lgs. 42/2004) with decree of 27 February 1990, is thus defined by the name of the last important industrial enterprise of the site and is the result of the annexation of various buildings built in several periods: 54 buildings including warehouses and service buildings, all in a state of abandonment for decades, with partial collapses and very advanced phenomena of instability and degradation.
The ex-Corradini area, owned by the Municipality of Naples, is divided into three distinct lots (Fig. 2):
Lot 1 (L1): A section of the industrial district known as "ex-Corradini," situated centrally between the other two lots.
Lot 2 (L2): The building known as the "former De Simone leather factory," located to the west.
Lot 3 (L3): Another section of the industrial district referred to as "ex-Corradini," located to the east.
This chapter compiles existing projects, some of which have been

Fig. 5. Ex Corradini. Evolution (image edited by Mara Capone).

partially approved by the municipal administration (Lot 1 and Lot 2), as well as project proposals originating from the academic world (Lot 3). The presentation of these projects has been instrumental in defining the framework of knowledge regarding the area and its various challenges.

The fundamental starting point is an understanding of the historical evolution of the complex and its current state of conservation.

The original system of internal roads and squares in the large industrial complex remains unchanged, but the buildings have deteriorated due to prolonged neglect and the corrosive action of the sea. Several structures are total collapsed, caused serious structural damage to others. This has resulted in significant damage, making restoration efforts complex, extremely expensive, and difficult to execute.

Two distinct original production centers can be identified, now merged into the single large former Corradini industrial complex: The Corradini

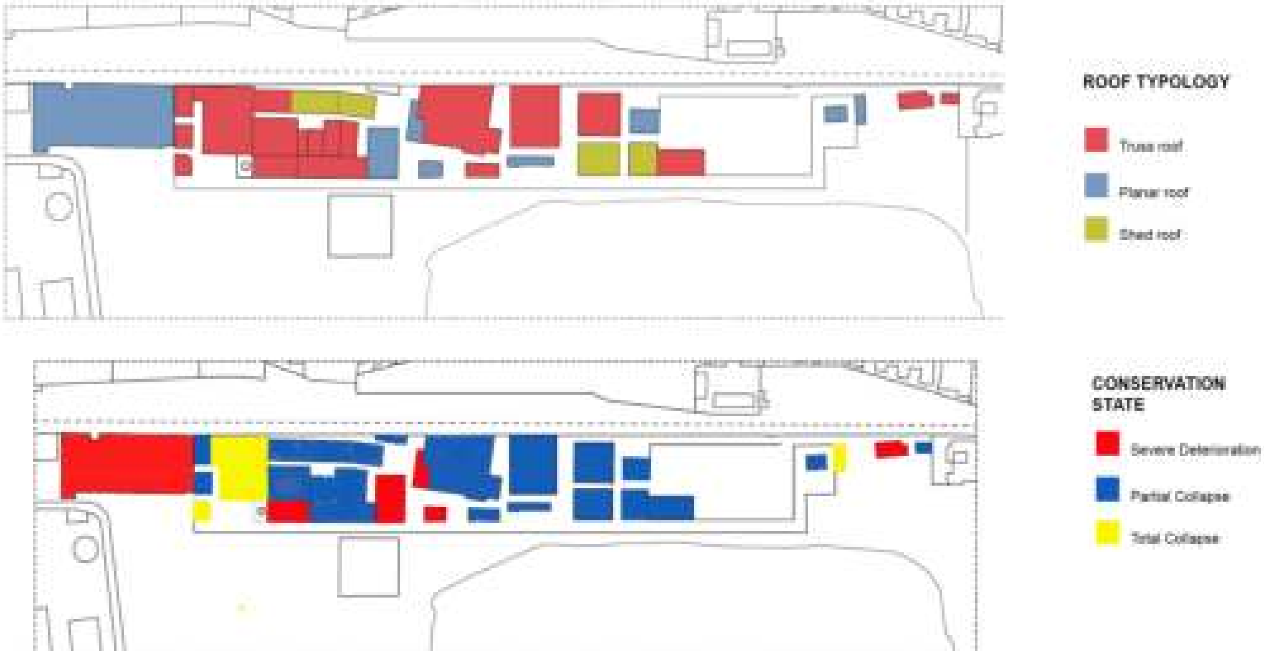


Fig. 6. Ex Corradini. Buildings conservation and typology(image edited by Mara Capone).

metallurgical and Pellami Fratelli de Simone (Fig. 3). Reconstructing the historical evolution of the complex and analyzing its current condition are essential for creating a comprehensive knowledge framework necessary for defining any design hypothesis (Fig. 4). Detailed plans and sheets summarizing the state of most buildings were made available facilitating various representations of the site during the workshop (Figg. 5,6) [1].
Understanding these conditions is essential for developing a comprehensive restoration strategy that balances historical preservation with practical considerations for reuse and revitalization.

Notes
[1] For more informotion about Municipality of Naples Ex Corradini program: https://www.comune.napoli.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/25678.


Pianta
CITTA DI NAPOLI

San Giovanni a Teduccio: from the Vigliena Fort to Federico II University, a territory to be regenerated

Alessandro Castagnaro

For a historiographical-critical analysis of urban and architectural developments in the Neapolitan territory and for the search for the nodal points of the current problems, two fundamental aspects must be highlighted. This text discusses the urban and architectural developments in the Neapolitan territory, focusing on two key issues that have contributed to the current problems facing the city.

The first issue is the erroneous assessment of the orographic structure of the ancient and historic city. The text argues that the expansion of the city was irreparably blocked by certain territorial policy choices that, over time, have proven to be wrong. One of these choices was the creation of an industrial hub with refineries and the consequent increase in port-related activities on the eastern coastal strip. This led to the transformation of the area from agricultural land to an industrial production area. The area grew in a shapeless and uneven way with the neighborhoods of S. Giovanni a Teduccio, Barra, and Ponticelli, both due to the necessarily hasty post-war reconstruction and the lack of an organic industrial plan, among other things.

The second issue is the crucial choice for the city's development on the coast of the establishment of the Cementir and Italsider plants in Bagnoli to the west. These plants inevitably contributed to closing the city in a vice. Even today, more than thirty years after the decommissioning of the industrial production fabric (1992), the splendid Bagnoli plain, despite its high environmental and landscape values, is unable to find its

Fig. 1. Pianta della città di Napoli e de' suoi contorni *(1828-65). Reale Officio Topografico della Guerra 1:7.675 stampa, 67 x 95. Firenze, Istituto Geografico Militare, cartella 90/19.*

Fig. 2. Didier Barra, Veduta di Napoli da occidente*, Hartford, Wadsworth Atheneum, seconda metà del XVII secolo.*

"place" and a tourist-productive identity, even though with the Mayor-commissioner there are finally concrete and effective prospects for a short-term placement (Aveta & Castagnaro, 2023; Aveta & Castagnaro, 2015).

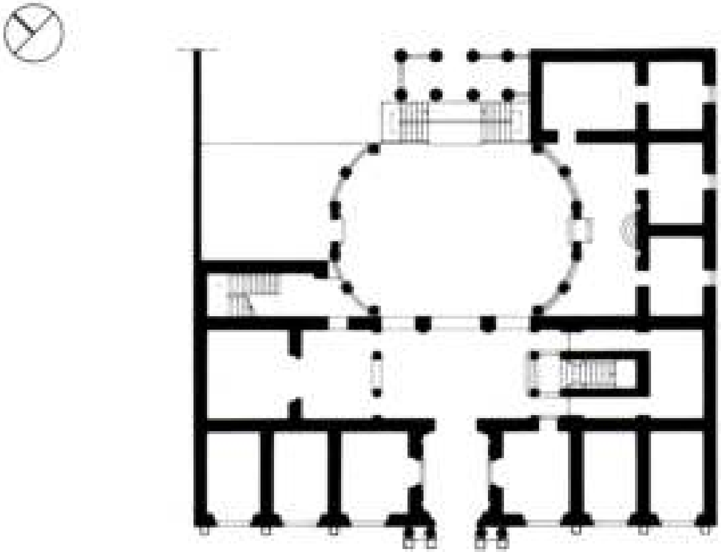
San Giovanni a Teduccio, an eastern district of the city, was once an independent municipality until 1926 when, with the establishment of the High Commission for the Province of Naples, it was included - like Barra, Ponticelli and others - in the city's districts or municipalities. It should be noted that this was a coastal area of considerable scenic value

with a vocation for bathing since the 1700s, enriched by the presence of splendid Vesuvian villas and the opulence of gardens rich in orchards (oranges, lemons and tangerines) from which the definition of Golden Mile for the road that connected it to the city. Among the prestigious villas in the area we remember Villa Cozzolino, built in the 19th century, which takes up historical-archaic forms; Villa Cristina and Villa Faraone. The latter is considered one of the most interesting 19th-century villas in the entire Vesuvian area for its internal courtyard, which is its most valuable architectural element, for its double elliptical exedra with the

Fig. 3. Georg Friderich Bolte, Wilhelm Wiltoff, Napoli. La veduta dal Belvedere della Certosa di San Martino, sotto il Castello di S. Elmo *(1840 ca.), stampa, 24 x 35 (4 fogli) Napoli, Biblioteca Nazionale, Sezione Manoscritti e Rari, Ba. 19 (80 1- 4).*

Fig. 4. S. Giovanni a Teduccio. Villa Faraone (1855). Facciata sulla strada.

tenaglia staircase with a pergola of eight columns (Venditti 1959, p.49).
There are also many other prestigious villas in the San Giovanni a Teduccio area, including Villa Papa, Villa Paudice, Villa Scarinzi, Villa Vacca, Villa Vignola, Villa Vittoria, and Villa Volpicelli. In addition, Palazzo Procaccini and Palazzo Robertelli are also worthy of attention (De Seta et al., 1980).
A further distinguishing feature of the Golden Mile – once the Royal Calabrian Road that connected San Giovanni a Teduccio and Barra, continuing on to the towns of San Giorgio a Cremano, Portici, and Ercolano – was that, in its relationship with the surrounding countryside, uphill towards Vesuvius and downhill towards the sea, the complex of all these buildings represented a close, effective, and valuable connection between asset and nature.
As we have already seen, this area, starting from 1820, was marked by a series of events that established its predominantly industrial vocation, giving rise to a century of development and innovation, the emblem of



which was the construction, in 1839, of the Naples-Portici railway line and the relative station still present on the main road; the first Italian railway used by bathers seeking pleasant and welcoming beaches along a coastal strip at the time still accompanied by a hinterland marked by the presence of windmills for processing wheat. Soon after, the industrial economy took off, which, on the one hand, erased the serene image of the resort, but on the other hand, gave a strong boost to employment, increased from 1872 with the establishment of the Corradini plant, which later became Cirio-Corradini (Picone, 2019).

This was a large industrial complex that remained active until the early part of the second half of the last century. Today, it is heavily affected by the weight of a degraded periphery which, despite its many qualities, including its scenic beauty, is in a state of abandonment amidst disused industrial complexes and unhealthy areas. It should not be overlooked that the railway, once a fundamental element of connection with the city, with its route following the coastline, today represents mainly a physical

Fig. 5. On the left. S. Giovanni a Teduccio. Villa Faraone (1855). L'ingresso con la serliana prospiciente lo scalone.

Fig. 6. On the right. S. Giovanni a Teduccio. Villa Faraone (1855). Pianta del piano terreno.

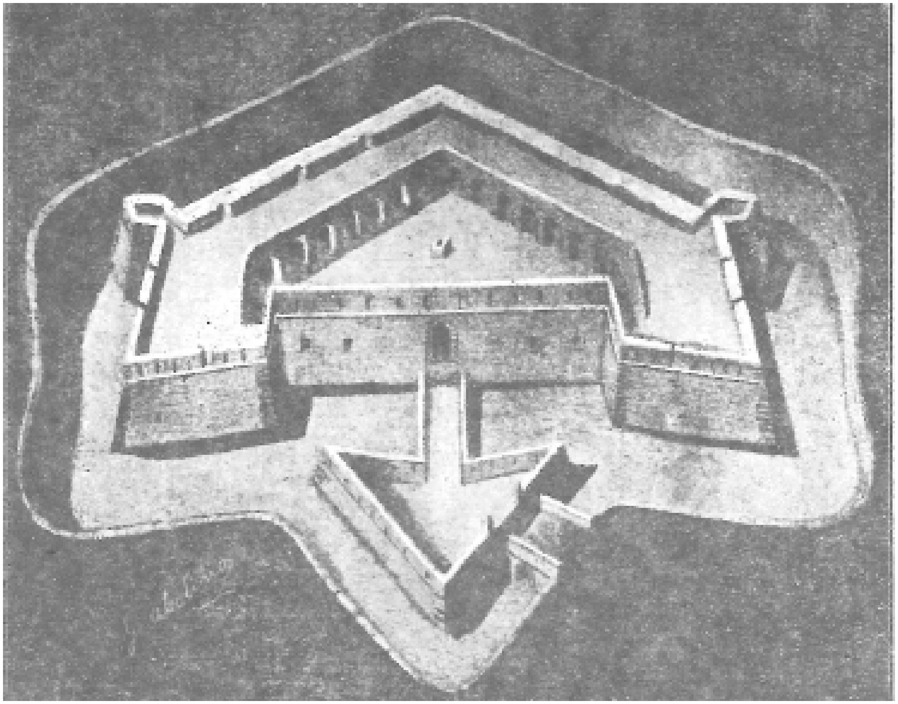


Fig. 7. Forte di Vigliena nel 1706. Ricostruzione grafica dell'ing. G. Abatino.

and perceptual barrier between the city and the sea, contributing to the impoverishment of the territory. At a time in history when there is a movement to reconnect the city to the sea, this physical separation constitutes an insurmountable barrier.
Among the artistic pre-existences of the area, with high historical value as a material asset for what survives, and immaterial for its high historical and symbolic values, is the so-called Forte di Vigliena, a structure of 18th-century origin, commissioned by the Marquis of Villena - from whom it takes its name - in San Giovanni a Teduccio (Abatino, 1999; Grillo, 1959). Another rather unfortunate work, shortly after its erection it seemed too large to be used for a single purpose, so that artillery arsenals and a rope factory were installed. It was then used as a prison for the supporters of the Neapolitan Republic of 1799 and, during the cholera epidemic

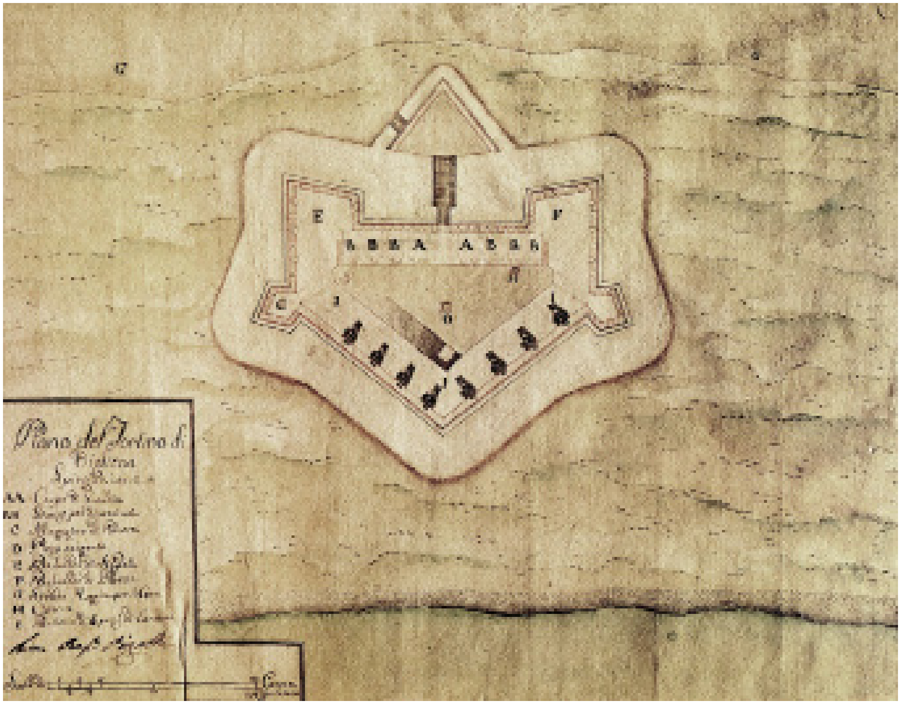


Fig. 8. Disegno della pianta del Forte di Vigliena firmata da Juan Bap.ta Bigotti. Archivio di Stato sala Piante. Busta 22 n.3.

of the years 1836 and 1837, it was also used as a hospital. It was also considered a convenient landing place for boats, since it had a landing stage on the sea, until its demolition in more recent times. Today it can be considered a national monument, a structure rich in history and historical and architectural values that requires redevelopment and enhancement. On the intangible values, linked above all to the events of 1799, we refer to the bibliography, here we focus on the architectural values of the work. Built by the military engineer Don Filippo Marinello during the reign of Philip V of Bourbon as a watchtower fort in defense of the coast, according to neoclassical taste it had a five-pointed plan, with a moat surrounding it and a wooden bridge to cross it.
A work already legible - as noted in an interesting publication by G. Ascrizzi and L. Esposito on the Fort in the Duca Noja cartography of

Fig. 9. Forte di Vigliena. Particolare dello stato di abbandono odierno (2022). Foto di C. Castagnaro.

1775 that 'clearly shows a plan of the said fort, which is located just south of the Marina tre Torri'. Ascrizzi and L. Esposito on the Fortress in the Duke of Noja's cartography of 1775, which 'clearly shows the plan of the aforesaid small fortress located just south of the Marina delle tre Torri'. To confirm this, an interesting watercoloured document with measurements expressed in Neapolitan canes is kept at the Naples State Archives.

It is a typical defensive structure of the time, with outworks, low bastioned walls, a guardhouse, a powder magazine, casemates, and a triangular entrance structure located beyond the moat and with its vertex opposite that of the fort. The materials used for its construction are also worthy of note: large-cut tuff stone, except for the corners reinforced with resistant blocks of Vesuvian lava stone, which also formed the parapet of the seaward side. In fact, yellow tuff, a typical material of Campania and Naples, is softer and sometimes crumbly, therefore the author, as a good military engineer, designed reinforcements in all the parts most exposed to war attacks from the sea and in the parts where there are the greatest structural stresses with a lava stone from the nearby Vesuvius, still particularly active at the time, which assumes a remarkable hardness and resistance.

Beyond its military architectural value, but still for reasons related to its function, the Fort became famous in 1799, the year of the Neapolitan Revolution. It was January 23rd when the Neapolitan Republic was proclaimed in the city and King Ferdinand IV of Bourbon was forced to board the English ship of Admiral Nelson bound for Sicily. Precisely because of these events, the Fort, abandoned and damaged in 1891, thanks to the initiative of the parliamentarians Imbriani and Villari, was declared a national monument and therefore subject to restoration work. Since then, great attention has been paid to it, even by figures such as Benedetto Croce, with his magazine Napoli Nobilissima (AA.VV., 2021).

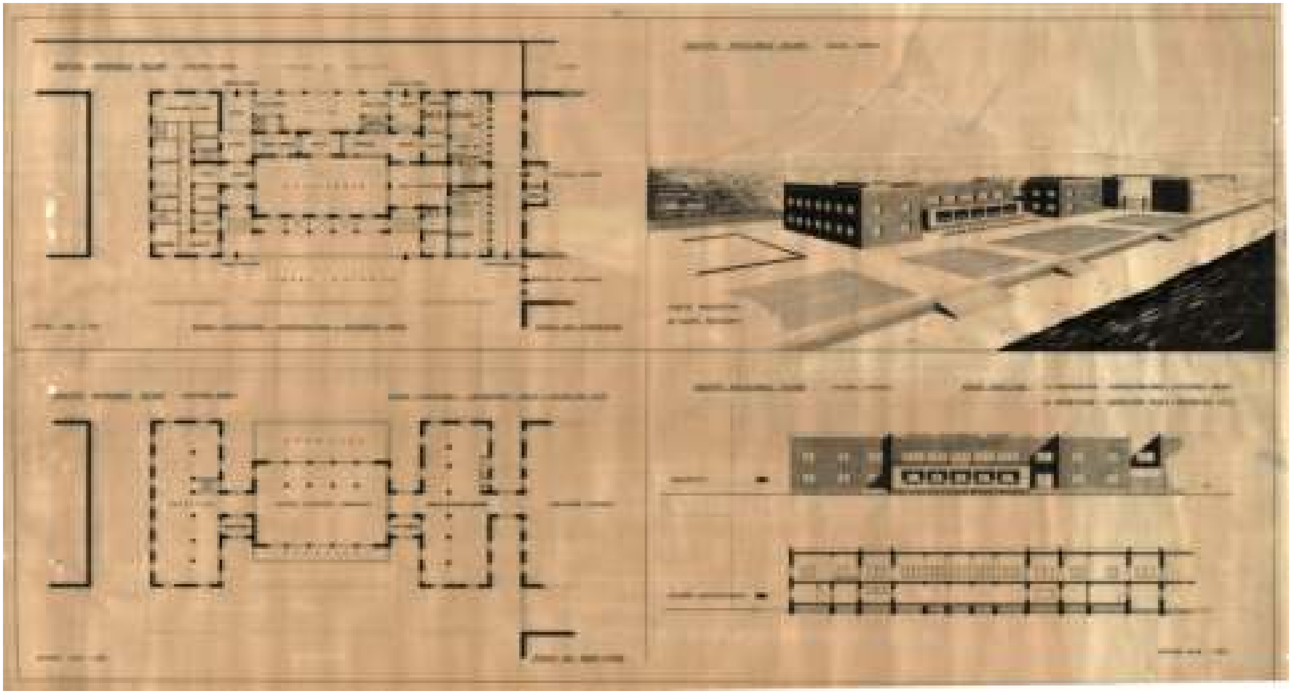
As the San Giovanni area resolutely seeks urban regeneration and the coastline, with its intact panoramic value, awaits a well-deserved environmental requalification, the fort, although an iconic national monument, remains in a state of utter abandonment and is unknown to a large part of the local community and the city. Personally, I do not believe that this structure can take on a different use, especially in the state it is in, but surely, even in its ruined state, it can be enhanced with a "green project" that gives it that rightful symbolic value for memory, as a flywheel for a desirable regeneration of the entire area and an adequate process of knowledge. We should not overlook the judgment on the alterations that the suburbs have generally undergone, particularly in the post-war reconstruction phase and at least until the 1980s of the last centuries when, with massive conurbation, coasts and slopes were altered up to the slopes of Vesuvius, despite being an area at risk of eruptions.

An urban layout originally characterized by hamlets and farmhouses that is now instead 'an uninterrupted series of houses suffocating the city but has irreversibly exploded, wiping out the point system that characterized the original one, pulverizing the values of recognizability and collective identity for having irresponsibly absorbed the echo of Neapolitan building speculation, ever since the years of the Laurin reconstruction policy and subsequent planning works, and for having lived parasitically behind the metropolis» (Visone 2009, p. 111). Another interesting industrial cluster is the already mentioned former Cirio plant in Vigliena (Picone, 2019; D'Arbitrio & Ziviello, 1992) which was refurbished in 2011 to house the workshops of the San Carlo Theatre of Naples in order to promote a training center with various performing arts and exhibition activities, and where the theatre's historical archive is also kept: images, photographs, autographs, sketches, plans, theatre programmes, documents, etc. Another excellence, on the border with San Giorgio a Cremano, is the Pietrarsa museum, on the site where Italy's first locomotive factory was set up in 1849.

Nonetheless, the area has several points of attraction, including the hub of excellence constituted by the new Engineering campus of the University of Federico II, created with the intention of decongesting the Fuorigrotta campus of the same faculty. A project in which the University is also involved in socio-political aspects since it wants to contribute, through the university campus, to the urban regeneration of a degraded and abandoned area. The same complex, which has been in operation for several years now, is also home to the Apple Academy and other significant institutions. A worldwide excellence, home to international groups that attract students and researchers from all over the world.

With these objectives in mind, a memorandum of understanding was signed on 31 March 1998 jointly by the Ministry of the University, the Campania Region, the City of Naples and the Federico II University, led by the Rector at the time, Fulvio Tessitore. The Ministry and the Region undertook to finance the work, the City Council to prepare the necessary urban planning variant, and the University to purchase the former Cirio area in Via Nicola Protopisani from the bankruptcy receiver.

Once the administrative bureaucratic process had been set in motion, the purchase of the entire area was formalized in 2002 and the international tender was launched for the choice of the designer, which was won by the group consisting of the Japanese Ishimoto Europe, Ishimoto Architectural & Engineering Firm Inc. architect Francesco Scardaccione and Corbellini srl (Castagnaro, 2019).



A project, the one later developed by Rector Guido Trombetti, with social values that were expressed in a vast open area: a sort of green park included between the main thoroughfares of San Giovanni, Corso Nicola Protopisani and Via Nuova Villa, and with an entrance also from Via Pietro Signorini, not circumscribed and usable only by the University's staff, but open to citizens.

Fig. 10. Industria Meridionale Pellami stabilimento di Vigliena. Progetto Ugo Mannajuolo, 1930 ca. (da A. Castagnaro, F. Castiglione, Giuseppe e Ugo Mannajuolo: ingegneri e architetti tra neoeclettismo e razional-funzionalismo*, Editori Paparo, Roma 2020).*

An urban layout strongly characterized by its permeability with the surrounding historical buildings - as opposed to the old Cirio factory, enclosed in a compact enclosure - which, with its surrounding greenery, stands as an integral part of the context on an urban scale with a complex, although avowedly modern, capable of dialoguing with the pre-existing buildings. The architectural layout, with a rationalist matrix, is spread over several buildings on the edge of the vast lot, within the large green

Fig. 11. Marina di Vigliena, Porto Fiorito. A sinistra visibili i ruderi della vecchia fabbrica Corradini.

area where the designers blend the Italian culture of the piazza with the oriental culture of the Japanese garden. It is shaped by a series of squares divided between those at the entrance, facing the public streets, and those inside the Campus, all characterized by the surrounding architectural volumes and a large park-like courtyard configured with alternating rows of trees of different essences - pines, olive trees, plane trees, lemon trees - and grassy areas or small artificial mounds that identify different rest areas. The buildings housing the university activities, while maintaining constant heights of four storeys each, have different volumes and façade treatments: two of them are marked by a volcanic stone base, the other two have walls - sometimes punctuated by imposing steel pilotis - consisting of large high-tech windows reflecting Vesuvius and the surrounding landscape

Fig. 12. Marina di Vigliena, Porto Fiorito. Realizzazione di un porto turistico e relative infrastrutture a terra (2012).

The overall project envisages a development of two hundred thousand cubic meters for classrooms, libraries, laboratories, departmental studies, a conference center for approximately one thousand eight hundred students and two hundred and fifty lecturers and a large basement for parking, a center for teaching, with more than one thousand seats in classrooms, and the vast suspended Aula Magna, equipped with advanced technology systems.
At the same time, the area also saw the development and redesign of the rail and road transport system and a new railway station for rapid connections. Therefore, this most recent Hub of the Federico II, in addition to being a complex with multiple architectural qualities, also linked to the contemporary needs of environmental impact, alternating between built and green areas, also represents, as per its original intentions,

Fig. 13. Nuovo polo universitario "Federico II" nell'area ex "Cirio". San Giovanni a Teduccio, 2008. Foto di R. Fellicò.

Fig. 14. L'ingresso al polo universitario. Foto di R. Fellicò.

a multi-ethnic and multi-cultural university campus, characterized by being a center of interaction between didactics, research, CNR and advanced industrial and entrepreneurial groups, bringing very significant training and work opportunities.
A Hub that is having a strong impact in a process of urban redevelopment also on local tertiary activities, in an area that from peripheral could become strategic for a significant reconversion, stimulating the local community to a strong sense of belonging, as envisaged by the FARO convention, an operation also highly appreciated by the European Commission as a good practice in the use of European funds. Finally, a further contribution would come from the redevelopment of the coastal strip with leisure activities, bicycle paths, and green areas for a renewed enjoyment of the sea and the coast - while also enhancing the infrastructure connecting the coastal strip to the islands.
In conclusion, starting from the historical knowledge of the places and their artistic, environmental and landscape values - with new re-functionalization and without neglecting the intangible assets, clear evidence of the site's values - a regeneration must be carried out that sees local communities and their quality of life at the center of the process.

References

Aa.Vv. (Eds.) (2021). *Il Forte di Vigliena*. Napoli: Editori Paparo.

Abatino, G. (1999). *Il Forte di Vigliena – una ricerca topografica e storica*. Napoli: Edizioni dell'Anticaglia.

Aveta, A., & Castagnaro, A. (Eds.). (2003). *Patrimonio culturale e naturale della Campania: Rigenerazione urbana*. Napoli: Fedoa Press – Editori Paparo.

Aveta, A., & Castagnaro, A. (Eds.). (2015). *Rigenerazione e riqualificazione urbana*. Napoli: Artstudiopaparo.

Castagnaro, A. (2019). Complesso universitario di San Giovanni a Teduccio. In A. Castagnaro (Ed.). *Passeggiando per la Federico II*. Napoli: FedOA Press.

D'Arbitrio, N., & Ziviello, L. (1992). *Dal Grand Eden Hotel di Piazza Amedeo alla Fabbrica Cirio di Vigliena*. Napoli: Ed. Fiorentino.

CHAPTER 3

De Seta, C., Di Mauro, L., & Perone, M. (1980). *Ville vesuviane*. Milano: Rusconi Immagini.

Grillo, F. (1959). Cosenza e gli eroi di Vigliena del 1799 un volume di storia dell'Arcidiocesi cosentina. In *Estratto da Calabria nobilissima*, Vol. XIII, No. 37.

Picone, R. (2019). Tutela e Restauro del patrimonio costruito della Federico II. In A. Castagnaro (Ed.). *Passeggiando per la Federico II*. Napoli: FedOA Press.

Venditti, A. (1959). La costa vesuviana da Napoli a Torre del Greco e la mappa del Duca di Noja. In Aa. Vv. (Eds.). *Ville vesuviane del 700*., pp. 19-51. Napoli: Edizioni scientifiche italiane.

Visone, M. (2009). Paesaggi perduti. L'hinterland napoletano e la mutazione dell'identità urbana. In C. de Seta & A. Buccaro (Eds.). *I centri storici della provincia di Napoli*. Napoli: E.S.I.

Crossing around San Giovanni a Teduccio

Mario Ferrara

«*We know, as we recognize the commonness of places, that this is our world and that the photographer has not cheated on his way to his affirmation of meaning*» (Adams, 1983).

The series of photographs presented here, relating to the San Giovanni a Teduccio district of Naples, is a selection taken from the photographic campaign created for the ECO_REGEN research project Circular economies and regeneration of peri-urban territories of the Department of Architecture of the Federico II University of Naples. The focus area covered by the study included the neighborhoods of Naples San Giovanni a Teduccio, Barra and Ponticelli and extended eastwards to the municipality of Castellammare di Stabia. The research program aimed to study the relationships between the concepts of the circular economy to examine in depth the potential situation of the urban and social regeneration of the peri-urban landscape in the metropolitan area of Naples and to guide new interna-tional research programs. Therefore, the aim was to rebuild the balance in the net of rejeted peri-urban open spaces, with reference to the panorama of wastescapes, spaces degraded from a social, environmental and economic point of view, whose circular regeneration requires multidisciplinary, systemic and inclusive approaches. As evidence of the strong interdisciplinarity that characterized the research program, a systematic action of detecting the focus area was prepared and conducted by me, through the tool of photography. The photographic campaign, entitled LOOKING TO THE N_EST, aimed to provide a contribution thanks to the dual character of the language of photography, committed to the representation of anthropized space: on the one hand its fact-finding capacity of what it represents, on the other its intrin-sic power of revealing the examined places.

The cartographic mapping of the peri-urban area was supported and integrated by the photographs of the places, intended as a tool to bring out the complexity of the territory for the identification of fur-ther descriptive indicators.

Just like *The Walking Man* [1], one of the major manga comics by Jirō Taniguchi (1990), capable of observing simple things during his long walks in the city of Tokyo, it was necessary to get ready to regain the pleasure of amazement towards the ordinary, crossing the places in solitude and silence.

Perhaps, these were the essential elements for looking at the territory in depth and not just seeing its surface.

Notes

[1] The Walking Man (歩くひと, Aruku Hito) is a Japanese manga by Jiro Taniguchi. It was serialized in Kodansha's Morning Party Zōkan from 1990 to 1991.

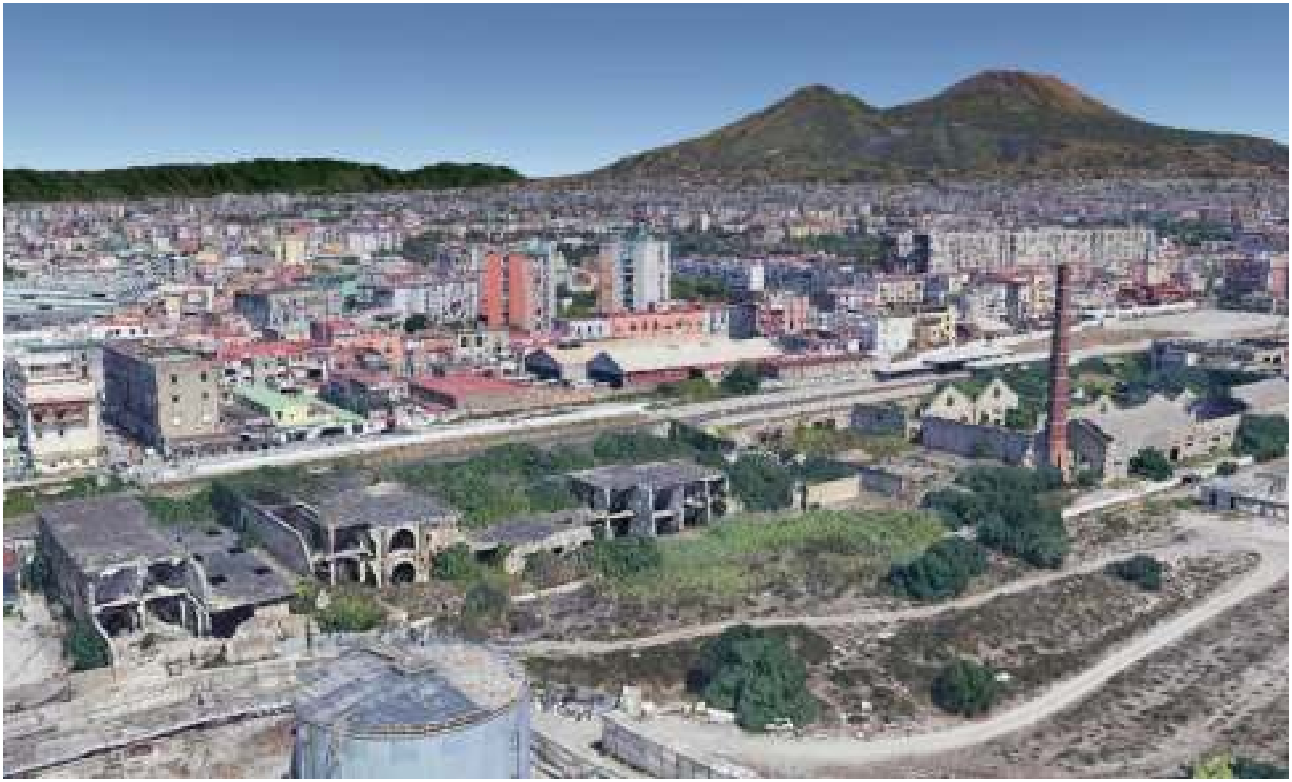
References

Adams, R. (1983). Introduction. In D. Wolf (Ed.). *The American Space: Meaning in Nineteenth-Century Landscape Photography*. Wesleyan University Press.


ESSERE
UMANI
DIOS UMANO

Crossing around San Giovanni a Teduccio

Mario Ferrara




Napoli Garibaldi
Vesuvio

GRID: a project for the future of the city

Marella Santangelo, Paolo Giardiello

The Green Innovation District (GRID) proposal is the result of a collaboration between numerous institutions that have strongly and competently supported this initiative from the outset, with the aim of creating an international-level hub in the Green Innovation sector to host public and private initiatives in the field of Research, Innovation, Technology Transfer, Business Creation, Specialized Training and Scientific Dissemination on the themes of digital and sustainability - with particular reference to some areas identified by the European Green Deal: Energy, Construction, Industry, Mobility, Green IT. The Green Economy in Southern Italy, and in particular in Campania, is among the sectors with the highest growth potential and can count on important production chains and districts.

The GRID aims to capitalize on the strengths of its partner universities, which excel in training highly skilled professionals in cutting-edge technologies and attracting international talent. This has facilitated the development and launch of training and innovation clusters with the involvement of renowned multinationals like Apple, CISCO, Deloitte, Accenture, Capgemini, Altran, IBM, TIM, Leonardo, FCA, Merck, Dompè, and Novartis, alongside prominent national companies such as Almaviva, Terna, and FS.

The overarching vision for the GRID encompasses a comprehensive approach to sustainability, encompassing not only environmental and energy considerations but also social aspects. This entails promoting

Fig. 1. The area of the former Corradini from above and the nearby landscape references (source: the authors).

Fig. 2. Identification of plot 2 of the GrID project (sorce: the authors).

urban regeneration, enhancing energy efficiency and conversion, embracing the circular economy, developing renewable energy sources, and ensuring the safety of the territory. The GRID will be structured as an interconnected Hub & Spoke model, seamlessly integrating with a vast network of university laboratories, public and private research centers, and businesses operating both regionally and nationally. It will feature a collection of shared facilities and infrastructures.

The area where the redevelopment intervention is planned is within the so-called Corradini complex, along the coast of the eastern area of Naples, in the San Giovanni a Teduccio district, and is historically characterized by a predominantly suburban condition crossed in the post-war period by a consistent process of industrialization, started in the early decades of the last century. The complex is physically squeezed, since its origin, between the railway line and the coast, with few possibilities of significant expansions except in the longitudinal direction to the beach line, on which it overlooks, which today is characterized by stretches of buildings still standing that testify to ancient forms of industrial

Fig. 3. Orthophoto from above of the former Corradini area (sorce: the authors).

architecture, telling the past between stratifications and tampering, mostly inaccessible. Accessibility to the eastern coast of Naples has long been a challenge, currently solely reliant on an underpass aligned with one of the side streets perpendicular to Corso S. Giovanni. This underpass is the first in a series that punctuates the relationship between the city and the coastline all the way to Castellammare di Stabia.

The Corradini complex, encompassing both Lot 1 and Lot 2, is in a state of advanced disrepair. Lot 2 holds strategic significance due to its size - approximately 7,000 square meters of gross building area - and its waterfront location. Additional crossing structures over the railway barrier could connect it to the San Giovanni subway station and bring

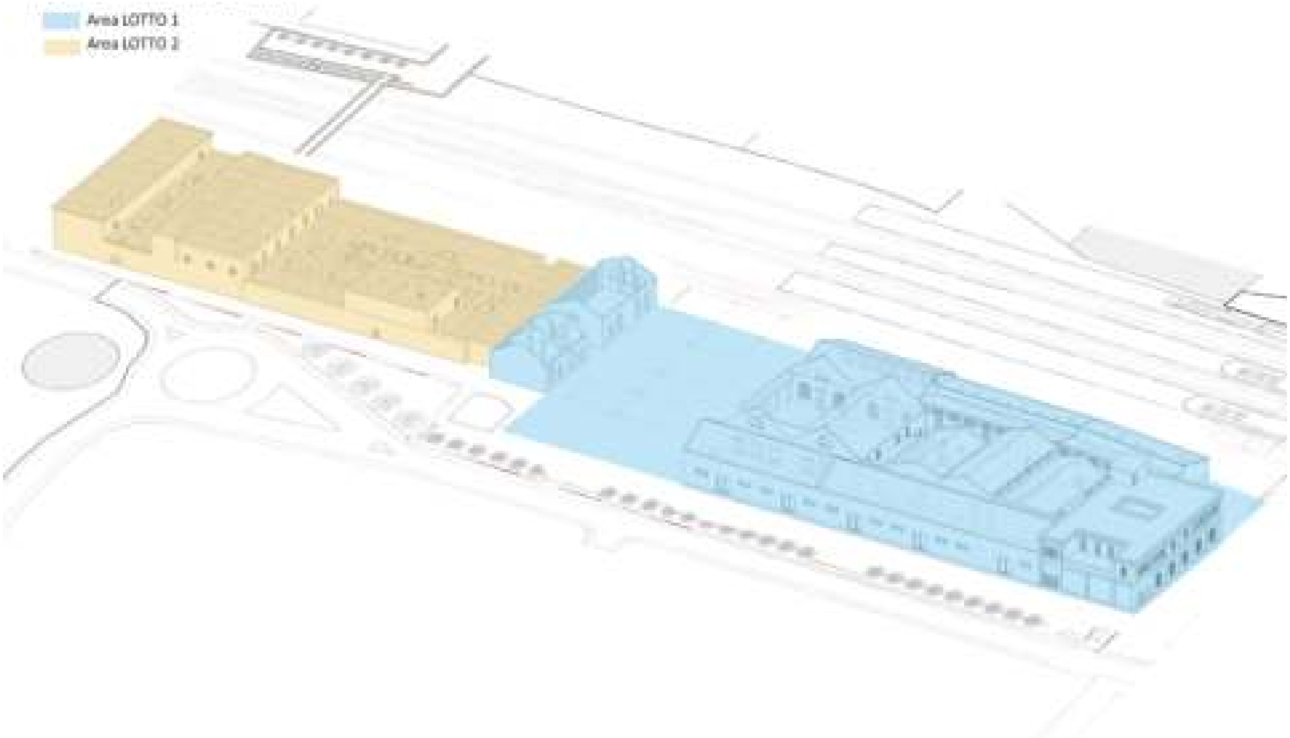


Fig. 4. Axonometry of the two project plots. State of fact (source: the authors)

it closer to the Federico II University campus in the former Cirio area. While awaiting the Municipality of Naples' approval of the implementing instrument, the current owner, in 2014, approved the preliminary project for the redevelopment of the former Corradini factory. Utilizing ministerial resources from the National Urban Plan, the project focused on the recovery of the decommissioned plant, concentrating resources on the first functional lot, Lot 1. Lot 1 now serves as the foundation upon which this proposal has been coherently built.
It is noteworthy that all the structures have been recognized as having historical and architectural significance as testaments to "industrial archaeology" and are subject to preservation constraints pursuant to Law 1089/39 (articles 2 and 3, now incorporated into Legislative Decree

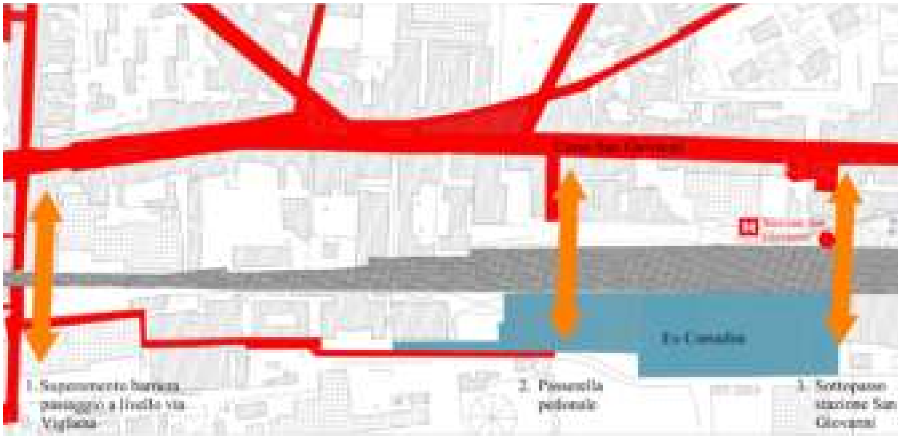


Fig. 5. Area accessibility system. State of fact (source: the authors).

42/2004) by Decree of the Ministry of Cultural Heritage and the Environment dated February 27, 1990.

The project for the first lot, the result of a Collaboration Agreement between the Municipality of Naples and STRESS s.c.a.r.l., a partner also in the GRID project, focused on exploring sustainable design methodologies and managing the existing heritage. The choices made for Lot 1, including its functions, aim to restore the complex's original morphological unity and establish a new functional coherence. Most important is the central open space between the two lots, the result of the collapse of some buildings warehouses, which is now conformed as the hinge square space, signaled by the still existing chimney, an open place that becomes a reception area and confluence of the different paths, internal and external, facing the sea and the urban park.

The "Green Innovation District" (GRID) project, particularly its focus on the former Fratelli De Simone tannery, represents an exemplary model in architectural and urban design for the rehabilitation, restoration, and repurposing of a protected architectural asset. This transformation serves as a catalyst for the revitalization of a vast area that holds strategic importance for the future of the neighborhood and the eastern district of Naples.

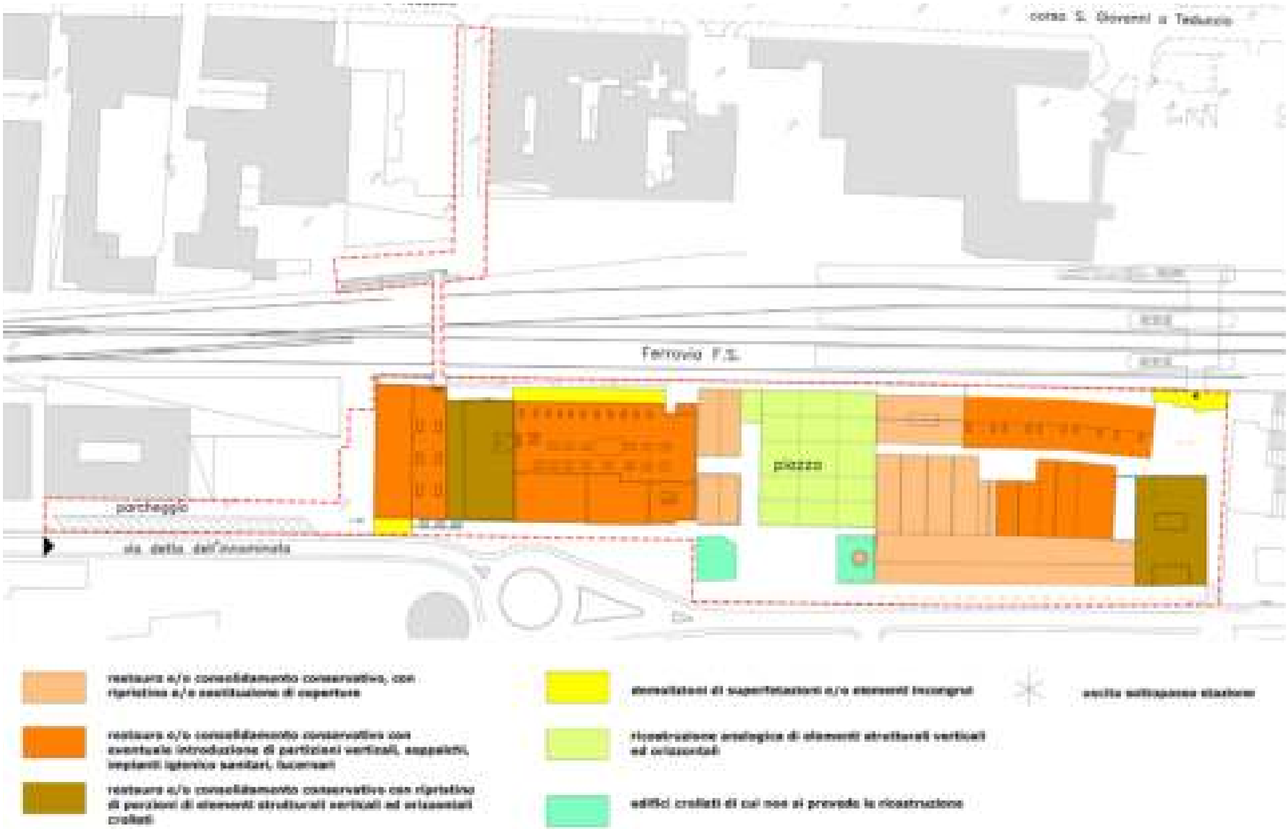


Fig. 6. Categories of intervention provided for by the City Plan of the Municipality of Naples (source: the authors).

The architectural project, through the processes of restoration, recovery, and enhancement of the built heritage and cultural assets, establishes the meaning of habitable space in relation to contemporary needs. It communicates the reasons behind the modification of the structure's significance, transforming its original purpose into a perceived one. It represents the preservation of the memory of the past, the communication of historical value, and the necessary transformations. In essence, it expresses a precise theoretical and methodological viewpoint on the relationship that habitable spaces establish with time, with changing

Fig. 7. Functional design destinations (source: the authors).

tastes, and with the perception of value and meaning attributed to them. Furthermore, the substantial change in the intended use of an industrial structure like the former De Simone factory, its recovery after a period of abandonment and severed connections with the built context, presents an opportunity to reconnect sensitive parts of the urban fabric, overcome limitations and constraints arising from complex consolidated situations (the presence of the railway line), restore the city's relationship with the coastline, and initiate virtuous processes capable of guaranteeing quality and safety from both a social and environmental standpoint.
The existing heritage can be enhanced and made available for contemporary use by carefully balancing conservation and transformation, preservation, and adaptation, to keep alive and usable the places whose values are understood by man and therefore he intuits the need for the permanence of the contents. Inhabiting the pre-existence is a way to "know" and "recognize", to respect and to love. In this case, the original artifacts are restored to their original consistency, the stratification and juxtaposition of parts over time are emphasized, the different nature, morphology, materiality and spatiality of the original bodies, and the new interventions

Fig. 8. Photograph of the state of the room with cast iron columns and beams in plot 2 (source: the authors).

Fig. 9. Functional design destinations for plot 2. Ground floor (source: the authors).

are arranged inside as autonomous, reversible and recognizable entities, which allow to read and understand all the traces of time respecting the morphology and the signs handed down from the past that come back to life in the new structure. Intervening according to this design mode means giving value back to the interior by refunctionalizing what has been deprived of the ability to respond to user expectations, manipulating the material of space, modifying its characteristics while fully respecting the pre-existing, inserting new entities, modifying the perception and relationships between the parts, thus building a new dialogue with the preserved envelope.

Fig. 10. Functional design destinations for plot 2. Foreground (source: the authors).

The project for the recovery and reuse of the former De Simone factory is aimed at restoring the historical parts, enhancing their value, with specific interventions of addition and modification aimed at an adequate use of the structure in coherence with the new intended uses, according to the methodology of "building on the built". This design activity involves minimal, recognizable, and autonomous interventions on the material and physical part of the artifact capable not only of responding to practical needs but also of adapting the signifier, that is the pre-existing material part of the architectural sign, its historical physical part, in order to highlight the new values of space, the renewed meaning of the work.

Fig. 11. Project Masterplan (source: the authors).

Minimal content adaptation interventions capable of expressing, through a legible and controlled overlap, the new role of the artifact without erasing its history, keeping alive the memory of the recognizable original form.

The scheme involves the addition of lightweight structures to the original volume to connect the roof level with the lower level, the arrival and dismantling of the planned overpass system, and lightweight systems for the use of the roof itself that meet both technical and plant engineering requirements and, at the same time, user needs by offering spaces and structures for the proper use of the roof, which becomes a large walkable terrace, a new elevated panoramic square. The aim of these actions is to

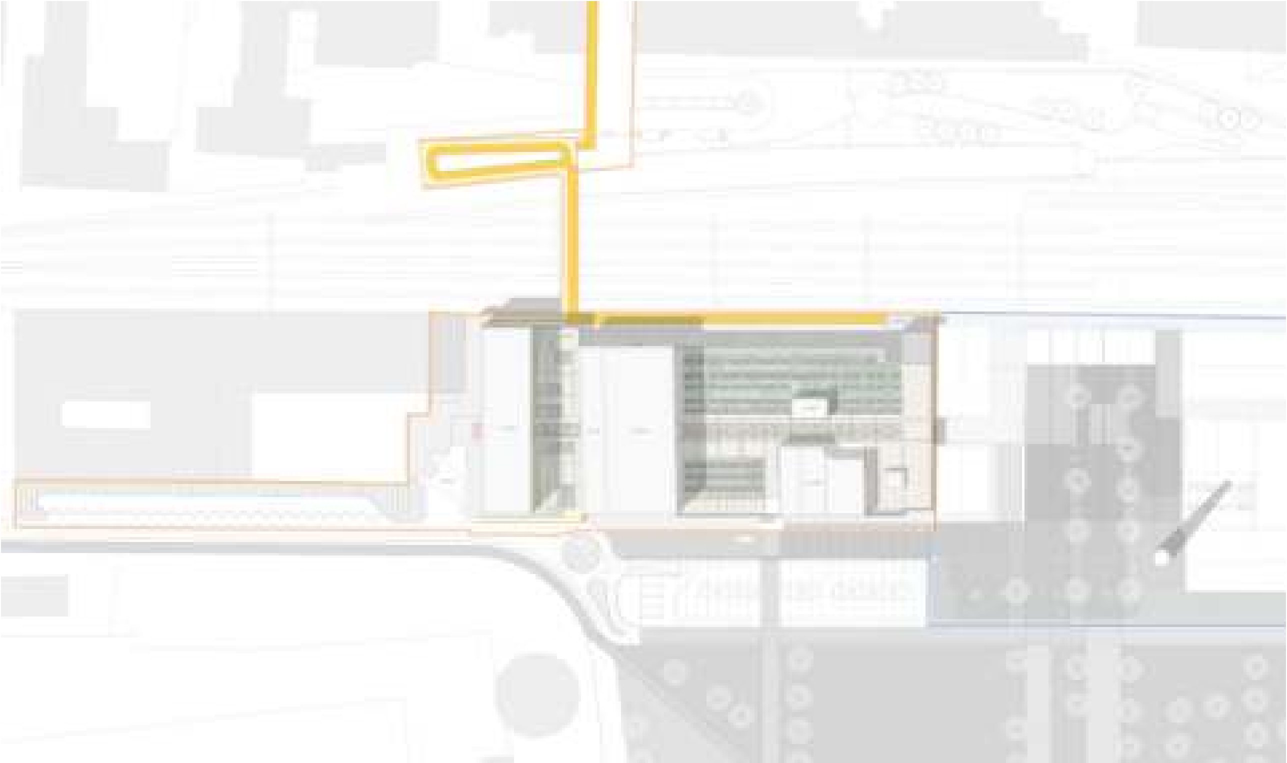


Fig. 12. Plan of the project roofs with focus on plot 2 (source: the authors).

increase the thickness of the stratification of the languages of history through the addition of new signs, new words capable of expressing the present by enhancing those already present, configuring a new order derived from the complexity of reality.

The described methods for intervening on the re-signification of the internal space while keeping its original value unchanged and discreetly adapting the preserved and enhanced original envelope with specific and legible grafts represent, considered synergistically, a conscious procedure for enhancing the testimonies of the past and updating their contents which, going beyond the purely technical or material aspects, focuses its attention on the value that architectural assets have assumed and must

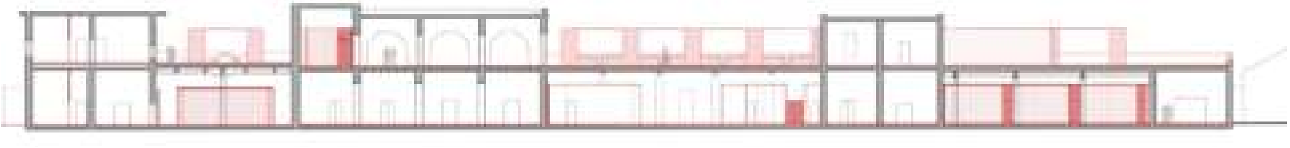


Fig. 13. Longitudinal section of the project (source: the authors).

still assume in society, which intends not only to enjoy them but also to use them; thus taking advantage of their presence to tell the present, to give shape to its culture, to encourage dialogue between the testimonies of the past and the expectations for the future.

The Green Innovation District activities that will be located in the former De Simone factory include research laboratories, shared infrastructures, an innovative business area and facilities. As far as the specific functions are concerned, they will be developed on 5,600 square meters in compliance with accessibility, development and safety requirements with a holistic approach that includes all initiatives aimed at promoting sustainability understood both from an energy and environmental point of view, and from the social impact, paying attention to the promotion of urban regeneration, energy efficiency and conversion, the circular economy and the development of renewable sources, up to the safety of the territory. The Green Innovation District will be constituted with a Hub & Spoke structure, where the Hub at the former Corradini (the subject of this proposal) will be interconnected to a vast network of university laboratories, public and private research centres, companies both in the regional and national territory.

Understanding the values that an architecture of the past can offer to contemporary society that uses it, means defining with precision the qualities expressed from its interior, the living and usable values, the symbolic and representative reasons, the principles of welcome and gathering that it is still capable of communicating, beyond the efficiency or usefulness of its spaces or the style and language of the architectural envelope that contains them. For this reason, the operation of restoration

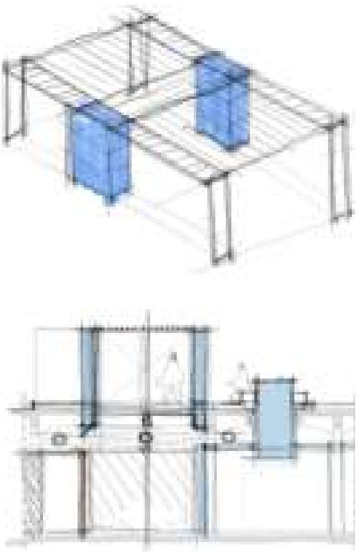


Fig. 14. Project sketches. Details of the system of skylights and light chimneys (source: th authors).

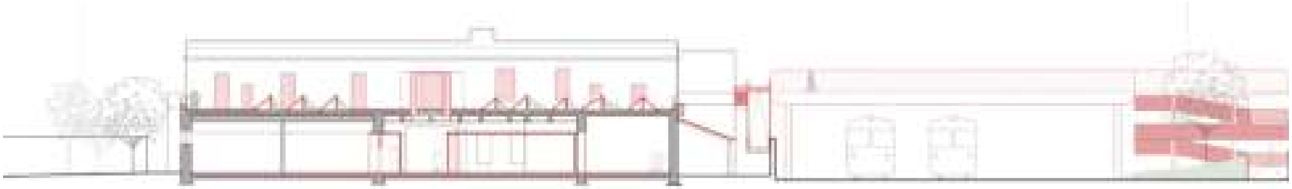


Fig. 15. Design cross-section. Overcoming the railway barrier (source: the authors).

of the existing structures must be accompanied by the evaluation and updating of the contents of the usable and functional space, through a design methodology aimed at returning a significant space capable of being a habitable form of the present even if defined by a stratified and time-marked envelope. This represents a complex theoretical and operational approach, where the restored asset emerges as a "new" entity, a work distinct from the original one, arising not only from conservation requirements but also from the need to express the contemporary perspective on the inherited and perpetuated heritage. In essence, it is an intervention of re-semantization of works that have lost their meaning, leaving perceptible only the material and physical part deprived of its original sense.

The commonly defined "building within the built" design operation identifies a system of interventions that concern the architectural volume, that is, the internal space, considered the main material of the project, determining its meanings and intervening on it more than on the physical boundary that contains it. The project is articulated on two levels, and the different spaces are structured through a central connective element, a sort of internal road that serves the laboratories and can be accessed from both sides, both from the central square that structures the entire complex and from the more reserved side. For both accesses, there is a reception area and a control point for entrances and exits for staff and visitors. From here, there is also access to the various services, with a logic of great openness and connection, underlined by the low mobile walls that allow you to always observe the spatial unity of the historical building and at the same time, through the different structures that

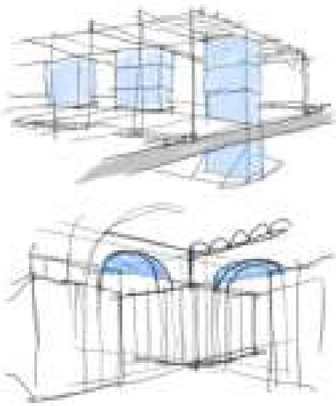


Fig. 16. Project sketches. System of light chimneys and vertical partitions for the vaulted tuff room (source: the authors).

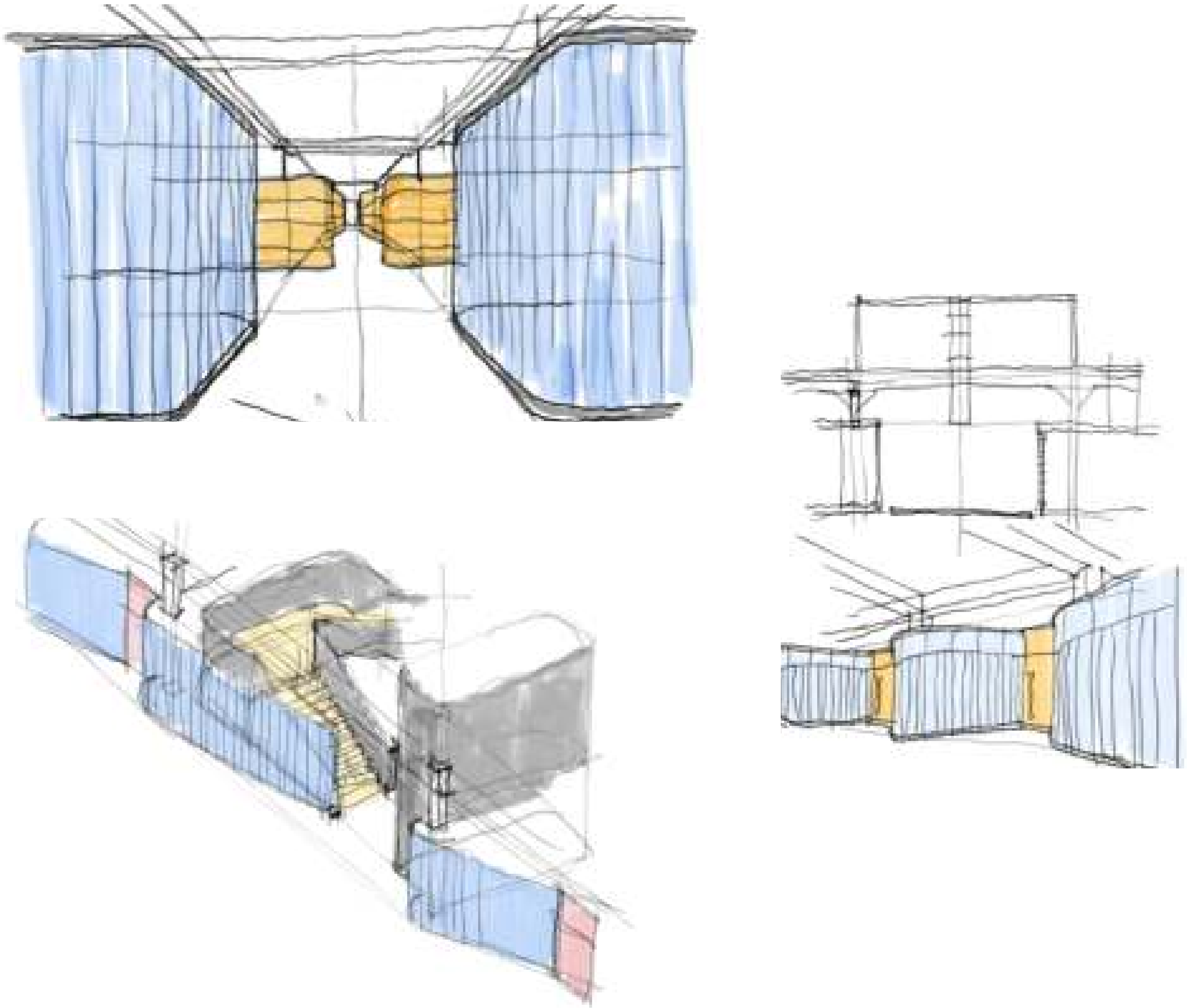


Fig. 17. Project sketches. The new internal partitions in UGlass (source: the authors).

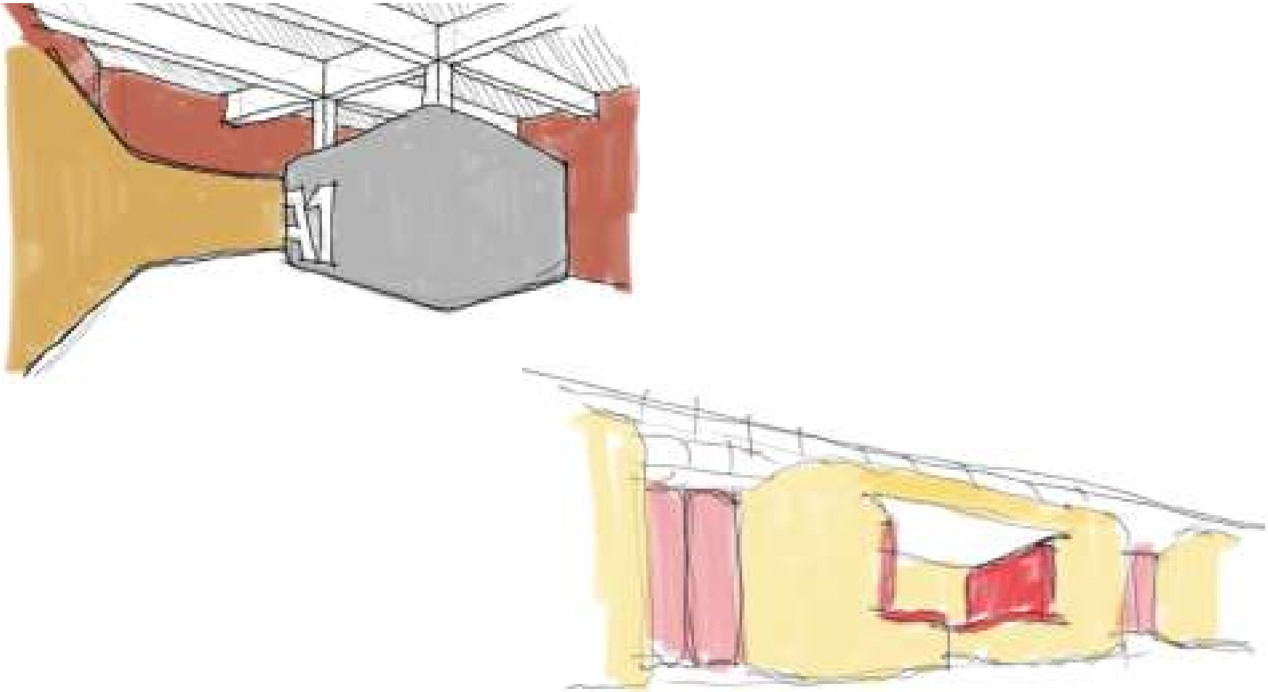


Fig. 18. Project sketches. Building in the built environment and areas of use (source: the authors).

contribute to its complexity, to read also the different construction and expansion phases.
The different functions have been distributed in the pre-existing spaces according to criteria of compatibility with the morphology and size of the environments, of proximity and flexibility of the same; they have been imagined on the basis of precise programs of use agreed with the proponents of the activities and respond to criteria of accessibility, safety and capacity to supply the essential materials. Along the internal longitudinal route, a reserved path has been imagined for an automated internal logistics system for distributing goods from the goods unloading area to the laboratories and both internal and external warehouses. Shared infrastructures represent the beating heart of the GrID, with the constant presence of academic and industrial researchers, a place for important

synergies between the different skills of research bodies and companies. The second level is intended for both public and private research laboratories, the activated laboratories will be able to take advantage of the availability of highly specialized research infrastructures, which will represent a real element of attraction and collaboration; the second floor will be served by various vertical connection elements, with access from the roof terrace which will have the function of an equipped square, a new public and collective space overlooking the sea and on which the overpass also disassembles. The structures that characterize this terrace will integrate in a single design the photovoltaic systems, the systems for giving light to the underlying floor (skylights), the systems, seats for the public, shading covers and green areas where specially selected plants are to be provided.

The construction systems of the internal parts will be entirely dry, both for the horizontal and vertical surfaces, so as to fully respect the external envelope which will be restored with the most suitable restoration techniques; the roof will be partially walkable, assuming an important role as a public space from which there will be access to the environments on the second level. The external space will be affected by interventions that highlight the importance of the historical artifacts, both in Lot 2 and in Lot 1, in compliance with the coastline and the relationship with the sea as provided for by landscape constraints, and in relation to the different infrastructural needs related to accessibility to the area. The central square will assume the important role of a hinge between the two lots, as well as configuring itself as a new public space for the neighbourhood and for the city, marked by the historic chimney still fortunately standing.

Acknowledgements

The GrID project was developed by the research group of the University of Federico II, coordinated by profs. M. Russo and M. Santangelo.

Research team: V. Allocca, F. Ascione, M. Botte, D. Calcaterra, F. Casalbordino, M. Cerreta, F. De Rossi, P. De Toro, D. Di Martire, B. Ferrara, E. Formato, G. Freda, G. Galluccio, M. Galterisi, P. Giardiello, R. Landolfo; T. Laudonia, M. Mastellone, F. Minichiello, F. Nocca, A. Pane, G. Poli, A. Prota, M. Rigillo, E. Russo; S. Russo Ermolli, G. Sabatino, A. Sgobbo, M. Simioli, G. Spizuoco.

The “Design Alliance”: a digital approach to support Public Administration decisional strategies for sustainable urban regeneration

Giuliano Galluccio, Marina Rigillo, Sergio Russo Ermolli

Introduction

The multidimensional reactivation of brownfield sites identifies a priority issue for any public administration that aims to encourage social inclusion, economic recovery, and the improvement of environmental quality with a view to sustainability. In the synergy of vision and action, the development of regeneration projects that rethink the integrated use of buildings and open spaces and that represent catalysts for further actions for the benefit of the community, constitutes a significant opportunity for both the physical space and the citizens who inhabit it. It is important to underline the procedural and systemic nature of urban regeneration, which is much more complex than traditional forms of intervention on the built environment, as it is aimed at triggering extensive and multi-objective transformations, through multiple integrated measures: urban, social, cultural, economic and fiscal.

The regeneration of the existing building stock is extensive and widespread. From Paris to Barcelona, from Lyon to Milan, the interventions for the transformation of the built environment involve multiple aspects: such as mobility, polluting and climate-altering emissions, the use of non-renewable resources, energy, land consumption, waste, abandoned and/or degraded areas and buildings, the presence of contaminated soils and buildings. A series of interrelated issues that, therefore, require integrated and coordinated projects capable of expanding in a widespread way beyond the areas of individual interventions, with measurable benefits

through tools that integrate technical-financial evaluation with indicators of social and environmental benefits.
This historical phase represents a perhaps unique opportunity for the public administration to play an important role in directing systemic actions to improve the fruitful, functional, environmental and technological quality of disused urban areas, with respect to chronic conditions of under-provision of infrastructures and services. A central condition for ensuring the effectiveness of the actions is a sort of "design alliance", a synergistic collaboration between the Public Administration (PA), research facilities and the reference community, capable of identifying innovative data-driven processes, methods, protocols and technologies. The creation, structuring and management of data becomes, from this point of view, absolutely fundamental to understand not only the technical reasons, but above all the real economic, social and environmental feasibility of urban regeneration interventions. The Department of Architecture of the University of Naples Federico II (DiARC) represents, in terms of activities, skills and resources, a priority interlocutor for the PA, as it is able to implement integrated actions of comparison with the different stakeholders and to develop multidimensional and multiscalar projects, as demonstrated by the activity of the Blended Intensive Programme entitled "Industrial Archeology: a European approach to recovery productive memory". as well as the research "Designing in Sustainability: qualification and digitalization in construction" [1].
In the first case, in fact, specific attention was paid to the definition of a replicable methodology for the analysis and representation of the ex-industrial heritage, especially in relation to the identification of the constituent elements and the construction of multi-scale digital models that made it possible to depict the transformation, simulate the processes and evaluate the design alternatives in the different contexts of reference. On the other hand, the work carried out by DiARC for PROSIT research represented an important opportunity to rethink the decision-making processes of PAs, in the light of the new opportunities for simulation and digital modeling, both with respect to the knowledge phase, but

Fig. 1. Overview of the ex-Corradini site (image: PROSIT Research Team).

above all in relation to the nature of design choices and their *ex-ante* and ongoing control (Rigillo et al., 2023).

The PROSIT research project: digital tools for sustainable decisions in building renovation

The general objective of PROSIT research is to rethink the entire production cycle of the construction sector in the light of new opportunities for simulation and digital modeling. These methods, in fact, determine an important advance both with respect to the knowledge phase, and above all in relation to the nature of the design choices and their *ex-ante* and *ongoing* control. The research question was structured along two converging lines of study: on the one hand, the dynamics related to issues of scale were highlighted, focusing on the specificity of the information required for the regeneration intervention, from its insertion into the urban system, to the conditions of buildability; on the other hand, centrality has been given to the concept of life cycle, interpreting the construction intervention as the beginning of a new functional and material phase of the buildings and of the city itself.

In fact, the research interprets the principles of the circular economy through the idea of Urban Mining, looking at the building system, and more generally at the entire building stock of the city, as a potential deposit of products and materials available for new functions, capable of generating reuse and recycling processes (Cossu et al., 2012). Similarly, the study takes up and develops the concept of Urban Metabolism (Wolman, 1963) declined as a "*complex system of transformation and exchange between anthropic, natural environment and economic structures*" (Russo, 2018) a conceptual tool for a conscious approach to the modification of the city and a driving force for actions aimed at increasing sustainable and resilient development in line with Goal 11 of the SDGs2030, Sustainable Cities and Communities.

The study's interest is mainly oriented towards disused urban spaces, which come back into play, in a metabolic logic, as places waiting for new and more efficient opportunities for use. The waste sites of the urban system are here re-interpreted in a resilient perspective, inspired by the notion of *hypercycle* as borrowed from chemistry and biology, i.e. "*the principle for the circular connection of positive, self-catalytic feedback, which, by analogy with the processes of transformation of the territory, become the engine for configuring new adaptive cycles aimed at increasing the performance of both the natural and built environment*" (Rigillo, 2017).

In this sense, the PROSIT research aimed to configure the urban regeneration intervention as an effective and strategic operation, aimed at directing the decision-making capacity of a territory towards new functional structures, consistent with the dynamics of organization and resilience of the territory itself. The spatial repercussions connected to this specific approach are the result of eco-socio-technical processes that combine heuristic processes with objective and data-driven analysis methods, functional to frame the intervention both in the local and global context. The main references are Goals 11 and 12 of the SDGs 2030, which define a set of strategic actions aimed at implementing integrated policies for inclusion, resource efficiency, climate change mitigation and adaptation, to ensure sustainable consumption and production patterns and the promotion of innovative practices in public procurement, in accordance with national policies and priorities15. The transfer of more advanced knowledge and good practices to the territory is, as already mentioned, a key step in achieving the change of pace hoped for by the United Nations and the European Union. The design experience for the contemporary city thus becomes a sort of open-air laboratory through which to effectively experiment with the limits and opportunities of the ecological and digital transition, in the reality of local contexts and cultures.

In particular, the expectation of adequate tools to respond to the diversity of the demand for innovation coming from Public Administrations has been considered, by the PROSIT research, a central element of the study, which identifies the production of "tailor-made" information systems as the keystone of the project's activity. In fact, starting from the original indication of the research contract, aimed at creating a BIM-Based platform through which to operate integrated analyses of building interventions, it was decided to develop a pilot case on urban regeneration intervention aimed at creating protocols specifically calibrated to the requests and peculiarities of decision-making contexts.

This is an important step in the research, as it allows us to shift the focus to the possibility of defining "sustainability" strategies of design choices specifically calibrated on the know-how and technical and digital capabilities of the reference context.

Tailor-made design strategies for the industrial heritage

The objective of PROSIT is to substantiate the ex-ante phase of the project, linking together strategic decisions and operational choices, in order to proportion the refunctionalization actions on intervention scenarios based on the actual requirements of the eco-socio-technical system in which the intervention will be implemented.In this sense, the adjective "tailor-made" takes on a strategic connotation, an immediate reference to a culture of the immaterial that makes it possible to create virtual "ecosystems" capable of modeling, simulating and therefore verifying the appropriateness of the design solution with respect to its context (Rigillo et al., 2021). In addition, the informative characterization of the intervention, developed as a meta-design phase, makes it possible to reduce the possibility of errors and to manage interferences between the different specialisms involved in the design, also facilitating dialogue between the various subjects having a role in the decision.

Similarly, the production of a BIM model makes it possible to verify any discrepancies between the forecasts made during the planning phase with respect to the physical characteristics of the buildings to be recovered, also with a focus on the demolition site, considered a key step for the sustainability of the intervention. In fact, the demolition project makes it possible to develop organizational processes and technical solutions aimed at reducing the use of non-renewable resources, planning strategies for the reuse and recycling of the demolished material right from the design phase.

The research has chosen as a pilot case the area of the former Corradini industrial complex, in San Giovanni a Teduccio, in the eastern part of the city of Naples, already the subject of a Technical and Economic Feasibility Project, developed in the framework of the ministerial project "PianoCittà", approved by resolution of the Municipal Council no. 785 of 6 November 2014.

In order to effectively finalize the research activity, the STRESS Consortium has signed an agreement with the Municipality of Naples concerning the transfer of knowledge and tools to encourage the experimentation of methodologies for the sustainable design and management of the archaeological-industrial heritage in a key aimed at implementing the use of digital technologies and the principles of sustainability in the implementation practices of the Public Administration. In addition, consistent with the characteristics of the site.

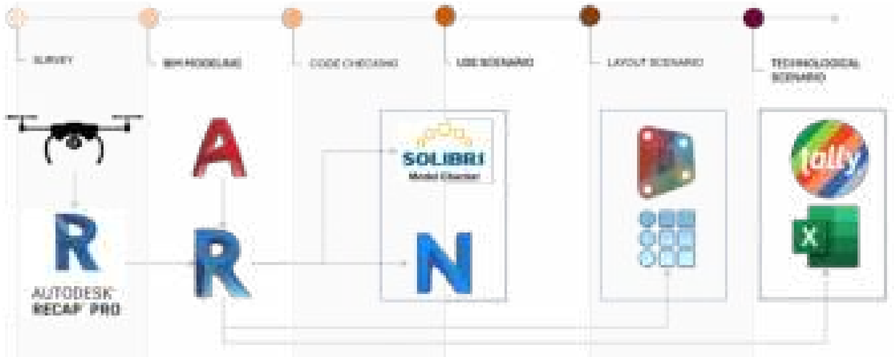


Fig. 2. PROSIT data-driven methodology (image: PROSIT Research Team).

The agreement aims to provide design criteria to direct the regeneration intervention towards the actual needs of the local community, integrating the new functions with the physical and social environment of the neighbourhood, and with the current regulatory framework, optimizing the available resources and using appropriate tools to verify regulatory compliance from the preliminary stages of the design.
The experience of the demonstrator becomes, therefore, relevant to the extent that it makes explicit the idea of tailor-made decision-making processes and tools. The result of the application to the pilot case is, in fact, the design of a protocol for verifying the congruence of the regeneration project with respect to the system of constraints that condition the tender contract, including the bonuses awarded for adherence to the Minimum Environmental Criteria (CAM).

The PROSIT research methodology

We hereby present the methodological process adopted by the research for the development of a decision support system that sees the integration of information modelling with the interpolation of GIS data and with Code and Model Checking platforms to define design scenarios characterized by a reduced risk of error.
The common thread that holds together all the components of the research is the conviction that, in order to trigger a virtuous process of

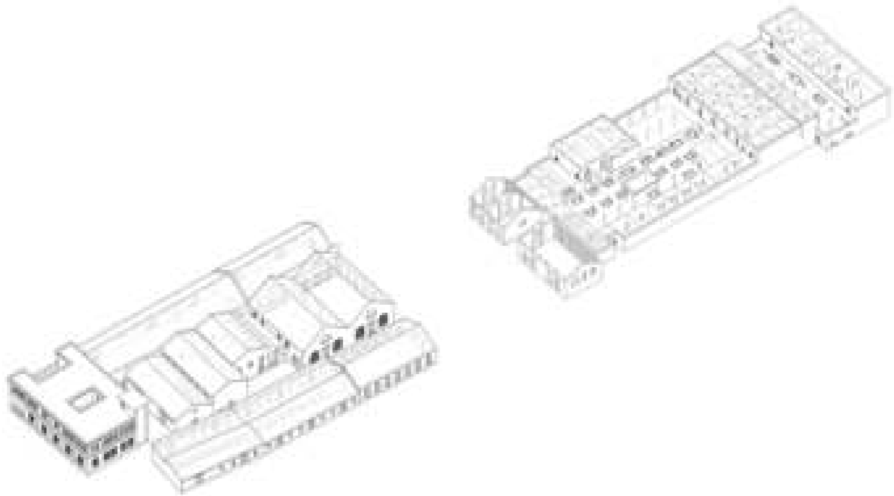


Fig. 3. BIM models of the two existing areas of the ex-Corradini site (drawing: PROSIT Research Team).

sustainable development of the city, it is necessary to work ex ante for the definition of project strategies organized on the clarity of objectives and knowledge of the context of intervention.

The regeneration process, in fact, cannot be considered exclusively as a technical challenge or as a marketing operation, functional to attract new development, but rather as an opportunity to "extend" the life cycle of disused urban areas, integrating the present and the past through the definition of new uses and new spaces designed to harmonize the emerging demands of living: environmental and energy sustainability, accessibility, not only "physical", to public space (Battisti et al., 2020) and the "reuse" of the city in a metabolic logic (Fioretti et al., 2020; Russo et al., 2021; Baiani & Altamura, 2022).

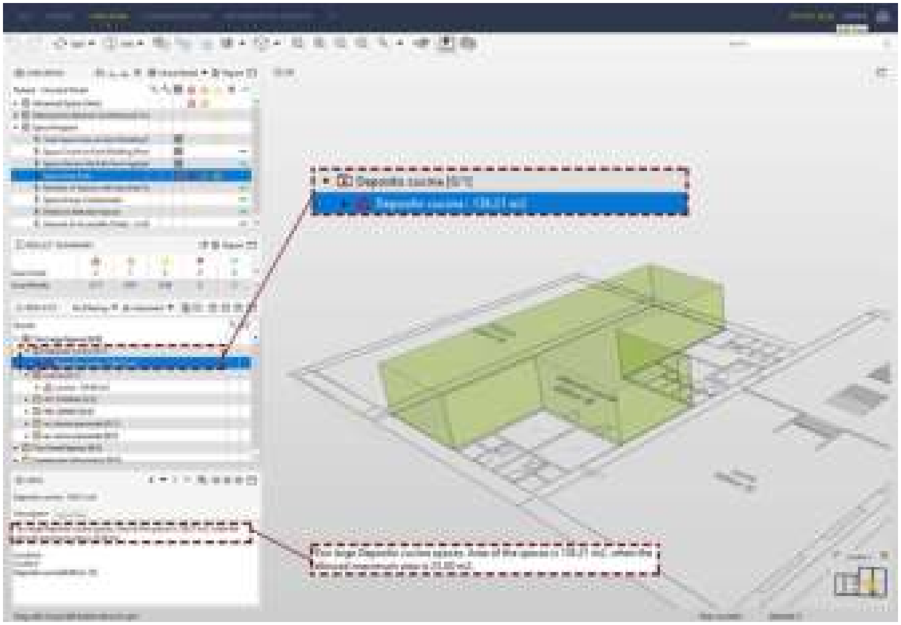
The experimentation carried out on the former industrial area embraces different design scales, ranging from the analysis of the intended use to the evaluation of distribution choices and technical solutions, the latter in particular brought back to the cogency of the Minimum Environmental Criteria - CAM (DM 23.06.2022), with a focus on the truss roofing systems that the "City Plan" planned to rebuild according to the original

Fig. 4. Verification of the previous functional program using BIM and Code Checking procedures (image: PROSIT Research Team).

configuration. This operation made it possible to improve the reliability of the results of the study, comparing the results provided by the software before and after the simulation of the intervention, both with respect to the functional distribution of the activities and with respect to the technical solutions to be adopted.

From a functional point of view, the research investigates the possibilities of transforming spaces and buildings while respecting the new uses, the historical and cultural identity of the complex and the "catalytic" value of the intervention. The spatial and distribution solutions described are all compatible with the legislative framework of reference and with the characteristics of the existing buildings and are designed with the aim of offering the district of San Giovanni a Teduccio a functional mix and adequate use to respond both to the demand for services in the eastern area and to the relaunch of the district as a university centre of excellence. Within the framework of the objectives defined by the PROSIT research,

Fig. 5. BIM Model check procedures - comparison between building features and functional options (image: PROSIT Research Team).



the architectural solution, far from arising deterministically from the Code Checking process, becomes, on the contrary, an open and flexible outcome to the imagination of designers, who can operate creatively within a scientifically validated information framework.

In continuity with this approach, the study carried out for the definition of the new Structural Design Scenarios allows an experimental verification of the theoretical assumptions of the research with respect to the themes of sustainable and digital design. The focus is on two different buildings in the complex, selected as

“demonstrators” by the research group precisely because they are representative of the structural design problems detected for the entire Lot 1, emphasizing the use of digital decision support technologies to reduce the risk of uncertainty related to the analysis of the state of the places and to intercept “systems of solutions compatible with the degree of information available. Also for structural design, PROSIT research

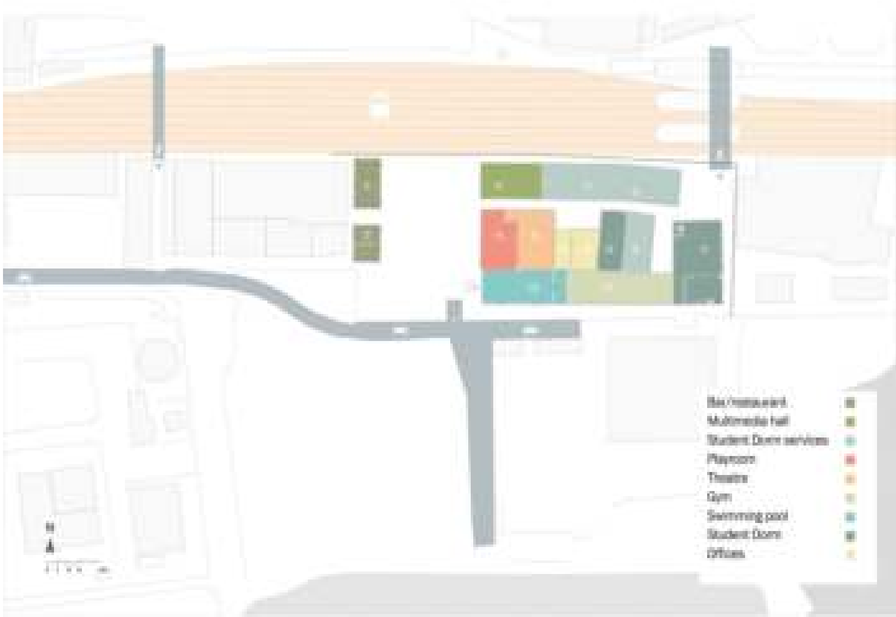


Fig. 6. New functional program developed by the PROSIT research for the ex-Corradini. Focus on the eastern part documented by the PianoCittà (drawing: PROSIT Research Team).

proposes a “scenario” approach in which the hypotheses of recovery of the existing are compared with those of demolition and reconstruction, in the light of the relationship between the objectives of the structural project and that of the architectural. This approach is made possible by the use of BIM and the preliminary work of regulatory verification, so that the interventions to be carried out can be compared in an integrated perspective, bringing into play a broader system of performance, including those relating to the material capitalization of the building in its life cycle. Also, in relation to the design of the life cycle of the building, the research explores the issues of recovery and recycling of building components and materials in the recovery project. The circularity objectives of digital fabrication (i.e. 3D printing) were analysed within a detailed analysis of the regulatory and technical context that characterizes the design experience. The research is a working method that, starting from the decommissioning project of a building, allows the production of Secondary Raw Material

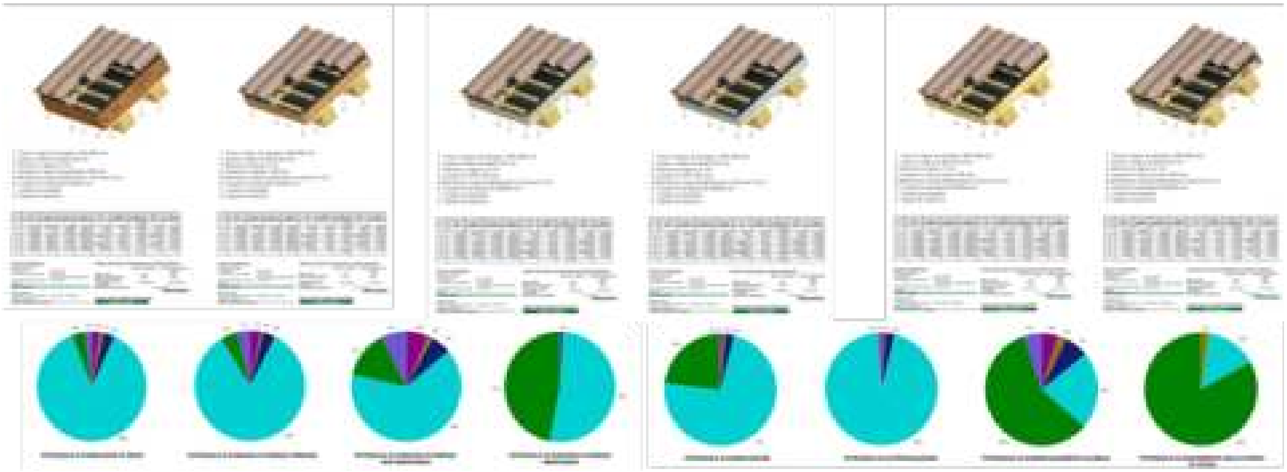


Fig. 7. Life-Cycle Analysis of the insultation options for the roofs of the ex-Corradini buildings. Simulations carried out within the Autodesk Revit plug-in Tally (image: PROSIT Research Team).

to be put back into the cycle in the same regeneration site through digital fabrication techniques. In particular, the experimentation draws attention to the conditions required to make the recycling process operational, specifying the regulatory and technical-procedural steps, with a focus on the particle size requirements of the demolished material in relation to the type of printer and on the functional constraints of printing machines when used on-site or off-site.

Conclusions

It is therefore possible to give a more precise meaning to the choice of the title of this contribution. The strategic condition of the project is in fact the leitmotif of all the research aspects outlined here, an unavoidable factor determined by the complexity of the contexts and choices, as well as by the demand to respond to the challenges that the ecological and digital transition imposes on us. In fact, the choice of objectives and rules of intervention that inform the decision-making process is strategic, while the relationship between the different souls of the project is strategic. And it is the result of a strategic choice the way in which objectives and rules are traced back to a system of objective validation of the solutions

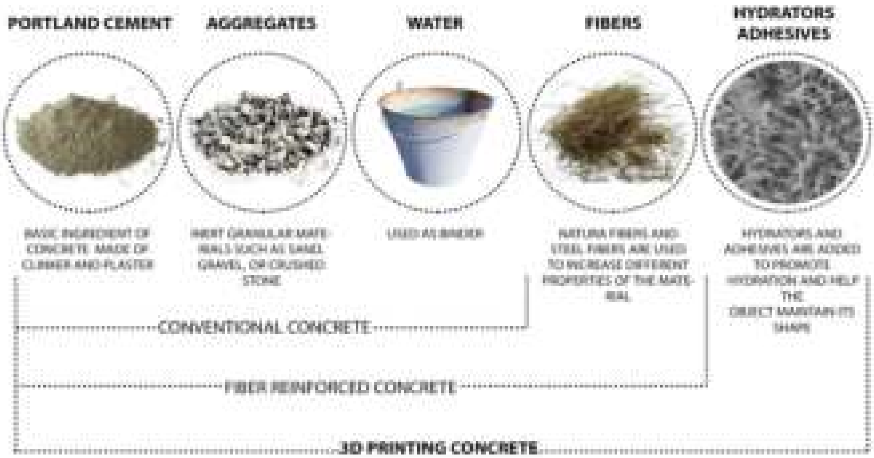


Fig. 8. Reuse concrete recipe mix for 3D printing from construction and demolition activities in the ex-Corradini (image: PROSIT Research Team).

adopted due to the corpus of rules and regulations that oversee their implementation. Finally, the relationship between the definition of objectives and the choice of cognitive and technological tools that best respond to the determination of the set of "steps" through which to achieve them is strategic.

In particular, there is a sort of "bipolar relationship" between the need to standardize the procedures of the decision-making process, in a logic aimed at recognizing their complexity and reducing the risk of failure, and that of specializing decisions on the basis of the "singularity" of the intervention, thus including both the quality of the places and the uniqueness of the social demand and the ability to manage the decision-making process in the technical and administrative context of reference. In this oscillation, the research emphasizes the hypertextual nature of the project, identifying digital thinking as the appropriate cognitive tool to access a different, and in some ways increased, level of cultural awareness and operational capacity. On the one hand, in fact, the production of reliable and scientifically validated "standardized" information systems makes it possible to keep together the multiplicity of requests and specialisms underlying the urban regeneration intervention, in a semantic

and not merely additive logic; on the other hand, the design of information systems "dedicated" to the intervention defines the framework of rules within which to develop comparable design scenarios as they all respond to the system of requirements and constraints established to respond to the specificity of the context and the intervention itself.
In this sense, the experimentation on the demonstrator case of the former Corradini industrial area makes it possible to highlight the reflection on the disciplinary culture that the challenge of digital and sustainability are already determining. The proposed experience brings the focus to the new attention paid to forecasting activities through modelling and simulation processes, to the relevance of ex-ante verification as a moment of the project, to the request for a continuity, not only formal, between the design phase and that of the management of the contract and the construction of the intervention. Above all, it is possible to work through comparative methods, comparing different design scenarios, but all generated by the same information system and the same design criteria, so that the choice can arise not only from technical evaluations but also related to the social and cultural specificities of the intervention context.
In particular, the research has identified large urban transformation interventions as the scale reference that seems to be most suitable for testing the actual potential of an approach governed by a new ontology of urban space design, focused on the combination of heuristic and analytical methods. The regeneration process has been considered here as a transitional operation par excellence. The experience of research on the disused area of the former Corradini factory demonstrates, in fact, the inherent potential in a project strategy organized through digital approaches and characterized by environmental, economic and social sustainability objectives. An experience aimed at demonstrating the opportunities immediately available for the integrated management of the city's cultural capital, in a perspective that brings together new demands for construction quality and the new "ecological" balances of the urban space that is generated in view of the significant impacts that this type of intervention offers to the city and its inhabitants.

The hope is therefore to be able to contribute through this research to the interdisciplinary debate, offering to the evaluation of the academic community, and not only, a work of semantic "mending" between different points of view and specialisms that can outline a scenario for the design of the urban environment in an increasingly sustainable present.

Notes

[1] The research was funded by the Campania Region, as part of the PRO-SIT Project – Designing in Sustainability: qualification and digitalization in construction, PO FESR 2014-2020 – Specific Objectives 1.2.1 – Expression of interest for the 'realization of technological platforms under the program agreement – High-tech districts, aggregations and public-private laboratories for the strengthening of the scientific and technological potential of the Campania Region', assigned to STRESS s.c.a.r.l. The activity involves among the project partners the Department of Architecture and the Department of Structures for Engineering and Architecture of the 'Federico II' University of Naples, the public-private consortium STRESS s.c.a.r.l. and the Municipality of Naples.

References

Baiani, S., & Altamura, P. (2022). Reusable Cities: A Circular Design Approach to Urban Regeneration through Materials Reuse. In A. Battisti & S. Baiani (Eds). *Sustainable Development Dimensions and Urban Agglomeration*, pp. 303-410. IntechOpen.

Battisti, A., Mussinelli, E., & Rigillo, M. (2020). Public space and urban quality. In *TECHNE Journal of Technology for Architecture and Environment,* No. 19, pp. 17-23.

Cossu, R., Salier, V., & Bisinella, V. (2012). Introduction: The Urban Mining Concept. In R. Cossu, V. Salier & V. Bisinella (Eds.). *Urban Mining: A global cycle approach to resource recovery from solid waste*, pp.13-20. Padova: CISA.

Fioretti, C., Pertoldi, M., Busti, M., & Van Heerden, S. (Eds.). (2020). *Manuale delle strategie di sviluppo urbano sostenibile*. Lëtzebuerg: Ufficio delle pubblicazioni dell'Unione Europea.

Rigillo, M. (2017). Note per un approccio cognitivo alla mappa dei drosscape. In C. Gasparrini & A. Terracciano (Eds.). *Drosscity. Metabolismo urbano, resilienza e progetto di riciclo dei drosscape*, pp. 78-91. Rovereto (TN): LISt Lab .

Rigillo M., Russo Ermolli, S., & Galluccio, G. (2021). Digital rule-based compliance processes. The urban regeneration of ex-Corradini, Naples (IT). In *Aghatòn. International Journal of Architecture Art and Design*, No. 10, pp. 59-72.

Rigillo, M., Attaianese, E., Galluccio, G., & Russo Ermolli, S. (Eds). (2023). T*ailor-made strategies for complex processes management. Digital approaches for sustainable urban regeneration*. Napoli (IT): CLEAN.

Russo, M. (2018). Rethinking resilience, design the city through its metabolism. In *TECHNE Journal of Technology for Architecture and Environment*, No. 15, pp. 39-44.

Russo, M. (2021). Metabolismo Urbano. In A. Criconia, I. Cortesi & A. Giovannelli (Eds). *40 parole per la cura della città. Lessico dei paesaggi della salute*, pp.151-155. Macerata: Quodlibet.

Wolman, A. (1965). The metabolism of cities. In *Scientific American*, Vol. 213, No. 3, pp. 179-190.

Workscapes: towards an interscalar design method. Restrictions and direction of mutations in the case study of Corradini

Paola Galante

Abstract

Starting from the examination of the restriction placed on the Corradini factory with Ministerial Decree 27 February 1990; from the urban planning legislation in force in the eastern area of Naples and from a reading of the "spontaneous" transformations in the former industrial area, the contribution intends to explore the admissible design directions to guarantee the stable balance of the relationship between memory and use of industrial archeology artefacts. Current legislation, spontaneous transformations, sectoral ambitions and design experiments will contribute to outlining a working method, conceived in autonomous but dialoguing steps, capable of detecting and revealing the "city demand" implicit in the historical landscapes of work (here "left-lanscapes") to prefigure contextual and contemporary scenarios.

The characteristics of the restriction imposed on the ex-Corradini complex

The restriction for the protection of the former Corradini metallurgical plant, imposed by the Italian Ministry of Culture with Ministerial Decree 27 February 1990, pursuant to law 1089/1039 for the protection of historical and artistic heritage, it extends over an area of approximately 5 hectares, in which there are 54 artefacts differing in size and time of construction.

The historical-artistic report attached to the constraint that motivates

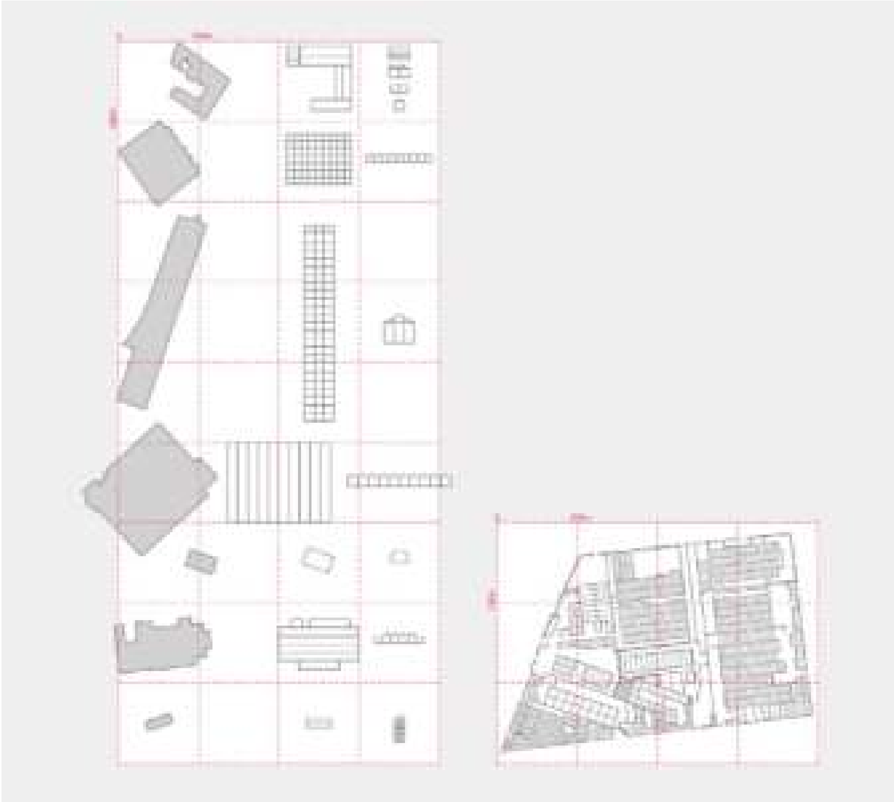
Fig. 1. The area affected by the ministerial decree 27 February 1990 with the identification of buildings of historical-artistic interest (source: P. Galante, 2024).

the need for protection, delves into the nature of the complex industrial palimpsest, specifying the documentary value of the settlement, "evidence of the industrialization process of Southern Italy" between the end of the 18th century and the first half of the 20th century, which survived - paradoxically - precisely "thanks to the closure of the plants which prevented the productive and therefore typological conversion of the complex, allowing the survival of the ancient structures, but not guaranteeing their protection" [1].

The study, signed by the architect Mario Grassia and countersigned by the then Regent Superintendent of Messe, explores the "Samplebook of industrial architecture the second half of the 19th century" [2], identifying the most significant elements in the new typological and plant solutions but above all in the structures load-bearing systems that used systems considered cutting-edge at the time: "The oldest form, the multi-storey building with cast iron columns, crutch capitals and brick vaulted ceilings, is flanked by the more modern lines of the tuff masonry warehouse with multiple spans and roof covering; this is further improved with the elimination of the spine walls replaced in more recent buildings by cast iron pillars and columns. The most advanced forms of entirely metal structure architecture also appear, with the use of Palanceau trusses and the zenithal lighting permitted by the roofs" [3].

Among the numerous buildings in the area of interest, 6 assets of them, considered most representative, are described with greater precision (Fig. 1):
1. Il LAMINATOIO, built in several phases in the 19th century, characterized by three naves of approximately 70m, covered by Palanceau trusses, skylights for diffused light and a complex system of canalization for the water necessary for the manufacturing processes. The building contains a three-level building from the first half of the 19th century, with floors made up of cast iron beams and brick vaults.
2. La FONDERIA GETTI: building consisting of two side-by-side naves and a third arranged orthogonally whose walls are made with alternating rows of tuff and bricks that form a decorative design; the spatiality of the building is characterized by the "transparency of space", obtained by eliminating the internal load-bearing walls and replacing them with cast iron pillars approximately 10 meters high and by the zenithal lighting, made possible by the 14 meter high cast iron trusses;
3. I MAGAZZINI OTTONE: defined as "a backdrop with an urban flavour", the long building of approximately 100 m being decorated with a play of tuff and piperno bricks, the building is composed of modular environments used as warehouses and small workshops arranged on two parallel bodies. The roofs are "shed" to allow effective lighting, a solution that is widely used today but was previously cutting-edge;
4. Il PICCOLO LAMINATOIO: Small building but of excellent architectural workmanship, due to the presence of cast iron trusses and brick and tuff walls, integrated into the complex of the largest rolling mill;
5. La FABBRICA PELLAMI: Buildings among the oldest of the entire complex (dating to the 18th century), which reveal in their stratifications the replacement of entire portions of attics, and the presence of systems for water distribution.
6. PORTER'S HOUSE and EMPLOYEES HOUSES: two buildings, dating back to around the mid-1800s, particularly interesting for the typological layout and the stucco decorations of the facades and the wrought iron railings. They constitute two civil episodes of the industrial complex.

Fig. 2. Left-landscape Gianturco, catalog of structural systems (source: P. Galante 2016).



If on the one hand the report specifies that the ruins of six of the industrial architectures that have survived are capable of testifying to the evolutionary "process" of production techniques in the geographical context of southern Italy, which finds resonance in the scientific achievements in the field of construction science and therefore construction systems. On the other hand, the report focuses on the positional value of the entire complex through the citation of the settlement characteristics of the former industrial center and the relational systems that the factory establishes with the urban surroundings and with the nearby historic buildings.

The former Corradini is located on a narrow strip of land between the eastern coast of the city of Naples and the first Italian railway line; near the current Pietrarsa Railway Museum, formerly the First Railway Station; immersed in an industrial fabric rich in precious turn-of-the-century "work architecture". The ex-Corradini is therefore recognized as having an inter-scalar value dimension in which the archaeological nature of the precious construction systems and the spatialities generated by them coexist with the "geographical" nature of the complex, visual and strategic reference of a much broader urban context.

The "sedimentation" of the constraint

The testimonial and positional value of the former Corradini complex, declared by the historical-artistic constraint, is assumed as a cornerstone in the urban transformations that concern the eastern area of Naples also by the current regulatory instrument, the *Variante al Piano Regolatore Generale* - historic center, eastern area, north-western area -, approved with the decree of the President of the Regional Council of Campania n° 323/11 June 2004.

The factory complex falls within *ambito* no. 14 "Cirio-Corradini", identified in sheet no. 72, which pursues the general goal of rebuilding the relationship between the San Giovanni neighborhood and the Sea, introducing a series of neighborhood and metropolitan-scale equipment aimed at relaunching the productive economy, penalized by delocalisations that have marginalized a traditionally working-class district. In particular, in article no. 144 of the "*Implementation Regulations, part III, regulation of the areas and other specifications*", in paragraph 3a), it is stated that "the redevelopment of the Corradini complex is envisaged in order to build a significant system of urban equipment and host activities related to the valorization of the sea resource". Furthermore, in paragraph 7 is stated: " (...) The plan provides for the recovery of the system and of the individual buildings listed pursuant to law no. 1089 of 1939 (...), integrating the new settlement with the urban context and opening the new structure towards the neighborhood, respecting the specific management needs

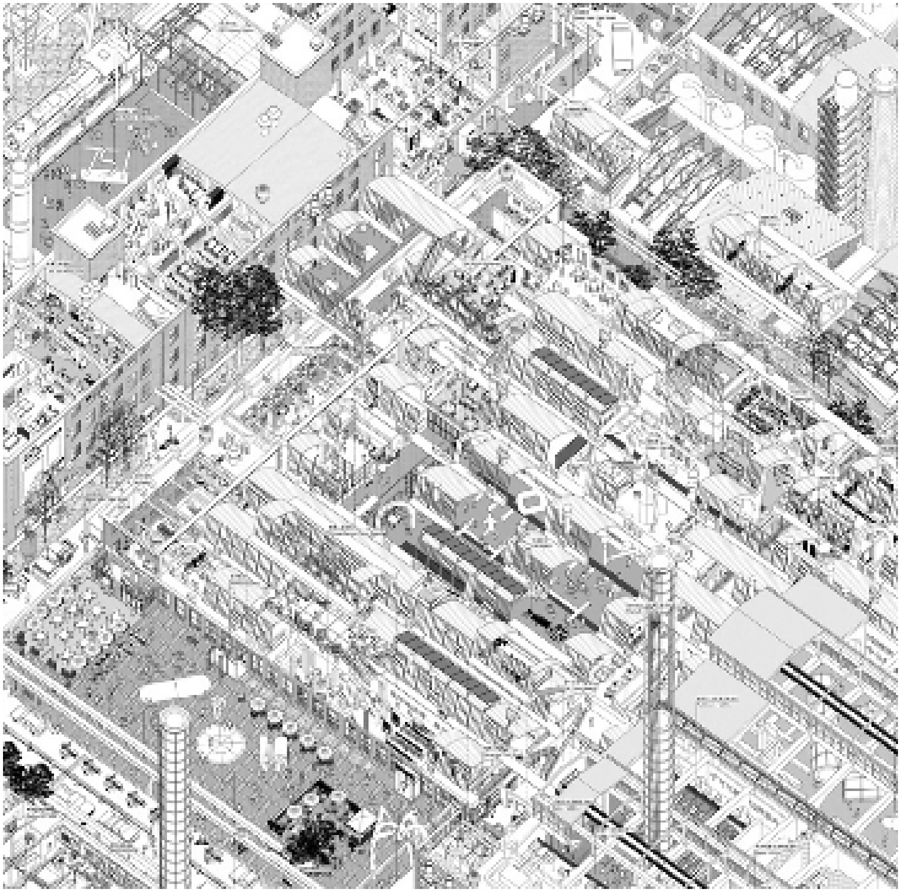


Fig. 3. 798 Art District, Axonometric survey of the redeveloped spaces (source: Li Han – Atelier 11, A Little bit of Beijing, 2011).

of the university. For this purpose, access and permeability points must be identified on the edges of the area towards the hinterland to recover the relationship between the neighborhood and the sea, which was interrupted with the construction of the railway". This last notation traces the possibilities of transformation to the peculiarities of the individual listed buildings, as identified in the restriction decree.

The setting of the *Variante al PRG* will be confirmed by subsequent instruments, the PIAU (Proposal for an Innovative Program in the

Urban Area) of San Giovanni a Teduccio in 2004, the PUA (Urban Implementation Plan) of San Giovanni a Teduccio in 2009, implemented only in part [4].
In the eastern area of Naples, the complex of the former Corradini factory certainly represents the best-known episode of industrial archaeology, together with the complex of the former Cirio factory, also located on the westernmost coastal strip. The constraints to which these complexes and their respective ownership regimes were subjected, if on the one hand prevented spontaneous transformations and temporary uses that could have distorted their characteristics, on the other contributed to the degradation of the structures and to a *damnatio memoriae* for the resident communities, so today the former workplace factory is the sad setting of a show that was promised but never staged.
These two famous ruins are immersed in a work-scape in continuous transformation that could "contaminate" their destiny, transferring the underlying design logic to the silent and spontaneous transformations that day after day adapt the disused industrial buildings to the "demand of cities" that evolves, making them part of a contemporary imagination.

Structures, systems, programs of the "left-landscape" in the eastern area of Naples.
Research carried out through the workspaces sedimented in the eastern Neapolitan area has highlighted a landscape characterized by the accumulation of buildings and industrial complexes dating back to different eras which testify to the evolution of production activity (Galante, 2016, pp. 17-36). These industrial artefacts, alternatively available for new uses due to decommissioning phenomena linked to the change in production logic, are offered as "ruins to be plundered", whose recognized value does not lie in the typological qualities or construction systems, but in the availability of surfaces to be multiplied and volumes and together they configure a "left-landscape".
In cases where these complexes are not subject to constraints for the protection of historical-artistic assets nor to area disciplines that

subject the transformations to executive plans of larger areas, they have been subject to continuous modifications even in recent times. In fact, the current urban planning legislation allows the change of intended use and the so-called "direct interventions", regulated by art. 36 of the Implementation Rules of the variant to the PRG of Naples which specifically concerns settlements for the production of goods and services that have architectural or typological-testimonial value. The eligible physical transformations concern: "the redevelopment of settlements, buildings and industrial artefacts through the recovery of the original structural elements, as well as the testimonial values of the historically established production functions"; "ordinary and extraordinary maintenance, restoration and conservative rehabilitation interventions"; "splitting and merging, the insertion of intermediate floors that do not alter the structural and compositional characteristics of the vertical walls as well as the intrados of the roofing system, the removal without replacement of parts of the roof, the insertion of internal vertical connections and horizontal, the introduction of special technological systems necessary for the needs of permitted uses..."; "the creation of small rooms and cloisters to determine conditions of usability-habitability of the redeveloped building..."[5]. Through "Direct Interventions" it is possible to carry out physical transformations to "adapt" buildings to new uses, but the demolition and reconstruction of buildings is excluded.

Main resistance to mutations, the structure is in fact the element that limits the intended use and sets the boundaries of the transformation. The skeleton of the building must therefore be surveyed, redesigned, studied, verified in its suitability to withstand its own loads, carried and which it will carry in the near or remote future when intermediate floors will cross large spaces or when instead new vertical connection elements will subtract portions of attics. In any case, the structure must be compliant with current regulations regarding the safety of the building's statics and the people who use it.

As with the types of complexes that inhabit left-landscapes, it is possible to draw up a list of the different load-bearing structures that are similar in Europe. We move from the load-bearing walls of modest-sized buildings to structures framed in steel or more often in reinforced concrete built on site or with semi-prefabricated systems. The spans of these structures vary from 5, 6, 7 meters of load-bearing masonry buildings up to over 15 guaranteed by steel arch structures. Regarding the heights, they range from 3 meters of multi-level reinforced concrete framed structures, up to 12-20 meters guaranteed in large production or storage spaces.

The history and technologies of construction of these structures become an indispensable key to approaching the project. This list, associated with a map of the locations of the structural typologies, appears to be a useful tool for verifying the potential for large-scale changes in use if, as expected, at least in the Neapolitan area, they are not planned building and urban renovations: you can imagine a table in which each structural type is associated with the possible intended uses (Fig. 2).

Another peculiar characteristic of contemporary design activity in left-landscapes is the absence of a detailed functional program. The level of static suitability to be ensured (relationship between structure and use) and, when required, the type of reclamation to be carried out (relationship between healthiness of the site and use) is established at the beginning of the design process. In these cases, the transformation value (the difference between the value of the transformed artefact and the cost of the transformation), calculated on short-term and low-risk investments, represents the parameter that most affects the choice of the range of possible uses, the relative suitability to be satisfied and therefore the projects to be drawn up.

On the basis of parameters that relate walkable surfaces and indispensable primary equipment, only the location and number of rooms for the toilets and the spaces intended for the systems are specified. The typology of the latter acts as a supporting actor, "support" to the structure in the design process. The need to adapt to the regulations on energy containment, the possibility of accessing funds and incentives, the competitiveness on the market of buildings with innovative systems makes an accurate and

far-sighted project essential with respect to the range of uses identified.
As a whole, the design activity actually consists of ensuring as many uses as possible for the available spaces. These needs, dictated by the already mentioned economic and regulatory contingencies, converge in the idea of an "open" project, considered a *conditio sine qua non* by the promoters of the transformations, not only when they are promising in search of promising people, but also when they themselves are future tenants. The construction sites proceed in successive steps, each of which is associated with a building practice that precisely identifies the limits of the intervention. Generally, we proceed with the recovery of the property through the elimination of superfetations, the verification and, if necessary, the consolidation of the load-bearing structure, the restoration of all the elements of protection from atmospheric agents: roof waterproofing and systems for the flow of water, fixtures, external facades. We then move on to a phase of valorization and construction of opportunities aimed to determine the future lives of the property. We proceed with the preparation of the systems, organizing the methods with which to multiply walking levels and consequent vertical connections, working on the existing structure or punctually planning the spaces of a new structure. In a subsequent phase, sometimes distant in time from the previous ones, we proceed with the definition of the internal partitions and finishes which, in principle, fall within one of the previously programmed options.
There are many situations in which the architectural project ceases to be a synthesis capable of orchestrating different needs and represses its own contribution. The asset remains a silent spectator, a blackboard of autonomous operations.
The "non-project" affects the spatiality of the interiors: autonomous environments and repetitive sequences; on the choice of technical alternatives: dry partitions, modular false ceilings, floating floors, recessed lighting fixtures distributed with impartial repetitiveness, anonymous fixtures careless or unaware of the future usability of the spaces; on the choice of finishes: neutral colours, washable paints, practical, economical

and resistant materials, medium-sized formats: the performance specifications (when they exist) are approved on what is considered average taste.
Regarding the exteriors, their regeneration is almost always entrusted to the consequences of the assessments made with respect to energy containment rather than to a study dedicated to their layout: the choices relating to plant engineering issues affect the inclined roofs covered with solar panels, the occupied terraces from technical rooms, on facades often distorted by excessively double frames of fixtures divided into mirrors which reflect subdivisions of the old removed iron windows or in other cases adapt available formats; the protection of buildings from atmospheric agents also intervenes to disrupt the rational facades of the buildings created for production: with the multiplication of accesses, the shelters to protect against rainwater multiply, the radius of the gutters and the number of downpipes increase exponentially, in some cases the facades are covered with metal panels that guarantee ventilation systems; the multiplication of foot traffic levels is also proportional to the increase in solar light screening systems (opaque glass or breisoleil) which were previously not indispensable. The need to eliminate architectural barriers is responsible for internal and external ramps, the fire safety of panic bars scattered here and there.
The customization of the spaces is entrusted to furnishings and accessories chosen by the tenants once they have settled in. The buildings and open spaces, orphans of a spatial idea, are consoled with the addition of street furniture.
Finally, the mutations that we define as "silent", because they can be implemented through "direct interventions", imply a lively if silent planning activity that reveals unprecedented peculiarities, developed in the face of the uncertainties of long-term investments and the rigidity of regulatory instruments.
These two contingent conditions move the project towards incremental solutions, created by adding minimal and autonomous interventions which affect relatively small portions of the industrial complexes, and

Fig. 4. 798 Art District, Axonometric survey of the redeveloped spaces (source: Li Han – Atelier 11, A Little bit of Beijing, 2011).

do not alter the overall volume of the buildings, but rather the methods of use which reverberate in the urban environment, often unconsciously.

From the protection of the factory to the rewriting of the industrial district. Methodological premises

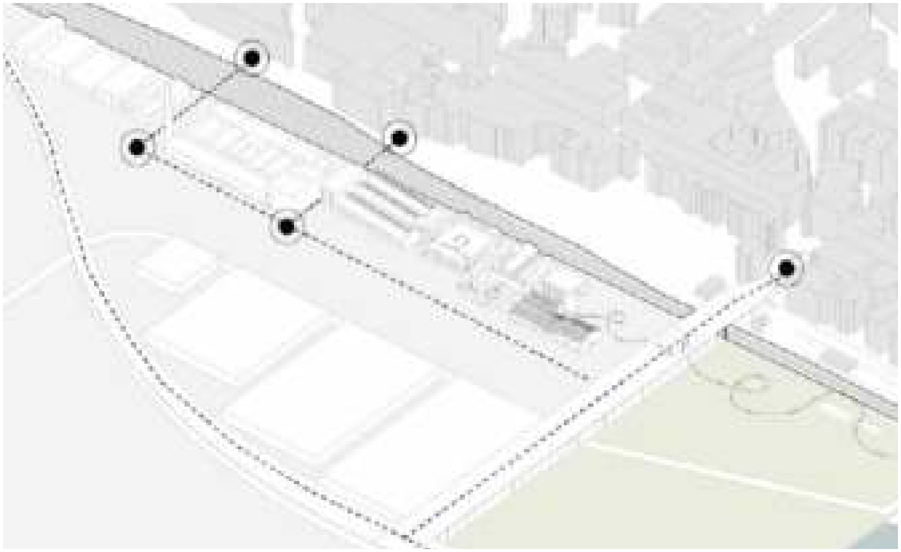
The need for an "open project" rather than an invitation to disengagement on the part of designers has been seen by some as the possibility of a new type of project that Jordi Bellmunt likes to call a "blurry project" (Galante, 2016). Not clear in the forms but precisely identified in the substance of the relationships it expresses. The definition opens the field to experiments which, aware of the urban role of buildings and the open space between them, use the interscalar relational system as a key to understanding design strategies for the re-signification of marginalized contexts (Galante, 2023). This means safeguarding the maximum flexibility of internal and repeated private spaces but hierarchically subjecting it to the rigorous design of all the parts that manage physical relationships, such as connective systems (paths, stairwells, thresholds), or contribute to the redesign of perceptive structures (viewpoints, rest areas, terraces). In some contexts the "fuzzy project" of regeneration of work spaces has assumed a non-negligible maturity due to the repercussions on the possibilities of creating architecture, this is the case of the Red-Hook district in New York or the 768 Art District in Beijing, the most famous of the Chinese artistic districts, the first headquarters of an electronics industry, built in the second half of the last century, then outside the city. These examples clearly show how the relational elements, and particularly the threshold, the staircase, the belvedere, have catalyzed the attention of the design efforts, becoming the pre-eminent hierarchical structure of the redevelopment design idea, capable at the same time of enhancing the typological peculiarities and structural of industrial buildings and to re-construct an urban imaginary (Figg. 3-4).

Considering these facts, it is possible to reread from an operational perspective the historical-artistic report attached to the Ministerial Decree 27 February 1990 (See Par. 1).

The restriction placed on the ex-Corradini complex recognizes the stratified factory at the same time as the positional value and the value of the individual building, suggesting inter-scalar transformations capable of bringing together "geographical vision" and "archaeological gaze". The design experiments rooted in this "interpretive" reading of the prescriptions can be configured as a research tool for the codification of a working method that can be extended to numerous "left-landscapes".

For these reasons is proposed to review a dissertation focused on the ex-Corradini factory titled *'The former Corradini factory, a new center on the seafront of San Giovanni a Teduccio'* [6], discussed by the student Chiara Arena in 2018. This thesis gained in the context of the research concerned the "Drafting of studies for the urban inclusion of extensions towards the

Fig. 5. Corradini as a new urban centrality. The access system and the study of new spatial configurations (source: C. Arena 2018).



east of the Port of Naples", conducted by the research group of the Alberto Calza Bini Interdepartmental Center for Urban Planning and promoted by the Port System Authority of the Central Tyrrhenian Sea [7] and assumes the envisaged scenario (Pagano & Galante, 2023).
The thesis concerned the eastern buildings of the former factory which were not already of interest in the project of the Municipality of Naples which concerns the construction of university structures. A re-drawing (2D and 3D) was capable of highlighting spatiality architectural and construction systems mentioned, reconstructing the state of the places of the entire complex and identifying the characters of value for each building.
At the same time, the positional value of the former Corradini Complex was studied, reconstructing the settlement dynamics of the eastern area of Naples, with particular attention to the construction of the railway line and the modifications of the Costa line. Furthermore, the architecture of the railway infrastructure was approached, identifying, on the basis of the indications provided by the PRG and the proposal

developed by the research group of the Calza Bini Centre, new points of overcoming. On the other hand, conflict scenarios proposed by the Port Authority, by the Municipality of Naples through the regulatory plans and by the neighbourhood associations were analysed to take as a reference the scenario proposed by the research group of the Alberto Calza Bini Interdepartmental Center. The discernment between the different scenarios present in the area has allowed the identification of desirable intended uses. The attribution of intended uses to the different buildings took place through a study on their mutual positions in the intervention lot; on the valorization of the "evocative" power of received or lost spatialities; on the "degree of transformability" of each in relation to the structures to be protected" (Figg. 5-6).

Once the overall project was defined, the minimum units of intervention were identified and subsequently constructed a "time-line" to establish the order of interventions based on a hierarchy of priorities that considers the symbolic value of the transformations and the economic value of the same.

It is possible, following this degree thesis experience, to deduce a 5-point working method, the so-called Corradini method, deduced from the silent mutations of the Neapolitan left-landscape and verified through the experimental project on the Corradini factory.

The method is designed to convey simultaneous attention to the different scales of the project, in order to ensure the protection of the historical-artistic characteristics of industrial archaeologies in the context of urban transformations capable of generating "landscapes of the present".

The "Corradini Method" in 5 points:

1. Identification of the architectural characteristics and structural principles that define the architectural quality of the complex through re-design and measurement of the spaces also at the detailed scale;
2. Understanding of the settlement context and geographical area of reference;
3. Construction of a new system of connections within the restricted complexes and with the adjacent city capable of acting as a narrative

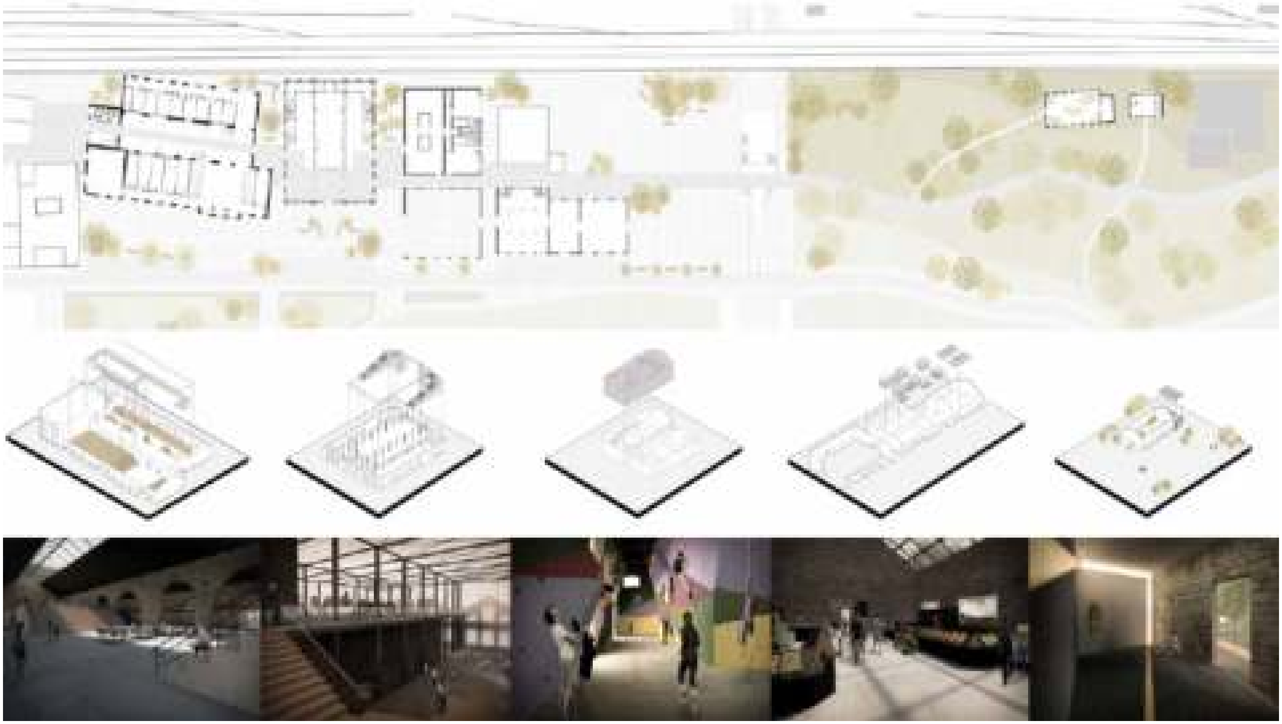


Fig. 6. Corradini as a new urban centrality. The access system and the study of new spatial configurations (source: C. Arena 2018).

system;
4. Evaluation of the scenarios in force and discernment of the desirable uses in relation to the architectural spaces to be protected or reconstructed;
5. Identification of a time strategy and minimum intervention units for the definition of autonomous but dialogical projects.

Notes

[1] See historical-artistic report attached to the Ministerial Decree. 27 February 1990 and beniabbandonati.cultura.gov.it/.

[2] Ivi.

[3] Ivi.

[4] All the documents cited are available on the official website of the Municipality of Naples, in the thematic area planning, heritage, housing policies, city cemeteries. See https://www.comune.napoli.it/urbanistica-patrimonio-politiche-casa.

[5] See Comune di Napoli, Variante generale al prg, centro storico, zona orientale, zona nord-occidentale. Norme di Attuazione, Parte I, Disciplina Generale.

[6] Italian title: *L'ex fabbrica Corradini, nuovo centro sul lungomare di San Giovanni a Teduccio*, Corso di Laurea Magistrale 5UE, Supervisor: Lilia Pagano; Co-supervisor: Paola Galante, Maria Cerreta, Pasquale De Toro; a.a. 2018-2019.

[7] Agreement agosto 2017. Contractors: Autorità di Sistema Portuale del Mar Tirreno Centrale e and Centro Interdipartimentale in urbanistica Alberto Calza Bini, Università degli Studi di Napoli "Federico II". Scientific research coordinator: Proff. Antonio Acierno, Maria Cerreta, Pasquale De Toro, Lilia Pagano. Research group: Paola Galante, Gianluca Lanzi, Giuliano Poli, Giuseppe Schiattarella.

References

Comune di Napoli, Variante al piano regolatore generale centro storico, zona orientale, zona nord-occidentale approvata con decreto del Presidente della Giunta regionale della Campania n. 323 dell'11 giugno 2004. <https://www.comune.napoli.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1023> (accessed 30 april 2024).

Galante, P. (2023). Workscapes. Le fabbriche Olivetti e la costruzione del paesaggio. In G. Mondaini G., P. Bonvini, M. Ferretti & F. Rotondo (Eds.). *Villard 21: From social housing to social habitat. Prospettive e Innovazioni. Il caso di Taranto*, pp. 162-175. Milano: Mimesis Editrice.

Galante, P. (2016). *Hi-Suk workable spaces*. Roma: Ermes Edizioni Scientifiche.

Galante, P. (2016). Dal progetto aperto al progetto sfocato. In C. Gasparrini & A. Terracciano (Eds.). *Dross-city*. List Lab.

Pagano L., & Galante P. (2023). The architecture of infrastructures and maritime identities. The case study of the new eastern maritime station in Naples. In *BDC* 22.

Ministero della Cultura (2024). Opificio Corradini. < https://www.beniabbandonati.cultura.gov.it> (accessed 30 april 2024).

Re-Generate_Re-Activate_Re-Inhabit
The ex Corradini industrial complex in San Giovanni

Adelina Picone, Caterina Mennella

The following text leads a reflection on the topics and practices involving urban and environmental regeneration, conducted following the design experiments carried out in the Final Synthesis Laboratory in Architectural Design of the Bachelor's Degree in Architectural Sciences (academic year 2020/2021). Instrumentally, the reuse, in its most complex meanings, of the disused industrial complex of the former Corradini in San Giovanni a Teduccio was used as a case study.

Topic of Urban-Spatial-Environmental Regeneration

The entire work focused on spatial regeneration, leading to an infused infra and interdisciplinary reflection. This approach had a didactic objective as well: to integrate the skills already acquired during the course of study and guide project choices towards original and sustainable solutions.
In this context, the design experimentation materialized in the case study by identifying significant project scenarios for the new, and potential, urban role of the site. The connection to an ongoing departmental research project with the Municipality of Naples provided an opportunity for a teaching experience strongly oriented towards the reality of design practices. This included factors like defining the functions and performances required of the new site, considering normative constraints, and leveraging the increased predictive capacity determined by the use of digital technologies. Finally, the search for solutions commensurate with the economic capacity of the context was emphasized.

Fig. 1. The former Corradini is marked in red and the relationships it establishes with the main infrastructure are highlighted: in black is the State Railways line, in yellow is Corso Garibaldi, in orange is the circumvesuviana line, and in green is Via delle Repubbliche Marinare. Blue, on the other hand, highlights the Apple Academy and the axis connecting it to the factory (graphic reworking of a Google maps photo by PhD Student Caterina Mennella).

Fig. 2. This is a photo taken from the station viewpoint observing the former Corradini (photo: Arch. Giovanni Rizzo).

The opportunity for interdisciplinary research within the Department of architecture (DiARC) further enriched the experience. While limited to the teaching context, the specialist contributions provided students with a precise idea of interdisciplinary interaction in design.

The activity aimed to develop a masterplan of a larger urban area, the definition of which was subject to initial reflection (in terms of relationships with the settlement structure, urban fabric, historical pre-existences, and disused areas), followed by specializing the work, to be carried out in groups of two or three people, in the design of open, internal, and relational spaces that compose the entire complex.

An integral part of the design studio was the definition of spaces of use consistent with the new demands of living (also considering the pandemic experience), soil design, redesign of open public space, recovery and refunctionalization of pre-existing elements, as well as the production of eco-innovative technological solutions.

The methodology adopted for carrying out the design exercise was structured into four phases:

1. Knowledge: Initially, there was a preliminary approach to the general theme of spatial regeneration, with an examination of the most significant experiences conducted in recent years. This was summarized by a list of projects and case studies, supplemented by applied knowledge work during which educational content was developed related to both traditional methods of knowledge utilized by the disciplines and innovative methods rooted in environmental technologies.
2. Interpretation: Tools were defined to comprehensively understand the study areas from various perspectives: urban morphology and typology, settlement history, mobility and accessibility conditions, conservation and degradation conditions and open space conditions. This interpretive exercise was accompanied by the presentation of ongoing research and studies in the area and a seminar on the structural evaluation of existing masonry.
3. Decision-making Systems: This phase focused on the design, from the scale of the urban whole to that of the disused complex, and the identification of technological solutions specifically tailored to the context's characteristics.
4. Verification: The final phase involved presenting the design outcomes as a means of verification and interpretation of previously identified themes.

The Design Laboratory was complemented by a module on Architectural Technology taught by Professor Marina Rigillo. This module provided students with the tools for in-depth technological analysis of the building system, referencing both existing buildings and project buildings, as well as eco-innovative technological solutions, with particular attention to energy management, inert waste production, building lifecycle, and the reclamation of the landfill rich in harmful substances adjacent to Corradini along the coastline.

An important teaching aspect related to this educational experience was the elective credit course taught by Professor Ugo Morelli titled "Cognitive

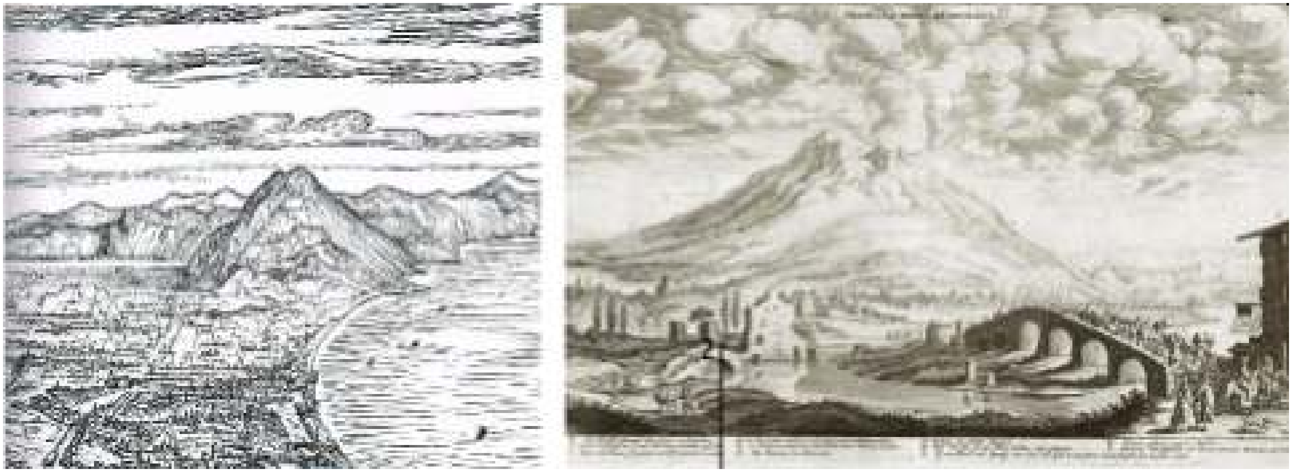


Fig. 3. On the left is depicted a detail of Jan van Stinemolen's view of 1582, on the right, we can see a detail of Joachim Sandrart's view, Eruption of Vesuvius 1631, View of the Marshes with Wheel Mill on the Sebeto (iconographic sources: de Seta, C. (2016). Napoli. Ediz. Illustrata. Napoli: artem (Original work published 1981) for Jan van Stinemolen view and https://pompeiiinpictures.com/pompeiiinpictures/Vesuvius/Vesuvius%20p1.htm for Joachim Sandrart's view).

Sciences Applied to Landscape, Environmental, and Territorial Design and Management."

Knowledge

The eastern area of Naples, stretching from the Piazza Garibaldi zone to the neighborhoods of Barra and Ponticelli, appears today as a highly heterogeneous territory overall, rich in infrastructures that are both varied and disorganized: large urban lots for affordable and popular housing, ancient settlements of farmsteads, agricultural areas, and enormous urban voids previously designated for the industrial sector, which over time have been subject to disuse and abandonment due to the evolution of production structures (Lucci & Russo, 2012).

Within this fragmented and contradictory landscape, the abandoned ex-Corradini factory since 1949 is situated, adjacent to the national railway line along the San Giovanni a Teduccio coast, parallel to Corso San Giovanni. It offers a rare visual connection to the sea, almost everywhere interrupted by the railway, which, since its construction, has been a true physical and relational barrier between the urban center and the coastline. The ex-Corradini is, in fact, a place strongly connected to the coastline,

Fig. 4. Duke of Noja, Topographical Map of Naples and its Surroundings, 1775, with the river Sebeto highlighted.

and its open spaces, also abandoned, are, in their current condition, simultaneously a place of degradation along the railway route and a great opportunity for the urban redevelopment of the entire area (Figg. 1,2).

To better understand all the relationships and contradictions among elements of the urban context, and to unveil permanences and memories (Rossi, 1982), an essential tool of knowledge in addressing the design theme is the study of historical maps to understand the settlement history that has shaped the city. The eastern area of Naples exhibits the characteristics of an “assembled landscape” resulting from its recent and rapid evolution, facilitated, following reclamation efforts, by its flat nature well-suited for the settlement of new infrastructures and initial industries (Lucci, 2012).

The first reclamation works in the area began during the Aragonese

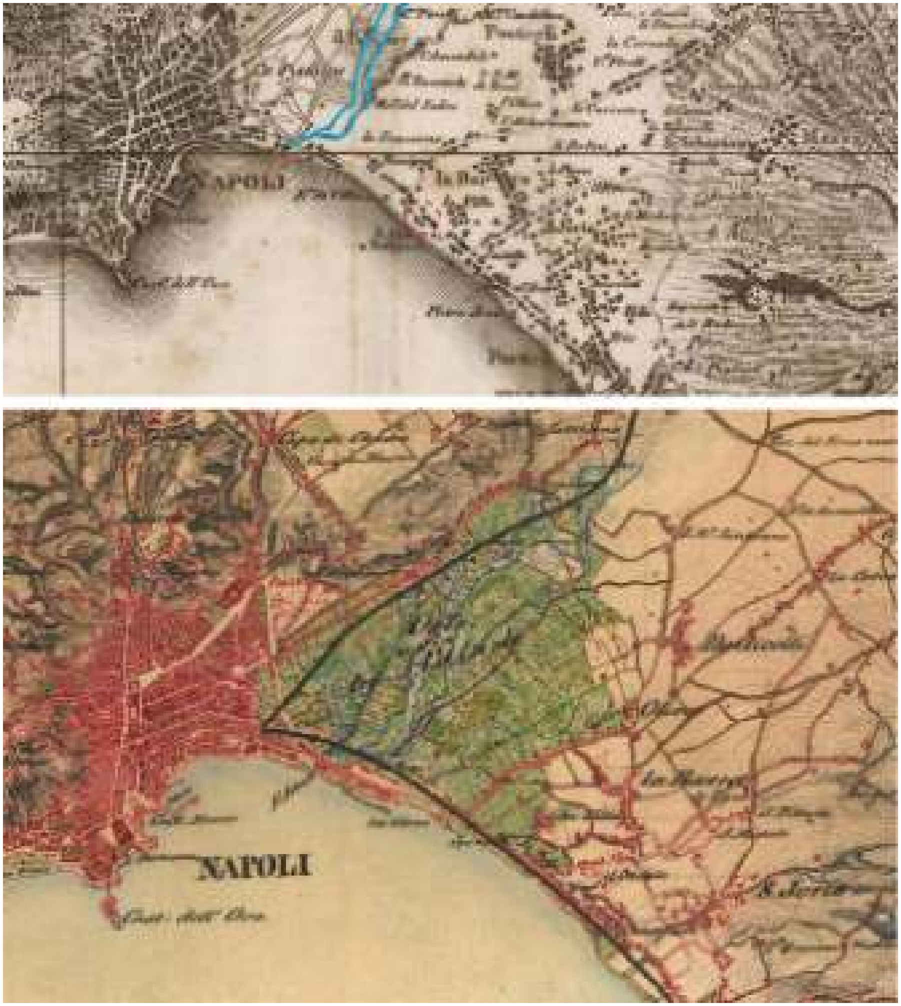


Fig. 5. Above is a detail of Rizzi Zannoni's 1808 cartography with the Sebeto River and the Corradini area highlighted in red. Below is illustrated a particola from the cartography "Naples and Sicily 1821-1826".

period since it was a watershed area for waters coming from hilly zones and Monte Somma, generating stagnant areas and marshes. Already from the 1582 view by Jan van Stinemolen (Fig. 3), it is evident how the entire territory outside the walls was primarily agricultural, with the field layout dictated by the numerous canals, rivers, and streams then present.

Fig. 6. On the left: Historical network of surface waters_Map of the environs of Naples Real Officio Topografico 1836-1840. On the right: Military Geographical Institute particular cartography East Naples 1907 and the Sebeto, railroad and Corradini area are highlighted.

Due to the presence of numerous canals and rivers, this area was known as the Valle del Sebeto, named after the river that crossed it, which since the seventeenth century favored the presence of numerous water mills and the first farmsteads that would later become the first residential nuclei of Barra, San Giovanni a Teduccio, and Ponticelli . The mills in the area numbered about 53 until 1831, and it was the law on the Economic Resurgence of the city of Naples that halted and led to the decommissioning of the milling industry to favor metallurgical industry instead (Palmentieri, 2018).

In the late eighteenth-century cartography, Naples East is still depicted as nature, where we can still clearly see the structure of the ancient center and walls, highlighting the Sebeto and its canal with the mouths flowing into the sea (Fig. 4). This relationship with the sea and the traces of ancient canals is one that the eastern area still retains. It is possible to identify traces of some ancient signs in the layout of contemporary streets, and it is impossible not to notice how the natural signs of agricultural fields are related to the anthropized urban fabrics that followed.

Even in Rizzi Zannoni's map, the relationship between nature, city, and architecture is clearly expressed, and this triad is brought into extreme opposition by the drawing of Vesuvius, which, along with water

traces, defines the fluidity of signs that we find in the identified study area. Another interesting element in the 1808 map is the urban fabric that begins to form in the plain, clearly rural in nature, where the first farmsteads were settled (Fig. 5).
It is only with the arrival of the Naples-Portici railway, inaugurated in 1839 under Bourbon rule, that the eastern area of Naples underwent progressive industrial expansion and the consequent construction of workers' neighborhoods. In the 1907 map, the ex-Corradini factory is already present, given its foundation date in 1882, and we can clearly identify the railway line marked in black and an increase in the number of industrial lots (Fig. 6).
A synchronic reading of settlement systems and layers with the current situation in eastern Naples clearly reveals how the relationship between nature and urban settlement is no longer recognizable. The area is, in fact, the result of expansion planning according to autonomous patterns and locations (Lucci, 2012), with huge industrial blocks interspersed and significant road sections that have facilitated the formation of "discard" areas. Today's situation, therefore, presents a set of denied relationships and correlations to which the design exercise tries to respond in some way, attempting to reconfigure the territorial/urban/architectural role of the remains of the ex-Corradini factory, so that it can be a germ of reactivation for new forms of living, restoring the lost relationship with the natural system.

The Regeneration Theme

Regeneration - urban, spatial, environmental - brings together, in intervening on the existing, under a broad umbrella various practices governing territory transformation, such as territorial redevelopment, housing policies, social and safety policies, in concert with themes of social cohesion, inclusion, and sustainable development. The act of regeneration in architecture expresses a desire for modification that brings together two components: the need to reduce land consumption and further "hardening" of the earth's surface, an awareness gained also

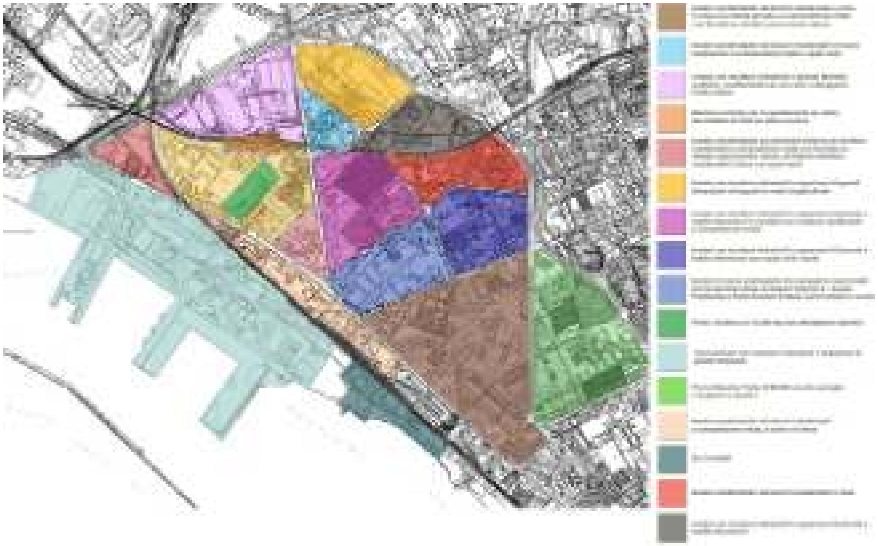


Fig. 7. Map of the Morphological Analysis of Blocks (source: the students of the Final Synthesis Laboratory in Architectural Design).

through the "policrises" (environmental and pandemic (Morin, 2020)) of the Anthropocene era (Crutzen & Stoermer, 2000) in which we live; the need to align material transformations involving human environments, as part of nature, with its needs. The increasing degradation and marginalization and the aspiration for the relationship between cohesion, inclusion and development, have placed communities at the center, and their need to reconstruct themselves around a task, a *"munus"* (Esposito, 2006).

Regeneration, thus conceived, rises to the level of strategy, capable of uniting transversal visions (trans-disciplinary and multi-scale) to be implemented through integrated projects that require innovation in governance, and in welfare matters, as the pandemic has well highlighted. Urban and architectural projects, capitalizing on past experiences, disciplinary and non-disciplinary, from the study of urban facts to soil projects, to the acquisition of present fluidity (Bauman, 2012), must find their space within that process, relating to the palimpsest of specific contexts in which they will operate, definitively resigning to the

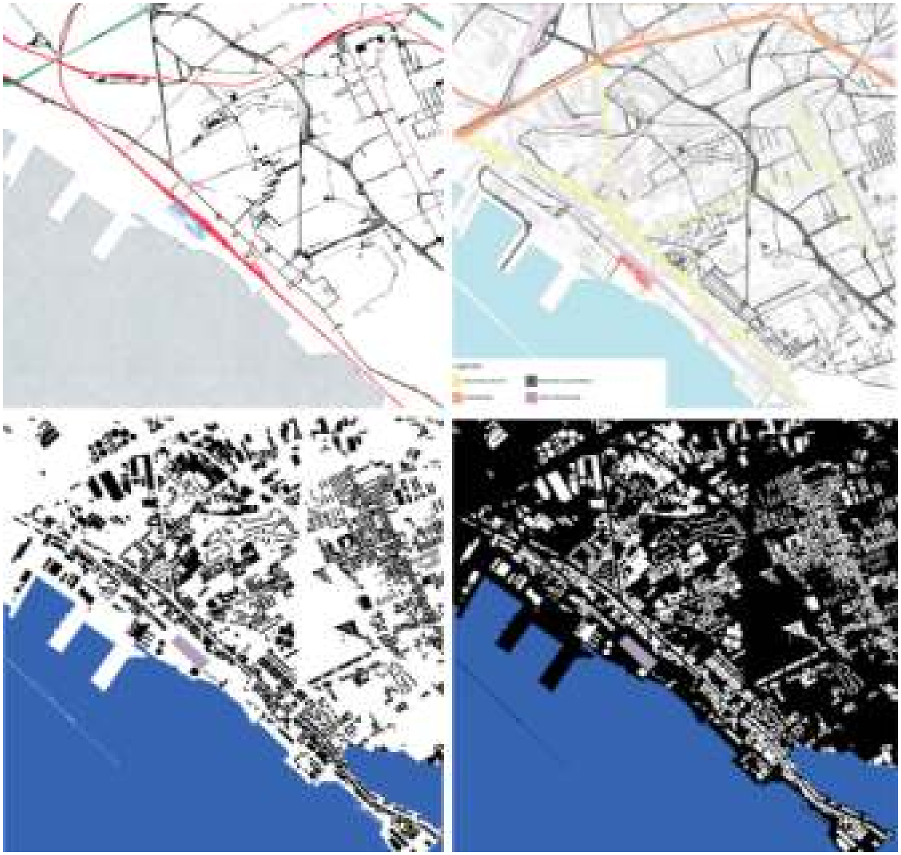


Fig. 8. Above: Mobility Analysis. Below: Analysis of Fullness and Emptiness. The maps were produced by the students during the design studio.

unfeasibility of an a priori form. Unveiling contexts and their "stories": those of physical construction, from pristine nature to settlement, those of living conditions, resource use, work, production, economy, and social development.

The elements on which to anchor regeneration are almost always already within the land; it is only necessary to lift layers of oblivion and indifference, an operation that corresponds in all respects to embarking on a research-action path. Regenerating, in fact, often coincides with implementing research-action processes.

The cognitive phase required students not only to study and interpret the historical and settlement evolution of the area but also to conduct in-depth research on urban regeneration case studies and recover past or ongoing project hypotheses from professionals who have intervened in the area. This was done to enable a new reinterpretation of the identified themes through different perspectives.

Interpretation

The method of studying the city, and therefore interpreting it, is based on foundational texts in urban studies such as "The Architecture of the City" by Aldo Loris Rossi and "The Image of the City" by Kevin Andrew Lynch, which, however, accommodates the more recent vision of the modern city described by Rem Koolhaas. This vision sees the city as a dynamic, hyper-connected, and contradictory place, rich in tensions and on the verge of losing its distinctive features. The lectures of the ex Corradini area thus employ the methodologies and tools of urban analysis theorized by Aldo Rossi: morphology, typology, and the definition of urban parts that allow us to read the city as if it were architecture itself.

Lectures based on Lynch's thinking embrace a more "sensitive" view of the city, enabling a perceptual, experiential reading that we do by living in it, thereby identifying elements that represent qualities or deficiencies of urban space.

Below is a list of some of the city readings carried out by the students, presented in the form of mappings, during the workshop:

1. Morphological Analysis of Blocks: This analysis reveals the identification of areas exhibiting characteristics of homogeneity due to the establishment of monofunctional settlement structures that over time have formed entire blocks completely distinct from contiguous areas. The ex Corradini area under examination is composed of a succession of spaces that appear to communicate with each other but, in reality, due to the heterogeneous settlement logics, they are unable to establish relationships, also because of the absence of open spaces that could have built connections (Fig. 7).

Fig. 9. Above: Building Fabric Analysis. Below: on the left there is the map of the Green Analysis, on the right there is the map of the Industrial Heritage Analysis (image: students).

2. Mobility Analysis: This analysis highlights the various types of mobility present in the territory today, such as railways, primary and secondary road networks, and highways. The focus was on recognizing mobility derived from ancient traces found in historical cartography readings, such as signs of rivers and canals. The main historical route runs

along Corso San Giovanni, parallel to the railway, but the ex Corradini factory remains completely isolated from it and does not relate to it in any way due to the composite system of various barriers (Fig. 8).

3. Analysis of Fullness and Emptiness: This is the canonical reading of the Schwarzplan, capable of clearly depicting the territory's heterogeneities by highlighting the different settlement characteristics of the lots recognizable by their typomorphological features (Fig. 8).

4. Building Fabric Analysis: This reading consists of matrices and positions of the building fabric only, distinguished based on their typomorphological characteristics, excluding all other anthropic and natural elements, except for the coastline, to highlight possible relationships of the factory area with the main thoroughfare and the sea, which are currently hindered by the physical limit of the railway (Fig. 9).

5. Green Analysis: A detailed description of the greenery in the area, classified based on its use or condition. This analysis shows that Naples predominantly features a mineral cityscape, with the almost total absence of public green spaces in this area being indicative of this reality (Fig. 9).

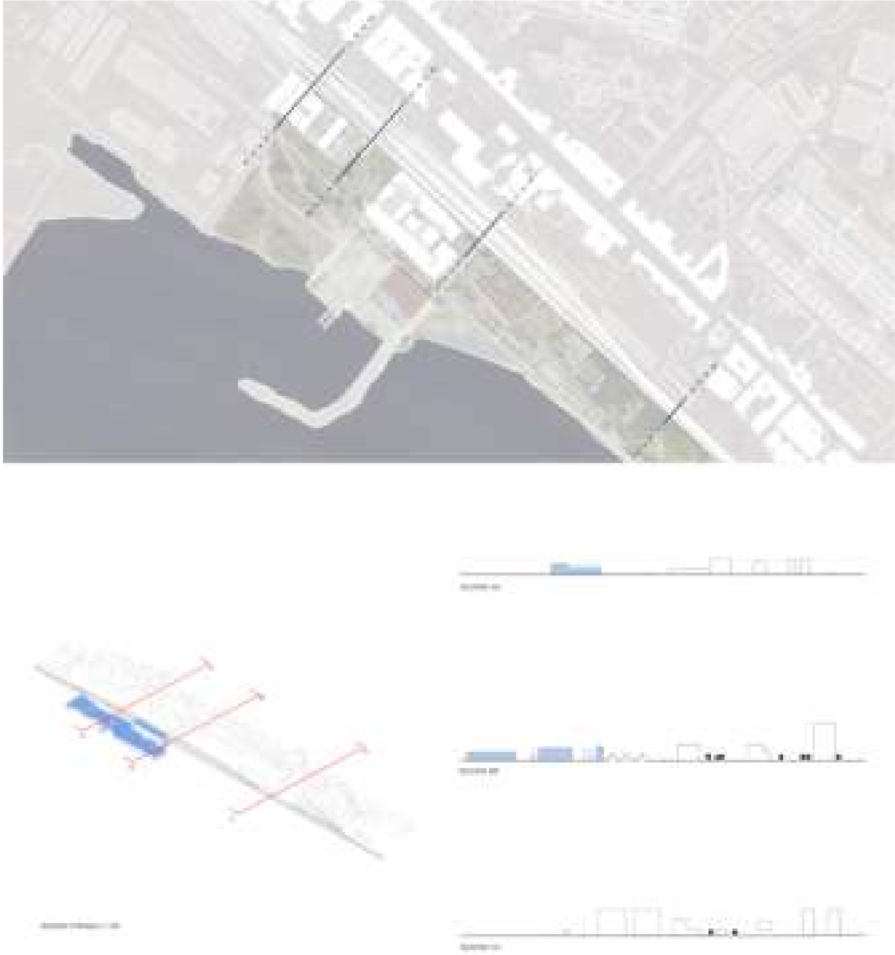
6. Industrial Heritage Analysis: This highlights the disused and active industrial heritage, a map from which we can clearly see how decommissioning has affected much of the sites in the area. This type of analysis is useful for gaining a comprehensive understanding but also for identifying hidden possibilities for other reactivation sites; it effectively serves as a map of transformation opportunities (Fig. 9).

All conducted readings are part of a complex methodological knowledge framework that is essential to guide decision-making systems, defining key points for the design exercise.

Choice System

The identification of certain key points, common to all students of the course, is exhaustively interpreted in a critical manner through a drawing called the "Table of Ins" (Fig. 10), which represents the synthesis of elements to be "kept" and with which the project will establish

Fig. 11. Above: a drawing showing the four possible crossing points identified during the design studio. Below: elevation study with cross sections on the former Corradini factory (drawings: students).



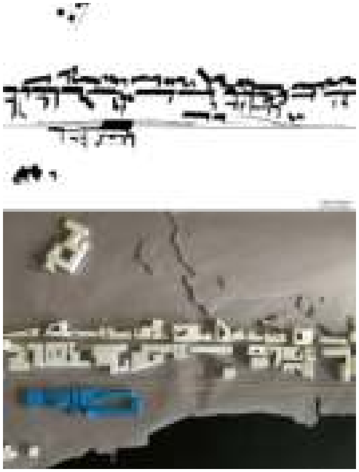


Fig. 10. This image shows the "Table of ins" and its study model produced by students during the design studio (image: students).

relationships, stemming from the reasoning derived from readings on the urban condition in relation to the ex Corradini factory. Within the elaboration, the key points of the area study are present:

- The factory, whose spatiality, both internal and external, is to be reinterpreted, which has undergone significant modifications due to the state of abandonment in which it remains, and its material consistency;

- The railway cluster, which from this point on takes on the dual value of a limit and a generator of design opportunities;
- Corso Garibaldi, to reinforce the intention of establishing relationships and connections that are currently non-existent with the factory;
- The coastline and the sea;
- The site of the Federico II University in San Giovanni a Teduccio, home to the Apple Academy, with which to establish a strong correlation with Corradini, as a consequence of the functional program assigned at the beginning of the course, which envisaged part of the factory building to be recovered and allocated to residences and ancillary functions for students;
- Piazza San Giovanni, the only open space along the study area, which has lost the characteristics and values that identify a public space and the relationships it should establish with the community.

The creation of study models of the "Table of Ins" has allowed for establishing altimetric relationships between the elements and, above all, through the study of the corso-railway-factory-sea relationship, with numerous transversal sections useful for understanding and verifying possible connections (Fig. 10).

The knowledge work conducted through various readings, the identification of key points - the "ins" and "outs," has allowed the identification of project themes:

- Crossings-Connections: Recognizing the need to connect the coastal area, and therefore the ex Corradini, to the urban context and analyzing the railway cluster, four special points were identified that allow the area to be related and communicated with the primary elements of the city (Fig. 11). Students have approached the theme of crossing-connection with diversified approaches, using both punctual elements, such as small bridges, and envisioning the project of promenade structures that would relate the abandoned areas adjacent to the railway with the factory or its roofs, as well as connecting Corso with the sea through panoramic paths that serve as belvederes and allow access to the coast.

Fig. 12. One of the outcomes on the issues faced by students, note the crossing points, the design of open spaces, and the restoration of the factory.

- Open spaces of the ex Corradini: The loss of volume of the factory due to degradation and abandonment has allowed the recognition of new possibilities to design an open space that takes on all the characteristics of a square. This new void, located adjacent to the two main buildings, houses a chimney inside that is well suited to the function of a landmark of the territory.
- The coastal fill: With the contribution of Professor Marina Rigillo, the part of the study area facing the sea has been the subject of projects and declinations on the theme of environmental requalification, as this area

Fig. 13. Models of the final projects during the examination (image: students).

requires reclamation works due to the harmful substances it contains. The theme seeks to respond to the need to regain the relationship with the sea.

- Internal longitudinal paths of the ex Corradini: The road within the factory area, parallel to its longitudinal axis, is an important connection to the Fort of Vigliena and the four identified transverse crossing points, making the area more accessible and permeable.

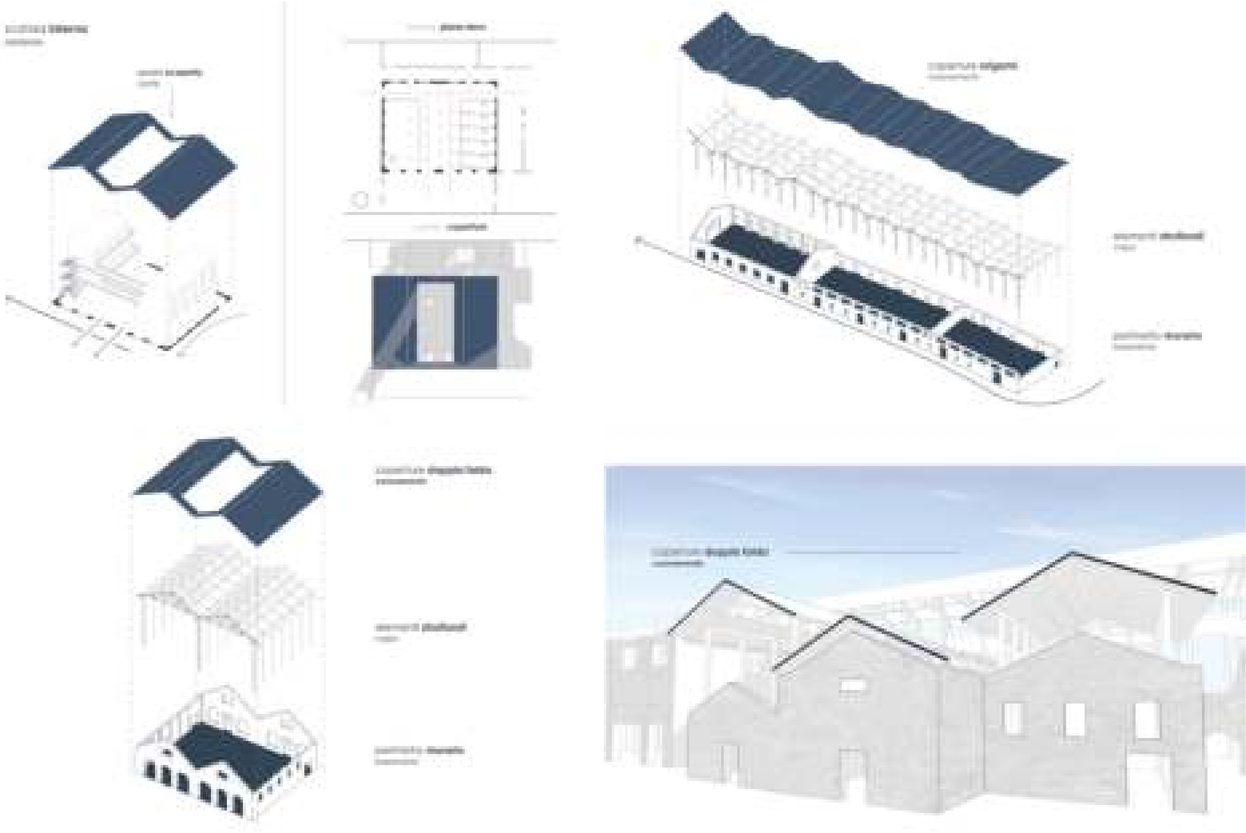


Fig. 14 Bachelor's thesis by Flavio Costantino, thesis advisor Professor Adelina Picone and co-rapporteur Professor Marina Rigillo entitled: Rehab the former Corradini foundry_ designing roofing.

Verification

The architectural project can be understood as a tool for understanding a place only if inserted into the dynamics of reading the characteristics of the context and has the objective of providing an answer to the prefigured transformation hypothesis and verifying its assumption. This leads to an ideal circularity in which the verification of a transformation hypothesis, conducted by a project, can trigger the generation of new hypotheses and visions, leading to a project condition closer to the idea of regeneration for the area. A concept dear to Bernardo Secchi who,

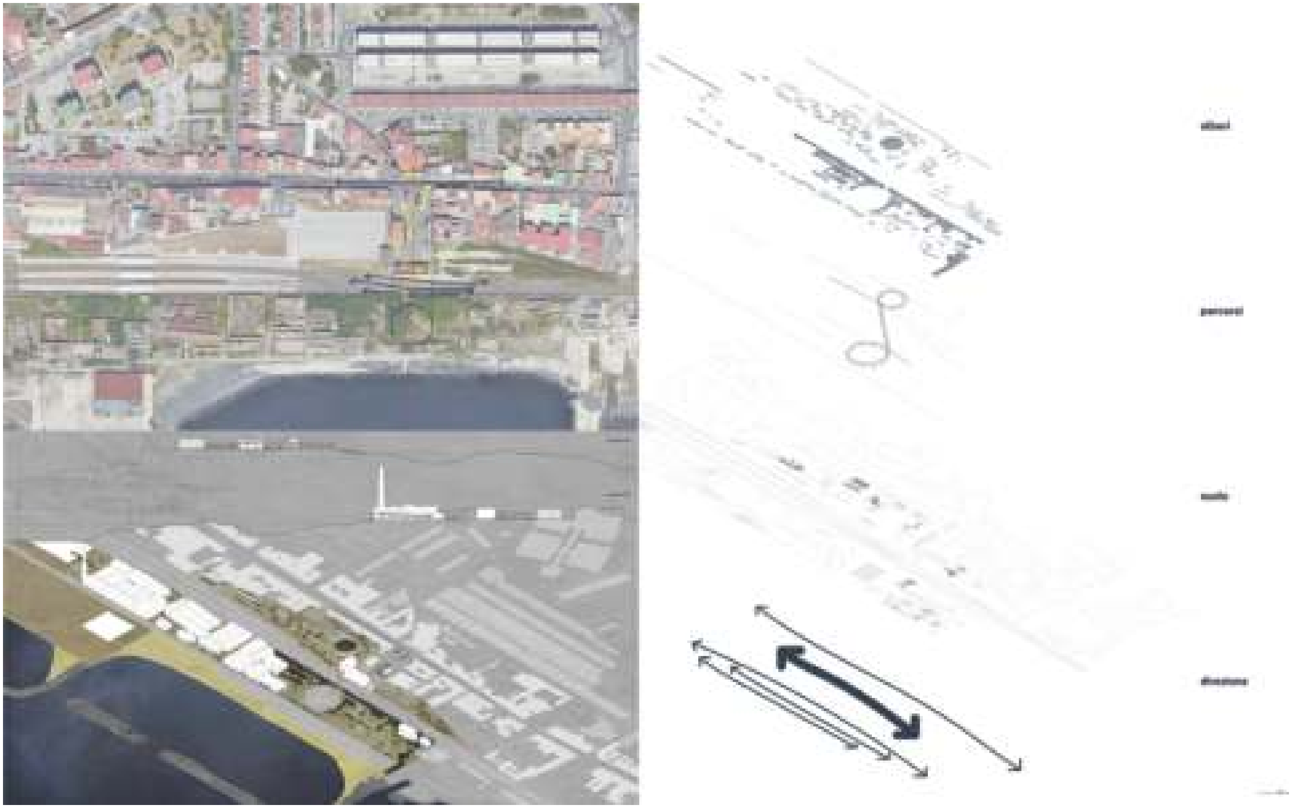


Fig. 15. Bachelor's thesis by Simone Della Ragione's ,thesis advisor Professor Adelina Picone and co-rapporteur Professor Marina Rigillo entitled: RIGENERATING / REACTIVATING / RIABITATING THE EX CORRADINI_*designing connections.*

regarding the project, stated: "... *A project for urban planning* emphasizes the project as a tool of knowledge, as a strategy to assume a critical distance from the context. Simply put, *A project for urban planning* seeks to establish an epistemological status of the project that eliminates the old distinction between analysis and project or, more simply, seeks to show the project implicit in most analyses and the analysis underlying all projects...".
Below are described some of the design variations resulting from the final outcomes of the Final Synthesis Laboratory but also from the thematic in-depth investigations addressed during the graduation workshop and ultimately materialized in the production of thesis documents for the

bachelor's degree. As observed in the students' design solutions, the various themes are consistent with the identified issues, albeit in different variations. Special attention has been paid to connections, whether punctual elements or part of a broader system integrating them into the requalification of areas adjacent to the railway. In other cases, the theme of connection is resolved through the design of superstructures that connect building rooftops and find a way to reach the sea, stitching together the city-factory-sea trinomial, transforming into small docks. The design interpretations for open spaces are also interesting, taking on a capillary character reconfiguring well-identifiable aggregation places (Figg. 12,13).

The two bachelor's theses illustrate further exploration of the themes: the first addresses the theme of recovery and reconfiguration of the factory, while the second one focuses on the connections for the requalification of areas near the station.

Recovery and reconfiguration: This thesis investigates the theme of new coverings for the ruins of the factory and studies their consistency, configuration, geometries, and conditions of being. The condition of the ex Corradini was first examined in detail, and an architectural design hypothesis was attempted to discretize the characteristic elements of the building itself. The hypothesis is to preserve the envelope and carry out potential recovery actions on it to insert structural elements inside aimed at configuring the covering element in a contemporary key. The same process is approached with different variations, interpreting the volumetrics in a completely different way from the starting condition, with the possibility of having courtyards within the volumes, creating a new condition for the inhabitant of the spaces and giving rise to different spatialities (Fig. 14).

Connections: In this case, the produced documents delve into the theme of traversal, paying greater attention to Piazza San Giovanni and the adjacent residual spaces, trying to configure a new system of open spaces of a capillary nature that seeks to hold together and weave new relationships with all the elements adjacent to the railway. The design and technological solution adopted to compensate for the different altimetry is a large promenade structure, integrated into the entire system of paths of open spaces, aiming to reach the sea and strengthen the visual axis it has with Piazza San Giovanni (Fig. 15).

References

Bauman, Z. (2012). *Modernità liquida*. Bari: Gius.Laterza & Figli Spa.

Crutzen, P. J., & Stoermer, E. F. (2000). "The Anthropocene". In *Global Change Newsletter*, No. 41.

Esposito, R. (2006). *Communitas. Origine e destino della comunità*. Milano: Einaudi.

Lucci, R., & Russo, M. (2012). *Napoli verso oriente*. Napoli: Clean.

Morin, E. (2020). *Sur la crise de Edgar Morin - Editions Flammarion*. Editions.flammarion.com. <https://editions.flammarion.com/sur-la-crise/9782081510869> (accessed 30 april 2024).

Palmentieri, S. (2018). *Dinamiche industriali e nuovi assetti territoriali. Le periferie di Napoli tra vuoti urbani e prospettive di valorizzazione*. Mantova: Universitas Studiorum.

Rossi, A. (1982). *L'architettura della città*. Venezia: Marsilio Editori.

CHAPTER 4
ex Corradini | Case study
Knowledge _ Representation _ Strategies
Mara Capone

Sharing knowledge about industrial archaeology with the public is crucial for raising awareness about the significance of industrial heritage. Public engagement strategies may include organizing guided tours, exhibitions, workshops, and educational programs to inform and engage different audiences about the history and value of industrial heritage.
The second phase of the BIP program is consistent with this approach.
The in-person workshop, that took place from 8th to 13th April 2024, focuses on conducting a comprehensive analysis of the case study and its context. The main workshop activity is based on the knowledge of the physical characteristics, historical significance, architectural features, and current condition of the site. This analysis involves context visits, engaging with local communities, stakeholders, historical documentation analysis and surveys data processing. In this phase of the BIP program collaborative approaches foster mutual understanding and collective decision-making, ensuring that the representation of industrial heritage reflects diverse perspectives and values.
Sharing knowledge defining communication strategies testing different representation methods and techniques are the main goals of the BIP program.
The first step was to clearly outline the objectives and goals of the workshop, including specific outcomes and deliverables. Before starting a survey has been done to determinate the target participants, considering their expertise and background in relation to the workshop topics. The

On side. Ex Corradini, industrial heritage. Photo by Maria Ferrara, taken during the Living Lab Inhabiting the City in Transition. Evolutionary Projects for the Reuse of Large Urban Containers (curated by Orfina Fatigato and Gianluigi Freda) included in the program of the Festival of Architecture, CA23 Campania Region Architecture in April 2023.

Urban Mapping

students

- Nataly Alina Stoica
- Maria Calvo Hidalgo
- Deva Leal Vazquez
- Lisa Bauss
- Julia Erben
- Eva Werner
- Alessia Fiorentino
- Pasquale Vessa
- Francesco Scotellaro
- Antonio Trezza
- Gabriella Orilio

Tutors:

Maria Simioli
Federica Itri
Gianluca Barile
Stephan Jost
Luis Agustin Hernandez

Physical model

students

- Sara Navarro Cozcolluela
- Gabriel Garzo Alonso
- Gonzalo Grijalba Molero
- Lydia Rodriguez Villarragut
- Jana Doom
- Hendrik Heuser
- Adrian Shellhorn
- Anna Sophia Weidert
- Annachiara Borrelli
- Valentina Caruso
- Carola Castaldo
- Matteo Ciancio

Tutors:

Francesco Casalbordino
Mario Galterisi
Angela Cicala
Victor Lafuente
Jose Angel Gil Bordas

Digital model

students

- Beatriz Lozano Aguilar
- Delia Rodriguez Viñas
- Patricia Romero Lopez
- Laura Sanchez Peña
- Kevin Bollerhey
- Oliver Otto
- Veronica Ida Auricchio
- Martina Caurio
- Andrea Zanna
- Giuseppe Rega
- Nicola Rota
- Cosimo Russo

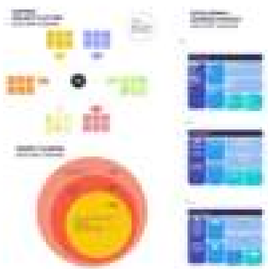
Tutors

Marta Alonso
Raquel Álvarez
Valeria Cera
Angela Cicala
Victoria Cotella
Daniel Degner
Marika Falcone
David Gonzales
Arianna Lo Pilato
Sara Peña
Simona Scandurra

Urban regeneration

students

- Khaddouj Titah
- Gloria Llorente Sanchez
- Ricardo Orive Fernandez
- Tamara Frey
- Ida Held
- Laura Kawecki
- Giuliano Rotoli
- Giada Galbiati
- Ivan Kononov
- Martina Formichella
- Aurora Bonora
- Federica Colella



Tutors:

Noelia Galván
Lucas Fernández-Trapa
Maria Cerreta
Piero Zizzania
Caterina Loffredo
Sveva Ventre
Sabrina Sacco
Giuseppe Ciciriello

main goal was to know the different skills especially in relation to use of some specific software for 3D modelling, BIM modelling, GIS/OPEN-GIS data management, point clouds data processing, graphic software and AR/VR software/app. We have defined working groups mixing students in order to have different skills in each group and students from different university to maximize impact.
By dividing the team into four working groups, each with a specific focus and set of responsibilities, the program can progress efficiently while ensuring that all aspects of site analysis and contextual understanding are thoroughly addressed. The collaboration between students and teachers within each group fosters interdisciplinary learning and knowledge exchange, enriching the overall outcomes of the project (Fig. 1).
We have identified the following topics for each working group:

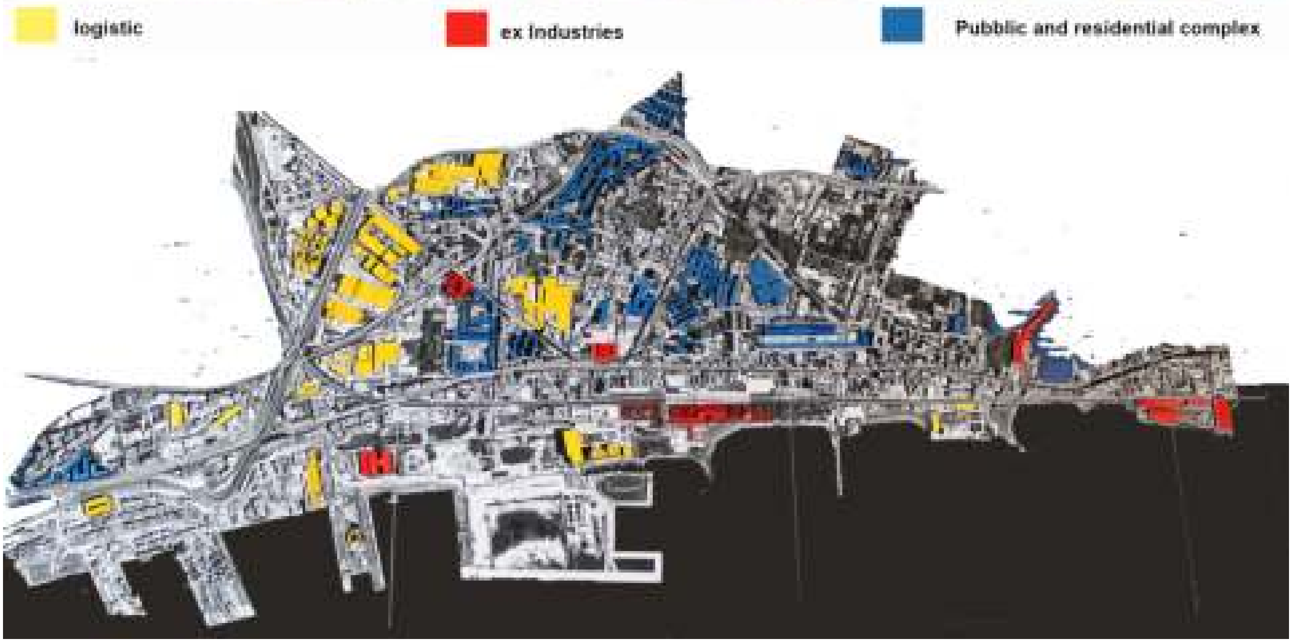
Teamwork 1_Urban Mapping of Abandoned Industrial Areas in Naples

The task of this teamwork would be to conduct a detailed cataloguing and mapping of abandoned industrial areas in Naples using Geographic Information Systems (GIS) technology. They would gather data on the location, size, condition, and historical significance of these areas, producing tangible outputs such as GIS maps, databases, and reports documenting their findings.

Teamwork 2 _Physical Model

The deliverables of this working group are two models: a physical model representative of the territorial context of the San Giovanni area and a more detailed physical model of the former Corradini area. These models would integrate data on land use, infrastructure, topography and other relevant factors to provide a 3D visualization of the surrounding environment. Tangible results can include scale models, renderings, and presentations that illustrate the spatial relationships and contextual characteristics of the area. These comprehensive physical models provide valuable information on the San Giovanni area and the site of the former Corradini factory, facilitating informed decision-making and planning

Fig. 1. Workshop activities (image by Mara Capone).


logistic
ex industries
Pubblic and residential complex

processes. In the territorial model, some uses of the territory have been highlighted which demonstrate the transformation trend from industrial to logistic (Figg. 2,3).

In the context of the former Corradini area, containers play a crucial role in shaping the landscape and influencing the site's potential for regeneration. Containers, due to their size and number, dominate the visual landscape, contributing to the site's industrial aesthetic. We have tested the Lego bricks as a tool for logistic representation, this creative method offers a dynamic and engaging method to visualize and plan complex logistics and urban development projects. Using Lego bricks to represent the scattered containers you can explore different configurations for their repurposing and integration into the new urban landscape (Fig. 4).

The detailed physical model of the Corradini allows you to analyze the transformation of the place. We have created a model that allows the replacement of some buildings, enabling changes in the configuration. Specifically, for several buildings, we have crafted models representing both their current state (ruins) and their original configuration. This removable physical model can also be used to assemble and visualize different design solutions (Figg. 5,6).

Having both the current and original models of buildings allows for a clear comparison of the site's transformation over time. This visual tool is crucial for understanding the extent of deterioration and the potential for restoration.

The model can be used to visualize and assemble different design solutions, providing a tangible way to see how proposed changes will look and function within the overall site.

The model serves as an interactive tool for engaging stakeholders, including community members, planners, and investors. It makes it easier to communicate ideas and gather feedback. During workshops and meetings, stakeholders can actively participate in rearranging the model to propose and evaluate different design ideas, fostering a collaborative planning process.

During workshops and meetings, stakeholders can actively participate in

Fig. 4. Workshop activities. Team work 2: Physical Model Using Lego bricks as a tool for logistic representation offers a dynamic and engaging method to visualize and plan complex logistics and urban development projects (image edited by Mara Capone).

Fig. 2. Logistic representation. In the context of the former Corradini area, containers play a crucial role in shaping the landscape and influencing the site's potential for regeneration (image edited by Mara Capone).

Fig. 3. Workshop activities. Team work 2: Physical Model. The logistic is one of the most important function in S.Giovanni District (image by Mara Capone).

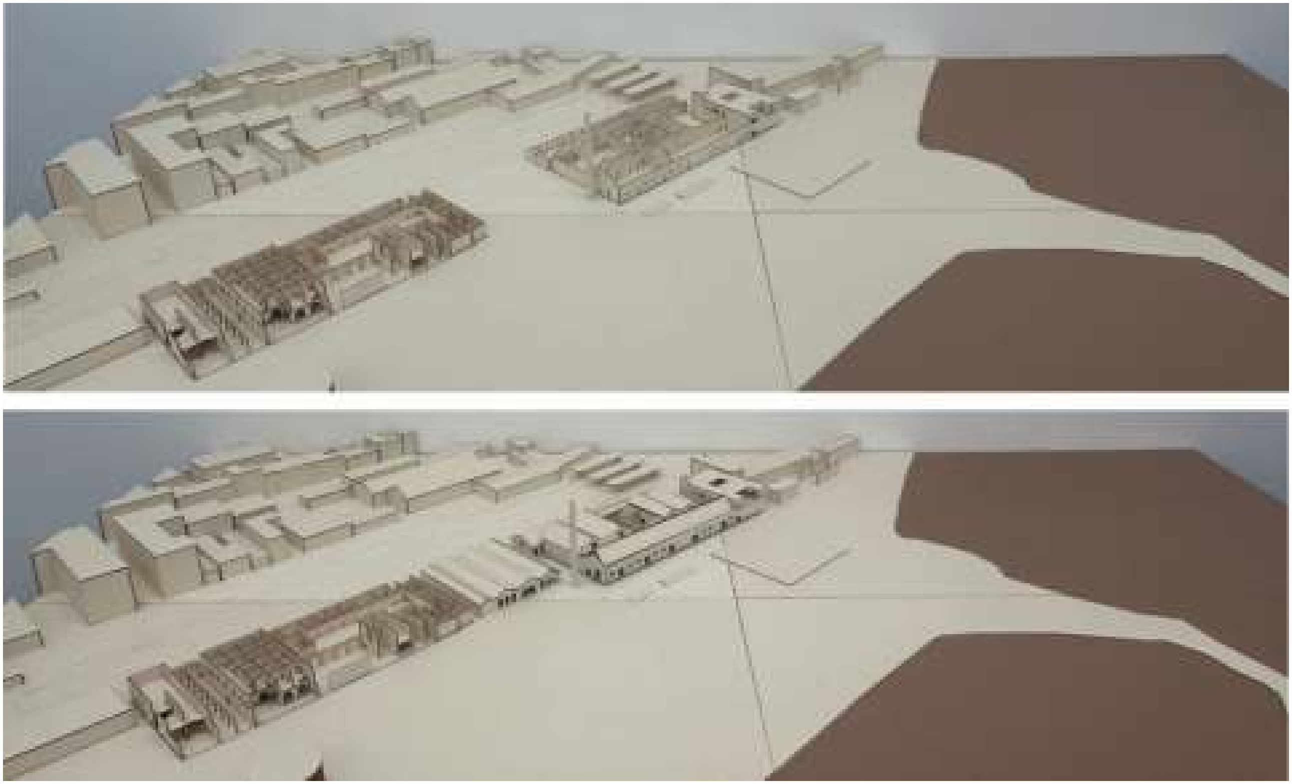
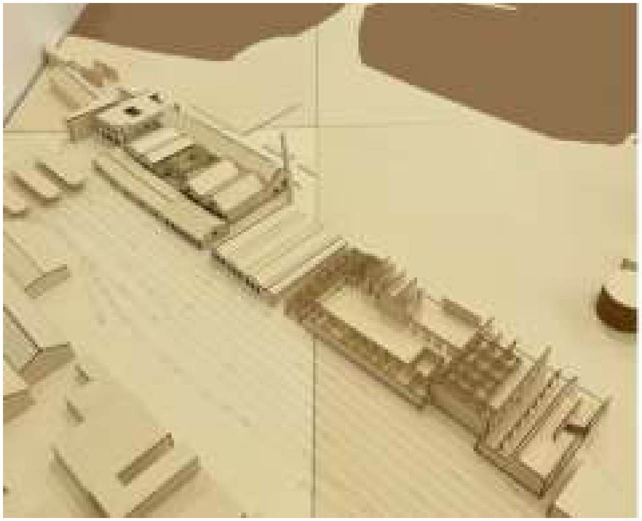


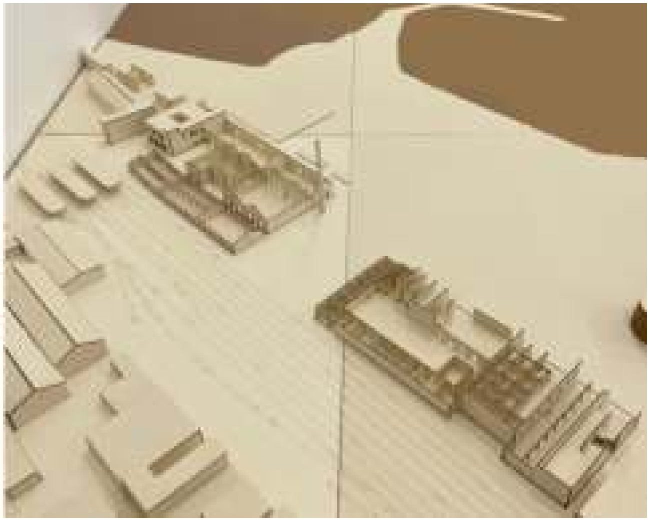
Fig. 5. Workshop activities. Team work 2: Physical Model. Ex Corradini Lot 2: campare present and original configuration (image edited by Mara Capone).

rearranging the model to propose and evaluate different design ideas, fostering a collaborative planning process.

Teamwork 3 _ Digital Model

The group focused on digital modelling and visualization techniques. Their task is to create 3D digital models of the site and its contexts and the representation of the transformations (timeline) (Fig. 7). Tangible outputs include 3D models of the site that can be used in VR\AR applications and the interactive exploration system to allow stakeholders to explore the site from different perspectives and simulate various design scenarios.





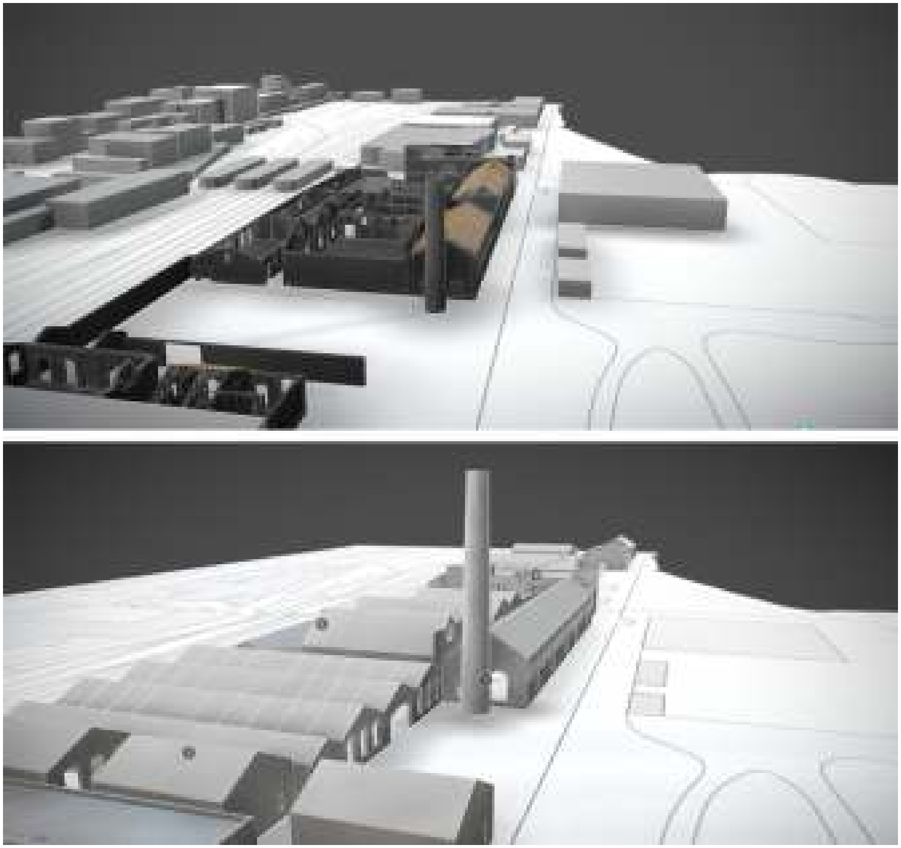
Teamwork 4_Urban Regeneration

The goal of this group is to develop creative and innovative solutions for urban regeneration within the San Giovanni area and for the ex Corradini site based on brainstorming activity. Drawing on the findings from the site analysis and contextual understanding, members of the group propose strategies for revitalizing the area, enhancing its economic, social, and environmental sustainability. Tangible results may include conceptual plans, design guidelines, and implementation strategies outlining the proposed interventions and their potential impacts.

By aligning each theme with a specific working group, the project can benefit from focused expertise and collaboration, ensuring that creative solutions and viable proposals are developed to address the identified challenges and opportunities within the study area.

The third and final part of the program, scheduled for April 29th to 30th, 2024, will also be conducted in virtual mode. This phase is characterized by the culmination of activities, during which the concepts developed in the intensive, in-person workshop will be refined for the final presentation and sharing.

Fig. 7. Workshop activities. Team work 3: Digital Model. Ex Corradini Lot 2: compare present and original configuration (image edited by Mara Capone).



During these concluding hours of activity, the students focused on perfecting the digital solutions designed to facilitate communication and dissemination of analyses and project concepts. The products were verified for the final publication of the results.

The aim has been to gather feedback from participants at the end of the workshop to evaluate the effectiveness of the sessions and to use feedback to develop future works.

Urban Mapping

Mapping cities life cycle.
A methodological approach to mapping former industrial area

Maria Simioli, Anna Attademo

Introduction

The current debate on Urban Metabolism (UM) and Circular Economy (CE) has been criticized for being mainly focused on technological and economic issues, forgetting the further impacts on spatial, social and systemic aspects (Agyeman, 2005; Korhonen et al., 2018).
These approaches and theories have arrived at the spatial field coming from much technological fields, in advanced economic model aimed at reducing the exploitation of raw materials and gas emissions within the production processes, while preserving value of natural capital, closing loops through integrated supply-chains (EMF, 2015). Still, such a technocratic perspective needs to be accompanied by a comprehensive rethink on the current economy trends, which could potentially leave vulnerable territories and communities behind, enlarging the field of knowledge and action through the mapping of supply-chains spatial impacts (Rifkin, 2022; Loiseau et al. 2016).
That is why, even if so far CE and UM have been mostly applied to the analytical description of material flows (Baccini & Brunner, 2012), there are clear opportunities to include disciplines of planning and design using UM theory as the storyline keeping multiple issues together, e.g. mapping the physical, social, industrial, urban, and political conditions that influence the territorial development and its life cycles (Grulois et al., 2018; Heynen et al., 2005). Thus, these theories can create an innovative baseline knowledge for urban transformations too, leading to a new type

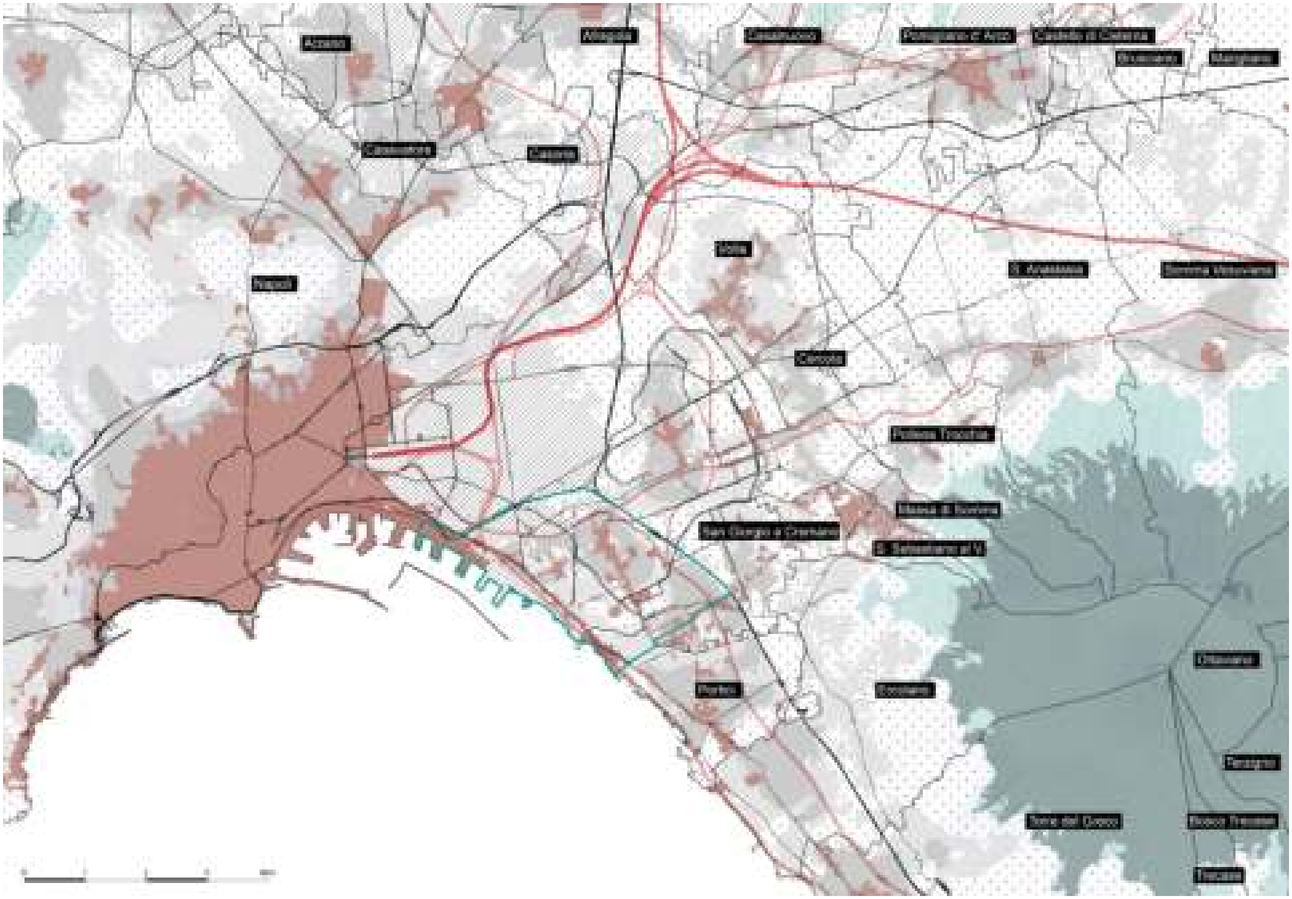


Fig. 1. Territorial framework of the metropolitan area of Naples. As part of the GRiD research work (drawing edited by M. Simioli).

of ecological approach, that is innovative for planning and construction, where the territorial capital is conceived as a reservoir of resources and space (Mostafavi & Doherty, 2016).

The present chapter builds on recent national and international research related to Urban Metabolism and Circular Economy, in which the co-authors had prominent roles for research:

- Horizon 2020 (2016-2020) REPAiR - REsource Management in Peri-urban Areas: Going Beyond Urban Metabolism, scientific coordinator: A.

van Timmeren - Delft University of Technology, UNINA coordinator: M. Russo. Its main objective was the creation of eco-innovative strategies, aiming at the reduction of waste flows in peri-urban areas of six European case studies (Amenta et al., 2022).

- EcoRegen. Circular economies and periurban areas regeneration (2020-2022); Research of Federico II University of Naples, 2020-2022, coordinator: M. Russo. The research is a spin-off of H2020 REPAiR, testing the methodology within public residential enclaves of the coastline of Campania, optimizing the flow of Construction & Demolition Waste. Both projects analyze the metabolism of urban and peri-urban areas, recognizing to waste and degraded landscapes, through the neologism of «wastescape» (Amenta & Attademo, 2016; REPAiR, 2018), the role of a discarded resource to be reintroduced into a new life cycle. For this reason, they started with a cross-disciplinary collaboration, from urban planning to Bioscence Engineering, which worked on integrating spatial analysis, material flows and life cycle assessment into the design of circular processes.

An innovative methodological model of intervention for baseline knowledge and mapping based on CE and UM is therefore approached. It presents some of the findings of the research funded by the University of Naples Federico II, titled "EcoRegen. Circular economies and periurban areas regeneration". This latter works on the design of circular processes and aims to increase the quality of life of peri-urban territories through the development of short supply chains, particularly those coming from Construction and Demolition Waste (CDW), generated by the renewal of the existing building stock, both when in a state of ruin and when in poor, non-efficient conditions. EcoRegen is supported by different disciplines (from urban planning to architecture and technological design) converging on the assumption that neglected areas (wastescapes, as for Amenta, Attademo, 2016 terminology) could become places for unexpected occasions of rebirth. Wastescapes are here intended as spaces to be reclaimed to improve the quality of life within disregarded communities, crossing spatial and social justice issues: a resource of

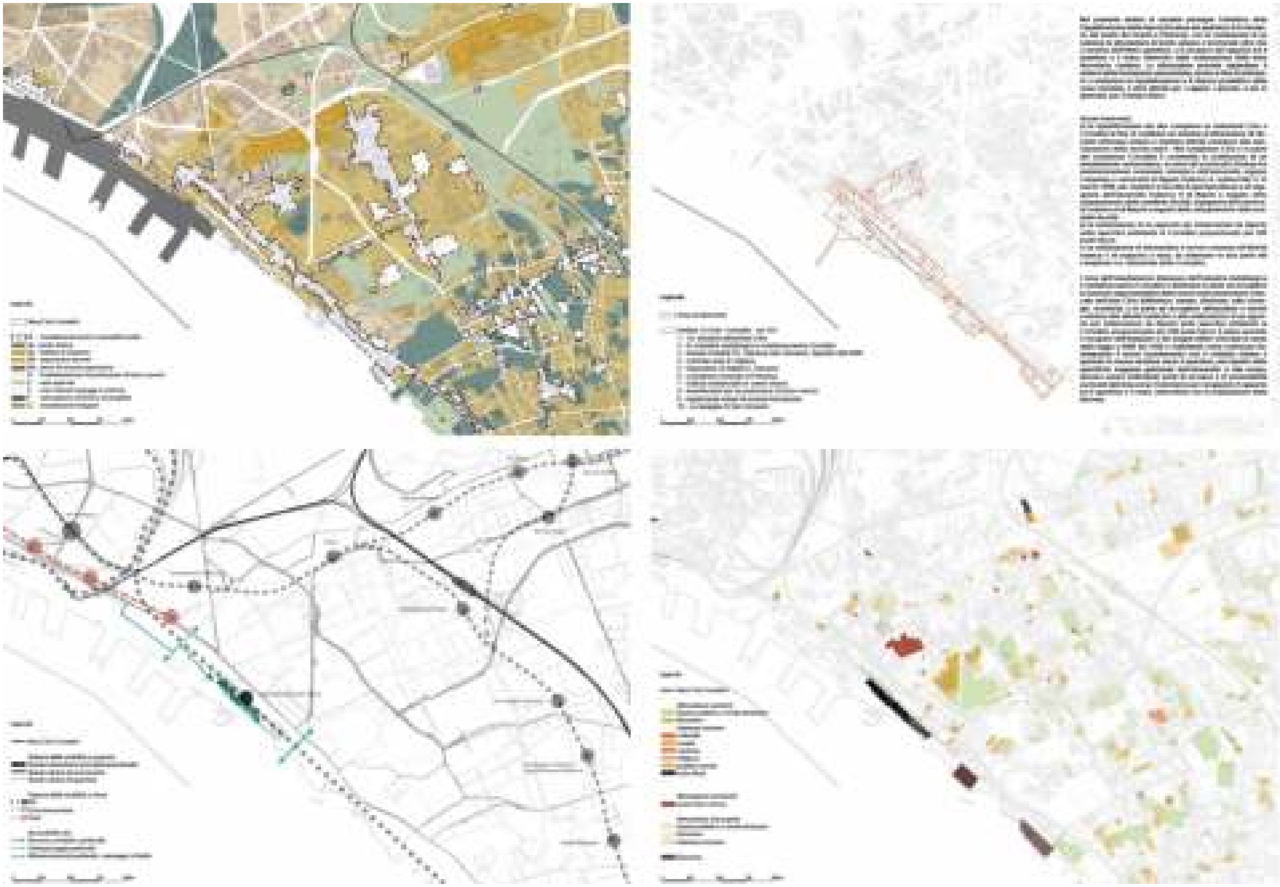


Fig. 2. Urban framework of San Giovanni a Teduccio. From right to left, from top to bottom: zoning of the master plan, PUA area sheet, accessibility system and public facilities. As part of the GRiD research work (drawing edited by M. Simioli).

biological and mineral capital through which to activate circular economy models for a resource-efficient city.

A key challenge is thus to impact on the one hand on multilevel governance efficiency for urban regeneration, to support the recycle and the reuse of the territory, avoid material waste and energy consumption, also through inclusive decision-making processes; on the other hand, on local planning, through the implementation of the developed methodology into innovative planning frameworks.

Based on these premises, EcoRegen research tries to design life cycles of the peri-urban areas, focusing on the relationship between uses, resources and values that characterize each type of wastescape. This approach led to the construction of a mapping and cataloging database of all wastescape areas, in which a regenerative process could revive the overall forms of living in these territories.

Materials and Methods. The case study area

The study area is in the metropolitan area of Naples, Italy. The research selected a huge territory in the eastern area of Naples featured for the presence of several former industries, built in the first decades of the 20th century. This is a dense urban and peri-urban area, extending itself from the coast and the Port of Naples to the Vesuvius volcano slopes. Since the 1950s, urban settlements were built to accommodate huge migration processes from the outskirts of the metropolitan area of Naples, without any consideration of the pre-existing patterns of natural landscapes, shorelines and agricultural areas that have survived after the 1900s' industrialization era. A general lack in comprehensive urban planning for new urban settlements and the post-war acceleration of the construction of big residential areas, resulted in urban and ecosystemic fragmentation, lack of mixed land uses and social deprivation.

Within this context, the EcoRegen research has identified a series of "areas for transformations". These are defined according to the key elements structuring the territory that have been interpreted as catalysts for future transformations. Notably, the research highlights "hard spines" that are areas featured for being functional corridors for providing new visions for local development. Particularly, the rows of public residential settlements (ERP, in Italian acronyms) are interpreted as public spines available for recovery and recycling processes.

The case study area is located on the edge of the city, where the compact patterns of the consolidated settlement turn into the chaotic structure of the urban fringe area. Here, the categories of density and dispersion, growth, and shrinkage, merge each other (Attademo & Formato, 2018).

Fig. 3. Cataloguing of the wastescapes of Spine 1 in East Naples: former steel industry, Parco Teodosia, kindergarten (drawing edited by the urban planning group of the EcoRegen research).

The historic centres, memory of the former rural hubs, are connected by a discontinuous urban pattern, where a hybrid urban-rural landscape is fragmented by abandoned industrial enclaves, underutilized settlements, low-density sprawl, greenhouses, and a variety of hybrid spaces, such as car parks, logistic platforms, shopping centers (Lucci & Russo, 2012). This area is also featured by a broad hydrographic network, historically regimented to reclaim the marshes between the eastern area of the city and the sea. These former marshes are still characterized by the presence of the water, remaining a primary landscape element, albeit in highly urbanized contexts fragmented by degraded spaces, with high environmental vulnerability, over and over exposed to flooding, hydrogeological and seismic risks (due to the near presence of Vesuvius volcano).

As previously mentioned, after the Second World War, the urbanization process in the area corresponds with the growth of small historical nucleus located in the peri-urban areas. Such a huge urban enlargement was led by a number of urban development programs for the construction of public housing. The INA-Casa program, funded with the American Marshall Plan for Reconstruction in 1948, the so-called "Fanfani Plan" (Italian Law no. 43/1949), was one of the main drivers of such a kind of peri-urban development. The plan worked on two seven-year periods, and it was finalized from a perspective of social and economic revitalization of the country, supporting the construction sector. The goal of providing a "house for all" was a political label of social responsibility and extended welfare, so that the public institutions responsible for the construction were also identified as the moral guarantor of the collective effort in improving the living conditions for the new generations (Attademo, 2021). In particular, in the second seven-year period, the "neighborhood unit" is given a role of control and guiding principle on urban growth. Following, as in the contemporary English model of the County of London Plan by Abercrombie and Forshaw (1943), settlement principles of functional autonomy with respect to the pre-existing fabric, the attempt is to support community-building, designing public spaces and promoting public uses to integrate the residential fabrics. But despite the well-structured projects, the almost exclusive presence of low-income families and the absence of mixité with no functions other than the residential one, has determined the gradual introversion and the consequent creation of deprived and isolated microcosms.

Additional national regulations (e.g. Italian Laws no. 167/1962, no. 457/78) and planning programs (above all, the Neapolitan Plan for Peripheries of

Fig. 4. Spine N. 1 of East Naples (drawing edited by the urban planning group of the EcoRegen research).

1980, and the Extraordinary Housing Program – P.S.E.R., for providing new residential areas after the 1980's post-earthquake emergency) have accelerated building procedures. The study area has been gradually featured by the construction of single-purpose settlements, without providing adequate structures and spaces where all the neighborhood's units could be transformed into real communities.

Currently, the city of Naples is addressing the legacy of this 20th-century urban planning, promoting the role of urban design in developing care measures for spatial and social heritage, also in national and EU planning programs. In this sense, it is interesting to point out the presence of a vibrant community of third sector actors that are reclaiming wastescapes, with the purpose to build new open spaces and provide social services, as for the case of the first Italian Energy Community (national Law no. 285/2020), providing energy to 40 families that live nearby to a no-profit organization, already providing activities for disadvantaged children.

Mapping methodology

The interest in viewing the territory through a metabolic lens and charting its evolutionary path using existing resources arises from the aim to establish an analytical, strategic, and design methodology that can guide various stakeholders involved in the territorial transformation towards "closing the loops". This involves repurposing waste materials (such as those from complete or selective demolitions) and revitalizing unused areas as part of the environmental infrastructure (Prendeville et al., 2018). Developing this methodology, alongside a strategic masterplan and the proposal of pilot projects as prototypes, can contribute to fostering dialogue with institutions. This dialogue aims to equip local policies with the necessary tools to transform and enhance the territory effectively.
Our methodological approach is based on a series of critical questions that guide our research on applying circular economy principles to the territory. The first fundamental question is: how can we translate the concept of circular economy into concrete actions on the ground? To answer this question, we have posed two specific sub-questions:
(i) The first sub-question concerns representing the territory based on the presence of waste. To do this, we need to develop a "language" that allows us to interpret and communicate the presence of waste clearly and understandably. This will help us identify areas where circular interventions can make a difference.
(ii) The second sub-question focuses on identifying opportunity territories where intervention is most effective. Here, we focus on identifying areas that offer the best opportunities for implementing circular strategies. This requires carefully analysing the local context to pinpoint areas where interventions can significantly impact sustainability.
The research is structured in three phases:
- *Exploration*: It involves defining a critical-interpretative analysis of the

Fig. 5. Cataloguing of the wastescapes of Spine 1 in East Naples: former industries and infrastructure buffer zone (drawing edited by the urban planning group of the EcoRegen research).

territory through an in-depth qualitative and quantitative investigation through a photographic campaign (Atlas) and spatial analysis in a GIS environment (Mapping). This approach allows for identifying critical areas of the territory and prioritising intervention areas for transformations, such as clusters of public residential buildings and wastescapes. Regarding wastescapes, data from the REPAiR project were utilized and refined at the municipal level using various sources such as urban plans, virtual and physical site inspections, and photographic documentation. The ERP heritage was identified through bibliographic sources, urban plans, municipal archives, and the province of Naples's ACER (Regional Company for Public Housing) database.

Subsequently, the mapping phase corresponds to acquiring data and information for each identified resource space, aimed at building a database, including analytical sheets on quantitative and descriptive-perceptive data.

For the ERP neighborhoods, based on a compositional-architectural reading and social context, information regarding users, uses (particularly ground floors and their alteration), building structure, and relationship with the context has been provided. Specifically, macro-categories have been identified to initiate data collection: Socio-spatial Dimension, Urban-landscape Dimension, Architectural Dimension, and Spatial Dimension within the built environment, to which a series of quality indicators have been associated to understand the criticalities and potentials of each public housing district.

On the other hand, the proposal for inventorying wastescapes is structured in four parts:

a) Basic data: (name, address, municipality, cadastral data, etc.), related to the asset's location and dimensional characteristics (technical drawings, area, height, etc.);

b) Enabling context conditions: (REPAiR category of wastescapes; ownership of areas (public/private), accessibility of areas, transformability of areas, relation to the waste-specific geography;

c) Additional elements to apply Eco-Innovative Solutions: urban function by local regulation, local regulation constraints, current destination, contamination data;

d) Additional elements to apply Life Cycle Assessment and environmental design: Building Materials, Physical aspect of outdoors.

- Actions: a systematization of the previously analyzed and elaborated information results in a matrix to guide specific interventions at the urban scale, identifying actions and strategies aimed at implementing the

Fig. 6. Cataloguing of the wastescapes of Spine 1 in East Naples: former Enel power plant (drawing edited by the urban planning group of the EcoRegen research).

circularity of cities. Areas are identified where to develop circular strategies elaborated in a toolbox (Abacus) as design prototypes to illustrate eco-innovative solutions for reuse and recycling.

- Transformations: developing a master plan that determines spatial strategies based on acquired knowledge, suggesting strategic directions for the entire territorial area, and providing guidelines for urban design.

Analyzing, interpreting, and planning the territory according to a metabolic circular approach, based on the careful use of resources, self-sufficiency, and resilience of a city, allows defining a helpful map for sustainable urban planning where various metabolic elements – resources (inputs), processes (resource life cycle), waste/emissions (outputs), flows (linear and/or circular) – are evaluated at different scales to become part of planning practices (Bote Alonso et al., 2022). Circular mapping necessarily requires using a continuously updatable tool capable of accommodating the mutability of changes in contemporary cities. In this sense, using an open-access WebGIS platform allows the process to be shared, updatable, and usable (Figg. 1,2,3).

The former Corradini as a resource space

The resource spaces identified within the EcoRegen research have allowed the identification of intervention and study areas at the municipal scale, which are identified as hard spines. Seven hard spines have been identified, but the research has developed an in-depth study on the first spine of Naples East (Fig. 4), on which to experiment with circular strategies for territorial regeneration. The former Corradini industrial complex was also identified within spine 1, among the mapped wastescapes. This industrial archaeology represents a strategic element for the San Giovanni a Teduccio territory in terms of regeneration, with the potential to serve as an urban system that anchors different types of interactions between the coastline and the city, implementing a large-scale regeneration aimed at a new and sustainable use of this portion of the territory by the diverse communities that inhabit it. In 2022, the Federico II University, in collaboration with important institutions, the Campania Region, and the Municipality of Naples, applied for funding for the property under a public notice from the National Agency for Territorial Cohesion to create an internationally renowned Hub in the field of Green Innovation to host public and private initiatives in Research, Innovation, Technology Transfer, Business Creation, Specialist Training, and Scientific Outreach on digital and sustainability issues. This perspective is in line with a development vision already outlined with the Federico II University campus, which also hosts the only European Academy of Apple, and the transformations underway and planned for the area: the demolition of public housing buildings in "Taverna del Ferro"; the construction of a cycle-pedestrian path along the coastline, the Federico II University campus, the restoration of Forte di Vigliena, etc.

The "Green Innovation District" (GrID) project, developed by the University of Naples Federico II, envisages intervention on the part of the former Corradini plant, specifically on the plot corresponding to the Pellami Fratelli De Simone Factory, formerly Dent Allcroft & Co. The former Corradini complex, subject to constraints under Law 1089/39, today the Cultural Heritage Code, by decree of February 27, 1990, consists of 54 buildings, including sheds and service buildings, all abandoned for decades, with partial collapses and advanced phenomena of subsidence and degradation.

The former Cirio-Corradini industry is located in the San Giovanni a Teduccio district (Fig. 5), which until 1925 was an autonomous municipality and today, together with the districts of Barra and Ponticelli, constitutes the sixth municipality of the Municipality of Naples. The entire eastern area of Naples had always been conceived as a large industrial hub of the city, starting from the 1939 plan coordinated by Luigi Piccinato. This evolution also affected the coastal area with industrial expansion along the coastline when, towards the end of the 18th century, in addition to the presence of important historic villas along the "Golden Mile" road parallel to the coast, the first industrial plants began to be located with the construction of the first industrial building called "Palazzo dei Granili" in Portici, designed by Ferdinando Fuga (Buccaro, 1992). The industrial character of the area was consolidated with the construction of the first Italian railway line, the Naples Portici route, which effectively facilitated the transport of goods, favouring the creation of new industries along the coast (Alisio, 1982). In the late 1970s, with the crisis of the industrial model and the phenomena of deindustrialization, and the public housing policies, which in the 1980s produced a significant increase in public residential construction carried out with the Extraordinary Reconstruction Plan (PSER), marked the isotropic and homogeneous character that characterizes this part of the city. A decline is also marked by phenomena of atmospheric, water, and soil pollution generated by industrial activity.

From the mid-1990s, the Municipality of Naples defined a territorial redevelopment strategy based on a substantial modification of the role attributed to the eastern coastal district of Naples: 1) the settlement fabrics of the old "peripheral" historical centres are recognized, including Barra and San Giovanni; 2) the reuse of old disused industrial areas with various functions is promoted and regulated; 3) the boundary of the commercial port is moved westward, allocating the coastal strip facing the district to recreational activities and the establishment of higher-level service functions, including, precisely, the University and a Youth Citadel in place of the Vigliena power station. Consistent with the redevelopment strategy at the urban scale, in 1999, the Municipality acquired ownership of the former Corradini plant, located on the coastline, to promote its reuse as a public facility predominantly for university purposes (Formato, 2023). In 2009, the Municipal Administration, to reformulate the territorial regeneration strategy and create synergies between territorial development and significant infrastructure projects, approved a Preliminary Urban Planning Plan (Pua) for the "Cirio-Corradini" area of San Giovanni. For the San Giovanni a Teduccio area, the Naples masterplan identifies the area as zone G "production of goods and services," and refers to the area sheet no. 14, the regulations governing the possible interventions within the PUA (implementing urban planning plan) (Fig. 6). The priority works identified by the preliminary plan that concern the former Corradini complex are: a) Pedestrian overpass of Vigliena; b) Urban archaeological park of Forte di Vigliena; c) New equipped square in front of the residential complex "Centocamerelle"; d) Restoration of the former Corradini, aimed at the formation of a complex for collective activities and artistic-cultural production.

The recovery of the plant and individual buildings is planned, integrating the settlement with the urban context and opening the new structure towards the neighborhood, in compliance with the specific management needs of the university. To this end, the identification of access points and permeability on the edges of the area towards the hinterland is prescribed to restore the relationship between the neighborhood and the sea, interrupted by the construction of the railway. The project developed as part of the GrID proposal thus pays special attention to open spaces, integrating with the coastal bicycle path project promoted by the municipality. These areas, placed in continuity with the adjacent coastal spaces, could represent an opportunity to create new green and equipped areas - a square, a "grove," weakly structured fields for games and sports, a space for the docking of the Metrò del Mare - increasing the degree of relationship between the city and the sea. A relationship, the latter, lost for decades, for the reconquest of which the role of the former Corradini is confirmed as crucial.

Conclusions

This contribution reflects on some insights developed within the EcoRegen research, with specific attention to the methodological approach adopted to identify novel and innovative ways of representing the territory, starting from the urban metabolism map. However, mapping is not the only descriptive method to be favored; it is necessary to use tools that can provide a perceptual description of places containing a significant design charge within them. The objective is not only cognitive but also strategic and design-oriented, working on the potential of the territory to transition from what is to what it can be.

Therefore, the main goal of this chapter becomes to point out and prove, in a specific neglected context, how the wider regeneration of urban assets needs to go hand in hand with circular economy principles, strongly considering the spatial impacts of waste flows (Rigillo et al., 2020). The research has been challenged with a model of intervention that puts together territories that can input waste (e.g. CDW from urban settlements in need of renovation, abandoned factories, etc.) and neglected territories (wastescapes) where waste could be recycled. Within this perspective fits the experimentation conducted in the area of the former Corradini, which represents both a wastescapes and a potential flow of material, thus becoming fertile ground for testing short supply chains in the on-site reuse of CDW materials, and reused to regenerate the wastescapes, largely applying Eco-Innovative and Nature Based Solutions to design accessible, public landscapes (parks, cyclo-pedestrian networks, squares, etc.).

By envisioning new purposes for all metabolic flows, functional needs can be satisfied in a planning framework aimed at working on the shortening of supply chains, avoiding the consumption of new soil, energy, material, or the accumulation of waste (Rigillo, 2022). In the following, some examples of solutions are proposed, promoted thanks to incentives, and aimed at improving the current performance of peri-urban ecosystems:

- Urban regeneration of neglected settlements, including selective demolition on site;
- Public facilities in recovered wastescapes interpreted as collection point/market place related to bulky waste (Attademo & Berruti, 2021);
- Technological upgrade of existing productive sites, into new reuse/recycle facilities;
- Production/use of recycled aggregates for different purposes, including innovative landscape transformations such as the shaping of new parks through artificial orography;
- Use of biobased materials for new developments, etc.

The adoption of the UM principles within the wastescapes regeneration reduces the consumption of renewable resources and enhances the reuse and recycling of waste within the intervention itself. In fact, the recirculation of waste makes it possible to capitalize on the investment in the natural resource (inert extraction), already realized at the time of the settlement construction.

The recovery intervention of the wastescapes thus takes the form not only of an opportunity to restore dignity and identity in neglected areas, but also as an innovative and ambitious practice for accounting in a "non-extractive" architecture perspective (Space Caviar, 2021) largely consistent with the objectives of circularity and sustainability.

Acknowledgements
Thanks to the EcoRegen research team of the University Federico II of Naples.
The authors have written and revised the paper together. However, A.A. wrote 1 and 2.1, M.S. 2.2 and 2.3. They wrote together the Conclusions.

References

Agyeman, J. (2005). *Sustainable communities and the challenge of environmental justice*. NYU Press.

Alisio, G. (1982). L'industria dell'Ottocento nella periferia orientale napoletana. In *Associazione per l'archeologia industriale. Centro documentazione e ricerca per il Mezzogiorno Bollettino*, No. 2-3, pp. 5-10.

Amenta, L., & Attademo A. (2016). Circular wastescapes. Waste as a resource for periurban landscapes planning. In *CRIOS*, No. 12, pp 79-88.

Amenta, L., & van Timmeren, A. (2022). From Wastescapes Towards Regenerative Territories. A Structural Approach for Achieving Circularity. In L. Amenta, M. Russo & A. van Timmeren (Eds.). *Regenerative Territories Dimensions of Circularity for Healthy Metabolisms*, pp. 147-160. Springer Cham.

Attademo, A., & Berruti, G. (2022). Planning Wastescapes Through Collaborative Processes. In L. Amenta, M. Russo & A. van Timmeren (Eds.). *Regenerative Territories Dimensions of Circularity for Healthy Metabolisms*, pp. 233-240. Springer Cham.

Attademo, A. (2021). Politiche per la casa tra dopoguerra e anni '80. In A. Attademo, E. Bassolino, C. Orfeo & L. Veronese (Eds.). *La costruzione della periferia. Napoli, 1945-1986*, pp. 23-28. Napoli: Clean.

Attademo, A., & Formato E. (Eds.). (2018). *Fringe Shifts. Nuove forme di pianificazione per urbanità in transizione*. Trento: LISt Lab.

Baccini, P., & Brunner, P. (2012). *Metabolism of the Anthroposphere: Analysis, evaluation, design (2nd edition)*. MIT Press.

Buccaro, A. (1992). L'area industriale orientale nel secolo scorso: origini dei luoghi e interventi fino all'Unità. In A. Vitale (Ed.). *Un destino industriale*, pp. 323-328. Napoli: Cuen.

Bote Alonso, I., Sanchez-Rivero, M. V., & Montalban Pozas, B. (2022). Mapping sustainability and circular economy in cities: Methodological framework from europe to the Spanish case. In *Journal of Cleaner Production*, No. 357, pp. 131-870.

Formato, E. (2023). La ex Corradini e il quartiere. In M. Rigillo, E. Attaianese, G. Galluccio & S. Russo Ermolli (Eds.). *Strategie Tailor-Made per il governo dei processi complessi. Approcci digitali per interventi sostenibili di trasformazione urbana*, pp. 166-171. Napoli: Clean.

EMF - Ellen Mac Arthur Foundation (2015). *Growth within: a circular economy vision for a competitive Europe*. Report sponsored by SUN (Stiftungsfonds für Umweltökonomie und Nachhaltigkeit) in collaboration with the Ellen MacArthur Foundation and the McKinsey Center for Business and Environment.

Grulois, G., Tosi, M. C., & Crosas, C. (2018). *Designing Territorial Metabolism Metropolitan Studio on Brussels, Barcelona, and Veneto.* Berlin: JOVIS Verlag GmbH.

Heynen, N., Kaika M., & Swingendouw, E. (2005). *Urban Political Ecology and the Politics of Urban Metabolism*. London: Routledge.

Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular Economy: The Concept and its Limitations. In *Ecological Economics*, No. 143, pp. 37-46.

Loiseau, E., Junqua, G., Roux, P., & Bellon-Maurel ,V. (2012). Environmental assessment of a territory: An Overview of existing tools and methods. In *Journal of Environmental Management*, Vol. 112, pp. 213-225.

Lucci, R., & Russo, M. (2018). *Napoli verso Oriente.* Napoli: Clean.

Mostafavi, M., & Doherty, G. (2016). *Ecological Urbanism*. Zurich: Lars Muller.

Prendeville, S., Emma Cherimb, E., & Bocken, N. (2018). Circular Cities: Mapping Six Cities. In *Transition*. Environmental Innovation and Societal Transitions, No. 26, pp. 171–194.

REPAiR (2018). *D3.3 Process model for the two pilot cases: Amsterdam & Naples*.

Rigillo, M., Formato, E., & Russo, M. (2020). Short Supply Chain of Waste Flows: Designing Local Networks for Landscape Regeneration, Detritus. In *Multidisciplinary Journal for Waste Resources & Residues*, Special Issue Waste Architecture Cagliari, CISA Publisher, pp. 35-44.

Rigillo, M. (2022). Hybridizing Artifice and Nature: Designing New Soils Through the Eco-Systemic Approach. In L. Amenta, M. Russo & A. Van Timmeren (Eds.). *Regenerative Territories Dimensions of Circularity for Healthy Metabolisms*, pp. 281-296. Springer Cham.

Space Caviar (2021). *Non-Extractive-architecture. On Designing without Depletion.* Berlin: Sternberg Press.

ARPAC

DERIVE SUBURBANE

QGIS CLOUD

PRG

Urban Mapping

Mapping Industrial brownfield sites in Naples: urban representation

Gianluca Barile, Federica Itri, Laura Simona Pappalardo

Introduction

The burgeoning interest in industrial heritage architecture underscores a burgeoning phenomenon, gaining traction across multiple sectors in recent decades. This interest spans disciplines ranging from heritage conservation and restoration to economic revitalization, urban planning, and territorial management. The exploration of abandoned industrial plants or areas is frequently facilitated through a suite of planning mechanisms, including redevelopment initiatives, heritage valorization projects, and urban regeneration schemes. The architectural engagement with industrial heritage necessitates an interdisciplinary approach, predicated on a deep understanding of urban history and the nuanced interpretation of traces left upon the landscape. Achieving this involves the meticulous mapping and detailed analysis of industrial archaeological sites, often facilitated by digital geographic information systems (GIS). These disused spaces represent not only valuable design resources but also serve as potent stimuli for designers, stakeholders, grassroots organizations, and citizens, galvanizing collective efforts towards the rejuvenation of these integral facets of everyday life. Enlisting the support of local governmental bodies holds promise for fostering synergistic collaborations among public agencies, private enterprises, civic institutions, and the resident populace. Such partnerships are poised to engender a culture of innovation, foster creative solutions, and advance sustainable practices in the realm of urban regeneration.

Fig. 1. Research and data acquisition. "ARPAC", "Derive suburbane", "QGIS Cloud", "PRG" (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

Numerous success stories attest to the viability and efficacy of initiatives aimed at reclaiming and repurposing industrial archaeological sites for contemporary needs (Marocco, 2017).
The industrial sites examined in this study are located within the ten municipalities comprising the city of Naples. These architectural remnants of industry exhibit a distinct spatial distribution within this urban landscape. Indeed, the Naples area is tightly enclosed to the east and west by two vast abandoned industrial zones, the abandonment of which has given rise to significant urban challenges at the extremities of the city. These zones delineate two substantial voids within the urban fabric: one in the Bagnoli district to the west and the other in the San Giovanni a Teduccio district to the east. In the former case, over 200 hectares were forsaken in the last two decades of the previous century by major steel and chemical industries established in the twentieth century. While a portion of this area has been repurposed for new tertiary and cultural functions (such as the City of Science), soil and water remediation has progressed slowly for over twenty years. The remaining relics, including the blast furnace and steelworks, have awaited restoration and new purposes since then. In the eastern area, also spanning hundreds of hectares, once stood one of the largest and most hazardous oil refining areas in the country, situated just a few dozen meters from densely populated neighborhoods. A productive collaboration between research and municipal urban management has enabled the identification of historically significant areas, employing flexible implementation tools to preserve the industrial heritage of the city without obliterating its traces (Vitale, 2012).

Objectives

The attention given to disused areas is due to the fact that urban settlements affected by the abandonment of productive areas become available for new uses without the need for further land occupation. These disused areas, mostly in a state of environmental and landscape degradation and often affected by potential or actual contamination, may possess historical and architectural characteristics of value, which

in some cases hold promise for preservation through comprehensive redevelopment prospects. In other cases, disused areas are regarded as potential strategic development areas for urban sectors now encompassed within the consolidated fabric of the city, as seen in the case of the San Giovanni a Teduccio district on the outskirts of the city of Naples.
The objective of this study, therefore, is to provide a response to the demand for understanding the phenomenon of decommissioning, which does not necessarily constitute solely a problem to be solved but also an opportunity for development in relation to aspects connected with the repurposing of such areas. Any intervention regarding the decommissioning phenomenon has been structured based on the knowledge of the location, achieved through a process of identification, localization, delineation, and characterization of these areas. To accomplish this, information systems such as GIS have been utilized, enabling the mapping of these sites, extending across the entire municipality of Naples. The realization of a GIS mapping, along with a summary inventory of disused industrial sites, has served as fundamental tools for the analysis and study of the territory, essential for implementing a project for the urban regeneration of the peripheral territory of the municipality of Naples.

Methodology
This study presents the culmination of efforts undertaken by students participating in the Blended Intensive Programme within the Department of Architecture at the University of Naples Federico II. Over the course of five days, students, alongside their tutors, embarked on a comprehensive exploration of disused industrial areas within the municipality of Naples, leveraging advanced Geographic Information System (GIS) platforms. The research process unfolded through a structured sequence of stages, commencing with meticulous data acquisition and culminating in a nuanced synthesis of findings. Embracing a multidisciplinary approach, the investigation traversed the realms of urban planning, environmental science, and architectural heritage preservation. At its core, the research

endeavor aimed to pinpoint specific territorial domains marked by the historical presence of industrial activity. These domains were selected based on their potential significance across several dimensions: urban and landscape dynamics, environmental stewardship imperatives, and architectural heritage value. Each criterion served as a lens through which the researchers evaluated the suitability of sites for prospective redevelopment and adaptive reuse initiatives. Within the urban and landscape framework, emphasis was placed on identifying opportunities for revitalizing abandoned industrial sites while harmonizing with surrounding urban fabric. From an environmental standpoint, the research prioritized the identification of areas requiring remediation efforts to mitigate potential contamination risks, thereby promoting sustainable redevelopment strategies. Architectural considerations played a pivotal role in the assessment process, with a keen focus on recognizing and preserving structures of historical and cultural significance. By delineating the spatial footprint of industrial heritage, the study aimed to inform future decision-making processes regarding the adaptive reuse and preservation of these sites.

Data research

The initial phase of the research project involved the strategic selection of data pertinent to the mapping exercise and delineation of methodologies for their acquisition. Stringent criteria were established, guided by comprehensive cross-referencing processes. A pivotal starting point entailed drawing upon prior research conducted within the Department of Architecture, aimed at mapping urban vacancies and defunct industrial complexes. This foundational work informed the structuring of attribute tables within the GIS framework. To gather information concerning these areas, reference was made to the regulatory urban plans of the Municipality of Naples, notably the PRG (Piano Regolatore Generale), which facilitated the identification of additional industrial settlement areas. Subsequent site identification was facilitated through the examination of aerial imagery and on-site reconnaissance efforts, pinpointing abandoned sites or areas earmarked for prospective redevelopment. Another invaluable dataset informing the identification of defunct industrial architectures was derived from the analysis of contaminated sites. Such data, accessible via the ARPAC website, in the form of maps and tables, cataloged and delineated contaminated sites distributed across the study area. Given the likelihood of contamination stemming from industrial activities, this analysis proved indispensable in pinpointing potentially disused industrial sites. Moreover, a thorough review of bibliographic sources served to enrich the research scope, providing supplementary insights into the sites under analysis. The integration of these diverse datasets formed the foundational database (Fig. 1), facilitating the comprehensive identification and understanding of industrial archaeological sites scattered throughout the urban landscape of Naples. Augmenting knowledge regarding the study of industrial archaeological artifacts necessitates a meticulous analysis of graphical representations specific to each site. Particularly in cases where planimetric information is lacking, on-site analysis, accompanied by extensive photographic documentation and precise survey campaigns, becomes imperative. This methodological approach enriches reference datasets, yielding a holistic understanding of the sites under study, thereby enhancing the knowledge base instrumental in the subsequent mapping phase using GIS platforms.

Systematization and synthesis of data

The outcome of the initial research phase coalesced into a roster of several disused industrial sites in Naples. Building upon this dataset, a process of systematization and synthesis ensued, facilitating the identification of criteria for establishing an attribute table for use within a GIS environment. This framework aimed to aid students in data collection and subsequent systematization, in preparation for further analysis. Leveraging the attribute table, exhaustive information was sought for each identified site, encompassing factors such as the industrial activity conducted, the year of construction and decommissioning, among numerous other criteria selected to achieve a comprehensive understanding of the locations.

Fig. 2. Sheets of data synthesis (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

The data obtained through this analytical endeavor were then utilized to produce summary sheets (Figg. 2-4), serving as the primary knowledge tool for the identified sites. These sheets provided insights into the pertinent data to be evaluated in subsequent phases. It was precisely through the deliberations arising from this initial collaborative phase between students and tutors that potential inquiries to be pursued within the GIS mapping were identified initially.

Fig. 3. Sheets of data synthesis: Analysis of the archeological industries of Bagnoli (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

GIS geographic information systems

As is well known, Geographic Information Systems (GIS) constitute an increasingly prevalent tool in the technological-informative landscape for the collection, organization, and utilization of data. These tools encompass a suite of hardware and software components facilitating the digitization, storage, representation, processing, and exchange of gathered information. The internet has affected GIS in three majorareas: GIS data access, spatial information disseminationand GIS modelling/

Fig. 4. Sheets of data synthesis (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

processing (Peng & Tsou, 2003). In recent years, such systems have found expanding utility in decision-making processes, leveraging their capacity for data analysis and representation (Stefanini, 2006). Their primary objective is to construct a data model capable of addressing posed questions or inquiries. Data processing engenders novel hierarchical information, thematic layers, and interpretations that can guide research endeavors. The distinctive element of such systems, as implied by their designation, lies in their utilization of georeferenced data, based on a

Fig. 5. The mapped area of Naples (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

reference system, and their capacity to store a broad spectrum of data of diverse nature, geographically referenced or referable, for employment in subsequent analysis stages. Data within these systems are typically collected in the form of alphanumeric databases, raster data, textual data, and multimedia data such as videos, documents, or non-georeferenced images. Numerous descriptive pieces of information can be associated with these data, enriching the GIS and facilitating subsequent analyses. Among vector data, it is possible to utilize point, line, or polygonal georeferenced elements to which a series of structured attributes can be linked in tables. These constitute the basic elements for creating statistical or spatial analyses and enable query execution. A particularly useful tool, especially in the context of mapping areas under study, is the ability to execute queries based on specific information, through numerous practicable and intersecting combinations. This facilitates the generation of intuitive thematic maps, characterized by ease of

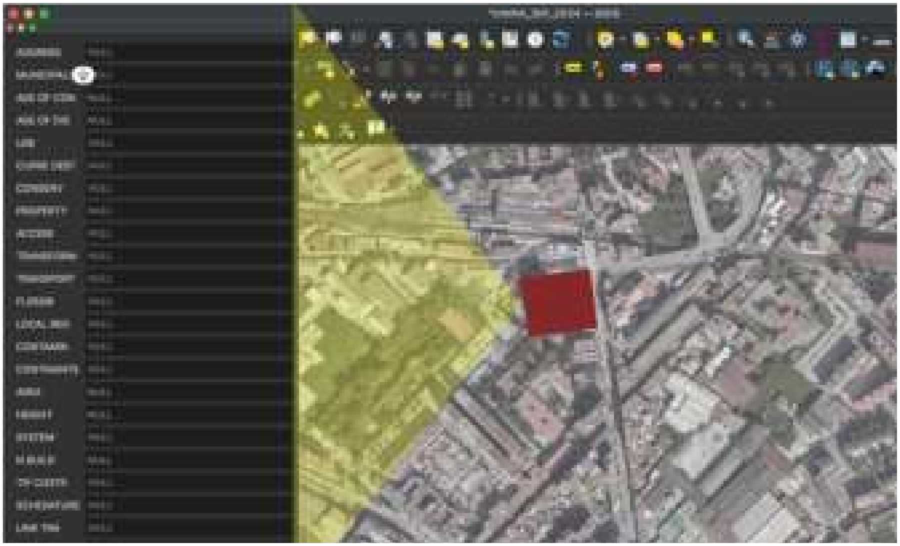


Fig. 6. Attribute table containing all the information for mapping (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

interpretation and with different levels activatable or deactivatable according to interpretative needs. Leveraging these core characteristics of GIS, it has been possible to conduct an analysis and investigation into the phenomenon of industrial abandonment in the city of Naples, based on the gathered information. The analysis has involved various stages, from data collection to their integration and analysis. Constant data updating is fundamental to keeping the GIS abreast of territory evolutions and studied phenomena. Furthermore, the use of open-source GIS such as QGIS has rendered the process more accessible and flexible, enabling users to tailor the software to their specific needs. This approach has fostered broader collaboration and greater dissemination of geographic information. Following the structuring of the GIS, it became possible to proceed to a phase of elaboration and analysis that allowed for a thorough investigation of the examined areas. (Forte, 2002).

Mapping

For the development and compilation of the database of abandoned

industrial areas, it was necessary to employ geoinformation technologies, particularly Geographic Information Systems (GIS). These systems allow for the association of geographic information with a polygon and a series of tabular data, accessible through querying elements. The work phases were initiated with data collection, already organized in an attribute table prepared in the initial operational phase, which facilitated the creation and subsequent filling of the digital map using QGIS. Subsequently, data sharing was planned through the creation of a webGIS and the execution of queries on the acquired data. In the preliminary phase, it was essential to define the types of areas to be researched, namely the abandoned industrial areas within the territory encompassed by the municipality of Naples (Fig. 5).
The study of these areas led to the structuring of an attribute table containing all the necessary information for mapping (Fig. 6). Students were tasked with collecting data that includes identifying aspects of the site, such as location, accessibility, state of conservation, historical context, construction and decommissioning dates, and the original intended use in order to investigate the productive characteristics of the Neapolitan territory. Subsequently, information regarding the conditions of the context in which the areas were located was researched, including any regulatory constraints and contamination data. After analyzing general and territorial data, attention was focused on specific site information and the typology of existing constructions, with particular attention to the planimetric system and the construction typology employed, thus creating a hierarchical system of information with different levels of depth, from the urban scale to the architectural scale. The organized data was then entered into the GIS as tabular data linked to polygonal elements.
The resulting table is characterized by various fields, where each row represents an area associated with a unique code, and columns containing all the necessary information. The mapping, carried out using the open-source software QGIS, utilized not only a satellite map directly accessible from the software, but also downloadable shapefiles from the municipality

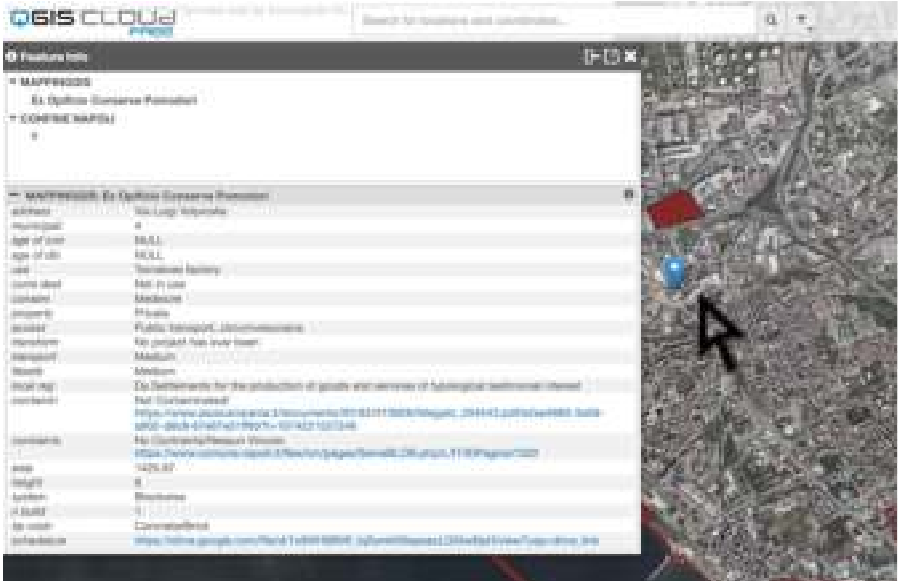


Fig. 7. QGIS Cloud plug in for sharing all the data (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

of Naples website, which provided the aerophotogrammetric survey of the 10 municipalities comprising the municipality, forming the basis for polygon drawing. The ability to visualize data as visually overlaying layers also allowed for immediate reading of the distribution of areas and other mapped elements (metro stops, municipal boundaries, etc.). All the information collected in the previous phases was linked to polygons to complete the mapping and make it ready for the subsequent query phase. Furthermore, based on the latest dictates of data sharing and open data, it was decided to share this data through the use of a plugin of the software used, QGIS Cloud (Fig. 7), which allowed sharing the work done via link, making it easily accessible for consultation.

Exploiting one of the fundamental characteristics of GIS, namely the ability to overlay informative layers, it has been envisaged not only to map industrial areas but also the individual buildings that compose them in order to gather information regarding their state of preservation, construction typology, contamination, and any ongoing regeneration projects. It has been useful, from a cognitive point of view, to investigate the use of each individual building, and therefore the function performed within the industrial complex. This allows us to understand the characteristics of these buildings, the structures inside them, but above all, it allows us to gather a historical memory of the building itself. This work has been of fundamental importance for the study of Ex Corradini, allowing us to understand how functions were arranged within the area and what activities were carried out in each industrial pavilion.

An additional informative layer has instead provided, through the use of point elements, the identification of viewpoints, allowing access to photographs of the various sites, for which the author and year of acquisition have been identified, in order to preserve a historical memory, always updatable, of the state of preservation and use of the different areas. As part of this mapping, for some of the analyzed buildings, graphs related to the individual pavilions or the entire area have also been included. The collection of this data also helps us in creating a comprehensive database, which can support the phases of knowledge and regeneration of such spaces.

In the context of GIS mapping, the role of representation and surveying should not be underestimated. Surveying, indeed, as it is directed towards the investigation and understanding of the built heritage, plays a significant role in the construction of systematic methods for cataloging data and information on artifacts of interest, in order to organize usable and continuously updated documentation, upon which to build interventions for the conservation and enhancement of architectural heritage.

The technological innovation of recent years, which has affected the architecture, engineering, and construction sector, has allowed the experimentation of new surveying methodologies, both direct and instrumental. The multiple acquisition methods make it possible to achieve results that, although different from each other, share the peculiarity of being characterized by a considerable amount of digital data (point clouds, three-dimensional meshes, georeferenced orthophotos, etc.), which, properly decoded, provide a translation from reality to representation. It

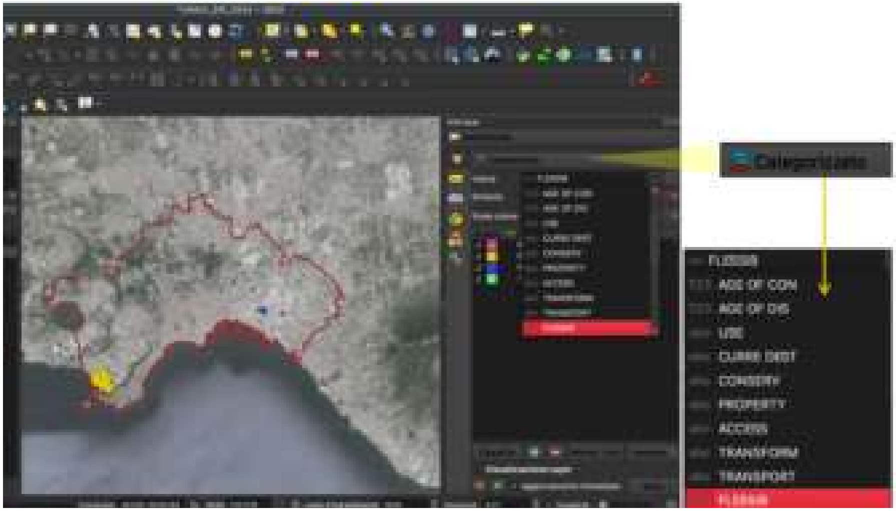


Fig. 8. Data querying based on the mapped attributes (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

is only through representation that the data, once reinterpreted, regains meaning by translating into a meaningful graph.

This can only be achieved through drawing, which serves as a clarifying tool, drawing on the specific fields of geometry and the most advanced techniques of representation and surveying. Representation is thus the outcome of architectural surveying, but not necessarily its ultimate purpose. There can be multiple purposes of this discipline, including: knowledge, documentation, cataloging, and mapping.

Data querying

After completing the phases of data acquisition and structuring in the GIS, we proceeded by leveraging one of the main features of such systems: the ability to query the data based on specific mapped attributes (Fig. 8).

This approach allowed us to create easily readable thematic maps and clear statistical summaries of the acquired data. Initially, for each of the analyzed sites, their locations were identified, focusing primarily on municipalities 3, 4, 6, 7, and 10, which correspond to the eastern and

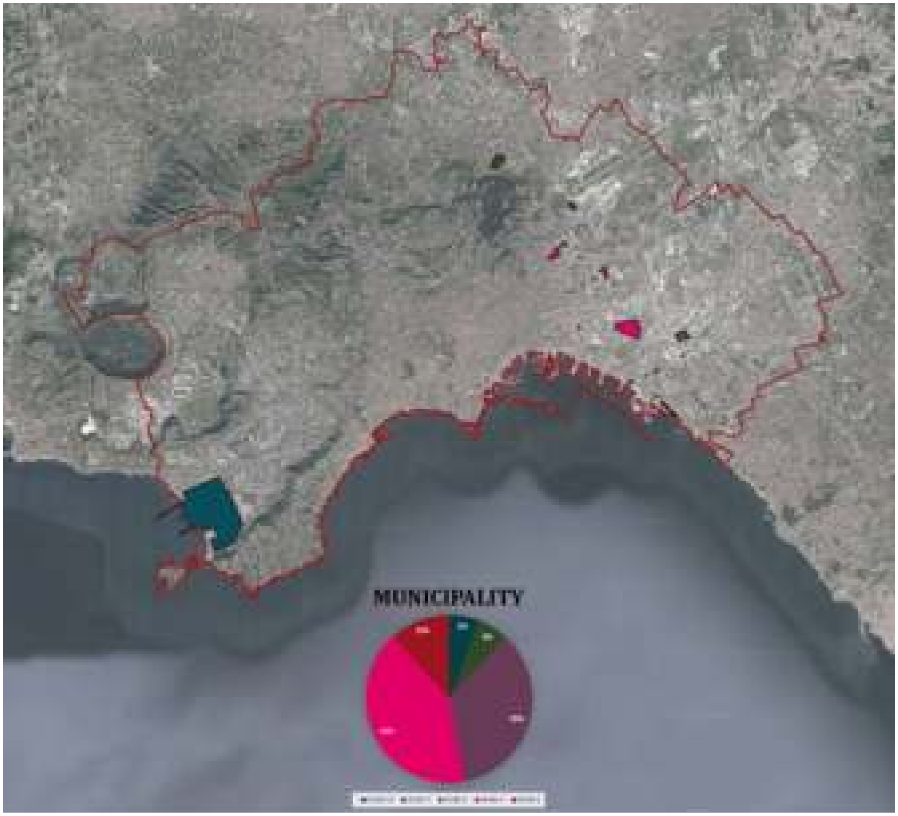
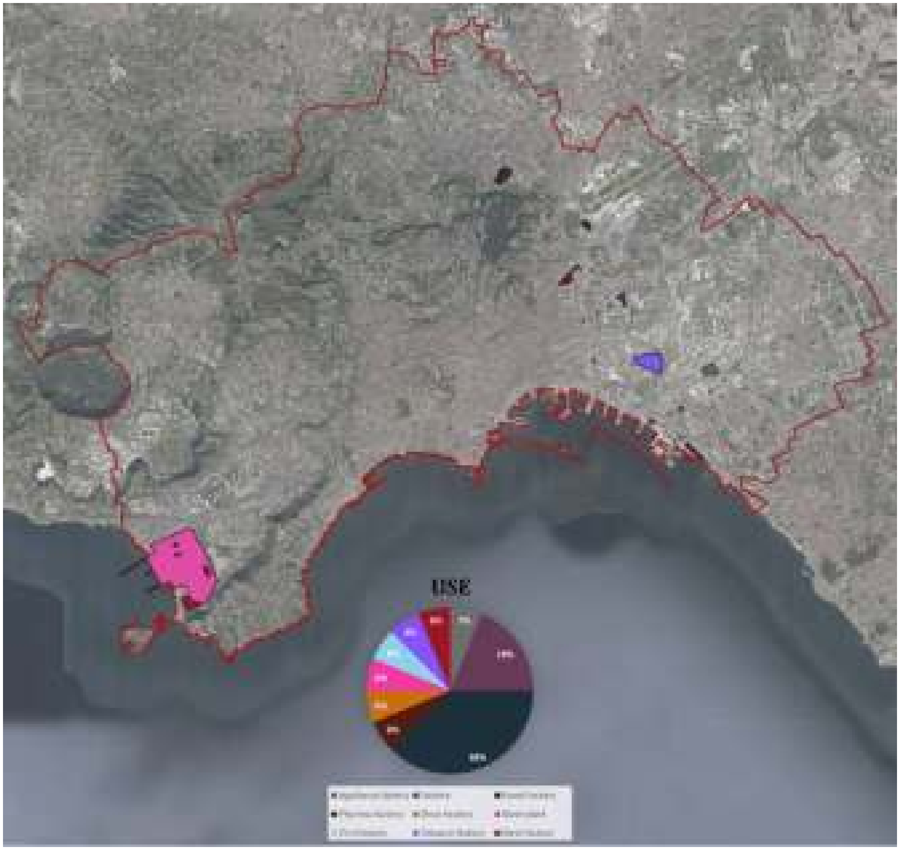


Fig. 9. Analysis of the municipalities where the studied buildings are located (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

western areas of Naples, characterized by a more pronounced peripheral nature (Fig. 9).
The construction of these sites began in 1861 and continued until the 1970s, followed by a progressive abandonment process that affected these industrial areas until a few years ago. Among the various types of production present before the decommissioning, we can mainly identify food industries, steelworks, and tobacco factories (Fig. 10).
The interrogation of the acquired data revealed the state of preservation of the industrial relics, classified as poor, mediocre, or good. In particular, over 60% of the analyzed sites exhibit a poor state of preservation.

Fig. 10. Analysis of the use of the factories (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).



However, this data requires further investigation and verification through targeted site visits to also assess the safety of the places, which is crucial for future regeneration. The redevelopment of disused areas, located in peripheral zones compared to the city center, requires that these areas be easily accessible to all, especially through public transport such as the metro or buses, in order to allow access even to tourists. Therefore, accessibility via public transport has been included among the fundamental attributes for research purposes (Fig. 11).

In most cases, these areas are accessible via both metro lines (Metro 1 and

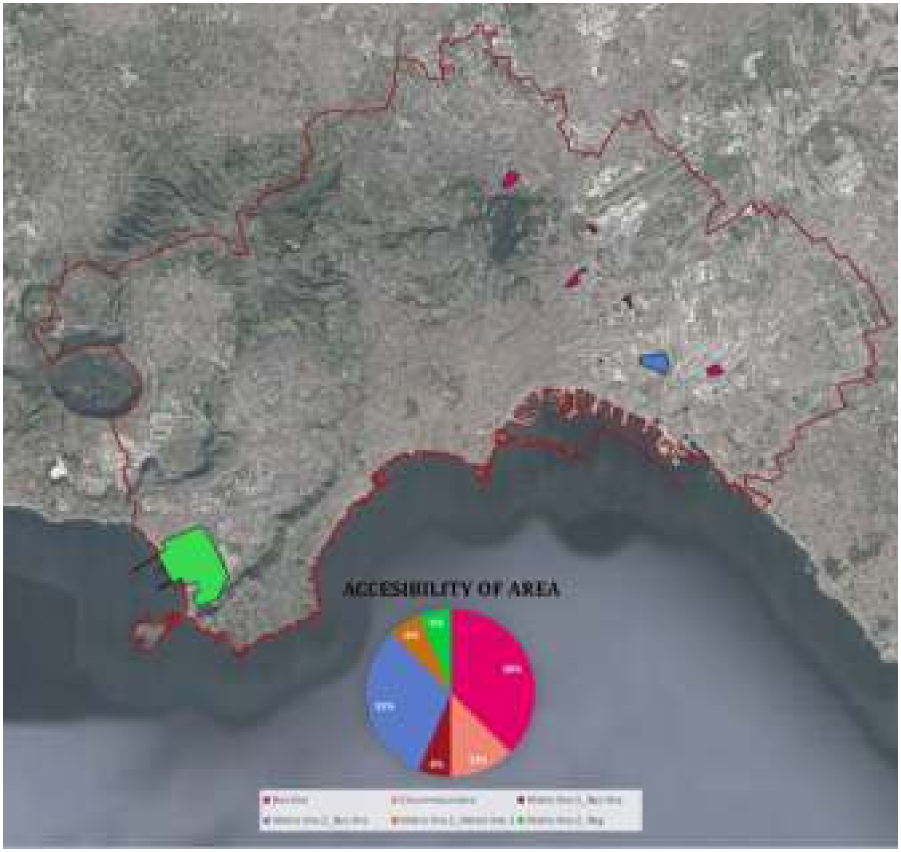
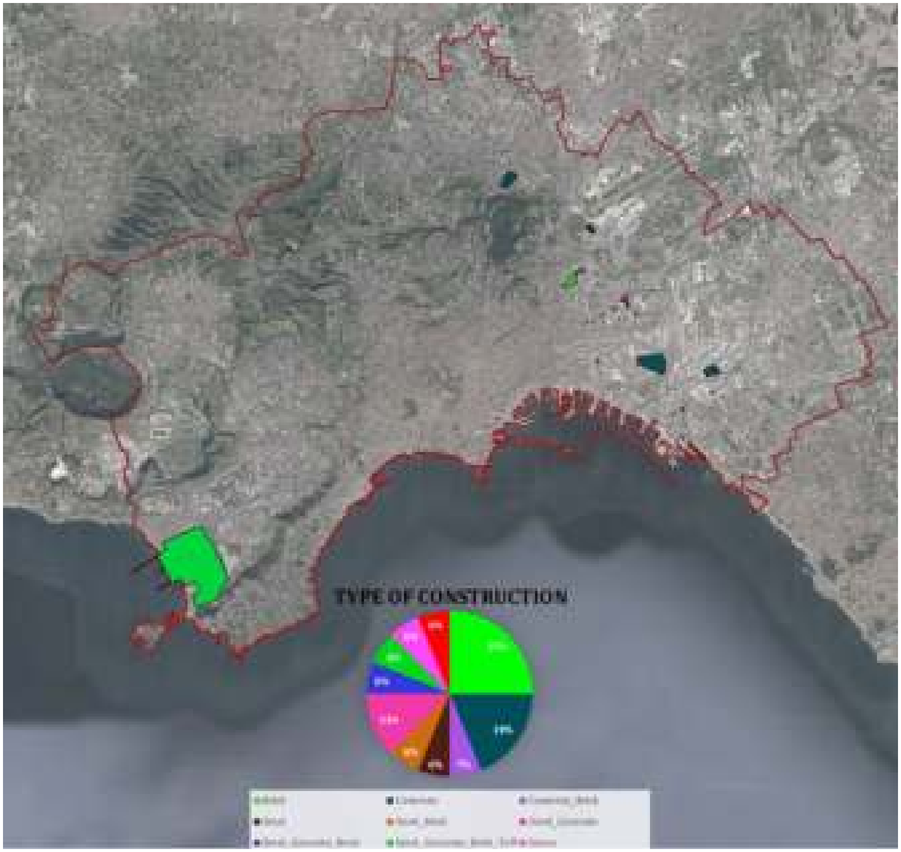


Fig. 11. Investigation of the accessibility via public transport (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

Metro 2) or by bus, and are well connected to the city center, offering an opportunity to enhance the surrounding neighborhoods. The structures investigated are mainly composed of buildings, of which today only skeletons remain, built using mixed techniques, such as steel/brick or reinforced concrete, while in a few cases it is possible to notice the use of tuff, a sedimentary rock typical of the Naples area (Fig. 12).
Another type of inquiry made possible through mapping is that related to the contamination of areas affected by the presence of industrial archaeological sites (Fig. 13).

Fig. 12. Interrogation of the aquired data through the type of construction of the abandoned sites (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).



Finally, it is worth noting the current involvement of these structures in transformation or regeneration processes, with the aim of making them cultural attractions in the area. Unfortunately, at the moment, these projects remain largely hypothetical, without concrete practical application. The areas are currently all unused and abandoned, often poorly fenced, becoming places for urbex actions or squatting. The redevelopment of these areas could not only remove hazardous materials still present but also create new services for local residents, making use of the numerous green areas included in these zones.

Fig.13. Analysis of contaminated sites where abandoned factories are located (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

Further works

A mapping of this nature is inherently continuously updatable. The work, indeed, is configured as an initial building block for the construction of a broader territorial knowledge project that can serve as a useful tool in decision support, which can be constantly updated, and easily accessible online in accordance with current open data principles (Fig. 14).

Through collaboration with various research groups, this endeavor could also be enriched with socioeconomic, environmental, or demographic information, enhancing the project from an interdisciplinary perspective.


Metro line 2
Ex Corradini
Green area

Ultimately, the mapping of abandoned industrial areas represents only the beginning of a research and action journey that can significantly contribute to the valorization and regeneration of the territory, promoting sustainable and inclusive urban development. The dynamic nature of the data and the potential integration of additional layers of information underscore the importance of this initiative as a foundational step towards comprehensive territorial management and revitalization strategies. Moreover, the iterative process of data collection, analysis, and dissemination ensures that the project remains responsive to evolving socio-economic and environmental dynamics, fostering a holistic approach to urban planning and governance.

Conclusions

In this historical period, the Western world is undergoing a significant transition: from an industrial-centric productive economic system, there is a gradual shift towards a service-oriented one. Large industrial giants are relocating their production facilities driven by low labor costs and regulatory simplification, transferring their legal headquarters abroad due to favorable tax treatment. The few small companies remaining in the Italian territory generally struggle to balance their budgets and are stifled by taxation and bureaucracy. This disastrous scenario has triggered an inevitable process of decommissioning of industrial complexes and facilities, bringing the issue to the forefront. We are indeed at a crossroads: on the one hand, there is the path of reactivation and productive conversion, hence industrial revitalization through technological renewal of the plants; on the other hand, there is the alternative of functional conversion, thus recovery and requalification of the complexes through the integration of new functions. In addition to the need for revitalization of industrial areas, there is the contentious issue of land use and consumption regulation, along with constraints of historical, archaeological, and landscape nature, which seem to strongly interest regulatory bodies.

The use of these cognitive and informational tools proves to be

Fig. 14. The mapping work serves as an analysis on which to lay the foundations for urban design and regeneration projects in these areas. The case study of Corradini (drawn by Alessia Fiorentino, Francesco Scotellaro, Antonio Trezza, Pasquale Vessa).

fundamental in guiding and supporting the design towards sustainable choices and compliance with the regulations dictated by the European Union within the framework of the Agenda 2030, particularly regarding the digitization of information that can be made available to a wide audience of users, thereby involving them in the decision-making process and remaining in line with best practices related to the circular economy for the improvement and development of a section of the city.

References

Forte, M. (2002). *I sistemi informativi Geografici in Archeologia*. MondoGis editore.

Marocco, M. V. (2017). *Recupero di archeologie industriali. Verifiche preliminari di fattibilità economica per un caso studio a Verbania*. Master's Thesis in Construction Engineering. Supervisors Prof. Ing. Manuela Rebaudengo, Prof. Arch. Francesco Prizzon, Prof. Arch. Marco Zerbinatti, tutor Ing. Giorgio Rocchia. Politecnico di Torino.

Peng, Z. R., & Tsou, M. H. (2003). *Internet GIS, Distributed GeographicInformation Services for the Internet and Wireless Networks*. Hooboken, NJ: John Wiley & Songs, INC.

Stefanini, L. (2014). I sistemi informativi geografici (GIS) e le nuove applicazioni dell'informazione georeferenziata. In *Argomenti*, No. 42, pp. 67-98.

Vitale, A. (2012). Luci e ombre sulla gestione del patrimonio industriale dismesso. In *Techne,* No. 3, p. 98.

Physical model

Visualizing the complexity of Corradini context. San Giovanni a Teduccio from production to logistic

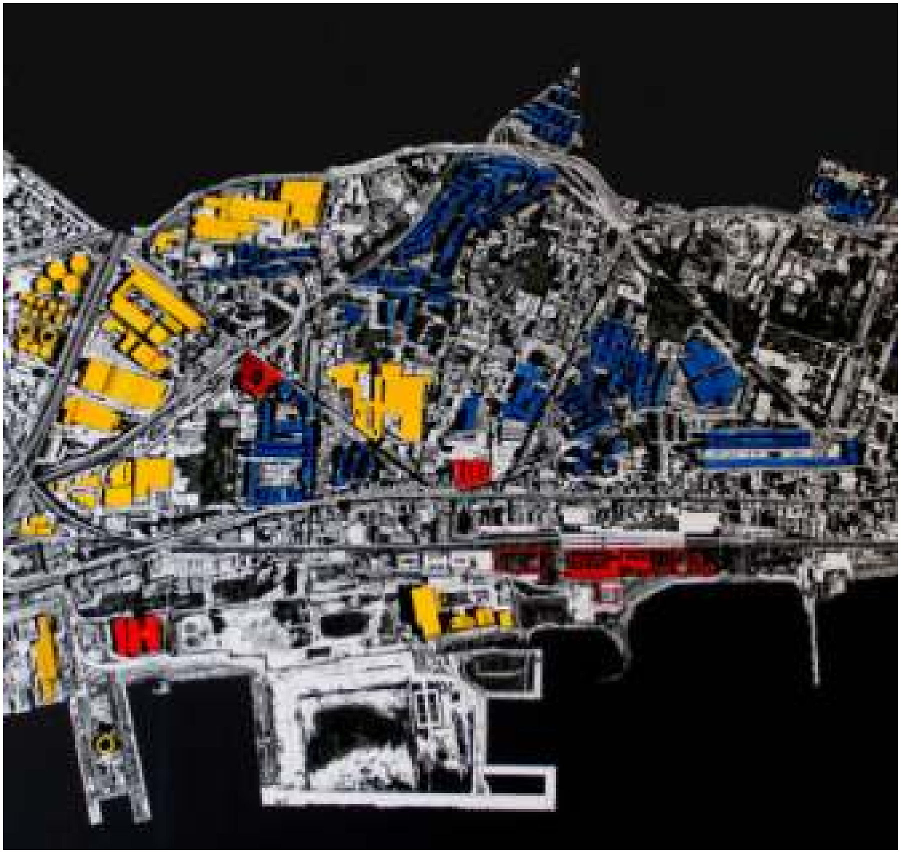
Francesco Casalbordino, Mario Galterisi

Exploring urban limits: morphological dynamics in the Eastern of Naples

"*Looking at cities can give a special pleasure; however commonplace the sight may be. Like a piece of architecture, the city is a construction in space, but one of vast scale, a thing perceived only during long spans of time [...]. At every instant, there is more than the eye can see, more than the ear can hear, a setting or a view waiting to be explored. Nothing is experienced by itself, but always in relation to its surroundings, the sequences of events leading up to it, the memory of past experiences [...]*" (Lynch, 1960, p.1).

In the context of contemporary architecture, the concept of the model has undergone significant evolution, transcending its traditional definition as a mere physical tool for representing the three-dimensional forms of an object. Currently, the architectural model emancipates itself from its tangible limitations to assume a more complex and multifaceted nature. Beyond serving as a means of representation, the model is conceived as a performative device and medium of conceptual and interpretative expression. This innovative concept situates the model at the center of the design process, making it a tool capable of revealing the intricate dynamics underlying the design practice itself. This conceptual extension of the architectural model prompts a thorough critical reflection, aimed at exploring the multiple facets and implications of this transformation. It invites us to consider the model not merely as a static representation of the architectural object, but rather as an active agent in the creative

Fig. 1. Territorial physical model detail (photo by Casalbordino F.).



process, capable of dynamically embodying and communicating design visions and intentions.

According to this logic, during the workshop "Industrial Archaeology: European Approach to Recovery Productive Memory", the development of the physical model was situated within this analytical framework, offering a detailed reflection on the intervention area, a particular example of the application of these concepts, the San Giovanni a Teduccio district in East Naples where the emblematic case of the disused former Corradini industry is located. Indeed, it represents an urban context rich

in specific challenges and opportunities that have significantly influenced its form and structure. The physical model was employed to highlight the infrastructural and physical limitations that have shaped the surrounding environment, while other extruded elements highlighted how they are distributed to understand the urban morphology and help to formulate design strategies.
The decision to employ the physical model as the primary tool for analysis and description stems from its capacity to provide a tangible and manipulable representation of the urban space in this area, which constitutes a unique and complex urban and architectural context, characterized by a layered history. "This is because the expansion of the city, throughout the ages, has had to contend with the complex topography of the place, which has determined shifts, intervals, and overlaps between the parts that were expanding" (Lucci & Russo, 2012, p.11). Indeed, located in the eastern part of the city of Naples, this area has been subject to significant transformations and developments over the centuries, influenced by a series of social, economic, political, and environmental factors. Its geographical position and historical evolution contribute to making it a fertile ground for the study of urban and architectural evolution over time.
Using modelling, we have been able to highlight the limits and distinctive characteristics of the study area clearly and visually. Infrastructural and physical limits have influenced the area's development over time, shaping its urban morphology and determining the opportunities and challenges for its future development, but they have also informed us of the form of the model that frames the study area. Simultaneously, the presence of extruded elements, such as industrial, commercial, logistical, economical, and institutional entities, allows us to grasp the heterogeneity of the urban fabric and the complex interactions among the various functions present in the area. These elements constitute a crucial component in the modelling and analysis of the East Naples area, as they reflect the diverse functions and characteristics within the urban context. They provide a representation of specific parts of the urban fabric, suggesting

Fig. 2. Containers (photo by Casalbordino F.).

the socio-economic dynamics present in the area. Industrial elements are fundamental for understanding the productive fabric of eastern naples, highlighting the presence of factories, warehouses, and industrial facilities, often disused or converted into logistical structures, which have contributed over the years to defining the local economy. Additionally, affordable housing complexes aid in understanding the social and demographic composition of the area, as well as the challenges related to housing access and urban livability.

Limits: Understanding and embracing complexity of San Giovanni a Teduccio district

In the realm of architecture, the concept of boundaries assumes a pivotal role in defining and configuring urban spaces. Recalling what Italo Calvino says in *The Invisible Cities* (1972), limits are the symbol of the city and can be interpreted across various dimensions, encompassing physical, social, cultural, and economic delineations that shape the form and structure of built environments. Physically, boundaries may consist of architectural elements such as walls, fences, and buildings, which delineate public and private spaces and define relationships between them. These physical boundaries can influence spatial perception and pedestrian circulation, thus contributing to the definition of a place's identity and image. In addition to physical boundaries, it is crucial to consider social and cultural boundaries that may either segregate or unite communities within an urban setting like socio-economic, ethnic, linguistic, or religious differences, that can impact social cohesion and quality of life in neighborhoods and cities.

When discussing boundaries, marginality, and shadow zones, the eastern periphery of Naples emerges as a dynamic and intricate stage where multiple morphological, historical, and infrastructural factors converge to shape its landscape and urban identity. These factors often manifest in the form of a boundary that is not merely a tangible demarcation but also underlies socio-cultural and economic divisions influencing the daily lives of its inhabitants. Major infrastructures such as highways and railways constitute tangible barriers that separate and define various zones of the city, contributing to the fragmentation of the urban fabric and creating visible and invisible divisions within this urban segment. "To this kind of morphology, contemporary development has added contradictions and tensions inherent in the planning of transportation infrastructures

Fig. 3. Territorial physical model stage 1: border definition (photo by Casalbordino F.).

of all kinds" (Lucci & Russo, 2012, p.11). The introduction of a robust infrastructure network has represented a significant turning point in the evolution of the eastern periphery. The implementation of transportation infrastructures has undoubtedly yielded ambivalent effects on urban accessibility. While it has expanded the possibilities of connecting the city center to its outskirts, it has also contributed to spatial fragmentation and functional overlaps among the different developing zones.

What emerges is a tangle of viaducts, overpasses, and underpasses which, although necessary to ensure an efficient road network, have also acted as physical barriers, affecting the fluidity of social relations and movement

within urban space, and shaping the morphology of this area. Indeed, this phenomenon has led to a complex and layered configuration of the urban fabric, characterized by a multitude of nodes and connections reflecting the complexity of human interactions and socio-spatial dynamics. The development of transportation and logistics infrastructure, such as the construction of the first railway lines towards the end of the nineteenth century, such as the Napoli-Portici line and the line to Caserta, which separated the city from the sea and from all the industrial complexes that emerged along its trajectory (such as the case study of the former Corradini factory), played a fundamental role in the development of the eastern city, giving it primary importance in terms of accessibility and connectivity but at the same time it was "the rigid segregating sign that from Naples turns south along the sea" (Lucci & Russo, 2012, p.11).
At the beginning of the 20th century, this sign became even more evident with the construction of railway networks leading from the central station towards Rome and Apulia, as well as the A1 and A3 motorway networks, determining a definitive division of the territory into three distinct zones, still influencing today the urban configuration of the area. The study of the current urban morphology has shown how transport infrastructure has played a predominant role in defining the boundaries between industrial and residential areas, contributing to the fragmentation of urban space. The presence of railway tracks, often abandoned, and the dense network of motorways and extra-urban roads physically delimits some areas and creates a sort of framework that separates the eastern area from the rest of the city, but at the same time can offer opportunities for redevelopment and transformation, favoring the connection and reinterpretation of these marginal places.
Based on these premises, we proceeded with the creation of a study model at a scale of 1:2000, which, overall, circumscribes the area under analysis within a framework defined by relevant infrastructural nodes, including the areas adjacent to refineries and gas pipelines, extending to the Pietrarsa railway museum. This spatial delimitation was further delineated by the presence of the highway and the coastline in other

Fig. 4. Territorial physical. Stage 2: manufactiring (photo by Casalbordino F.).

directions. At this scale, various territorial emergences are observed that relate to each other and can serve as visual and orientational reference points. Furthermore, it was evident how the city retains traces and signs of its past that can be integrated into urban projects to promote spatial stitching and continuity. For instance, the layout and trajectory of the Corso San Giovanni or Via Argine represent significant organizing elements of the area. These road axes have influenced urban development along their paths, determining the location of productive and logistical industrial structures. The morphology of this urban space and its limits thus reflect a complex interaction among physical, historical, and cultural elements that contribute to defining the identity and spatial structure of the urban area.

Understanding and valorizing these elements was fundamental to undertake a knowledge-oriented approach to study a significant piece of the city. During the study phase, which led to the realization of the physical model, the analysis of urban morphology and its boundaries revealed a series of noteworthy elements, which were interpreted from a design perspective aimed at emphasizing spatial orientation. In this context, the model assumes a primary role, being a tangible and accurate representation of urban reality. The choice to adopt a scale of urban representation allows for capturing the morphological and spatial characteristics of the area in question, thus providing a comprehensive framework upon which to base subsequent stages of study and design. Through careful and systematic analysis of urban morphology delineated by the physical model, an articulated framework of salient elements emerged, including the arrangement of main roads, the distribution of buildings and infrastructure, as well as the spatial relationships among various components of the urban fabric. These elements were interpreted and evaluated in the context of urban design, with particular emphasis on optimizing spatial orientation to enhance the area's usability and livability. The model highlighted the limits and potential of the study area in a clear and visual manner, thus providing valuable support for the eventual development of targeted design strategies. Furthermore, the three-dimensional representation of the urban environment enabled the understanding of spatial and functional relationships among different components of the urban context, thereby facilitating the definition of targeted interventions consistent with the needs and characteristics of the area in question. This demonstrates that in the development of the 1:2000 scale study model, the concept of limit played a crucial role in defining a model aimed at understanding the complexity and dynamism of this area.

The working group interpreted the space of the limit as those transitional places where conflicts, changes, and potential intertwine to generate new forms of creativity and social expression. These spaces, located at the margins of the ordinary, suspended between past and future identities, represent sites of phenomenological and design experimentation, where formal and informal transformation processes manifest. Through the reading of such spaces, a new perspective of observation within the

Fig. 5. Territorial physical model details (photo by Casalbordino F.).

fragmented urban space opened, allowing for the identification of key elements to reinterpret the eastern city. In this context, limits become not only an object of study but also a method of reading and interpretation to understand metabolic mechanisms, namely those dynamic processes of urban change, such as demographic growth, economic evolution, and social transformations, which have affected East Naples in the last century. As the work progressed, it became evident how the value of the limit in defining a study model to analyze an urban area was useful in capturing the complexity and richness of the urban context, highlighting the discrepancies and potentials of San Giovanni a Teduccio.
The analysis of urban morphology and its boundaries in the proximity of former Corradini, and more broadly, in San Giovanni a Teduccio and Eastern Naples, reveals the complexity and richness of the urban

context. Understanding and valuing urban boundaries is crucial for the development of design interventions that respect the specific characteristics and needs of these areas.

San Giovanni a Teduccio from production to logistics: the city through its elements

The limits of the neighborhood are the visible testimony of the different phases that San Giovanni a Teduccio went through in the history, and which led to the construction of different types of human settlements, responding to the different cultures and societies that settled there over time. The construction of the model was therefore completed by the recognition of these elements, parts of the urban fabric fundamental to represent this complex history, selected as an essential part of the visual description of the contemporary neighborhood aimed at its transformation.

Until the 19th century, San Giovanni a Teduccio was the countryside of Naples, located just outside the city walls, as depicted in the marvelous *Duca di Noja Plan* (1775). In this map, the area stretching from the city towards the Vesuvius appears divided into various cultivated lands, with very few buildings and farmhouses scattered sporadically. Divisions are logically drawn based on waterways and other natural elements of the territory, such as the orography and the coastline (Lucci & Russo, 2012, pp. 13-16). Along this line, the main road connecting Naples with its countryside and the entire gulf, called the *Miglio D'Oro* (Golden Mile in Italian), served as the axis along which many aristocratic buildings and palaces were constructed, often accompanied by gardens and open spaces. They were located there due to the significant presence of the Bourbonic Royal Palace of Portici, aiming to maintain proximity to the royal family and court. This was also the reason, in the following century, it was decided to construct a railway close to this road. While serving as a means of connection, it created the initial significant division between the land and the sea, separating settlements from the coastline.

From this point onward, this harmoniously balanced landscape underwent significant transformations and development. The local history of such landscape reflects a global story related to the changes in terms of means and ideals of production that, over the last two centuries, shifted from artisanal industry to Fordist industry, then to disuse, and ultimately to the conversion of the capitalist economy of Europe and western world to logistics. This transition has become more and more evident in the urban space of post-industrial city, reflecting different typologies of space control and organization based on the fact that "whereas Fordism operated through linear assembly lines and hierarchies of subcontractors, [...] contemporary lean-production operates in an entirely different way, calculating its output in response to consumer demand while processing materials at different times and places using an extended network of autonomous suppliers and assembly operations. Whereas Fordism was based on direct production, logistics is founded on meta-production: the production that makes any other production possible" (Khosravi et al. 2019, pp. 23). Alongside this evolution in production, another relevant narrative emerges in San Giovanni – the story of the public city.

These changes concerning economic and social spheres are reflected in the forms of cities, their spaces, and their conception. Like every area of post-industrial cities, indeed, San Giovanni today experiences the need to understand its constituent parts to project itself into the future with a renewed idea of the city. This renewed vision embraces the past to understand which vocations, both in terms of form and physical characteristics of the territory, can truly contribute to its regeneration.

The physical model in the scale 1:2000 tries to recall the complex history of San Giovanni a Teduccio by selecting various architectural elements representing the different conceptions of the area that in different periods of time influenced the construction of its parts. These elements include industrial facilities, public housing complexes, public facilities, logistics architectures and infrastructures. Once these elements were selected, they were extruded as volumes, 3D printed and then, put on the general map. The aim was to create a visual representation of the historical layers of San Giovanni a Teduccio's built environment and its urban composition made up of different and separate parts, not interconnected and communicating with each other, but rather like enclaves. This approach enables viewers to observe how different periods and ideologies have influenced the physical landscape of the area over time.

In the present discourse, we shall direct our attention towards three spheres that serve as effective frameworks for grouping these elements, each reflecting a distinct conception of the city. These spheres, namely the industrial city, the public city, and the logistics city, presently exist as isolated entities, lacking communication with one another.

Industrial city

This city represents the transition from artisanal to Fordist industry, showcasing the area's economic evolution through large industrial complexes, until their actual disuse and abandonment, still representing different productive memories. This evolution is exemplified by the transformation of the former Corradini factory. The factory's documented history reveals its initial use, particularly in what is now known as lot 2, for leather and glove production under the De Simone brand. This almost artisanal activity was supplanted by the rise of the 20th century, marked by the emergence of the war and metallurgical industries. During this period, similar industries emerged in parallel, spurred by the growing importance of the railway, although they were not specialized but rather focused on mass production, alongside residential neighborhoods designed to accommodate the influx of workers.

The eastern countryside of Naples thus underwent radical transformation for a relatively brief period. In less than eighty years, European deindustrialization also impacted San Giovanni, turning it into a post-industrial city with its accompanying social and physical challenges, including the progressive abandonment of industries. Today, in many cases, the reuse of disused industrial buildings becomes a catalyst for regeneration, adding facilities beneficial to the community in a new conception of public heritage, understood not only as service provision but also as the provision of collective spaces open for use by citizens.

This is exemplified by the reuse of the former Cirio factory, reimagined as a high-specialization hub of the University of Naples Federico II, housing the Apple Academy. This choice further testifies to how San Giovanni, from a mere production site, has become a place where product ideation and design (for production elsewhere) is possible, while simultaneously serving as a destination for the commercialization and distribution of the finished product.

Public city

From the post-World War II era until the post-earthquake period of 1980, various plans and programs for the construction of public housing complexes served as the most significant driving force behind urban growth of this part of the city. This led to the proliferation of new residential nuclei along this stretch of coast and in the San Giovanni a Teduccio neighborhood, marking a significant departure from the previous productive industrial and rural landscape and indicating the emergence of a vast urban periphery. Together with changes in industrial dynamics, these developments underscored the end of countryside dominance and the profound transformation of the area into an expansive peripheral zone of the city, marking the transition from rural to chaotic urban landscape.

The public housing complexes present in this area can be attributed to three main plans and their respective historical periods: *INA-Casa* and the *Fanfani Plan* (1943-1963), *PEEP* with *Law 167/1962* (1962-1981), and the *PSER Post-Earthquake Extraordinary Plan* (since 1981). As Paola Di Biagi explains, it is evident that "the various neighborhoods express different ideas of the city, and this is precisely what explicitly differentiates public intervention from private intervention: the awareness, often the intention, to express through urban and architectural design different ideas of society, of relationships between individuals and social groups, of connecting a structure "with something other than itself (society, history, collective mentality, author's theme)," and thus attributing meaning to it" (1986, p. 16). As is known, these are not just residential

buildings, but urban units that often include facilities, open spaces, roads, and parks. This complex mosaic along the Vesuvian coast highlights a true public city where "the majority of urban space, in addition to being physically constituted, is structured, configured, by the arrangement of public assets on the territory" (Di Biagi, 1986, p. 9), including schools, hospitals, and other services built to support the increasing population.
Most structures built according to this concept of the city have not provided adequate housing solutions, contributing to the social marginalization and stigmatization of their residents. In addition to spatial inadequacy, there is also a problem of structural inadequacy and poor maintenance, resulting in an incredible degradation of the structures today. What emerges is a landscape of the periphery, where imposing volumes stand degraded against the intricate fabric of what remains of the historical and rural fabric.

Logistics city

San Giovanni a Teduccio in the last twenty years has undergone a transition towards an economy based on the management and commercialization of raw materials and processed products, spurred by the presence of the port and its related infrastructures. This shift reflects the evolving nature of urban space, as described by Manuel Castells: "The space of flows [...] is becoming the dominant spatial manifestation of power and function in our societies" (2014, p. 437).
The area's inclination towards logistics stems from its strategic position in relation to the city of Naples, the primary hub of southern Italy. Historically, it has been identified as the city's main gateway, with its western side hemmed in by hilly terrain and the Campi Flegrei, while the eastern side opening to the countryside and connections with the rest of the land. Consequently, there has been a concentration of linear transportation infrastructures in the area, particularly the commercial port area. The combination of these factors defines a space identifiable as the space of flows, characterized by the constant movement of goods, commodities, and people, who transiently animate and inhabit this area

of the city in various ways. Thus, the railway, originally established to link aristocratic residences to the city center, has expanded and fortified itself to support the transportation of increasingly large volumes of goods to and from the port, as well as the vast number of commuters traversing the Naples metropolitan area daily. This expansion has further heightened its impact on the physical division between land and sea. Similarly, as mentioned in the previous paragraph, the highway and other roadways facilitate road transport, with entire road axes dedicated to supporting port logistics.

Logistics activities encompass three primary areas: order processing, inventory management, and freight transportation. These categories manifest differently in the territory and city, spatializing their dynamics and constructing a veritable logistics architecture that "generates an operational space […] It not ony circulates goods, capital, and information but also distributes spaces, rights, and bodies, and thus produces territories" (Khosravi et al. 2019, pp. 23-24). Khosravi et al.'s study on the port areas of Venice and Rotterdam, presented in the volume *Aesthetics and Politics of Logistics* (2019), seeks to explore the aesthetic characteristics of this landscape shaped by controlled movements and dimensions. Similarities with the landscape of San Giovanni are evident, where the linear and sleek dimension of the infrastructure, animated by constant movement and flow, contrasts with the horizontal and areal dimension of large storage and distribution complexes, embodying the dynamics underlying logistics and the space of flows: the movement and stasis of the involved elements. This landscape is complemented by the port skyline, characterized by the verticality of cranes necessary for moving large containers and the stacks of containers themselves. Symbolically, these elements signify the global interconnectedness of the neighborhood, tied to broader commercial networks. Because this area exhibits both distinctive physical characteristics and unique immaterial and symbolic traits, we can speak of a logistics landscape. This specific aesthetic associated with logistics assumes significant meaning and importance within a broader perspective of the city just like any other part of it. Compared to the traditional industrial city, it is apparent that a city of this nature prioritizes goods over people. The conversion of industrial buildings and open areas of the city into logistics hubs near the city center, close to the port and major infrastructure, constructs a new gateway to the city where people give more and more way to objects. Residential settlements increasingly find themselves squeezed amidst container stacks and storage complexes. The challenge, therefore, considering the necessity of these areas within the city, lies in preserving the humanity of this landscape, preventing what Rem Koolhaas observes in the Tahoe Reno Industrial Center in California, described as such in *Countryside. A Report*: "there is no planning; brisk millennials under thirty-two create the (always rectangular) buildings without the 'help' of architects. […] It is a repository of buildings so big they don't fit in any city. They 'coexist' at TRIC in seemingly random arrangement […]. Most are surrounded by colossal loading bays, but parking lots […] are of a timid size. They can be small, there are no workers. […] The buildings here are not for humans but for things and machines. […] It is post-human" (Koolhaas, 2022, p. 272).

In an area like San Giovanni a Teduccio, the presence of a diverse array of pre-existing structures, ranging from residential complexes to industrial facilities, serves as a repository of memories tied to production and residency. These structures embody different narratives and histories that contribute to the area's identity. Embracing the coexistence of these diverse facets of the city and envisioning its transformation can begin by acknowledging the dual identity of the place, where both ideation and logistics intersect. This represents an evolution of the city's production landscape and offers a fresh perspective on urban regeneration.

The model serves as a methodological tool for identifying, describing, and visualizing these diverse elements, providing a starting point for contemplating how this perspective, rooted in the city's various identities, can reshape the area. It also invites a reevaluation of the current material and immaterial boundaries that isolate and marginalize the neighborhood from the rest of the city.

Combining the different historical layers of San Giovanni and projecting them into the future contributes to a full approach to regeneration. This approach honors the area's past while shaping its future, acknowledging the importance of preserving community identity and local industrial heritage as fundamental aspects of the area's memory and character. Furthermore, it aims for sustainable development and growth that does not negate the area's logistical and ideational vocations but rather supports them. Achieving a balance between honoring the past and embracing future opportunities, this strategy identifies a way through which San Giovanni a Teduccio can evolve while retaining its unique identity and heritage.

Acknowledgements
Mario Galterisi is the author of the paragraphs "Exploring urban limits: morphological dynamics in the Eastern of Naples" and "Limits: Understanding and embracing complexity of San Giovanni a Teduccio district". Francesco Casalbordino is the author of the paragraphs "San Giovanni a Teduccio from production to logistics: the city through its elements", "Industrial City", "Public City", "Logistics City".

References

Calvino, I. (1972). *Le città invisibili*. Torino: Einaudi.

Castells, M. (2014). *La nascita della società in rete*. Milano: UBE.

Di Biagi, P. (1986). La costruzione della città pubblica. In *Urbanistica*, No. 85, pp. 8-25.

Lynch, K. (1960). *The image of the city*. Cambridge: MIT press.

Lucci, R., & Russo, M. (2012). *Napoli verso oriente*. Napoli: CLEAN.

Khosravi, H., Kuzniecow, B., & LaFleur, F. (Eds.). (2019). *Aesthetics and Politics of Logistics*, Milano: Humboldt.

Koolhaas, R. (2020). *Countryside, A report*. Köln: Taschen.

Physical model

Unveil the inaccessible: from physical model to Augmented Reality

Gianluca Barile, Angela Cicala

Introduction

Industrial archaeology sites constitute a significant part of humanity's cultural and industrial heritage, bearing witness to the evolution of industrial activities over the centuries. However, often these sites are inaccessible or difficult to access due to precarious conditions, risk, and the hazardous nature of the area. In this context, the use of Augmented Reality (AR) emerges as an innovative solution to allow users to explore these historic places safely and immersively, overcoming physical barriers while ensuring their preservation. This study aims to critically examine the use of AR in the contexts of industrial archaeology in the Ex Corradini area of Naples, to understand the benefits and potential of this technology in making industrial sites accessible and usable. Industrial archaeology is a discipline that deals with the study and preservation of evidence from past industries and industrial activities. Industrial archaeology sites include factories, mines, production facilities, and other places linked to the production and transformation of materials. These sites are often characterized by complex and monumental structures, evidence of past eras and the industrial revolution. However, physical accessibility to archaeological sites can be limited by various factors, including the age of structures, the presence of toxic and hazardous materials, and the risk of accidents. Moreover, many of these places are subject to strict safety regulations that limit public access. In this context, the use of Augmented Reality presents itself as a promising solution to allow

Fig. 1. Example of augmented reality application for the case study of the former Corradini site (image: G. Barile).

users to virtually explore these historic sites without necessarily physically accessing the area. This study employs a systematic literature review to critically examine the use of Augmented Reality in industrial archaeology contexts. Scientific articles, technical reports, and academic publications relevant to the topic have been identified and analyzed to understand the practical applications of AR for the enjoyment of industrial sites and the associated benefits of this approach. Furthermore, the ex Corradini site has been taken as a case study to illustrate the implementation of AR-based solutions in specific industrial archaeology contexts, in order to evaluate their effectiveness and potential. The results of the literature review indicate that the use of AR offers numerous advantages for the enjoyment of industrial archaeology sites. Firstly, AR allows users to virtually explore historical structures and access contextual information, thus enhancing the visiting experience and facilitating understanding of the historical and industrial context of the site. Additionally, the ability to follow safe and virtual paths through the sites allows users to avoid hazardous areas and reduce the risk of accidents. AR also enables digital documentation and virtual reconstruction of structures, thereby contributing to the preservation and valorization of industrial heritage. However, further research is needed to evaluate the long-term effectiveness of AR implementation in industrial archaeology contexts.

Technology as a tool to reveal the past

Technology serves as a potent tool for uncovering and illuminating the mysteries of the past. By harnessing advancements in various fields, such as archaeology, paleontology, and historical research, technology enables us to delve deeper into historical narratives and unearth hidden truths. In archaeology, cutting-edge techniques like ground-penetrating radar, LiDAR (Light Detection and Ranging), and 3D scanning offer unprecedented insights into ancient civilizations and long-lost settlements. These methods allow researchers to map ancient landscapes, identify buried structures, and reconstruct past environments with remarkable accuracy. Additionally, advancements in remote sensing technologies facilitate non-invasive exploration of archaeological sites, preserving fragile artifacts while uncovering their secrets. Similarly, in paleontology, technology plays a pivotal role in the study of prehistoric life forms and ecosystems. High-resolution imaging techniques, such as CT scans and laser scanning, enable researchers to analyze fossils in intricate detail, revealing anatomical features and evolutionary adaptations. DNA sequencing technologies offer insights into the genetic makeup of ancient organisms, shedding light on evolutionary relationships and population dynamics. Moreover, in the realm of historical research, digital archives, and databases provide access to vast repositories of historical documents, artifacts, and cultural materials. Text mining and data analysis tools facilitate the extraction of valuable insights from large volumes of historical data, enabling historians to identify patterns, trends, and connections across different time periods and geographic regions. Beyond exploration and analysis, technology also plays a crucial role in education and public engagement, bringing the past to life for audiences worldwide. Virtual reality (VR) and augmented reality (AR) technologies allow users to immerse themselves in historical environments, experiencing key moments in history firsthand.

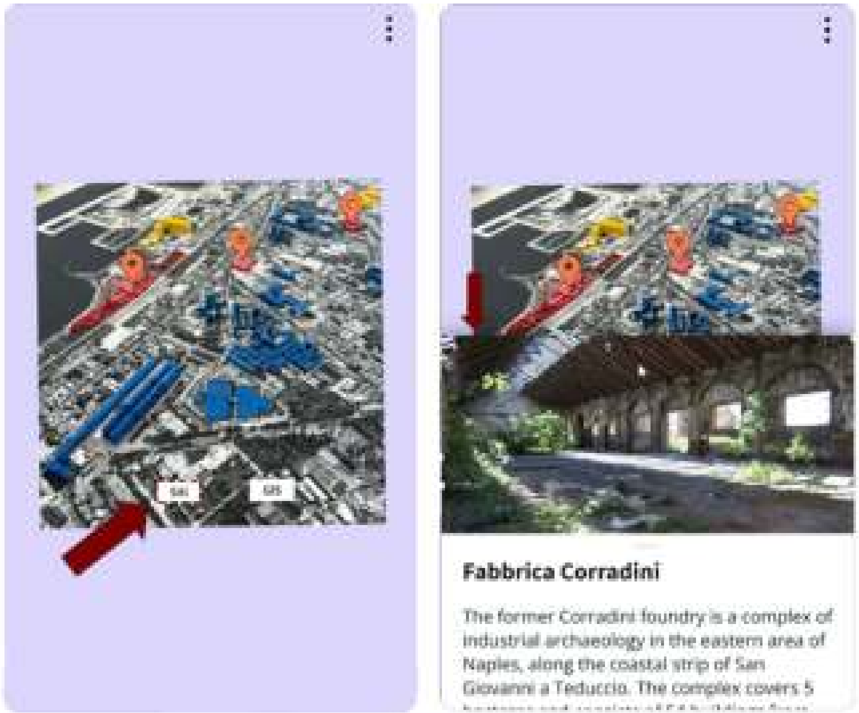


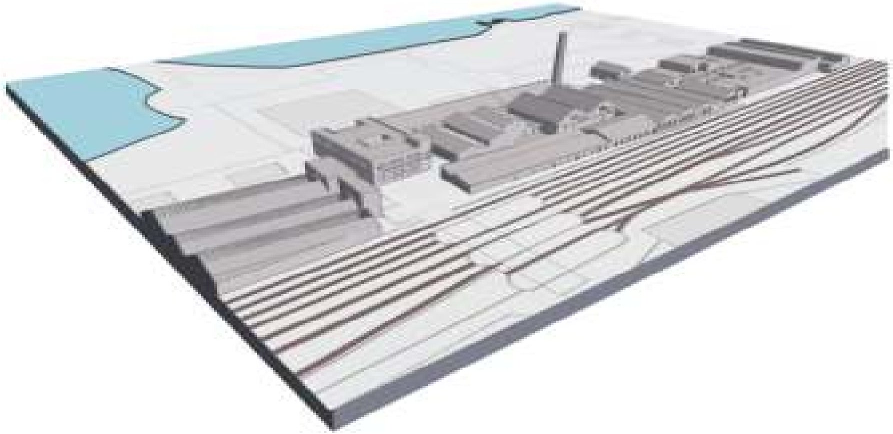
Fig. 2. Experimentation with the Onirix app (image: F. Itri).

Interactive digital exhibits and online platforms provide opportunities for collaborative learning and engagement, transcending geographical barriers and making history accessible to diverse audiences. In essence, technology serves as a powerful catalyst for uncovering, preserving, and sharing the rich tapestry of human history. By harnessing the tools of the digital age, we can unlock new perspectives on the past, fostering a deeper understanding of our shared heritage and collective identity.

Augmented Reality (AR) seeks to enhance real-world experiences by overlaying digital information onto physical environments. As a cutting-edge technology, it continually explores innovative methods across various domains. AR enriches reality by integrating real-time information seamlessly into our surroundings. It aspires to revolutionize traditional

approaches and establish efficient models across diverse applications. In fields like education, medicine, robotics, manufacturing, and entertainment, AR enables the display of computer-generated content in real-time. Positioned as a subset of mixed reality, AR represents an evolution from virtual reality, offering unique possibilities in the digital era. This article delves into the emergence of AR as a pivotal digital technology following the success of Virtual Reality, showcasing its broad spectrum of applications. Understanding AR necessitates grasping its technological underpinnings, architectural aspects, device requirements, types, advantages, limitations, and distinctions from VR. This article provides a simplified exploration of these fundamental concepts. Additionally, it offers a chronological summary of research papers published in the field, offering insights into the evolution of AR-based applications. Virtually every sector leverages the transformative capabilities of AR, underscoring its ubiquitous presence across diverse domains. Concluding with reflections on current trends, implications, and future prospects, this article aims to offer a comprehensive overview of AR-based applications. In essence, it underscores the pervasive impact and boundless potential of AR in reshaping human experiences and interactions with technology (Dargan et al., 2022).
AR is augmented reality, i.e., a newer technological system or a new human-to-machine interaction tool that is defined as the immersion of technology with digital objects in the real world. This includes integrating real and virtual worlds, engaging in real-time interaction, and accurately registering virtual and physical objects (Azuma, 2001). Augmented reality (AR) fulfills three essential criteria: merging real and virtual elements, aligning them, and facilitating dynamic interactions between them. By seamlessly integrating virtual content with real-world surroundings, AR elevates and enriches human experiences. Leveraging computer vision, AR-capable cameras in mobile devices, and object recognition technologies, the physical environment becomes interactive and manipulable. Key enablers of AR include global positioning systems, wireless communication, location-based computing, and wearable

Fig. 3. Digital model of the former Corradini complex (image: G. Barile).



devices. AR amalgamates tangible reality with digital artifacts to construct interactive environments. For instance, real-world scenes or images are augmented with digital overlays, creating novel interactive realms within the physical world. This synthesis results in environments where both physical and digital elements coexist harmoniously. Virtual environments, generated through computational analysis of the real world, seamlessly blend with reality, fostering immersive experiences. In this virtual realm, every facet of reality integrates seamlessly, blurring the boundaries between the physical and digital realms. The augmented reality system has the potential to:

- Integrate both real and virtual objects into a real situation.
- Run collaboratively in real-time.
- Arrange for virtual and physical objects to interact with one another.
- Consider formative and summative user-based evaluations.

- We believe that failure to understand the needs of a user will create frustration and unsatisfactory experiences.
When the real environment is modified with images, sounds, videos, and graphics, it is made interactive and interesting with digital images, videos, and animations and proves wonders in diverse application areas, aviation, education, learning, manufacturing, medical, sports, gaming, aircraft design, interiors, and so on.

Case study

Within the project concerning the study and revaluation of the former Corradini industrial plant, now a disused archaeological site extensively degraded, the objective is to create a digital usability of the site that can connect the physical models made with AR and make them computerized. The methodology employed involves several fundamental phases: an initial study of techniques suitable for connecting physical models and AR; a cataloging of existing applications with subsequent division between open source and private apps, and a final phase of building the physical model and studying the interoperability between physical and virtual models through the case study at hand.
1. The connection between physical models and augmented reality (AR) occurs through a series of techniques that allow overlaying digital information on real physical objects, creating a fluid and dynamic interaction between the real and virtual.
The main techniques used can be classified as follows:
● Image recognition and marker tracking: This technique is based on the use of visual markers (such as QR codes, fiducial markers, or specific images) placed on physical objects. The AR device's camera detects these markers, and the AR software overlays corresponding digital content on the recognized physical objects.
● 3D model-based tracking: 3D model-based tracking uses a digital representation of the physical object. The AR system compares real-time images captured by the camera with the stored 3D model to recognize and track the physical object. This allows overlaying digital information

even on complex and detailed surfaces.

● SLAM: SLAM technology allows the AR device to build a map of the surrounding environment while tracking its own position within it. This allows overlaying digital content on physical objects without the need for predefined markers. SLAM is particularly useful in dynamic or complex environments.

● Surface and plane recognition: Some AR systems use surface and plane recognition to identify and track flat surfaces in the environment, such as floors, walls, and tables. Once these surfaces are recognized, the AR system can anchor digital content on them, allowing for precise and stable overlay.

● Integrations with sensors and IoT devices: Integrating sensors and IoT (Internet of Things) devices with AR allows real-time data collection from physical objects. For example, motion sensors, temperature sensors, or proximity sensors can be used to activate and control AR content, creating a dynamic interaction between the physical and digital worlds.

● Photogrammetry and 3D scanning: Photogrammetry and 3D scanning allow for the creation of accurate digital models of physical objects. These models can be imported into AR systems and used to overlay digital information directly on the scanned objects. This technique is particularly useful for complex or large objects.

● Computational vision and machine learning: Computational vision and machine learning techniques improve the AR system's ability to recognize and track physical objects. Machine learning algorithms can be trained to recognize specific objects or features, improving the accuracy and speed of AR tracking.

Specifically, for the case study at hand, the connection between the physical model and AR can be based on one of the most experimented and used techniques currently. It starts from the digitization of the case study or the acquisition of it from an existing physical model through scanning, which will be optimized both geometrically and aesthetically through the application of textures and materials to make the virtual experience as realistic as possible. Subsequently, the optimized model will be imported into AR development software, including Unity or Unreal Engine, where the model can be positioned and integrated with additional information of different types that will be displayed during the virtual experience. The practical connection between the real and virtual will then take place through visual markers, such as QR codes, positioned near the physical model, which the user can scan. This will allow access to a platform where interaction with the three-dimensional model can occur (Fig. 1).

2. As previously stated, the virtual and interactive experience takes place through the use of applications suitable for AR development starting from physical models. Below is an overview of the main platforms, divided based on accessibility.

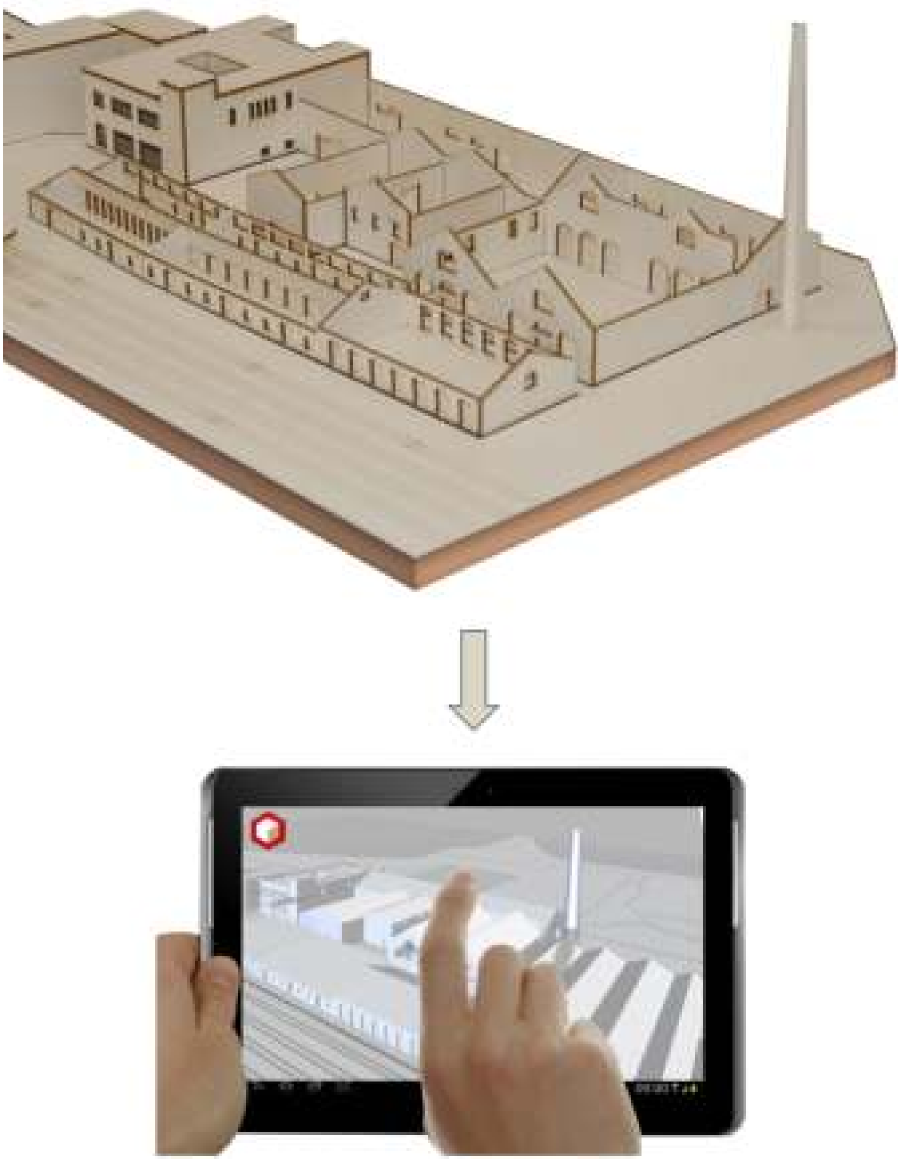
- Open source

AR.js: a web browser library that allows web development without native apps and with support for marker-based and location-based AR.
ARToolKit: one of the first open-source libraries functioning through marker recognition.
OpenCV: a library for computer vision, also used for AR projects through image recognition and object tracking.

- Commercial

Vuforia: a platform for mobile application development using 3D objects, markers, and with support for AR glasses.
ARKit: Apple platform also functioning through facial recognition.
ARCore: Google platform supporting motion tracking, surface detection, and light estimation.
Unity with Vuforia Engine: a game development engine with advanced 3D rendering capabilities to create detailed digital models and advanced interactions for immersive experiences.
Onirix: a platform based on the use of a web editor supporting tracking techniques. The interface allows for the development of AR experiences without the need for code subscription and quickly.
Augment: a platform with the possibility of using some open-source features. It allows for viewing digital 3D models in real-world contexts through mobile devices and with model customization capabilities.

Fig. 4. Experimentation with the Augment app (image: G. Barile).



3. Regarding the case of the former Corradini, a first test was carried out for the creation of a virtual and interactive experience to simulate the interoperability of physical and virtual models using two applications: Onirix and Augment. The models that were created are two:
A. a 1:2000 scale model representing a volumetric of the current state of the site; both the former Corradini plant and the surrounding buildings have been depicted to fully understand the relationship between the industrial plant and the surrounding area, in particular by making a division between four types of buildings present through the use of colors. The categorized types are: logistics and commercial buildings in yellow, industries in red, residential and public buildings in blue. The creation of the model was based on an orthophoto indicating the boundaries of the area under consideration and the positioning of the categorized volumes; these were made using 3D printing techniques, following the definition of print files for each type.
B. a 1:300 scale assemblable model of the former Corradini plant in its current and original state through laser cutting technique.
For the creation of the first virtual model from the physical model (A) concerning the industry and the context, the Onirix platform was considered. The process on the Onirix app involved the use of image tracking; it starts from the loading of representative images of the physical model, in which a series of parameters related to the markers that are identified on the optimized image are defined and associated with specific actions. User marker detection involves a series of possible actions that have been associated by the creator (Fig. 2). The use of this application proved advantageous both for the precision of tracking, which allowed precise anchoring of points on the image of the physical model, and for the ease of use provided by an intuitive app interface.
For the creation of the virtual model (Fig. 3) of the second physical model (B), the Augment application was experimented with. The process involved loading the digital model, previously created, and the physical model, thus allowing them to be overlaid to integrate the two views. The use of the app on a mobile device allows scanning of the physical model

and obtaining the display of the digital model, with which the user can interact and have an immersive and realistic experience (Fig. 4).

Conclusion

In conclusion, the use of Augmented Reality presents itself as an effective solution to make industrial archaeology sites accessible and usable, overcoming challenges related to physical accessibility and user safety. This technology offers unprecedented opportunities to explore historical sites safely and immersively, while simultaneously contributing to the conservation and valorization of humanity's industrial heritage. Further research and technological developments are necessary to fully harness the potential of AR and to ensure its effectiveness and sustainability in industrial archaeology contexts.

References

Azuma, R., Baillot, Y., Behringer, R., Feiner, S., Julier, S., & MacIntyre, B. (2001). Recent advances in Augmented Reality. In *IEEE Comput Graph Appl*, Vol. 21, No. 6, pp. 34-47.

Dargan, S., Bansal, S., Kumar, M., Mittal, A., & Kumar, K. (2022). Augmented Reality: A Comprehensive Review. In *Archives of Computational Methods in Engineering*, No. 30, pp. 1057-1080.

Digital model

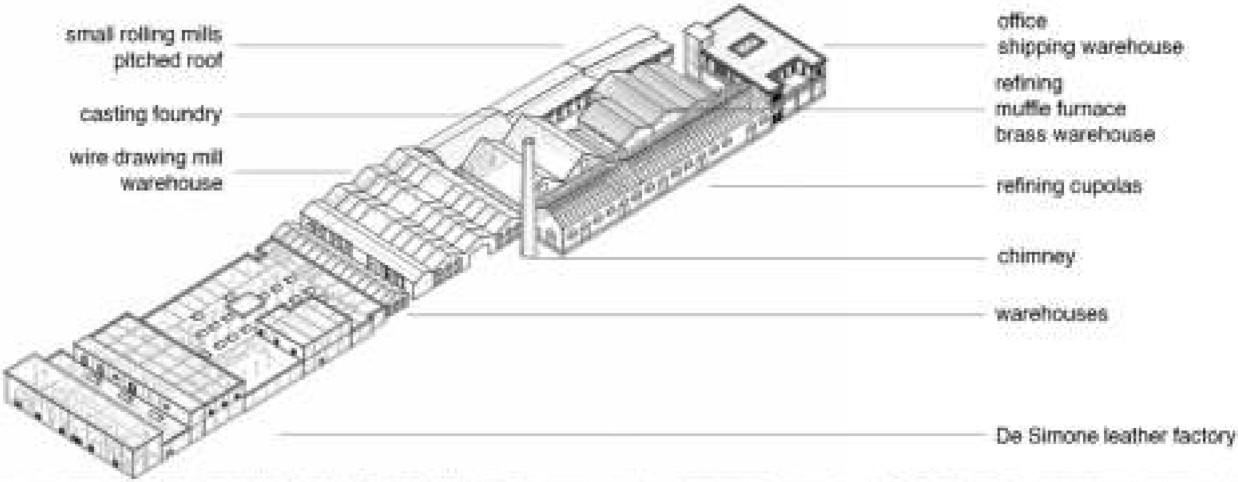
Visualizing history: the case of the ex Corradini

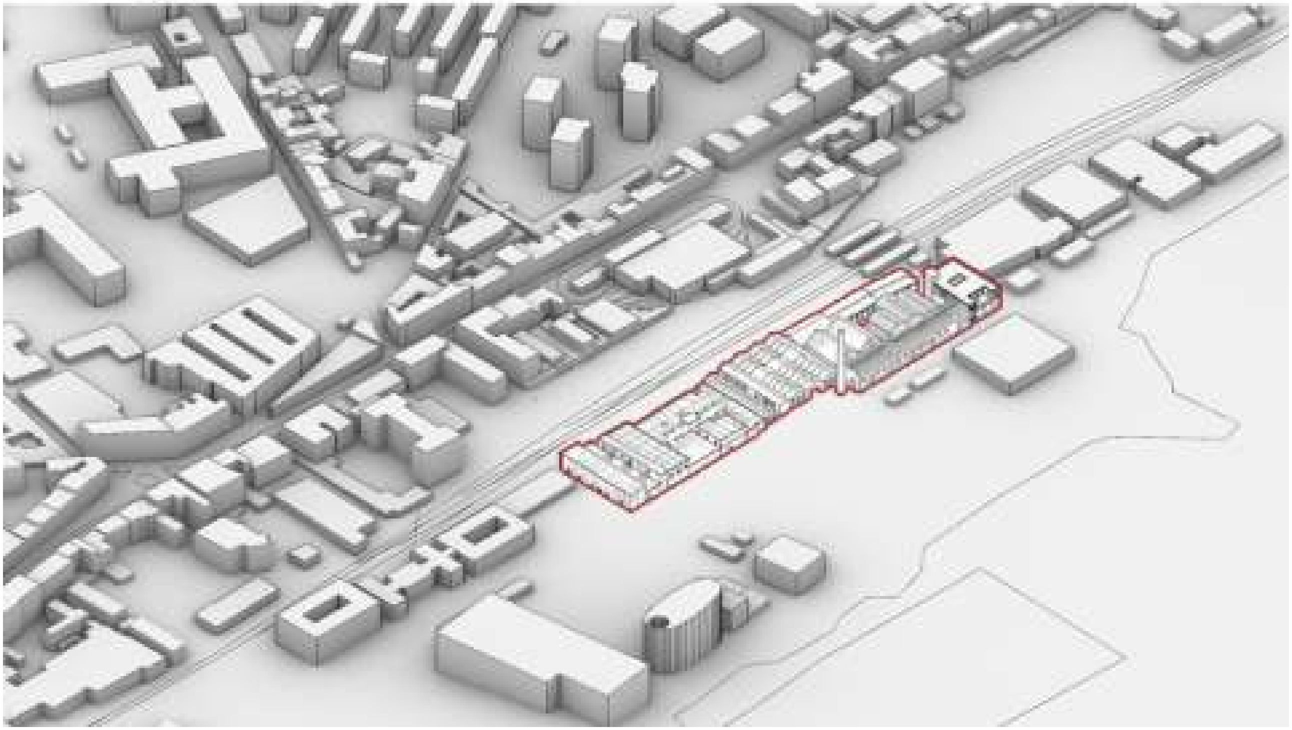
Angela Cicala, Arianna Lo Pilato

Introduction

"Each phenomenon is never analyzed in isolation, but always in relation to the context, taking into consideration the dynamics that have marked its origin, the ways in which this phenomenon manifests itself and its location, the repercussions it has on the territory, and the possible future scenarios. And perhaps this is even more true for the industry which, since its inception, has deeply and indelibly shaped human life." (Palmentieri, 2018, p. 11)

The study of industry, as a territorial phenomenon that links the concept of heritage with the territory in which it develops, represents the key point for delving into the events that have involved the Neapolitan territory, especially when referring to the eastern area. The eastern area of Naples, traditionally considered a connection zone between the historic center and the eastern outskirts, is in turn composed of the Poggioreale, Industrial Zone and the area comprising the neighborhoods of San Giovanni a Teduccio, Barra, and Ponticelli. Thanks to its strategic position, resources, and the presence of extensive road, rail, and port infrastructure, it has always been identified as a nerve center for production and distribution, playing a crucial role in the economic development of the metropolitan area of Naples. However, starting from the 1970s, the downsizing of productive activities, along with relocation and decentralization policies, has profoundly altered territorial balances. Numerous areas and buildings previously used for productive purposes have been abandoned, remaining


small rolling mills
pitched roof
casting foundry
wire drawing mill
warehouse
office
shipping warehouse
refining
muffle furnace
brass warehouse
refining cupolas
chimney
warehouses
De Simone leather factory



unused in many cases. The eastern outskirts of Naples have certainly not been excluded from this process of industrial disinvestment that has affected the entire country. Unfortunately, as is well known, these places are currently in a state of considerable degradation and urban disorder, characterized by a high presence of urban voids, disused and abandoned factories, as well as vast territorial potentials completely unused. Starting from the study of the context of East Naples, the transformations that these territories have undergone since the bourbon age, due to favorable territorial, morphological, and accessibility conditions, up to becoming one of the most important historical industrial suburbs in Italy.
This contribution aims to particularly delve into the case of the former Corradini, an industrial complex located in the San Giovanni a Teduccio neighborhood, once the flagship of the metallurgical industry in the South and now a true industrial monument, a testament to its outstanding architectural quality (Fig. 1).

The industrial expansion of the eastern suburbs of Naples
Despite being adjacent to the historic center of Naples, the San Giovanni a Teduccio neighborhood is identified as a peripheral area deeply marked by its past, which has shaped its distinct identity. Characterized by a mixture of abandoned industrial plants, residential buildings, commercial areas, and green spaces, it occupies a strategic position near the port and the industrial zone, making it still economically relevant for the city of Naples. It serves as a territorial hinge, once known as Valle del Sebeto, which, in a north-south direction, marks the opening to the sea of the inner plain. Once occupied by marshes, it represented the natural eastern boundary of the city of Naples (Fig. 2).
The complex structure of the area has meant that it has always been characterized by interventions of various kinds that have accentuated this complexity. The social housing buildings constructed in this suburb from the late nineteenth century onwards show that efforts to expand the urban structure have not been lacking, but that such expansion has been hindered by the location of the railway station and the rail network,

Fig. 1. Current urban context with the existing core of the San Giovanni a Teduccio complex (3d model edited by M. Capone, drawing: by A. Cicala).

Fig. 2. G.A. Carafa, Mappa topografica di Napoli e de' suoi contorni, 1775. In red, identification of the plot where the Corradini will be built (editing: A. Lo Pilato).

as well as by the industrial designation reserved for much of the area. The neighborhoods present today are indeed the result of the fusion of multiple rural nuclei, which then merged with nineteenth-century social housing fabrics, industrial and commercial complexes, and recent residential subdivisions.

Indeed, with the industrialization that took place during the 18th century and especially at the beginning of the 20th century, the territories of Naples also underwent a process of industrial and economic transformation, albeit more slowly and to a lesser extent compared to other cities in Europe that had already embarked on significant industrial development. Under the Bourbons, the Kingdom of Naples experienced a period of fervor and cultural, artistic, and architectural revival: the expansion of ceramics production with the establishment of the Royal factory of Capodimonte, the development of the textile industry in San Leucio, and the development of new technologies and improvement of the infrastructure made the Kingdom of Naples competitive compared to other economies in Europe.

Serving as a conduit for the industrial process that occurred between the 18th century and the Unification of Italy, we recall the construction of the Royal Bourbon Workshop of Pietrarsa in 1840 by Ferdinand II of

Bourbon, the first of many factories that would be built in the eastern area of Naples and the first railway facility in the entire Italian peninsula. However, with the Unification of Italy, a slow and gradual decline began throughout the South, quickly resulting in a significant economic gap between Northern and Southern Italy. The political strategies introduced with Unification were particularly favorable to the development of the internal economy of the North. The same cannot be said for the South, whose workshops had been halved in favor of those in the North and deprived of international trade. In the South, small landowners and farmers remained subject to the class of large landowners who enjoyed increasing rights, corruption spread, and the lower classes became indebted.

The policies implemented during the war only widened the gap between North and South. The initiatives subsequently applied to address the crisis proved ineffective or even exacerbating. Decisions based on political rather than thorough studies to ensure correct demographic development, healthcare system, and trade generated various dysfunctions, poor urban planning, and a disorderly process of urbanization. During the war, many industrial facilities had been converted to produce war material. After the war, these complexes no longer used for military purposes were sold to private individuals. These practices contributed to the crisis of the main industrial sectors, from the woolen industry to the metalworking industry. One of the main territorial consequences of these dynamics is represented by the disuse of large industrial areas and by a massive and disorganized increase in the building fabric.

In relation to this fluctuating situation, as defined by S. Palmentieri (2018) in the volume "Industrial Dynamics and New Territorial Arrangements: The Outskirts of Naples Between Urban Voids and Enhancement Prospects," it is possible to identify three phases for the historical-industrial development of East Naples:

1. 1840-1904: Transfer of settlements from the historic center of the city to the outskirts;
2. 1904-1960: Expansion of the industrial area;

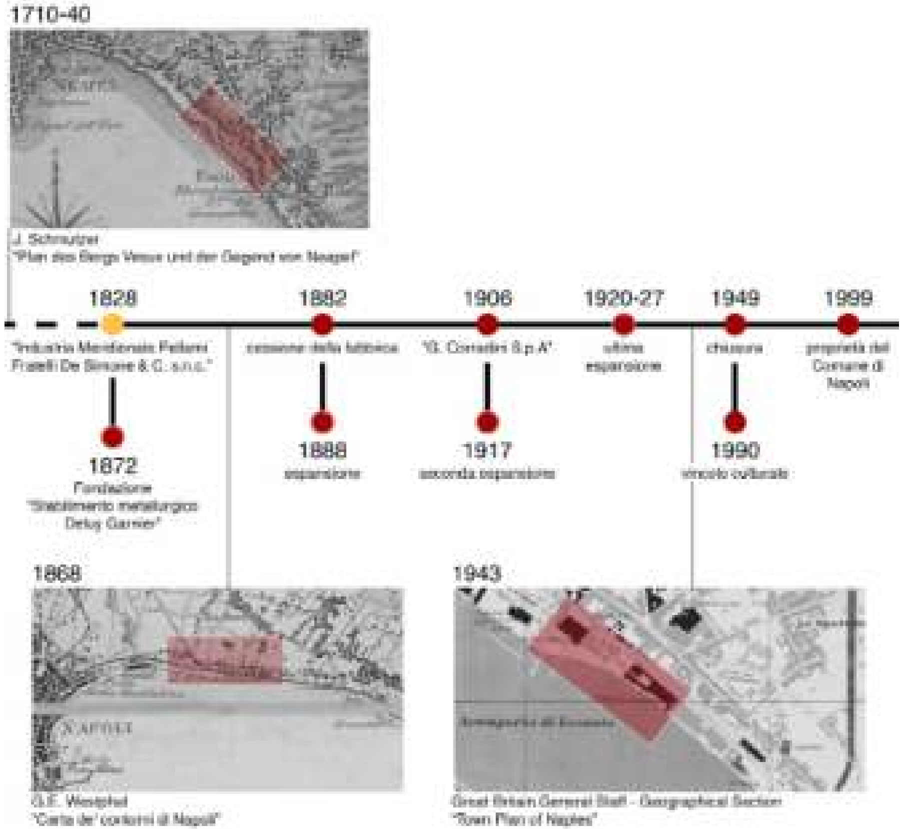


Fig. 3. Timeline of the historical development of the industrial complex (drawing: A. Cicala).

3. 1960-1990: Disposal of obsolete industrial buildings.

Examining the three periods, it emerges that as early as the 1887 Plan, the eastern outskirts of Naples had been identified as an industrial area to be developed, always conditioned by the railway, in such a way as to accommodate industrial plants, productive facilities, and workers' residences. Subsequently, with the 1910 Redevelopment and Expansion Plan, the relocation of the railway towards the east brought the industrial area back within the urban perimeter; an industrial area where, shortly thereafter, the neighborhoods of San Giovanni a Teduccio, Barra,

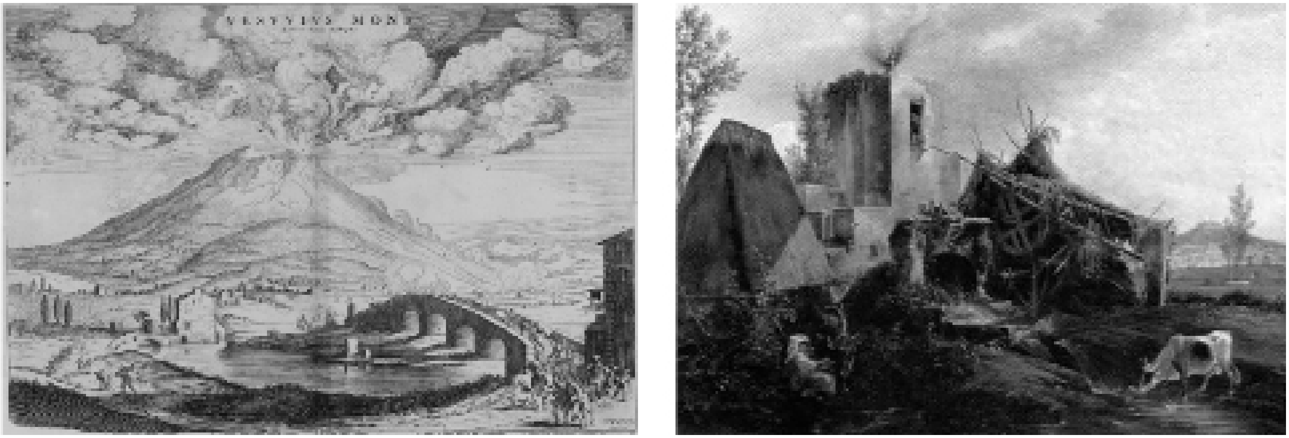


Fig. 4. Ponte della Maddalena, 1704; Veduta di Napoli dalle paludi del Ponte della Maddalena, 1837 (http://media.bibliothek.uni-augsburg.de/node?id=46729; http://www.ilportaledelsud.org/barra11.5f.htm).

and Ponticelli were also included, previously defined as autonomous hamlets that allowed the connection of the outskirts with the port area. Throughout the twentieth century, this industrial area underwent significant expansion, transforming it into a complex territorial network connecting the surrounding areas. However, even though the 1910 Plan defined the intention to redefine the urban image by adding social housing neighborhoods, the split between the industrial area and the rest of the city seemed inevitable. This was mainly due to the construction of large oil refining plants that longitudinally occupy the entire extension of the plain in its central part. These plants created a physical and visual barrier that contributed to urban separation, but on the other hand, the high pollution produced by the plants already established a well-defined closure.

Regarding urbanization, on the other hand, it can be noted that during the time corresponding to the first phase, there was an increasing delineation of an increase in the building fabric around the hamlets. With the projects of the Redevelopment Plan, the inhabitants evicted from the historic center were transferred to the eastern area; all attempts to implement an adequate urbanization plan failed due to political obstacles. In the last phase, and particularly in the period following the Second World War,

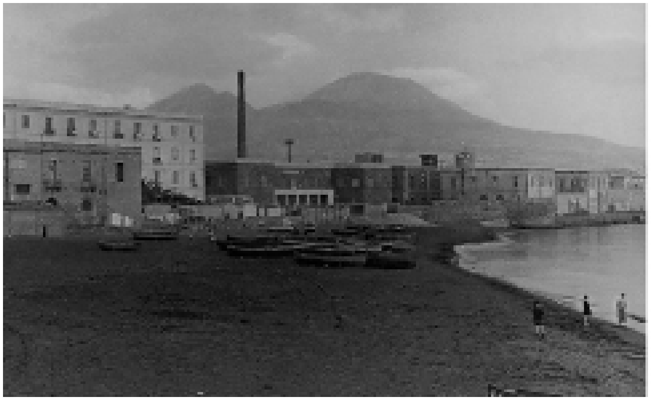



Fig. 5. At the top, views of the Corradini plant during the years of activity, at the bottom, the current state of degradation of the Corradini structures (photographs: D.M. Massari and F. Miranda's thesis).

East Naples saw a resurgence of the agri-food sector and construction, accompanied by a consequent demographic increase. The expansionary process was twofold, and organizational plans failed to support this increase, until the beginning of the deindustrialization process.

The decline of the industrial sector

The process of deindustrialization that began in the 24th century and affected the entire country was a complex and multifactorial phenomenon that had a significant impact on the economy and social fabric of the area. It represents a key transition that allows us to understand why for years now, we have referred to the eastern outskirts as an extensive area of industrial archaeology, including former factories of which only ruins remain. Deindustrialization began in the post-war period, with the crisis of many manufacturing industries that once constituted the engine of the local economy. Factors contributing to this decline included international competition, changes in production models, obsolescence of technologies, and loss of competitiveness of local industries. Indeed, the obsolescence of production facilities, often inadequate to meet the new market demands, led to the closure of many factories and loss of jobs, causing an increase in unemployment and a decrease in available income for area residents. Furthermore, the economic crisis that hit

Italy in the 1970s and 1980s further contributed to the decline of this area, leading to the closure of additional plants and loss of investments. Among the main causes of the crisis were rising prices and the oil crisis, among others. During those years, the desire to reorganize the territory to overcome the dismal conditions became a matter of primary importance, which is why in 1972, the new General Urban Plan of Naples was drafted and approved (in force until 1999) with the aim of decongesting the city. The Plan envisaged a general redistribution of residential buildings to address the imbalance between the depopulated inner areas and the overcrowded coastal areas, and last but not least, special attention to productivity with considerations on polluting industries so that they could be relocated outside the urban fabric to safeguard the environment and citizens. Unfortunately, as known, the non-implementation of these rules led to uncontrolled urbanization in all areas of the city, triggering strong alarmism as awareness of the health risks associated with industries began to emerge. All these conditions laid the groundwork for a slow decline, to which relocation was one of the main responses.

From industrial engine to industrial monument: the case of the former Corradini

As previously stated, the presence of an industrial structure inevitably affects the entire surrounding area. From the analysis conducted on the context of the East area of Naples, it has emerged how the concentration of industrial buildings has strongly influenced the history of this area, also significantly impacting its current situation.

Among the ruins that remain today, the former Corradini industry represents a emblematic case of this industrial past. It is one of the most important metallurgical factories, a testament to the process of industrialization and transformation of the eastern area of Naples. Founded in 1872 by the Frenchman Deluy Garnier, hence the original name “stabilimento metallurgico Deluy Garnier”, it was then definitively named “G. Corradini S.p.A” in 1906 with the transfer to the Swiss entrepreneur Giacomo Corradini.

The industry, or rather the complex, is the result of the aggregation of buildings belonging to different historical periods. The primitive nucleus consists of the ancient "Dent Allcroft" plant, which in 1828 was incorporated into the "Industria Meridionale Pellami Fratelli De Simone & C. s.n.c.", these buildings originally used for the textile industry, were later incorporated, and repurposed in subsequent transformations. The plant indeed had a horizontal development that encompassed numerous areas along the coast, marshy lands, and buildings specialized in ceramic production, for a total of 70,000 square meters (Massari & Miranda, 2021, p. 131).

In fact, the Garnier metallurgical industry consisted of a plant for processing copper, brass, and other metals, covering a total area of 3,000 square meters, using 5 steam engines with the potential employment of 200 workers (De Rosa, 1968, pp. 68-69).

With the transfer to the industrialist Corradini, the complex became one of the most important, if not the most important metallurgical factory in the south. Corradini progressively transformed the initial enterprise into the large metallurgical complex that we still observe today. Sandwiched between the sea and the railway line, the plant could only expand along the coast. The first expansion of the working area occurred with the purchase in 1888 and then in 1897 of some marshy lands and the ruins of some buildings where ceramics were worked. In 1917, the metallurgical complex further expanded with the purchase of the plant to produce bottles by Eduardo Falcocchio. The last expansion is attributed to the period between 1920 and 1927, years in which the Merchant Navy leased additional areas for the expansion of the facilities for 25 years. This period of immense prosperity saw a setback following the bombings of the Second World War and the expansion of the railway line. In 1949, finally, the company - which had almost tripled the volume of the plants between the two wars, expanding northwards - was put into liquidation and the plants sold off after a failed attempt at worker self-management. With the end of operations and the closure of the plants, the entire complex was abandoned and left in a total state of decay. Numerous technical and economic factors, as well as the changed destination of the area from industrial to residential, prevented technological renewal and productive recovery of these plants. After years under different companies, in 1981 it was acquired by the company Agrimont Sud s.r.l.. The deteriorating situation of the Corradini plant began to be a relevant social and cultural issue, thanks above all to the emerging Bulletin of the association for industrial archaeology. In 1999, ownership of the plant passed to the Municipality of Naples, with most of the buildings in a state of ruin. The high historical-architectural and testimonial value, which identifies the area of the Corradini plant as one of the preferred areas of the first industrialization of the city, is just one of the reasons that motivated its declaration as a property of historical and architectural interest. The entire plant was subject to protection with a decree from the Ministry for Cultural and Environmental Heritage on February 27, 1990 (Comune di Napoli, 2023). The case of the former Corradini perhaps for the first time in Italy, poses a problem of protection of vast proportions, as it is not a single building, but a complex system of factory (factory system) consisting of 54 real estate units (including processing sheds and service buildings) distributed over an urban area of about 7 hectares (de Seta, 1982, p.1). The acquired awareness of this complex as an industrial monument represents one of the most interesting architectural challenges in the Neapolitan territory, which still sees numerous projects today and could allow for the social and cultural revitalization of the entire neighborhood.

Methodology

Studying the ex-Corradini site means dealing with an industrial archaeological site that has undergone significant transformations over time. The result of this succession of sectoral developments, disconnected from each other and indifferent to the overall settlement context, has been disastrous: a chaotic mix of buildings lacking urban and functional coherence (Dal Piaz, 1982, p.19). Moreover, it is in such a state of decay that it is not accessible. Therefore, the process of reconstructing the area

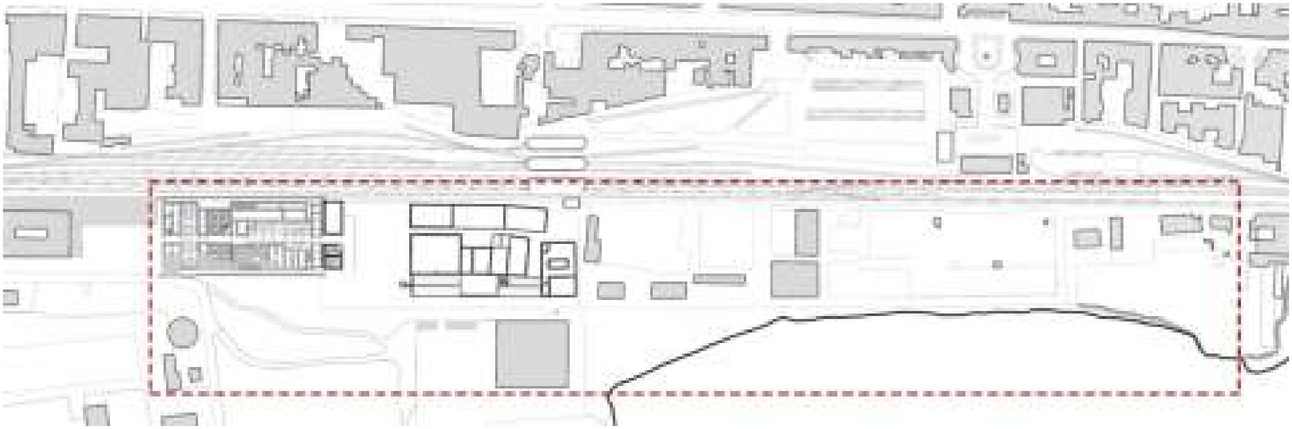


Fig. 6 Original building configuration of the complex, reconstructive hypothesis on the current layout (drawing: A. Cicala).

requires a combination of historical, documentary, and contextual data to propose an accurate representation of the site in its original state. The goal of this reconstruction is to provide an accurate and informative vision of the historical development of the complex, thereby contributing to its conservation and enhancement, and above all, aiming to facilitate its recovery (Capone & Cicala, 2023).

Based on now widely established techniques, the implemented workflow included the following phases:

1. Research and collection of historical data, iconographic sources, and documentation related to the current state;
2. Analysis and interpretation of historical documentation to define a timeline of historical events and identify the most important phases of the site's development;
3. Three-dimensional modeling of the organization of buildings in the identified phases;
4. Hypothesis of reconstruction divided into temporal phases.

Overview of construction process and timeline evolution

To identify the transformations that have marked the territorial context and consequently the entire complex, iconographic research was conducted through topographic maps and historical photos. Starting from the assumption that in the oldest historical maps, the San Giovanni a Teduccio neighborhood and the entire eastern area appear to be sparsely urbanized rural areas, it is possible to identify the Maddalena Bridge (Fig. 4) as the connection between the peripheral areas to the east and the center of Naples.

Analyzing the sources, it is possible to identify, in the area where the Corradini complex will be defined, some buildings not well defined in Joseph Schmutzer's "Plan des Bergs Vesuv und der Gegend von Neapel" from 1710-1740, in the subsequent "Carta de' contorni di Napoli" from 1868 by Giovanni Enrico Westphal, the organization of the buildings begins to be more clearly delineated. Until we arrive at the "Town Plan of Naples" from 1943 by the General Staff - Geographical Staff of Great Britain, in which, instead, the final configuration corresponding to the last expansion of the complex is identified.

The reconstruction of the aggregation of the former Corradini complex is not straightforward; as previously stated, it consists of a series of buildings from different historical periods and consequently different architectural styles. (Fig. 5)

The reading of the various phases of typological development of the nineteenth and twentieth-century factory-building allows us to affirm that from the first structures characterized by vertical and multi-story development, typical of textile plants, the complex evolves towards more modern lines of masonry shed buildings with multiple bays and pitched roofs.

However, the current state does not specifically allow us to trace the intended uses of individual buildings, so we analyze them synthetically based on information available in the Bulletin of the Association for Industrial Archaeology of 1982 (Fig. 6):

- The rolling mill (1), dating back to the years 1872-74, is the oldest structure; it is a multi-story building whose spaces are divided by cast iron columns with capitals. The actual rolling mill, however, is represented by an additional shed adjoining this nucleus made of load-bearing tuff

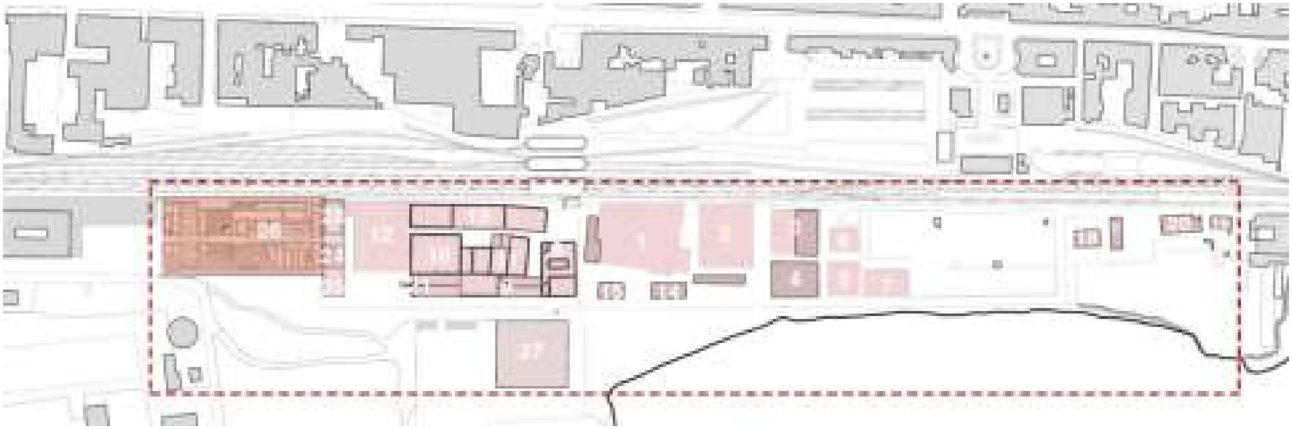


Fig. 7. Current site plane (drawing: A. Cicala).

masonry with multiple bays and pitched roofs with skylights;

- The wire rolling mill (2), whose construction date is uncertain, located to the right of the previous rolling mill, is developed on three naves with load-bearing tuff masonry and pilastered division in reinforced concrete, presenting a facade typical of basilicas;
- The electric accumulators room (3), located next to the wire rolling mill; consisting of two naves with pitched roof and connected by a corridor covered by a vault made of latero-cement;
- The workshop (4) consists of three shed naves separated by reinforced concrete and steel pillars. Immediately to the right, with the same configuration, there is also the boiler workshop (5);
- Continuing to the right of the electric accumulators room, there are facilities and changing rooms (6) developed on two levels with flat roof and mixed structural composition;
- Adjacent to the boiler workshop, we find the cast iron foundry (7), of complex recognizability. Presumably, the load-bearing masonry is in tuff with reinforced concrete and steel structure next to it of the internal pilastered;
- In 1917, the office and shipping warehouse unit (8) was built, this reinforced concrete structure has a facade made of friezes and linear

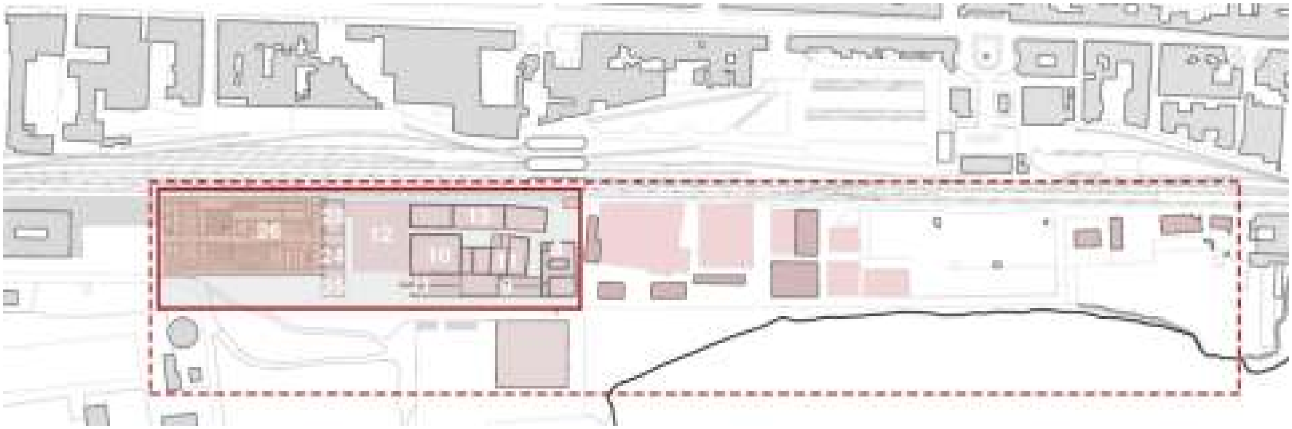
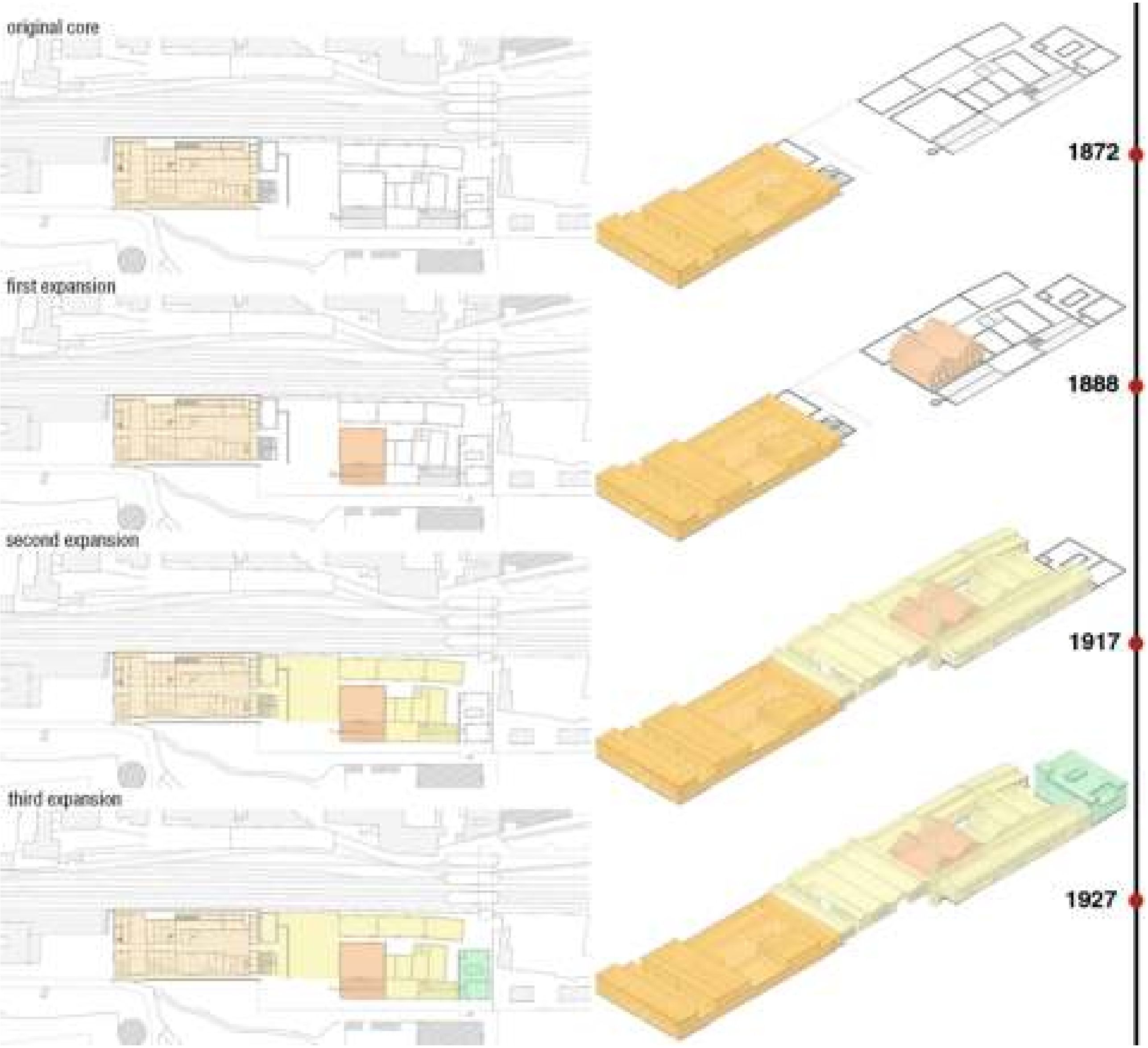


Fig. 8. Original configuration of the area for the reconstruction hypothesis on the current site plan (drawing: A. Cicala).

designs at the entrances, while stucco decorations inside;

- Next to it is the refining cupolas (9) with pitched roof and load-bearing masonry in tuff. It features special iron and wood polanceau trusses with tie rods and struts supporting the roof;
- The casting foundry (10) is articulated in two naves and a third orthogonal to the first two. The perimeter load-bearing masonry features alternating courses of tuff and bricks and free internal spaces thanks to cast iron pillars adorned with stylized bases and capitals;
- Moving forward, there is a unit of four buildings (11): refining, muffle furnace, and brass warehouse. The recognizable resulting elements are pitched roofs, wooden trusses with steel chain, and load-bearing walls in tuff;
- The wire drawing mill and warehouse (12) are articulated on three naves with load-bearing masonry in tuff and pitched roof with metal framework, probably dating back to the early years of the twentieth century;
- A unit (13) articulated according to three parallel wall strips is divided into two different architectural typologies: small rolling mills with load-bearing masonry in tuff and pitched roof, and the warehouse articulated in two naves with load-bearing tuff masonry and shed roof.


original core
first expansion
second expansion
third expansion
1872
1888
1917
1927

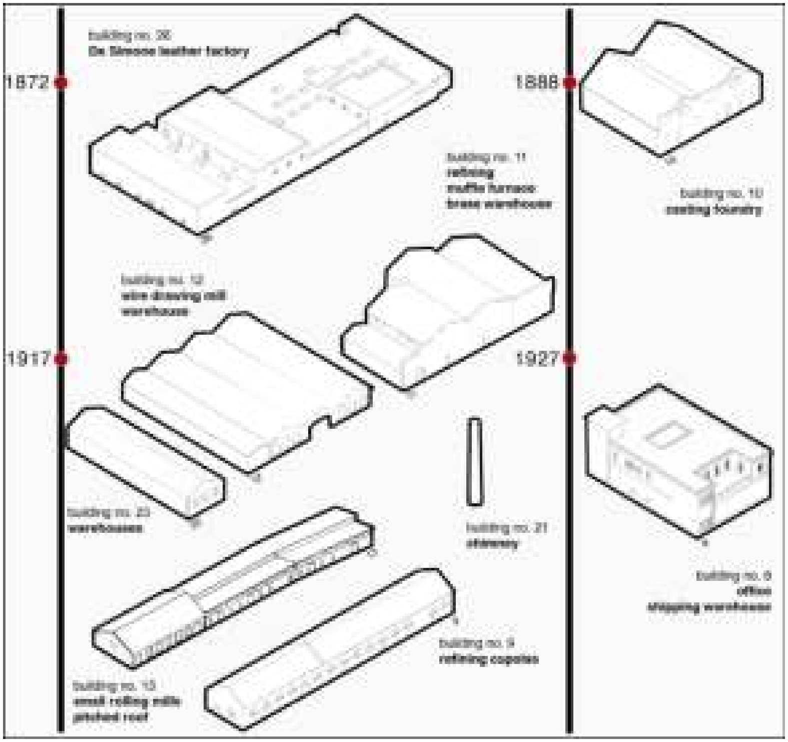


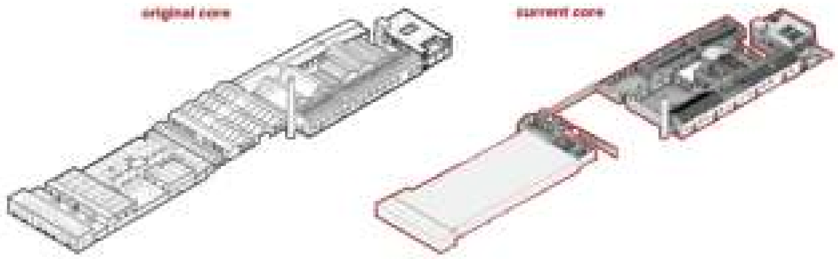
Fig. 10. Cataloging the buildings based on their period of construction (drawing: A. Cicala).

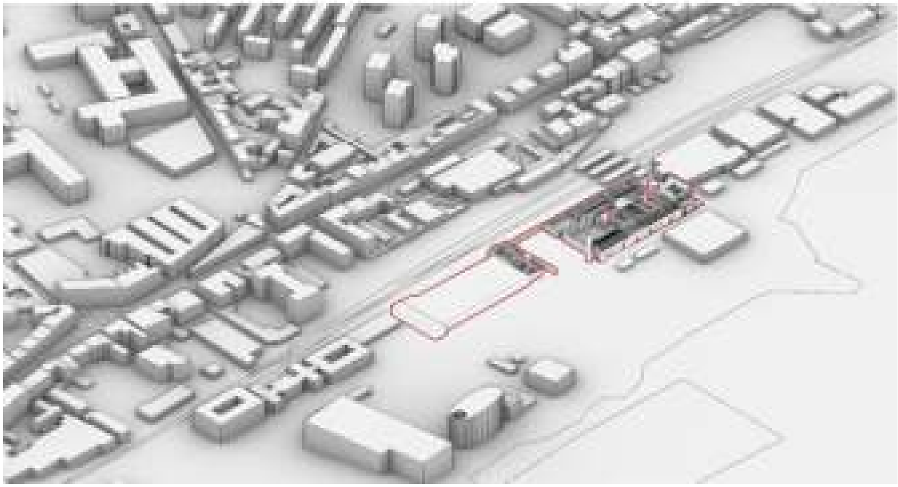
Additionally, there were other buildings intended for:

- coal and carpentry (14);
- general warehouses (15);
- chemical (16);
- shipyard (17);
- Corradini villa (18);
- gatehouse (19);
- employee housing (20);
- chimney (21);
- electrical cabin (22);
- warehouses (23-24-25);
- the sheet metal shed probably added after final closure (27);

Fig. 9. 3D model of the evolutionary phases of the complex (drawing: A. Cicala).

Fig. 11. Current urban context with the insertion of the original core of the complex (drawing: A. Cicala).





at the eastern boundary of the complex, we find the first building of the complex corresponding to the De Simone leather factory (26), divided into three bodies. The first partly has only one above-ground floor and partly two above-ground floors; the load-bearing structure consists of tuff masonry walls, steel beams at the first floor, and brick vaults, steel and reinforced concrete beams and slabs at the second floor. The second body, articulated on two above-ground levels, has a load-bearing structure in tuff masonry with cruciform pillars and masonry arches. The third and last body has one above-ground level except for a small area with a second level. The main structure is in tuff masonry with a central area of concrete

reinforced pillars and beams, a large environment with columns and cast-iron trusses with iron beam horizontals and brick vaults (Barbaglio et al., 1982). Currently, the conditions of the aforementioned buildings are terrible. Many units have completely collapsed, while others are barely recognizable, either due to the lack of fundamental elements or because much of them has disintegrated over time (Fig. 7). However, the study of the evolutionary phases of the complex has allowed the development of a hypothesis for reconstructing the original state, starting from the initial core up to the office and dispatch warehouse blocks, thanks to the cartography and documentation available (Fig. 8).
There are four phases that have been considered (Fig. 9):
1872: Original nucleus consisting of the "Pellami De Simone" factory;
1888: First expansion phase, presumably consisting of the three buildings used as a casting foundry;
1917: Second expansion phase, during which most of the buildings in the complex were constructed. Based on cartography, it is possible to highlight some differences compared to the current configuration; the buildings next to the original nucleus appear to form a single block, whereas currently, the block is divided into two different units, as is the case for the nucleus in front of the casting foundry building (Fig. 10).
1927: Third and final expansion phase, probably related to the construction of the office and dispatch warehouse buildings, which appear to have been built at a later period.

Conclusions

Within the study of a site that is part of the industrial archaeological heritage, it has been essential to delve into the historical events that have shaped and marked it to the extent that it has transformed itself and the surrounding environment. Analyzing the causes and defining the significant time periods has allowed for the creation of a reconstruction hypothesis of a portion of the complex, in which the original configuration has been identified and its development over time revealed (Figg. 1,11). In this process, tools such as detailed drawings, historical maps, and three-dimensional models prove fundamental for documenting and obtaining a clear vision of the complex industrial history of the former Corradini site. This representation effectively communicates historical interpretations, thereby contributing to the understanding and valorization of the complex and the San Giovanni a Teduccio neighborhood as a tangible testimony of Naples' industrial heritage.

References

Bollettino dell'Associazione per l'Archeologia Industriale, No. 2-3. Napoli: il Torchio s.r.l.

Barbaglio, F., de Seta, C., Guida, E., & Starace, F. (1982). Il recupero del complesso metallurgico ex-Corradini di San Giovanni a Teduccio. In *Bollettino dell'Associazione per l'Archeologia Industriale*, No. 2-3, pp. 23-32.

Capone, M., & Cicala, A. (2023). Digital twins _represent post-war urban transformation. The case of the Incoronata Church in Naples. In R. Amore, M. I. Pascariello & A. Veropalumbo (Eds.). *Città e guerra. Difese, distruzioni, permanenze delle memorie e dell'immagine urbana*., pp. 403-412. Napoli: FedOA – Federico II University Press.

Comune di Napoli. (2023). Recupero ex complesso industriale Corradini. <https://www.comune.napoli.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/25678> (accessed 2 May 2024).

Dal Piaz, A. (1982). Verso il recupero urbano di San Giovanni a Teduccio: ruolo e potenzialità della fascia costiera. In *Bollettino dell'Associazione per l'Archeologia Industriale*, No. 2-3, pp. 19-22.

De rosa, L. (1968). *Iniziative e capitale straniero nell'industria metalmeccanica del Mezzogiorno 1840-1904*. Napoli: Giannini Editore.

Massari, D.M., & Miranda, F. (2021). *Racconti dal margine: il complesso industriale ex Corradin i tra memoria e storia*. Bachelor's thesis in Architecture for Sustainable Design. Supervisor Prof. S. Gron, co-supervisor V. Manni. Politecnico di Torino.

Palmentieri, S. (2018). *Dinamiche industriali e nuovi assetti territoriali. Le periferie di Napoli tra vuoti urbani e prospettive di valorizzazione*. Mantova: Universitas Studiorum.

Digital model

HBIM Applications for the Re-valorization of industrial archaeology areas

Victoria Cotella, Giuliano Galluccio

Introduction

Digital technologies play an increasingly central role in serving as a tool for holistic documentation of Cultural Heritage. In this framework, in recent years there has been a growing popularity of the BIM (Building Information Modelling) methodology, mainly due to the introduction of regulations and standards that impose or regulate its use. Several studies and researches on the application of BIM processes to Cultural Heritage (HBIM) have emphasised the significant challenges related with reconciling historical architecture's heterogeneity with the required discretization and standardisation suggested by parametric representation procedures: BIM's potential for documentation (Grilli et al., 2017; Weinmann et al., 2017) pathology analysis (Rodrigues et al., 2022), archaeological digitisation and archiving (Su et al., 2015; Xie et al., 2020) scenario simulation, digital support for conservation plans (Minaee et al., 2021), digital representation through augmented and virtual reality (Schölkopf & Smola, 2018; Fisher et al., 2016; Pedregosa et al., 2011) and interoperability with GIS and CityGML (Bradski & Kaehler, 2009; Khan et al., 2018).

Although HBIM is now a well-established practice, in the academic literature the ways in which content and libraries are created vary widely on a case-by-case basis (Lecun et al., 1998; Krizhevsky, 2009; Krizhevsky et al., 2017). This is due to the variety of historical architectural features, whose complexity requires highly distinct solutions suited to each specific

Fig. 1. Overview of the ex-Corradini site area (editing: G. Galluccio).

situation. Furthermore, due to its sophisticated 3D modelling needs and a lack of standard references and strategic guidelines for semantic data (Sriyolja et al., 2021), its use remains limited and is rarely adopted by facility/building managers in the Cultural Heritage field. Furthermore, the dependence on specialized, often expensive, software not widely used by digital archaeologists hinders the models' long-term usability and collaborative potential across various disciplines (Cotella, 2023).
Digital archaeology, a discipline closely aligned with HBIM, influences 3D modelling for a multitude of purposes, encompassing meticulous documentation of existing structures, generation of virtual reconstructions (Demetrescu, 2015), visualizations (De Fino et al., 2022), gaming (Surer et al., 2017), monitoring (Colace et al., 2024), structural diagnosis (Merello et al., 2014), and even simulations. These advancements offer a powerful toolkit for archaeologists and heritage specialists. An additional, and frequently overlooked, aspect is the ability to visualize the inherent uncertainties associated with the reconstruction process. Archaeological research is inherently uncertain, and the process of virtual reconstruction

necessitates that archaeologists grapple with various possibilities. Current BIM workflows are designed to show certainty, reflecting project decisions and their evolution.
In these regards, the present manuscript is structured into two main sections. Section 2 presents a literature review of Digital and BIM applications within the context of Industrial Heritage. Section 3 illustrates the development of the PROSIT framework, focusing on the Ex-Corradini case study located in southern Italy. This section is divided into eight subsections, each corresponding to a specific step within the framework. Finally, the manuscript concludes with a concluding section and references.

Literature review

Industrial archaeology presents a fruitful ground for exploring the potential applications of HBIM. Within this domain, HBIM's capacity to manage extensive datasets and generate complex scenarios becomes particularly useful. As highlighted by (Graham et al., 2018), many previous studies focused on new projects rather than historic or industrial heritage buildings. They either didn't mention design or maintenance/repair issues, or they weren't focused enough to propose a model. In contrast, HBIM studies focus on the structural characteristics of buildings. In this sense, (Gürcanlı & Hartmann, 2024) propose a novel method for integrating safety considerations into BIM for industrial heritage projects. Their approach aims to engage safety professionals, restoration experts, and site managers from the very beginning of the design phase introducing the "8D" dimension in BIM. This strategy, known as "prevention through design," empowering BIM to identify potential health and safety hazards associated with both construction and the future operation of the restored structure. The study utilizes two gasometer projects as case studies. A team of experts was assembled to pinpoint potential risks during construction and post-commissioning. This critical information was then incorporated directly into the BIM model, allowing for the development of safer design proposals and the integration of necessary

safety measures within the Level of Detail (LOD) for each element. The authors emphasize that unforeseen hazards necessitate adaptable design solutions, safer construction methods, and vigilant on-site operations.
On the other hand, heritage railways serve as tangible remnants of human industrial civilization and have made significant contributions to global transportation, economic progress, and cultural exchange. Railway tourism is a significant factor in addressing poverty and promoting sustainable development in developing countries such as China and Vietnam. Wang et al. (2024) proposed a novel approach to assess the visual quality of these industrial heritage sites. Their method combined computer vision (CV) and Immersive Virtual Reality (IVR), overcoming limitations of traditional methods. Environmental audits and on-site interviews can be expensive and time-consuming, while evaluations based on 2D images lack the immersive experience offered by VR [1]. Computer vision techniques automatically segmented 16 landscape elements within the heritage sites. This objective data was then integrated with subjective perception scores gathered through immersive virtual reality experiences. Statistical models were used to analyse the relationship between these two datasets, allowing the researchers to classify the 120 heritage sites based on their visual quality. Findings suggest that vegetation, water, and buildings have a stronger influence on perceived visual quality compared to elements like sky or hard ground.
Research carried out by Rovelli et al. (2020) focuses on creating a practical tool to aid decision-making when transforming disused railway lines into greenways, specifically within areas that blend urban and rural environments. Their approach centers around developing a transferable methodology, meaning it can be applied in various locations facing similar situations. To achieve this, they tested their method in Piedmont, Italy, a region rich with potential for greenway development due to its abundance of abandoned railway lines and stations. Their strategy hinges on two key elements: Geographic Information Systems (GIS) and the Analytic Hierarchy Process (AHP). GIS allows them to analyze spatial data related to the disused railway lines and surrounding areas. This data encompasses

factors like natural elements, historical and cultural resources, local food and wine production, scenic value, accessibility, and population density.
Biagini (Biagini & Arslan, 2018) delved into the complexities of industrial heritage restoration through the lens of four Italian case studies: "Lanificio Ricceri","Pagliere Factory," the Arezzo grain silo, and "Manufattura Tabacchi" also in Arezzo. Their research explored the challenges and opportunities BIM presents in this unique context. A critical issue addressed in the early design phases was the presence of asbestos-cement building components, commonly used in post-WWII renovations, similar situation that is facing the Ex-Corradini Factory. BIM facilitated the identification and planning for safe removal of these hazardous materials. Additionally, the technology enabled the team to select sections for demolition – those deemed incongruous with the original structures. Furthermore, BIM allowed for the crucial assessment of the load-bearing structures' performance in relation to seismic risk.
The significance of Biagini et al.'s work lies in highlighting industrial heritage as a valuable testing ground for BIM applications. However, research in this domain holds immense potential for broader application in restoration projects. The act of overcoming these complexities through the development of BIM procedures, strategies, and software specifically tailored to Industrial Heritage can pave the way for advancements in the field. These solutions, forged in the crucible of Industrial Heritage restoration, can be adapted and refined to benefit the restoration of a wider range of existing structures.
Galieva (2018) address a significant challenge faced in reconstruction projects: the absence of technical documentation for the building in question. Their approach uses laser scanning technologies and BIM to overcome this hurdle and streamline the inspection and reconstruction process. The study focuses on utilizing laser scanning for building facades, particularly in the context of residential structures, cultural heritage sites, and industrial buildings. This method offers several advantages. Firstly, it enhances safety during the inspection phase by minimizing the need for physical contact with the structures. Secondly, the detailed point cloud

data captured by laser scanning allows for the creation of highly accurate construction drawings and specifications. Finally, the resulting 3D model of the building facilitates static calculations to assess the structural integrity.

The spirit of the place and the social lifestyle and activities associated with industry are intangible elements (ICOMOS, 2003). Industrial archaeology heritage sites can vary greatly in their purpose, design and evolution over time. It is therefore a history that includes the value and significance of the industrial heritage buildings, the equipment of the production site, the texture of the materials, the effect of other components and the structure of the building's outbuildings. In this sense, the collection and compilation of information on these structures is important in terms of facility management, sustainability, as well as risks during construction and the safety of the building's users.

The present has explored the increasing field of digital archaeology and its impact on industrial heritage preservation. By harnessing the power of HBIM, alongside advancements in digital capture technologies like laser scanning and computer vision, researchers are unlocking new avenues for documenting, analyzing, and revitalizing these valuable historical sites. While HBIM offers a powerful toolkit for managing complex datasets, generating scenarios, and facilitating collaboration among diverse specialists, challenges remain. The inherent heterogeneity of historical structures often clashes with the standardized processes of BIM, demanding project-specific solutions. Additionally, the reliance on specialized software and a lack of standardized workflows for semantic data can hinder long-term usability and interoperability across disciplines. Digital archaeology offers a complementary approach, particularly in meticulously documenting existing structures and generating virtual reconstructions. This field also sheds light on the inherent uncertainties associated with archaeological reconstruction, a crucial consideration often neglected in traditional BIM workflows.

Industrial archaeology presents a fertile ground for exploring HBIM's potential. Here, HBIM surpasses at managing extensive datasets and

generating complex scenarios for restoration projects. A key example is the integration of safety considerations into the BIM process from the very beginning. This "prevention through design" approach allows specialists to identify potential hazards during construction and future operation, fostering safer design proposals and construction methods. Beyond restoration, HBIM plays a role in assessing the visual quality of heritage sites and guiding greenway development decisions. Researchers are employing computer vision and immersive virtual reality to analyze landscape elements alongside subjective human perception gathered through VR experiences.
The relevance of Industrial Archaeology goes beyond the physical structures themselves. These sites embody the social and technological advancements of bygone eras, serving as tangible testaments to human originality. Digital technologies offer a powerful approach to capture the spirit of these places, encompassing not only the buildings themselves but also the equipment, materials, and social context associated with them generating crucial documentation for facility management, ensuring the long-term sustainability and safety of these irreplaceable cultural assets.

PROSIT framework application in the ex Corradini case study
The purpose of this section is to present a methodological framework for using BIM in the renovation of industrial heritage, within the context of Italy's regulatory system for BIM-based design in public procurement. This contribution traces the design process from the initial survey to defining scenarios for the future maintenance of the asset.
Specifically, the described uses of BIM concern: i) Digital survey ii) Definition of the Levels of Detail (LOD) for BIM objects iii) Verification of the existing building's regulatory compatibility with new functions iv) Coordination and verification of BIM models v) Energy renovation project vi) Integration of Life Cycle Assessment (LCA) analyses into the BIM workflow vii) Verification of the potential for construction and demolition waste recovery (reuse, recycling, disposal, etc.) viii) Facility Management of the asset during the use phase. Further subsections in the

Fig. 2. Evolution of the voluntary BIM legislation over time. Credits: Marco De Gregorio, Adriana Romano (Source: https://www.ingenio-web.it/articoli/normativa-bim-da-dove-partire/).

manuscript will be structured according to this step-by-step framework.
The present framework has been developed and tested on the eastern part (Lot 1) of ex-Corradini industrial area in San Giovanni a Teduccio, Naples, as part of the research project "PROSIT – Designing in Sustainability" (Administrative Manager Dr. Ing. Alberto Zinno – STRESS scarl; Scientific Coordinator: Prof. Ing. Domenico Asprone – Department of Structures for Engineering and Architecture, University of Naples Federico II), funded by the Campania region PO FESR 2014-2020 (Fig. 1). The activity, in particular, was carried out by the research group of the DiARC - Department of Architecture of the University of Naples Federico II, composed of Prof. Arch. Marina Rigillo (DiARC Scientific Director), Prof. Arch. Sergio Russo Ermolli (OR3 Manager), Dr. Giuliano Galluccio (BIM Manager), eng. Sergio Tordo and arch. Martina Costanzo, Eufemia Guarino, Lucia Pierni, Fiorella Zullo (Rigillo et al., 2021; Rigillo et al., 2023; Russo Ermolli & Galluccio, 2022).
The use of the BIM methodology in public procurement in Italy is in line with the provisions of art. 23 of Legislative Decree 50/2016 and art. 43 of Legislative Decree 36/2023, and in compliance with the Ministerial Decree 312/2021.
The methods of implementation of BIM in the processes of planning, design, execution and management of works is regulated by voluntary

Table 1. Summary of the voluntary BIM legislation in Italy (source: author's elaboration, G. Galluccio).

	ISO	
Series/Part	**Year**	**Title**
UNI EN ISO 19650-1	2019	*Organization and digitization of information related to construction and civil engineering works, including Building Information Modelling (BIM) - Information management through Building Information Modelling.* Concepts and principles
UNI EN ISO 19650-2	2019	Real Estate Delivery Phase
UNI EN ISO 19650-3	2020	Real Estate Management Phase
UNI EN ISO 19650-4	2022	Exchange of information
UNI EN ISO 19650-5	2020	Security-Oriented Approach to Information Management
UNI EN ISO 16757-1	2019	*Data Structures for Electronic Product Catalogs for Construction Services* Concepts, architectures and models
UNI EN ISO 16757-2	2019	Geometry
UNI EN ISO 12006-2	2020	*Construction - Construction Information Organization* Classification Structure
UNI EN ISO 12006-3	2022	Structure for object-oriented information
UNI EN ISO 23386	2020	Building Information Modelling and Other Digital Processes Used in Construction - Methodology for Describing, Creating, and Maintaining Properties in Interconnected Data Dictionaries
UNI EN ISO 23387	2020	Building Information Modelling (BIM) – Data Models for Building Objects Used in the Life Cycle of Building Assets – Concepts and Principles
UNI EN ISO 29481-1	2017	*Building Information Models - Information Exchange Guide* Methodology and format
UNI EN ISO 29481-3	2022	Data Schema
	CEN Standards	
Series/Part	**Year**	**Title**
UNI EN 17412-1	2021	*Building Information Modelling - Level of Information Need* Concepts and principles
UNI EN 17632-1	2023	*Building Information Modelling (BIM) - Semantic Modelling and Linking (SML)* Generic Modelling Schemas
	UNI	
UNI 11337-1	2017	*Construction and civil engineering works - Digital management of construction information processes* Models, drawings and information objects for products and processes
UNI/TR 11337-2	2021	Information flows and decision-making processes in the management of information by the client
UNI/TS 11337-3	2015	Models for collecting, organizing and storing technical information for construction products
UNI 11337-4	2017	Evolution and information development of models, drawings and objects
UNI 11337-5	2017	Information Flows in Digitized Processes
UNI/TR 11337-6	2017	Guidelines for the drafting of information specifications
UNI/PdR 11337-7	2018	Knowledge, skills and competency requirements of the professionals involved in information management and modelling

Table 2. Accuracy Levels – LOA (source: U.S. Institute of Building Documentation).

Object Development Levels Reference System - LOA LOA 10 >>> LOA 20 >>> LOA 30 >>> LOA40 >>> LOA50 Low >>> High		
Level	Upper Range	Lower Range
UDLOA	User Defined	User Defined
LOA10	15cm *	5cm *
LOA20	5cm *	15mm*
LOA30	15mm*	5mm*
LOA40	5mm*	1mm *
LOA50	1mm *	0 *

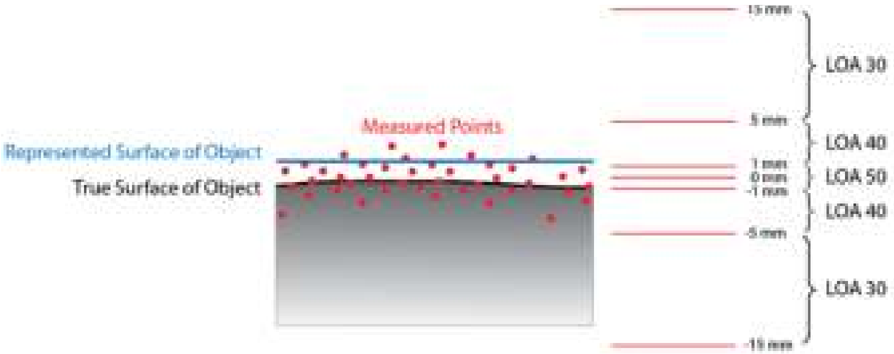


Fig. 3. Measurement of Accuracy Levels – LOA (source: U.S. Institute of Building Documentation).

regulations, the evolution of which is summarized in Figure 2. The summary regulatory framework is shown in Table 1.

SCAN-TO-BIM Modelling

In case of an integrated digital survey (SCAN-TO-BIM modeling), it is possible to refer to the Level of Accuracy (LOA) prescribed by the USBID (U.S. Institute of Building Documentation), which defines the geometric deviations allowed with respect to the point cloud with respect to the level of geometric-informative development of the BIM modeling (Tab. 2; Figg. 3,4,5).

Level of development of BIM information objects

In BIM design, the level of development of both geometric and non-

Fig. 4. Ex Corradini point cloud (image: G. Galluccio).

Fig. 5. BIM modeling process using the point cloud (image: G. Galluccio).

geometric attributes of the objects that make up a graphical information model is established by the LOD - *Level Of Development* or *Level Of Detail* [1] (Bolpagni, 2022) (Fig. 6).

UNI 11337:2017-4 standard defines the LOD as a measure of

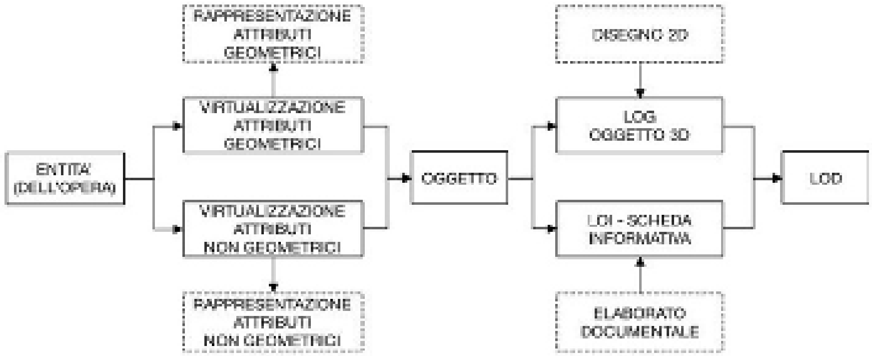


Fig. 6. LOD scheme. UNI 11337-4 (source: UNI 11337-4).

information characteristics in qualitative and quantitative terms. These features were linked to the objects through a simulated representation in 3 dimensions (graphical information model); any graphic representations and alphanumeric codes.

The general scale of LODs adopted in Italy can be summarized as follows: LOD A symbolic object; LOD B generic object; LOD C defined object; LOD D detailed object; LOD E specific object; LOD F executed object (as-build); LOD G updated object. For interventions on existing buildings, UNI 11337-4 reports the following. Conservation activities on existing buildings declared of cultural interest presuppose a continuity of knowledge management and therefore are based on a level of information content and detail of representation as resulting from the scientific balance of the previous intervention (LOD F) implemented in subsequent management activities (LOD G).

Individual specialist activities (structural, energetic, behavioural, computational analyses, etc.) may refer to appropriate simplifications of the information model (corresponding to LOD D or E). However, the high level of detail characterizes information modelling for cultural heritage, as singularities that may not be relevant for individual technical activities can take on decisive relevance for other design choices. In the case of an initial transitional period in which information on previous interventions is not available, the start of the activities must in any case

LOD	Indications for interventions on existing/listed buildings UNI 11337-4
A to E	For restoration interventions, they are not significant except for some appropriate simplifications of the models of a specialized nature.
F	The objects express the virtualization detected on the site of the specific existing system (as-built). The quantitative and qualitative characteristics (size, shape, location, orientation, cost, etc.) are those specific to the individual object, identifying possible abstractions that allow groups of similar objects or coherent aggregations of objects. The management, maintenance and/or repair interventions to be carried out over a programming period are defined for each individual product. NOTE - Virtualization, of a descriptive nature, with which it is possible to identify, for example, the "systems" and "subsystems" up to the "components" in relation to the "(construction) products" installed (see points 3.3 and 3.4 of UNI 11337-1).
G	Objects express the up-to-date virtualization of an entity's state of the art in a defined time. Historicized representation of the passage of the useful life of a specific system updated with respect to what was treated or installed in a previous intervention. The quantitative and qualitative characteristics (size, shape, location, orientation, etc.) are up to date with respect to a previous state of the art. Every single (and significant) management, maintenance and/or repair and replacement work carried out over time is recorded, as well as any forms of degradation that may exist.

Table 3. Indications for LODs in restoration, UNI 11337-4 (source: extracted from UNI 11337-4).

tend to the level of detail and information content (characterization of materials and previous interventions) corresponding to or higher than LOD F (Tab. 3, Fig. 7).

Code Checking Procedures for Compatibility Verification in the Refunctionalization Project

BIM regulatory compliance procedures introduce self-verification mechanisms to iteratively "validate" design assumptions. These procedures are rigorously outlined within BIM protocols as coordination and verification activities, aimed at intercepting gaps, interferences and regulatory inconsistencies between two or more digital entities positioned in the virtual modeling environment in a timely manner (Amor & Dimyadi, 2021).

UNI 11337:2017 - part 5 identifies, more precisely, three coordination and verification activities:

- "Clash Detection", i.e. analysis and control of geometric interferences between digital objects;
- "Model Checking", intended as the analysis and control of the

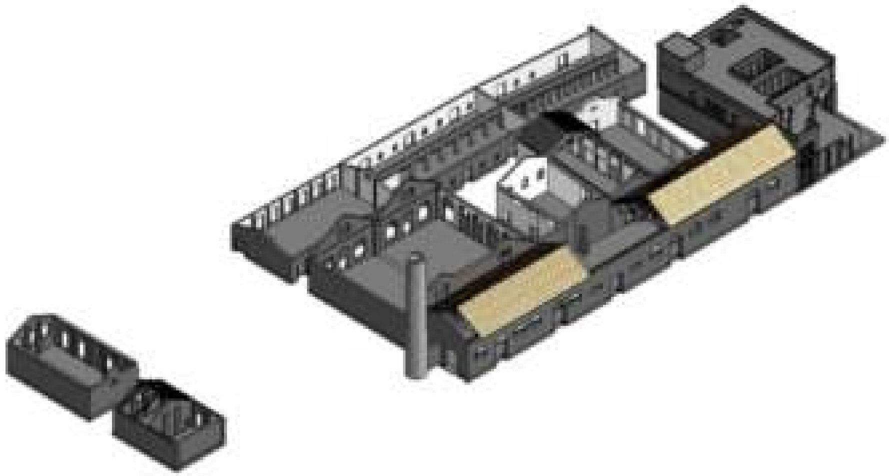


Fig. 7. As-is BIM model for the ex-Corradini – Lot 1 (image: G. Galluccio).

geometric and informational coherence of digital objects;

- "Code Checking", aimed at identifying regulatory discrepancies in digital objects and environments.

In *Code Checking,* automated rule verification systems are usually organized into three phases. The first involves the development of a *ruleset*, i.e. a logical and structured organization of rules for verification. The second coincides with the definition of the data in the information model, corresponding to the rulesets. The third is to perform compliance checks, the result of the comparison between rules and modeled entities. This comparison consists of checks of:

- compliance with the minimum dimensions of the modeled objects, based on the specific reference standards;
- partial or integral overlaps of objects;
- compilation of parameters and encodings of objects;
- exact positioning of objects in the virtual environment;
- correct interrelation between objects with respect to the specific virtual restitution methods;
- presence of overall dimensions, maneuvering and opening spaces, tolerances, etc.;

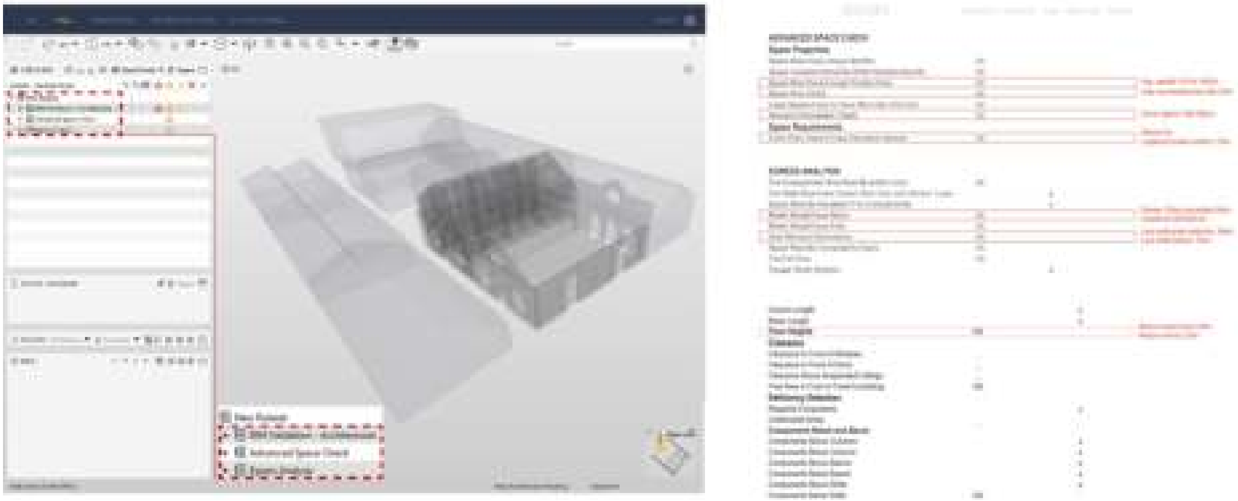


Fig. 8. Example of the Model Checking Analysis for the ex-Corradini buildings (image: G. Galluccio).

- presence of specific objects referable to devices (e.g., security), or equipment.

Code Checking therefore offers the possibility of verifying and managing any inconsistencies with project requirements or technical/legislative regulations of the model. Compliance verification systems also make it possible not only to create databases of rules, but also to integrate models relating to different disciplinary areas and to transmit any inconsistencies that have emerged in the form of reports.

Regulatory verification procedures require the use of specific software applications in order to be executed: some of these systems are considered real "*black boxes*", in which users have very limited access to the rules creation engine; others are referred to as "*grey*" or "*white box*" methods, based on the freedom of users to customize the verification procedures. Currently, there are several software platforms available developed to support the implementation aspects of automatic control systems, which generally differ in: i) the ability to automate the design verification process; flexibility in the insertion of project information; ii) the richness of the standards libraries and the possibility of importing new "rulesets", both

standard and customized; iii) the ability to provide intuitive 3D reporting and visualization systems; iv) the possibility of communicating with other applications, both inside and outside the BIM environment.
As part of the redevelopment project of existing buildings, it may be useful to carry out preliminary Code Checking analyses, i.e. aimed at verifying the regulatory compatibility between the existing environments and the functions to be installed. The results of this analysis can provide useful decision-making support for the design.
The rulesets to be adopted for the application of Code Checking protocols may include: i) analysis of site properties, such as orientation, ventilation and position with respect to the main accesses; ii) dimensional analysis of spaces (area, height, perimeter, volume); iii) dimensional analysis of glass surfaces and air-illumination ratios; iv) safety conditions (e.g. number of emergency exit doors compared to the requirements for the assumed function) and v) accessibility conditions.
Finally, it is possible to implement a Space Analysis on the environmental system, in order to verify the distance between the functional units and the total area per floor compared to the minimum dimensions established for each functional location (Fig. 8).

Model Checking Procedures for Model Coordination and Verification

As part of *the Clash Detection* checks, three categories of interferences are identified (Bertella et al., 2018):

- Hard Clashes are an effective intersection of two or more objects;
- Soft Clashes (also known as Clearance Clashes) are generated by the inadequate proximity between two elements;
- Workflow Clashes occur between objects that are impossible to make or assemble in the different stages of processing on site. The resolution of the latter can take place by intervening on the phases of the time schedule, even before the elements themselves.

In particular, the Clash Detection rules among digital objects identify: i) intersection between components of the same category (the latter

understood, in principle, as classes of technical elements according to the UNI 8290:1981 standard); ii) intersection between components of different categories; and iii) intersection between other elements.
In relation to the procedures adopted by the State Property Agency, Table 4 shows a scheme for the coordination and verification phases of the digital models:

- LC1/LV1 – coordination and verification within the information model;
- LC2/LV2 – coordination and verification between multiple information models;
- LC3/LV3 – coordination and verification between information models and documents.

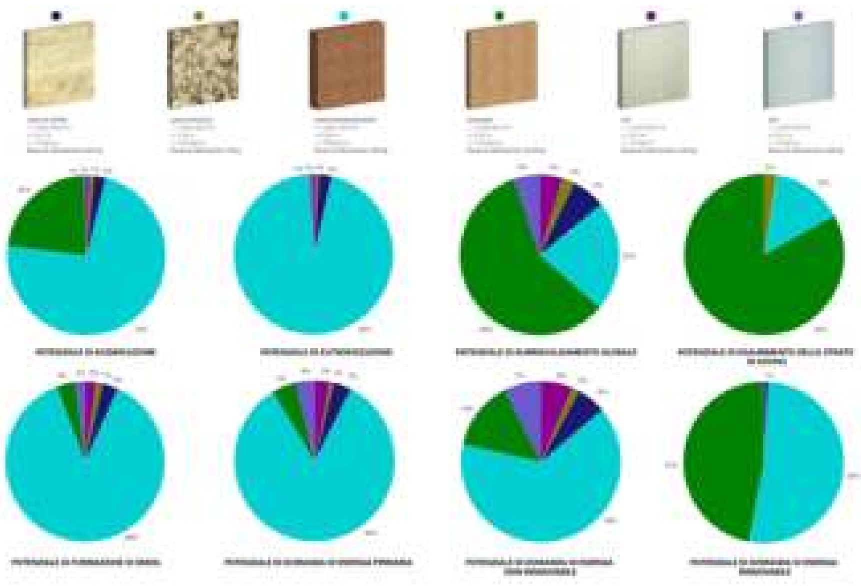
Use of BIM for energy requalification

For the application of BIM to energy analysis and requalification, please refer to the "Guidelines for the use of BIM for energy performance" drawn up in 2021 by IBIMI - Institute for Building Information Modelling Italy.
The document, in particular, states that at each stage of the restructuring, different information is exchanged between the different actors. The phases considered are: i) Modelling of existing conditions or feasibility study; ii) Preliminary project or technical and economic feasibility project; iii) Final design; iv) Detailed design; v) Construction and vi) Operation and maintenance and related costs.
The Guidelines identify the main managers of the process and assign each other's responsibilities in the BIM workflow.

Integration of LCA analyses into the BIM workflow

In its application in construction, the LCA methodology requires the processing of a large amount of data, due to the high complexity and heterogeneity that characterizes the building system in terms of components, processes. In this sense, an integration between BIM systems and LCA tools can bring important advantages to process management,

Fig. 9. LCA Analysis of the insultation materials for the renovation of the ex Corradini buildings roofs using the Autodesk REVIT plug-in Tally (image: G. Galluccio).



as the information necessary for the LCA assessment can be collected and structured directly in the BIM model, from the early stages of design (Marsh, 2016).

The potential of this approach would thus make it possible to verify the sustainability of the design choices adopted during construction or to turn towards more advantageous ones, being able to predict their behaviour at different times of the life cycle of the work. In addition, by drawing directly on the information entered in the model, the information "friction" due to the manual transfer of data into LCA software is minimized, which is one of the major drawbacks of their application (Galluccio, 2023).

The advantages, therefore, of an integration between BIM systems and LCA tools consist of:

- avoiding manual data transfer;
- comparing different alternatives, in order to select the one that can guarantee the best environmental performance;

- assessing the entire life cycle of the building, thus achieving a more integrated approach;
- using different environmental indicators for the assessment;
- implementing a real-time assessment, which can be used as a decision-making tool.

It should be emphasized that, in order to advantageously implement the methodology and analyze the environmental impact of a building work according to the "from cradle to grave" or "from cradle to cradle" approach, each material chosen and included in the BIM model must contain as input all the data relating to its life cycle, from extraction to processing, use and decommissioning or recycling (Fig. 9).

Assessment of the potential for recovery of construction and demolition waste in a BIM environment

Within the BIM workflow, it is possible to perform the ex-ante assessment of the waste stream from C&D with the aim of supporting the decision-making process for the redevelopment project in a perspective of valorization of the waste itself. The methodology involves the use of two key technologies: selective demolition, to reduce the amount of waste to be sent to landfills; BIM, as a methodological and technical support for information management and decision-making.

The methodology is in line with the current national regulatory framework on C&D waste management (Ministerial Decree 23/6/2022; Ministerial Decree 152/2022) and European (COM (2015) 614; 2018/851/EU) and is part of the preliminary audit process provided for by the EU protocol for selective demolition (European Commission, 2018).

The audit phase includes the *desk* and *on-field* study of the product, and returns the inventory of waste by quantity, type and characteristics. The inventory is essential to configure the layout of the demolition site and to plan the management of C&D waste streams, constituting an essential cognitive support to ascertain its quality and traceability.

Intervening in the inventory phase according to an ex-ante approach corresponds to estimating the selective demolition process and the

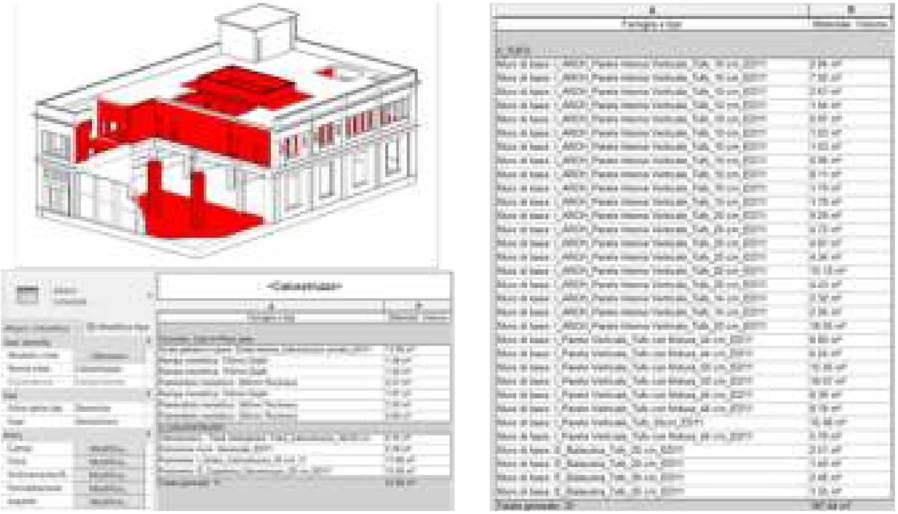


Fig. 10. Construction and Demolition Waste Analysis via BIM for the buildings of the ex Corradini (image: G. Galluccio).

risks associated with it (Fig. 10). In the BIM workflow, it is possible to implement the building inventory phase to support the selective demolition intervention. This application is specifically aimed at:

- provide data and estimates on the quantity and type of waste to be disposed of, reused or recycled;
- pre-catalogue C&D waste according to CER codes;
- model data according to intervention scenarios;
- define ways and times for deconstruction and demolition;
- Develop an integrated design of the demolition and construction site, able to optimize the use of waste within it.

In addition, the introduction of the BIM methodology can help to know in advance:

- the type of material to be classified as hazardous/non-hazardous waste, indicating the CER code and, possibly, the techniques aimed at recycling;
- the quantity of material referred to the individual types;
- the inventory of the components of the building system to be used for reuse;

- the composition of the waste;
- the precise location of potentially hazardous materials to maximize demolition safety;
- the potential for recovery/reuse of the post-demolition material depending on the characterization carried out and the indications of the urban redevelopment project.

The same methodology can be applied to carry out the mass balance starting from the quantities and types extracted from the BIM model, in order to comply with the Minimum Environmental Criteria (Galluccio et al., 2023).

Facility Management

In the case of project development at LOD G (“Updated Object”), each single and significant management, maintenance and/or repair work carried out is noted in the model. In this way, the model will serve both as a “historical archive” and as a basis for all subsequent restoration and maintenance operations on the artefacts. In fact, by developing the information model up to a G LOD, a real management system will be provided organized and bidirectionally connected to future Record models to effectively support the management and maintenance phase. The BIM model will be used to carry out economic evaluations, planning of short-term and long-term interventions, visualizing the asset in the model before carrying out operations (Ferrara & Feligioni, 2016, 2018). The BIM LOD G model will contain, for each object, specific sheets showing, for example, the maintenance costs, frequency, indication of the number and skills of human resources to be employed, the link to the product sheet used, the warranty, the user manual, etc.

The data of each object can be easily exported to the most common file formats, such as Excel or Access, as well as interoperable with databases such as ACCA, ARCHIBUS, BIM VISION, FM SYSTEM, etc. In fact, each element of the model will be made in such a way as to keep track of it and make the relationship between the object in the model and the entry in the schedules biunique. Each object belongs to a specific type and family, has an id – identification number, and has specific IFC parameters, which are not likely to be lost during the transfer from one file format to another.

Conclusion

The research analyzed the application of BIM approaches for the renovation of Industrial Heritage, specifically through the PROSIT project's work on the Ex-Corradini area in Naples, Italy. The experimentation highlighted not only the opportunities BIM presents but also its limitations. The complexity of BIM software and the less-than-optimal interoperability between platforms are challenges to consider, particularly for tasks like LCA analysis which require data from different sources.

However, BIM offers significant advantages for renovating abandoned buildings, where uncertainties and data gaps exist due to access limitations or missing original documentation. As demonstrated in the PROSIT project, BIM's simulation capabilities allow for managing uncertainties by creating and validating different design scenarios based on hypotheses.

Furthermore, a comprehensive framework is crucial to fully exploit BIM's potential. Implementing a digital twin, capturing data from the initial survey all the way to facility management, creates a rich data archive for the building. This data becomes invaluable for future refurbishments or renovations throughout the building's lifespan.

In conclusion, the synergy between digital archaeology and Historic Building Information Modelling (HBIM) presents a powerful tool for preserving and enhancing industrial heritage sites. This approach overcomes the limitations of traditional methods. Fostering collaboration in this field ensures that these sites continue to educate and inspire future generations, serving as vital bridges between the past and the future.

Notes

[1] Although the acronym LOD is associated, almost synonymously, with the terms Detail and Development, or even Definition (present in Anglo-Saxon regulations - PAS 1192-2), there are specific differences that denote different interpretations depending on the reference system. The Italian system distinguishes between LOG (geometric) and LOI (informative), encoded in letters rather than numbers (from A to G), relating to BIM objects and not to the entire models or to the development phase of the project. See Sattanino, E. (2018), "LOIs in the scales of LOD USA, UK, ITA", Ingenio-web [Online] Available at https://www.ingenio-web.it/18926-i-loi-nelle-scale-di-lod-usa-uk-ita [Accessed: 19 May 2020]. UNI EN ISO 19650:2019 goes beyond both terms, to embrace that of "Level of Information Need" (LOIN), with the aim of further optimizing information flows and containing the risks of transmission of redundant or superfluous data, evaluating according to each different project document. See Galluccio, G. (2021), "Digital Strategies and BIM Adoption Scenarios in Italy", in Block, M., Galluccio, G. (eds), *Digital Processes for Public Procurement Management. The use of BIM in Italy and Germany*, Maggioli, Santarcangelo di Romagna (RN), pp. 47-65.

References

Amor, R., & Dimyadi, J. (2021). The promise of automated compliance checking. In *Developments in the Built Environment*, Vol. 5, 100039.

Bertella, A., Caputi, M., Rota, A., & Versolato, A. (2018). *BIM per professionisti e stazioni appaltanti*. Palermo (IT): Grafill.

Biagini, C., & Arslan, P. (2018). Industrial Heritage in the historical neighbourhood: BIM strategies for urban regeneration. In *DisegnareCON*, Vol. 11, No. 21, pp. 9.1-9.15.

Bolpagni, M. (2022). Livello di fabbisogno Informativo: le norme EN 17412-1 e UNI 11337-4. In *Ingenio*. <https://www.ingenio-web.it/articoli/livello-di-fabbisogno-informativo-le-norme-en-17412-1-e-uni-11337-4/> (accessed 24 April 2024).

Bradski, G., & Kaehler, A. (2009). *Learning OpenCV-Computer Vision with the OpenCV Library*. O'Reilly Media, Inc.

Colace, F., De Santo , M., Gaeta, R., Loffredo, R., & Petti, L. (2024). FAUNO: a Machine Learning-based methodology for monitoring and predictive maintenance of structures in archaeological parks through image analysis. In H. Degen & S. Ntoa (Eds.). *Artificial Intelligence in HCI*. HCII 2024. Lecture Notes in Computer Science, Vol. 14735. Springer, Cham.

Cotella, V. (2023). From 3D point clouds to HBIM: Application of Artificial Intelligence in Cultural Heritage. In *Automation in Construction*, Vol. 152, 104936.

De Fino, M., Bruno, S., & Fatiguso, F. (2022). Dissemination, assessment and managementof historic buildings by thematic virtual tours and 3D models. In *Virtual*

Archaeology Review, Vol. 13, No. 26, pp. 88-102.

Demetrescu, E. (2015). Archaeological stratigraphy as a formal language for virtual reconstruction. Theory and practice. In *Journal of Archaeological Science*, No. 57, pp. 42-55.

European Commission (2018). Guidelines for the waste audits before demolition and renovation works of buildings. <https://ec.europa.eu/docsroom/documents/31521> (accessed 24 April 2024).

Ferrara, A., & Feligioni, E. (2016). *BIM e Project Management. Guida pratica alla progettazione integrata*. Palermo: Dario Flaccovio.

Ferrara, A., & Feligioni, E. (2018). *Come redigere il capitolato informativo secondo la metodologia BIM. Guida pratica*. Palermo: Dario Flaccovio.

Fisher, R., Breckon, T., Dawson-Howe, K., Fitzgibbon, A., Robertson, C., & Trucc, E. (2016). *Dictionary of Computer Vision and Image Processing*. John Wiley & Sons Ltd.

Galieva, A., Alekhin, V., Antipin, A., & Gorodilov, S. (2018). Defects search during the inspection of civil and industrial buildings and structures on the basis of laser scanning technology and information modeling approach (BIM). In *MATEC Web of Conferences*, Vol. 146, 01007.

Galluccio, G., (2023). Un protocollo 'data-driven' per interventi di rigenerazione urbana circolare. In *EcoWebTown*, No. 26, pp. 114-126.

Galluccio, G., Paragliola, F., Piccirillo, S., Tordo, S., & Rigillo, M., (2023). Valutazione ex ante BIM based dei rifiuti da C&D per la demolizione selettiva. In A. F. L. Baratta, L. Calcagnini & A. Magarò (Eds.). *Atti del V Convegno Internazionale Recycling*, , pp. 352-365. Conegliano (TV): Anteferma.

Graham, K., Chow, L., & Fai, S. (2018). Level of detail, information and accuracy in building information modelling of existing and heritage buildings. In *J. Cult. Herit. Manag. Sustain Dev.*, Vol. 8, No. 4, pp. 495-507.

Grilli, E., Menna, F., & Remondino, F. (2017). A Review of Point Clouds Segmentation and Classification Algorithms. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. 2(XLII-2/W3), pp.339-344.

Gürcanlı, G., & Hartmann, T. (2024). Digitalization for safer restoration practices of industrial buildings using building information modelling (BIM): A review and a case study for gasometers. In *Digital Applications in Archaeology and Cultural Heritage*, 32.

ICOMOS. (2003). *The Nizhny Tagil Charter for the Industrial Heritage*. <http://www.icomos.org/18thapril/2006/nizhny-tagil-charter-e.pdf> (accessed 28 April 2024).

Khan, S., Rahmani, H., Shah, S., & Bennamoun, M. (2018). *A Guide to Convolutional Neural Networks for Computer Vision*. Springer Cham.

Krizhevsky, A. (2009). *Learning Multiple Layers of Features from Tiny Images*. Toronto,ON: Technical Report TR-2009, University of Toronto.

Krizhevsky, A., Sutskever, I., & Hinton, G. (2017). ImageNet classification with deep Convolutional Neural Networks. In *Communications of the ACM*, Vol. 60, No. 6, pp. 84-90.

Lecun, Y., Bottou, L., Bengio, Y., & Haffner, P. (1998). Gradient-based learning applied to document recognition. In *IEEE Procedings*, Vol. 86, No. 11, pp. 2278-2324.

Marsh, R. (2016). LCA profiles for building components: strategies for the early design process. In *Building Research & Information*, Vol. 44, No. 4, pp. 358–375.

Merello, P., García-Diego, F., & Zarzo, M. (2014). Diagnosis of abnormal patterns in multivariate microclimate monitoring: A case study of an open-air archaeological site in Pompeii (Italy). In *Sensors*, No. 488, pp. 14-25.

Minaee, S., Boykov, Y., Porikli, F., Plaza, A., Kehtarnavaz, N., & Terzopoulos, D. (2021). Image Segmentation Using Deep Learning: A Survey. In *EIEEE Transactions on Pattern Analysis and Machine Intelligence,* Vol. 44, No. 7, pp. 3523-3542.

Moyano, J., León, J., Nieto-Julián, J., & Bruno, S. (2021). Semantic interpretation of architectural and archaeological geometries: Point cloud segmentation for HBIM parameterisation. In *Automation in Construction*, Vol. 130, 103856.

Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B., & Grisel, O. (2011). Scikit-learn: Machine Learning in Python. In *Journal of Machine Learning Research*, No. 12, pp. 2825-2830.

Rigillo M., Russo Ermolli, S., & Galluccio, G. (2021). Digital rule-based compliance processes. The urban regeneration of ex-Corradini, Naples (IT). In *Aghatòn. International Journal of Architecture Art and Design*, No. 10, pp. 59-72.

Rigillo, M., Attaianese, E., Galluccio, G., & Russo Ermolli, S. (Ed.s). (2023). *Tailor-made strategies for complex processes management. Digital approaches for sustainable urban regeneration*. Napoli (IT): CLEAN.

Rodrigues, F., Cotella, V., Rodrigues, H., Rocha, E., Freitas, F., & Matos, R. (2022). Application of Deep Learning Approach for the Classification of Buildings' Degradation State in a BIM Methodology. In *Applied Sciences*, Vol. 12, No. 15, 7403.

Rovelli, R., Senes, G., Fumagalli, N., Sacco, J., & de Monti, A. (2020). From railways to greenways: a complex index for supporting policymaking and planning. A case study in

Piedmont (Italy). In *Land Use Policy*, Vol. 99, 104835.

Russo Ermolli, S., & Galluccio, G. (2022). Data-driven urban regeneration: university housing in the ex-Corradini factory in Naples. In *Techne. Journal of Technology for Architecture and Environment*, No. 24, pp. 199-207.

Schölkopf, B., & Smola, A. (2018). *Learning with Kernels*. MIT Press.

Sriyolja, Z., Harwin, N., & Yahya, K. (2021). Barriers to Implement Building Information Modeling (BIM) in Construction Industry: A Critical Review. In *IOP Conf. Series: Earth and Environmental Science*, Vol. 738.

Su, H., Maji, S., Kalogerakis, E., & Learned-Miller, E. (2015). Multi-view convolutional neural networks for 3D shape recognition. In *IEEE International Conference on Computer Vision*, pp. 945-953.

Surer, E., Inci, C., & Duzgun, S. (2017). *A Multifaceted Gaming Platform for Interactive Learning of Archaeology and Culture of Kültepe*. Kültepe International Meeting III. Kayseri, Turkey.

Wang, Y., Wang, S., Pan, Y., & et. al.,. (2024). Immersive virtual reality and computer vision for heritage: visual evaluation and perception of the industrial heritage sites along the Yunnan–Vietnam railway (Yunnan section). In *Heritage Science*, Vol. 36, No. 12.

Weinmann, M., Jutzi, B., & Mallet, C. (2017). Feature relevance assessment for the semantic interpretation of 3D point cloud data. In *The Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. 10(II-5/W2), pp. 313-318.

Xie, Y., Tian, J., & Zhu, X. (2020). Linking Points with Labels in 3D: A Review of Point Cloud Semantic Segmentation. In *IEEE Geoscience and Remote Sensing Magazine*, No. 8, pp. 38-59.

Digital model

Digital Open Data. Evolution of the digital model for the community

Marika Falcone, Giovanni Angrisani

Introduction

The digitalization processes and disclosure strategies represent a fundamental aspect for the conservation and valorization of industrial heritage. The use of the most modern software and the possibility of building digital models, *mìmesis* of reality, aided by technologies has undoubtedly contributed to provide new opportunities for documentation, conservation, and regeneration also in the field of industrial archaeology. Undoubtedly techniques such as terrestrial laser scanners, mobile mapping scans, terrestrial and aerial photogrammetry are examples of methodologies that allow the creation of digital models that can be explored through interactive web-based platforms. These three-dimensional data management platforms offer a variety of options, from archiving, rendering and annotation tools to more advanced features, such as point cloud alignment and/or scan registration. Furthermore, it is possible to integrate data from different sources with the possibility of creating specific virtual tours and highlighting the different historical phases as well as the changes of the site through an immersive virtual space in which users can interactively experience the present and the past. The possibility of building a digital model and exploring it within it calls for fascinating and interesting experiments that until recently were unthinkable. In this context, the promotion and exploration of industrial heritage opens new scenarios that make it possible to explore places that are not always accessible due to multiple reasons (Spallone et al., 2015;

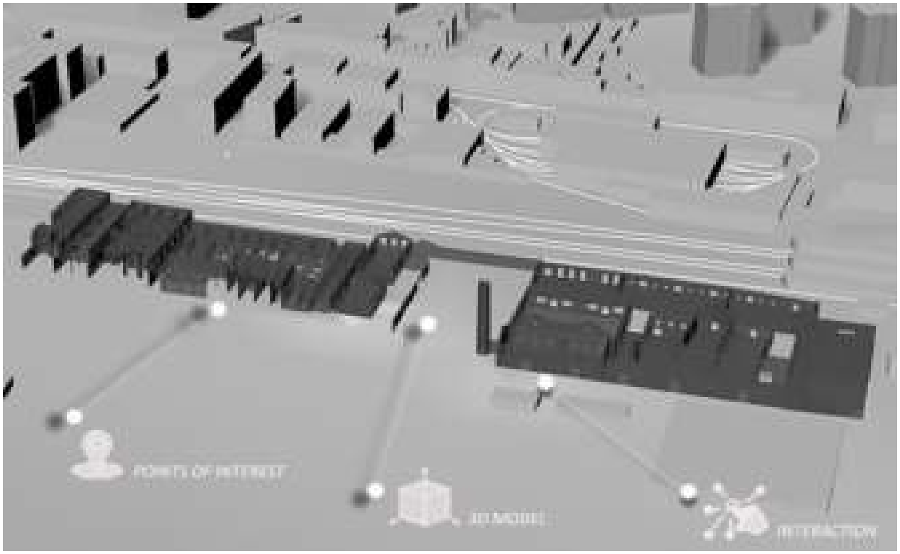


Fig. 1. The research methodology for the Corradini industrial complex in Naples (image: M. Falcone, G. Angrisani).

Bakhmut et al., 2021; Gabellone, 2023; Fascia et al., 2024; Gaspari et al., 2024). This intertwining of technology and enjoyment has led to a new model that changes the way users interact with industrial heritage, offering opportunities for learning and exploration. Starting from this assumption, the didactic, scientific and operational objective of the research carried out, within the Erasmus + KA131 Blended Intensive Program (BIP) project, on the industrial archeology complex of the former Corradini foundry in Naples has privileged the methodological and procedural aspect to reread through the construction of digital interpretative models the characteristics of the overall structure and the articulation of the individual parts to return a database capable of representing and communicating reality as well as the evidence of the diversified articulations typical of industrial archaeology [1]. In this perspective, the research on the former Corradini factory aimed to draw up, also at a cognitive level, a sampling of the volumes that highlighted the complexity of the place. Therefore, the study underlying the work of representation of the digital model set itself a dual objective: one aimed at exemplifying a methodology aimed at analyzing, representing, and synthesizing the signs of reality through a cognitive strategy; the other aimed at the dissemination and use of the model itself. In the first case, a modeling phase has been conducted which, through photographic documentation, *eidotypes* and the cloud of reference points, was able to prepare the work for the next phase, that of fruition. In fact, alongside the modeling, has been developed a documentary *corpus*, based on analytical sheets accompanied by a descriptive report relative to each of the pavilions of the former Corradini industrial complex, necessary for the fruition phase. [2] (Fig. 1).

Three-dimensional modeling as a cognitive strategy

The use of three-dimensional digital models for the construction of a set of representations able of illustrating a site, an object or a project is an indispensable tool full of potential. These systems allow three-dimensional simulations that contain homologous, isomorphic and analogous properties, allowing, in a single digital representation space, "*the totality of possible vision mechanisms*" (Docci & Migliari, 2000; Derkach, 2023). This type of representation therefore has the aim of conveying the legacy of a place, giving the possibility of codifying the historical memory of a reality that is no longer visible today. The possibility of returning data in a 3D environment, in the field of cultural heritage, has led to a radical change in the interpretation of architecture in which it can be stated that three-dimensional modeling is identified as a cognitive strategy in which the different communication levels. In fact, it is possible to create different digital models with a different level of geometric/informative detail depending on the audience it is aimed at.

For this purpose, three different levels have been identified for the communication project, through which reading the multiple aspects of reality, that is three interpretation keys:

i) the basic level, aimed at children and the curious, which offers basic information on the history of architecture and uses a simplified three-dimensional model. These are simple solids made by extrusion and each

Fig. 2. The three-dimensional model as a cognitive strategy: three levels of knowledge (image: M. Falcone, G. Angrisani).

single solid volume is associated with a point of interest from which it is possible to access a summary descriptive sheet, which indicates: identification code, name, description and image.
ii) the intermediate level, aimed at tourists and interested parties, which offers sufficiently accurate historical and technical information supported by very refined graphic representations. In this level of knowledge, it is possible to explore the digital model which is characterized by a more detailed geometry compared to the previous level with the possibility of also accessing significant information relating to the materials, color or degradation phenomena that characterize the work. Finally, this level also includes association with multimedia content such as photos and video clips.
iii) the scientific level, aimed at researchers and, in general, at an expert public, which offers accurate historical and graphic documentation with a level of scientific detail. At this specific level it is possible to analyze the three-dimensional model in detail. For each different point of interest, it is possible to access specific documentation such as, for example, 2D technical drawings, more specific information sheets, even about construction techniques.

The objective of the research has been focused based on these parameters, i.e. the development of a project to gain knowledge of the industrial archaeological heritage of the former Corradini factory in order to recover the historical memory of this specific architecture.
In this sense, the project of knowledge has been organized for the former Corradini foundry into three levels, distinguished by type of user, level of geometric detail of the digital model and types of connected information.
For this reason, it has been necessary to create three different models for the three different levels of knowledge:
i) the basic level which offers generic information on the different buildings that make-up the former Corradini through a simplified 3D model made up of extruded volumes.
ii) the intermediate level which offers somewhat detailed information on the construction techniques of each building through a 3D model which matches the actual state of conservation of the buildings.
iii) the scientific level which offers technical information on the dimensions of the buildings, the structural system and the construction materials through a more geometrically detailed 3D model.
Therefore, for the basic level it has been necessary to model all the buildings in the area as simple volumes and draw up a sheet for each of them showing: name, function and photographic reference. For the intermediate level it has been necessary to model the buildings according to the current state of the art (without walls, without roofs, etc.) and prepare for each building a sheet with the information from the previous level and in addition a description of the construction techniques and photo on the state of conservation.
Finally, for the scientific level the basic model remained the same as the intermediate level with detailed modeling only for some buildings, in which some elements of the structure have been modeled (for example the trusses) and some functional elements such as ovens for cast iron. For each building it is necessary to prepare a sheet containing the information of the previous level and in addition some sheets with technical drawings

Fig. 3. Intermediate level of knowledge of the former Corradini in Naples (image: M. Falcone, G. Angrisani).

and sheets containing a graphic representation of the construction techniques (Fig. 2).

A three-phase operational workflow.
Management, reconstruction and communication of the former Corradini industrial area

The architectural, constructive and formal characteristics that today define the value of the former Corradini foundry as an episode of industrial archaeology, unique in its kind, are the result of the numerous transformations that have occurred over time. In this perspective, starting from the analysis of historical data and archive documentation, a valid support for the knowledge of the morphological evolution of the site, a series of information was deduced relating to the transformations that have affected the area over the years, which have allowed to validate the modeling phase.

Considering, in particular, the transformations that affected the industrial area during 1900, the phases relating to the temporal configuration of the

past and present were set. In fact, to fully grasp the complexity of the place and to interpret the sequence of stratifications and transformations that over time have led to its current configuration, it was necessary to define a methodological research process as well as a historical formative process that generated it.
The research line has developed into an operational workflow divided into three main phases.
In the first phase, it was necessary to systematically plan and organize the collection of bibliographic and archival sources relating to the knowledge of the characteristics of the buildings (historical information, stylistic characteristics, typological structure). For the historical analysis and archival research, the consultation of textual sources, general plans of the area, graphs relating to the characteristics and construction techniques of the individual buildings, maps and historical photos was fundamental. These sources have provided a general framework of knowledge of the area with respect to the context in which it is inserted, and, at the same time, have allowed a first evaluation of the buildings that characterize it in constructive and functional terms.
This phase was followed by cataloguing, digitization and reconstruction of the digital model. In this area of graphic restitution, a three-dimensional model of the area under examination was specifically developed in which both the archive sources and the data deduced from the aerial photogrammetric survey were integrated (Azzola et al., 2019). Therefore, some pavilions of the industrial area were examined in depth in the 3D space as they were transformed or completely collapsed with the aim of transmitting and disseminating a broader knowledge of the industrial heritage with an "intermediate" level of information (Fig. 3).
Finally, the third and final phase was dedicated to the dissemination and use of the digital model. In this step we made use of the help of web platforms that allow an immersive experience accessible to all users. The functions that these platforms integrate within them allow the exploration of the 360° model on which an information system has been connected to the different scales of representation.

Fig. 4. State of some pavilions of the industrial complex of the former Corradini foundry in Naples (image: M. Falcone, G. Angrisani).

The case study. The former Corradini foundry

The methodology described was applied to the case study of the former "Corradini" steel industrial complex. Located in the east of Naples, precisely in San Giovanni a Teduccio, Corradini preserves the historical memory of what was one of the most important steel mills and arms factories in Italy. Founded in 1882 by the Italian-Swiss entrepreneur Giacomo Corradini who expanded the pre-existing eighteenth-century metallurgical plant, the factory expanded to an area of about 6000 square meters counting on a workforce of about 7500 workers.

Initially, the structure occupied only the first pavilion, but with the arms race of the late 1800s it was able to expand becoming a specialist in the production of heavy weapons. Subsequently, the government decided to cut funds on the production of weapons, so the company fell into crisis, until in the early 1900s it was purchased by the Officine Meccaniche Milanesi. This slow recovery, however, was short-lived, until 1949, a year that marked a progressive collapse of activities following the damage suffered by the Second World War, and which gave way to an inevitable

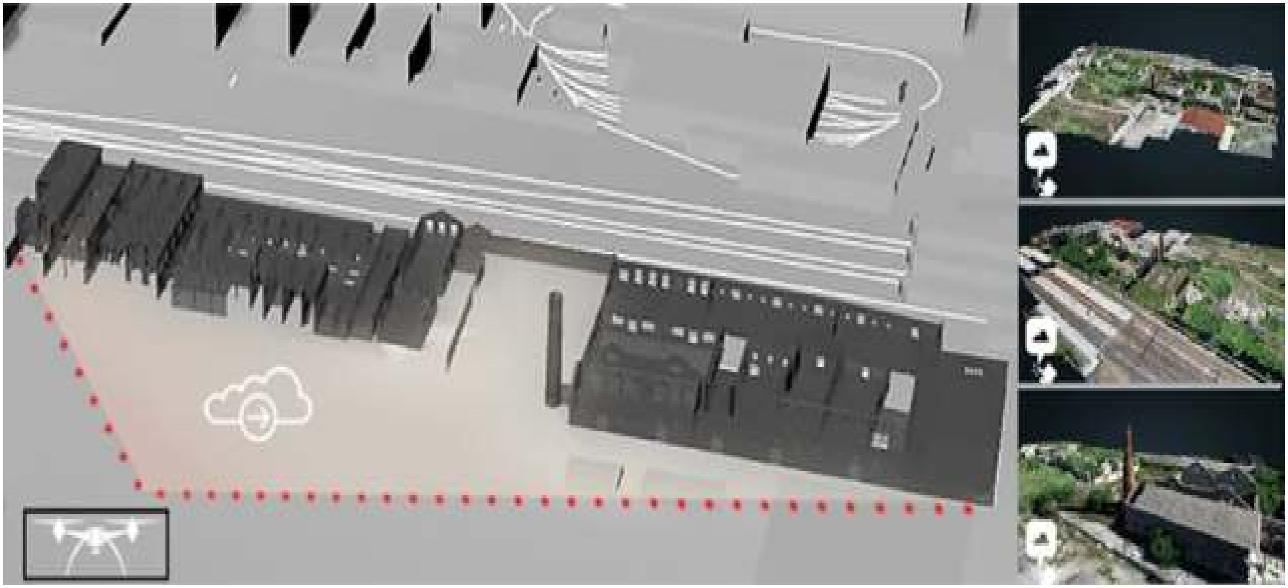


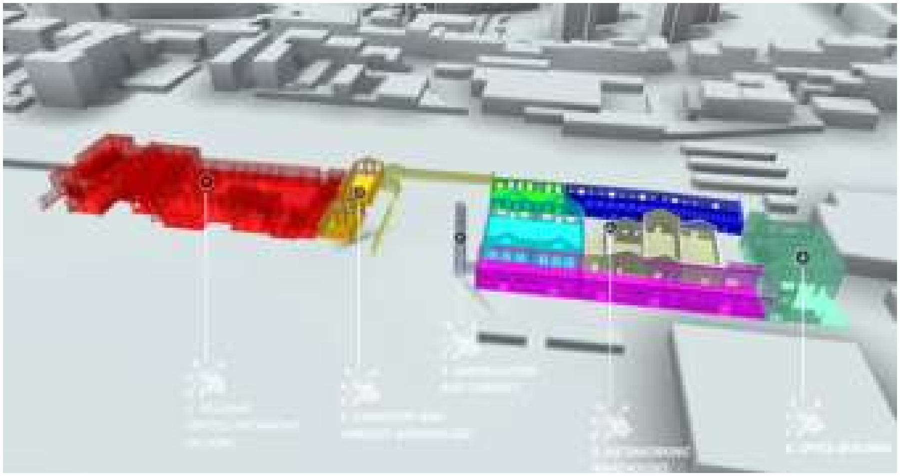
Fig. 5. From acquisition to 3D modeling. Integration of 3D survey data and archival data (image: M. Falcone, G. Angrisani).

decline and the abandonment of the entire complex that still persists today (Fig. 4).

From the 3D model to the digital fruition model

In this specific case, the working group focused on the configuration of the current state of the site. In order to conduct an appropriate survey of the industrial complex of the former Corradini foundry and achieve the above-mentioned objectives, the modelling was carried out by simulating an "intermediate" interpretation. In applying this level of communication to the digital model, it appeared necessary to prepare multidimensional documentation for reading the current state. Therefore, a series of 3D modeling operations have been carried out in the *Rhinoceros 3D* application necessary to understand and document the industrial site in its entirety and in its transformations (Capone et al., 2015; Moore et al., 2018). The tools used by the software dedicated to this modeling are usually vector type, and find wide versatility through sets of basic 2D and

Fig. 6. Visualization of the multi-layer 3D model of the former Corradini in Naples in the Sketchfab application (image: M. Falcone, G. Angrisani).



3D shapes (primitives) that can be used to create complex objects with editing, assembly and deformation operations. Other possible operations are manual manipulations, addition, subtraction and intersection operations, extrusions, path extrusions and revolutions based on two-dimensional profiles. In addition, given the complex articulation of the site, in addition to the procedural modeling, it was considered necessary to integrate some information that made it possible to expand the geometric conformation of the site, importing the point cloud, acquired with aerial photogrammetry, directly into the project environment. This also allowed a constant control of the third dimension by configuring a punctual information system (Remondino et al., 2017) (Fig. 5).
The next step was to export the 3D model in .obj to proceed with the use of the same.
For this operation, the Sketchfab program was used, an interaction platform in which it is possible to publish, share, view and edit three-dimensional models in real time (Flynn, 2019). With this software it was possible to edit the entire three-dimensional model by grouping, with color display graphics, the individual buildings of the industrial complex according to their intended use prior to the decommissioning after the

Fig. 7. Visualization of the point of interest of layer 1: "Fratelli de Simone" Leather Factory Building (image: M. Falcone, G. Angrisani).

Second World War. To date, the complex of the former Corradini is in a state of conservation of the buildings of complete decay. The prolonged abandonment due to decommissioning, the lack of conservation and protection interventions and the continuous exposure of the structures to environmental agents have led many of them to partial or total collapse. Therefore, also on the basis of bibliographic information, five layers have been defined*: i)* "Fratelli de Simone" Leather Factory Building, the oldest building of the entire complex, dating back in some of its structures to the end of the eighteenth century; ii) Carpentry and various warehouses, with some buildings with tuff supporting structure and iron and wood trusses with double-pitched roofs; iii) Warehouses for metalworking, of which some fragments remain; iv) Offices, a building that dates back to the early 1900s; v) Sandblasting machines and chimney, the latter completely isolated from the complex (Fig. 6).
Finally, a point of interest has been prepared for each individual layer, i.e. a portion of the lot studied and deepened by means of a detailed information sheet (Figg. 7,8).
To support the implementation of the model, space was also given to the point cloud not only as a support for three-dimensional modeling

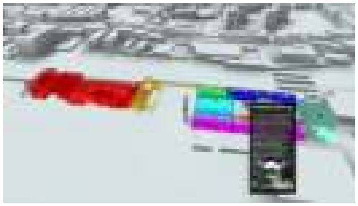


Fig. 8. Layer 3 Point of Interest Visualization: Metalworking Warehouses (image: M. Falcone, G. Angrisani).

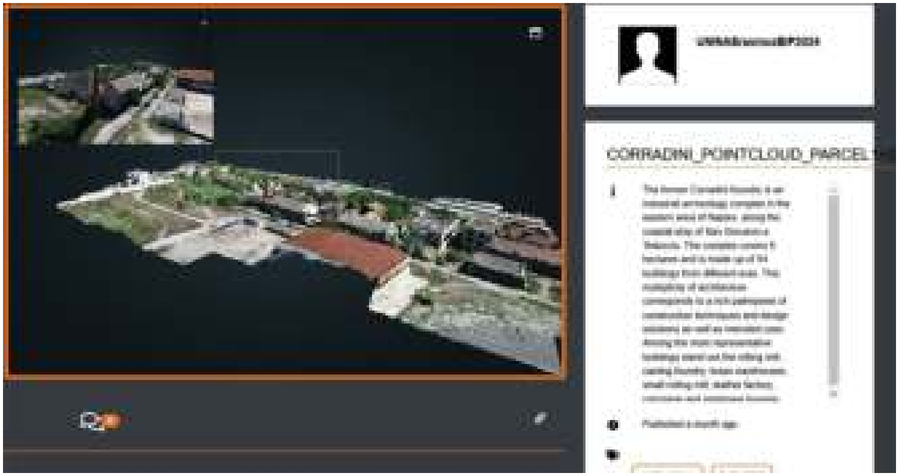


Fig. 9. Visualization of the point model in the PointBox application (image: M. Falcone, G. Angrisani).

but as an additional information element of the cognitive project. The point model, in fact, has been uploaded to the PointBox online platform, accompanied by a brief description of the complex and viewable at 360° by any user via link (Fig. 9).

Conclusion

The research carried out as part of the Blended Intensive Programme (BIP) with the case study of the industrial complex of the former Corradini Foundry illustrates a methodology for the digitisation of disused industrial heritage with the aim of developing a process of knowledge and use for a wider audience, i.e. the community, with a multi-key level of information. At the same time, this work highlights how the integrated use of digital models and open-source platforms have been innovating issues such as regeneration, accessibility and preservation for some time now. This integration between real and virtual data allows for a total immersive exploration of the actual state of the architecture. In the wake of modern platforms of use, we reasoned on the best methodology to be used to create a shared system with detailed and timely information of the industrial complex. The decision to use digital visualization through the three-dimensional model inserted on the web platform has made it possible to make the contents of the research explicit and above all to ensure accessibility and immediacy of the information as well as to verify possible updates of the data itself. In this way, the link between the 3D model and the information sheets constituted a multi-layer model, allowing the description of the complex in the different periods and according to the different transformations undergone. The *information* derived from the analysis, survey and modeling operations has flowed into the multi-layer system. With simple processing tools, it was possible to communicate and share data at different levels of information with web users. In fact, by using these communication platforms such as *Sketchfab* and *PointBox,* it is possible to obtain the widest dissemination of the results obtained. In addition, visual documentation and dissemination to a wider audience will be fundamental in the future for important repercussions on the economic process both from the point of view of cultural tourism and the management of the territory itself. In fact, in the future, research will be functional to the enhancement of the place and will be an important resource in possible regeneration programs on an urban scale with a social impact on the territory and on the citizens who will be the first to read the transformations of the places they love.

Notes

[1] We would like to thank all those who participated in the different phases of the Erasmus + KA131 Blended Intensive Programme (BIP) project on the industrial archaeology complex of the former Corradini foundry in Naples. In particular, thanks to all the students involved in the research phases.

[2] Although this contribution is the result of a joint work, G. Angrisani is the author of paragraph 4 and M. Falcone is the author of all the other paragraphs.

References

Azzola, P., Cardaci, A., Mirabella Roberti, G., & Nannei V. M. (2019). UAV photogrammetry for Cultural Heritage preservation modeling and mapping Venetian Walls of Bergamo. In I*nt Arch Photogram Remote Sens Spat Inf Sci,* Vol. XLII-2/W9, pp. 45-50.

Bakhmut, R., Kunanets, N., Pasichnyk, V., Artemenko, O., & Tsmots, I. (2021). Using augmented reality WEB-application for providing virtual excursion tours in university campus. In *IEEE 16th International Conference on Computer Sciences and Information Technologies (CSIT)*, Vol. 2, pp. 243-247.

Capone, M., Catuogno, R., & Palomba, D. (2015). Image-based modeling, metodologie di rilievo low-cost per svelare le geometrie nascoste. La chiesa di Sant'Eligio al Mercato a Napoli. In *DisegnareCON*, No. 8, pp. 1-12.

Derkach, A. (2023). *History of the development and current state of the 3D modelling*. Scientific bulletin of South Ukrainian National Pedagogical University named after K D Ushynsky. 2023. 7-14.

Docci, M., & Migliari, R. (2000). La modellazione come strategia creativa e conoscitiva. Il rilevamento dell'anphytheatrum Flavium. In A. Baculo (Ed.). *Architettura e informatica*, p. 37. Napoli: Electa Napoli.

Fascia, R., Barbieri, F., Gaspari, F., Ioli, F., & Pinto, L. (2024). From 3d survey to digital reality of a complex architecture: a digital workflow for cultural heritage promotion. In *Int Arch Photogram Remote Sens Spat Inf Sci*, Vol. XLVIII-2-W4, pp. 205-212.

Flynn, T. (2019). What happens when you share 3D models online. In J. Grayburn, Z. Lischer-Katz, K. Golubiewski-Davis, & V. Ikeshoji-Orlati (Eds.). *3D*, No. 3, pp. 73-86.

Gabellone, F. (2023). Development of an Immersive VR Experience Using Integrated Survey Technologies and Hybrid Scenarios. In *Heritage*, Vol. 6, pp. 1169-1186.

Gaspari, F., Barbieri, F., Fascia, R., Ioli, F., & Pinto, L. (2024). An Open-Source Web Platform for 3D Documentation and Storytelling of Hidden Cultural Heritage. In *Heritage*, Vol. 7, pp. 517-536.

Moore, J., & Kettler, H. S. (2017). Who Cares About 3D Preservation?. In I*ASSIST Quarterly*, Vol. 42, No. 1, 15.

Remondino, F., Nocerino, E., Toschi, I., & Menna, F. (2017). A critical review of automated photogrammetric processing of large datasets. In *Int Arch Photogram Remote Sens Spat Inf Sci*, Vol. XLII-2/W5, pp. 591–599.

Spallone, R. (2015). Reconstruction modeling, animation and digital fabrication of 'architectures on paper'. Two ideal houses by Carlo Mollino. In *SCIRES-IT-SCIentific RESearch and Information Technology*, Vol. 5, No. 1, pp. 101-114.

https://beniabbandonati.cultura.gov.it/beni/opificiocorradini/#:~:text=L'ex%20fonderia%20Corradini%20%C3%A8,di%20fabbrica%20di%20epoche%20diverse (accessed 1 may 2024).

Urban Regeneration

A Collaborative Decision-Making Process for a Sharing Strategy in San Giovanni a Teduccio

Maria Cerreta, Giuseppe Ciciriello, Gaia Daldanise, Caterina Loffredo, Sabrina Sacco, Sveva Ventre, Piero Zizzania

Introduction

The ongoing process of deindustrialization has profoundly impacted the city's landscape, reshaping economic structures and causing significant shifts in its social and cultural fabric. This transformation is particularly evident in the city's port areas, which were once bustling hubs of economic activity and social interaction. Despite the European Union recognizing the vital connection between the city and its port for the economic ecosystem, these port areas have gradually become disconnected from their surrounding neighborhoods.

Addressing this complexity requires urgently establishing a new paradigm for the development of the city-port ecosystem. Today, ports are acknowledged as critical strategic nodes for economic competitiveness, job creation, and investment, playing a significant role in the economic, social, and environmental dynamics of cities. Increased community awareness of the impact of port infrastructure has led to a demand for involvement in decisions about their seafront.

Drawing inspiration from the Sustainable Development Goals (SDGs) outlined in Agenda 2030, our research aims to chart a path towards a sustainable vision capable of addressing complex environmental, social, and economic challenges. By navigating the intricate web of interactions and conflicts within the city-port ecosystem, we aim to pave the way for a transformative process towards sustainable urban development.

Amidst the challenges posed by deindustrialization and urban transformation, there is an opportunity to redefine the relationship between the city and its port. Through coordinated efforts and innovative strategies, the synergy between the city and port could drive inclusive growth, environmental stewardship, and social resilience.

Our research focuses on the impact of these challenges on the Neapolitan context, particularly in San Giovanni a Teduccio, located in the eastern port area of Naples. This neighborhood's geographical position highlights its importance as a transition zone between the city and its port. Once a thriving industrial center, it now faces the legacy of disused and degraded spaces, contributing to its isolation.

However, despite these challenges, San Giovanni a Teduccio remains a focal point for exploration and study, serving as a microcosm of the broader dynamics shaping urban port areas. In recent years, the neighborhood has seen the emergence of many new urban regeneration projects involving the reuse of abandoned buildings, offering new opportunities to its socio-economic and socio-cultural system.

As we delve deeper into the complexities of San Giovanni a Teduccio, we encounter various relevant challenges, from preserving historical heritage to revitalizing urban spaces and fostering community resilience. Our research is dedicated to understanding and addressing these issues through meticulous analysis, including urban exploration, exploration of the neighborhood's industrial past, and mapping stakeholders to identify their interests, powers, and capacities to drive transformative processes. Through an interdisciplinary and multi-methodological approach, we aim to unravel the layers of this multifaceted landscape and identify innovative strategies for promoting sustainable development and fostering inclusive growth. This contribution is structured into two main subchapters focusing on urban exploration and the collaborative workshop conducted during the BIP project in Naples in April 2024 with students from diverse academic European backgrounds. Finally, we draw insights and lessons learned from applying our methodology, contributing to a deeper understanding of sustainable urban development in complex urban environments.

Urban Exploration in San Giovanni a Teduccio

The neighborhood of San Giovanni a Teduccio, although steeped in a rich history and a strong identity linked to its industrial and maritime roots, emerges as a complex and contradictory context. Its urban geography and history have favored the presence of a dense network of commercial activities along the Corso San Giovanni, which gives the neighborhood a frenetic and chaotic atmosphere. The Corso San Giovanni, the beating heart of the neighborhood, is the first access point if one arrives in the district by train or from the main arterial roads. Once in the neighborhood, the group also stands to gather and get their bearings once they reach the Napoli San Giovanni-Barra stop. The silence of that non-place makes it immediately perceptible that something has stopped in time. Irregular, neglected and sometimes abandoned buildings peep out along the areas bordering the railway line, underlining a certain degree of abandonment and urban decay, which negatively affects one's perception of the area.

After sharing the morning's programme, students, tutors and professors gather for observation.

The coexistence of different urban strata manifests an unharmonious connection between the Corso San Giovanni and the coastline, a succession of interstitial spaces, alleys and large industrial esplanades, many of them in complete abandonment, which do not induce citizens to use the spaces in a safe and accessible manner. Continuous barriers, from cars to buildings, obstruct the view to the sea. All this is visible to the eyes of those who are there, and it is easy to imagine that what has just been described has severely affected the liveability and management of urban spaces, especially in a context characterized by strong demographic pressure. The industrial history of the neighborhood, although a distinctive element of its identity, now translates into a series of socio-economic challenges concerning the void this past has left when most of this heritage has been dismantled or moved elsewhere. Disused industrial structures, often in a complete state of disrepair, not only shadow some missed opportunities in the urban landscape, but also limit access to the sea, hindering a link that it would be important to mend in order to

Fig. 1. The arrival from Naples San Giovanni-Barra station (photo: Piero Zizzania).

return a valuable resource to the local community.
This is the case with the first stop on our route: the former Corradini factory (Fig. 1). The metallurgical complex was founded in 1882 by the entrepreneur Giacomo Corradini, who took over and implemented the pre-existing Deluy-Garnier plant dating back to 1872. The majestic industrial complex, covering 5 hectares and consisting of 54 factory buildings from different eras, was an important asset for the whole of southern Italy. Many of the families still living in San Giovanni a Teduccio owe their presence in the area to this important site. The site mainly comprises single-storey buildings, with load-bearing masonry structures made of tuff blocks or listate, with a double-pitch roof supported by wooden or iron trusses (Rigillo et al., 2021). Due to the numerous collapses that have affected the buildings since 1960, in its current state the complex appears to be a collection of ruins, with a widespread presence of weedy vegetation that aggravates the state of surface deterioration. Inside, one

Fig. 2. The beach of San Giovanni a Teduccio (photo: Piero Zizzania).

can still see a plaque bearing the date ‘1828’. At that time, in fact, there was a factory for the production of gloves by Dent Allcroft&Co. Alongside Corradini, Pellami fratelli De Simone & C.s.n.c., which has been included in the complex since 1960, remained active. The entire complex bears witness to an industrial history rooted in the first decades of the 19th century, when, with the construction of the Naples-Portici railway line, more factories sprang up along the coast. It was precisely the advancement and expansion of the railway line and the collapse of wartime production after 1945 that led to its definitive closure: the metallurgical enterprises of San Giovanni a Teduccio were first purchased by Officine Meccaniche Milanesi, but the company was put into liquidation in 1949, also due to the excessive damage suffered during the war. Only in 1999 was the former factory sold by the company Agrimont Sud to the City of Naples, which currently owns it.
The charm of this complex is unquestionable and constitutes an important

Fig. 3. The meeting with Art33 (photo: Piero Zizzania).

testimony to nineteenth-century industrial construction in Naples, which led it to be listed by the Ministry of Culture in 1990. This dualism between industrial identity and urban decay highlights the need for urban regeneration aimed at enhancing the district's resources, including human and not just economic ones, in order to improve the quality of life of its inhabitants. The social hardship and economic precariousness that afflict many families in San Giovanni a Teduccio are evidence of the deep inequalities in the neighborhood. The historical presence of organized crime, highlighted by the Taverna del Ferro district, adds further challenges to security and social cohesion. However, signs of hope and resilience also emerge, embodied by urban regeneration initiatives and the collective participation of the local community.

The walk continues through the district, aimed at discovering this important testimony to the expansion of the metropolitan city of Naples towards the east and how the frenetic industrial and maritime development

determined the future of these areas and undermined their identity. We arrive, in fact, at the second stop on the route: the Industries beach (Fig. 2). From here, the entire coastline of San Giovanni a Teduccio is visible, stretching for about 3 kilometers, representing a precious natural and cultural heritage that, although present, is invisible from the Corso S. Giovanni we have just walked along. The enthusiasm of the participants in the morning's urban exploration bears witness to the quality of the landscape, which deserves to be preserved and enhanced to allow citizens to regain access to the sea. However, the presence of port facilities and the railway line running through the area limit accessibility to the beaches and reduce their attractiveness. A few brave citizens have decided to open a small bar, offering a few seats between the beach and the resilient industrial warehouses. Despite the decay, the disused industrial landscape seen from the coast is truly fascinating. For the past few months, work has been underway on the sewage system that will allow the shoreline to be fully swimmable. The district boasts unexplored riches and absolute potential as a driver for the regeneration of the eastern area of the city of Naples, which is at the center of interest in political debates and urban plans being drawn up.
Continuing along the route, the group arrived at the former school complex of the S.M.S. Giotto Monti, where today stands a highly innovative integrated center for culture (Fig. 3), capable of prefiguring and experimenting around a 'disused school', no longer in use, a new model of intervention of youth employment policies in the cultural enterprise sector. Combining the creative potential of the area with the desire to invest in art, ART33 (https://www.art-33.it/), the first cultural hub in Campania, was born and is based here, promoting art and culture in its various expressions, and taking shape from the regeneration and redevelopment of these spaces. Starting from a strong link with the local dimension, the center activates processes of social inclusion, urban regeneration, and cultural innovation, to give life to a new model of territorial development of the suburbs, which creates connections and contaminations between tradition and innovation.

Fig. 4. The route along Taverna del Ferro (photo: Piero Zizzania).

We meet Maria Rosaria Teatro, representative of the 'Gioco, Immagini e Parole' association, which runs the center, founded in 1995 and active in the neighborhood since 1998. In 2010, in collaboration with the Nest collective, it transformed the gymnasium of the former Giotto Monti school building into a 99-seat theater, named NEST - Napoli Est Teatro, and in 2015, thanks to the Young People's Call for Proposals for the Enhancement of Assets, it expanded the redevelopment of the former school building, creating the ART33 - Cultural Hub center.
Before the tour of the spaces, Maria Rosaria and the cultural workers who work inside the hub tell us their story, which is not without great complexity with the municipal administration regarding the management of the building. In spite of the funding won and the numerous cultural-based valorization and redevelopment projects promoted by the institution, often in collaboration with other institutional, local and international bodies, it is very difficult for realities such as Art33 and the administration's interests in models of co-management of public heritage to coexist.
The district of San Giovanni a Teduccio (Fig. 4), in addition to its historic core, consists of an 'assembled' landscape, which brings it closer to the neighboring districts of Barra and Ponticelli. Together, the three districts constitute the sixth municipality of the city of Naples. This area, which starts in the north-east from the slopes of Vesuvius and reaches as far as the coast, where before the industrial complexes the area was considered marshy, has undergone several transformations. These include the Programma Straordinario di Edilizia Residenziale (P.S.E.R. - Extraordinary Residential Building Programme), which represented an important episode for the Italian suburbs between the 1970s and 1980s, tackling the widespread housing discomfort of that period. After the 1980 earthquake, the P.S.E.R. was transformed into a complex instrument of urban transformation, which contemplated important new building interventions based on respect for the planning choices already made, operating within the existing Periphery Plan (Ventre & Cerreta, 2023). This intervention made it possible to meet housing needs, but left

enormous gaps in terms of design and landscape due to the experiments of the time. An example of this are the 'slats' of Taverna del Ferro, the fourth stop of our exploration. Constructed according to the design of architect Pietro Barucci, the two enormous buildings, together with those built around them, were to function as a sort of autonomous and self-sufficient macro-neighbourhood, as was the case with the Rozzol Melara in Trieste. Due to its construction and design characteristics, the enormous buildings are the result of a plan that demanded its own recognisability, both in terms of construction and landscape, which failed to integrate with the surrounding context, causing a process of social stigmatization to the detriment of the local community over time.

Currently, the city administration of Naples is implementing a regeneration project for the Taverna del Ferro settlement, which aims to radically transform the area through the demolition of the two existing residential buildings and the construction of 28 buildings. The average height of the buildings will vary from 3 to 6 storeys. In total, 360 new dwellings will be built, all classified as NZEB (Nearly Zero Energy Building), to maximize their energy efficiency. The ground floor of the buildings will host a mix of functions, promoting exchange and interaction with the neighborhood. It is envisaged that this space can be used by residents for activities such as meetings, study, shared work and management of condominium spaces. With the aim of improving the physical appearance of the neighborhood and giving the residents back a decent home and greater liveability of the entire area, the city of Naples has adopted a participatory process to support the implementation of the demolition and building site, fostering project integration and acceptance of the reconstruction process.

One of the neighborhood's historical resiliency is the Fort of Vigliena, which we encounter on the route connecting the center of the neighborhood to the port area. Also the subject of the recent coastal redevelopment project, only a few remains of the fort are visible today in Via Marina dei Gigli. It was built around 1706 at the behest of the then Viceroy Juan Manuel Fernández Pacheco y Zúñiga, Marquis of Villena,

Fig. 5. Officine San Carlo (photo: Piero Zizzania).

after whom it was named. Only 6 meters high to avoid bombardment from the sea, it was partially destroyed during the conflict between the supporters of the Parthenopean Republic and the Sanfedist forces of Cardinal Ruffo on 13 June 1799. The fort was later abandoned until, in 1891, thanks to the initiative of parliamentarians Imbriani and Villari, it was declared a National Monument and restored. However, in 1906, part of it was demolished to make room for the military bakery. The fort was originally made of tuff and Vesuvian stone, had a characteristic pentagonal shape and was surrounded by a 9-meter wide moat. Today, its state of abandonment requires immediate restoration work.

Not far from the Fort stands the former Cirio factory, also part of the district's industrial archaeology. Distinguished by its characteristic architecture, the former Cirio factories in Vigliena constitute a huge late 1920s reinforced concrete complex, long since disused and partly reborn in 2009 to house Le Officine del Teatro di San Carlo (Fig. 5). The project to convert the disused industrial spaces for cultural and social purposes is the result of a 2007 agreement between the Port Authority, the State Property Office, the City of Naples and the Campania Region. The regeneration has given rise to an ideal structure, which now houses large-scale laboratories and workshops for the construction, assembly and preservation of stage sets. Over time, explains director Michele Mangini, who is now also artistic director of the 'Arte al Forte' project, the San Carlo Theatre has increased its activities in Vigliena, leading to the creation of a creativity pole called Officine San Carlo, a training and production center that aims to place this new urban creative factory within a connective tissue involving various entities in the area, generating a fruitful exchange with them and new spin-offs in the territory. The project was partly made possible by public funding from the Ministry of Culture's General Directorate for Contemporary Creativity (Creative Living Lab - 3rd edition), of which the proposal was the winner. This win allowed the implementation of the workshop activities already existing within the facility, creating new opportunities for dialogue with the community through the active participation of citizens in the educational-recreational activities.

In line with the story of the recovery of the district's industrial archaeology, we come to the last stage of our urban exploration: the University Pole of San Giovanni a Teduccio (Fig. 6). Thanks to EU funding, it was possible to build a real innovation hub, linked to the University of Naples Federico II, in the area of the former Cirio tomato cannery.

The San Giovanni hub covers approximately 200,000 square meters. Care has been taken to preserve the architectural history of the former industrial buildings, in place of which laboratories, multifunctional halls and an auditorium now stand on site, as well as a park nearby. The project, financed by the Third Mission Actions of the University of Naples Federico II, has ensured the redevelopment of an area of the city by incorporating university spaces.

The Apple Developer Academy also occupies part of the former industrial complex, focusing on training computer developers for innovative and high-tech projects in any field. Completely in English, the Academy's programme attracts young people from all over the

Fig. 6. Apple Developer Academy in the University of Naples Federico II campus (photo: Piero Zizzania).

world, from a wide range of backgrounds and education, and focuses on software development, start-up creation and app design. Classes are based on Challenge Based Learning (CBL), a multidisciplinary approach to teaching and learning that encourages students, through a collaborative and hands-on climate, to work in teams with other students, their teachers and experts.

Here our exploration of San Giovanni a Teduccio ends. The neighborhood presents itself as full of contradictions, where socio-economic challenges are intertwined with the potential for regeneration and growth. Collective commitment is needed to address the challenges and enhance the neighborhood's resources in order to create a more inclusive, safe and sustainable urban environment for all its inhabitants.

Collaborative workshop

After the urban exploration and following the preparatory work conducted by the workshop participants, a pivotal stage was the Collaborative Workshop structured as a focus group. The aim of this collective effort

was to identify the main local and potential actors that could play a key role in the industrial landscape regeneration process. This allowed for understanding and describing possible conflicts and alliances resulting from certain project choices.
The focus group work was structured into three phases, each characterized by the implementation of a specific tool necessary to facilitate group work. The first phase, Mapping Project Actors, involved identifying the main actors divided according to the potential role they could have in the regeneration process; in the second phase, Developing a Sharing Strategy, key project actions were hypothesized, clarifying the roles and conflicts of the engaged local actors; in the third phase, Priority Ranking, the different project actions were prioritized based on the priority they should have from an economic, social, and environmental sustainability perspective.

Mapping Project Key Actors
A stakeholders map is a visual depiction of the key organizations and/or individuals that make up a system, including those directly affected by the system as well as those whose actions influence the system (Gopal & Clarke, 2017; Jones & Pranay, 2023). Stakeholders mapping focuses on understanding the interconnections and relationships among various actors involved in a particular issue or project. It delves into how these actors interact with each other and how their roles and relationships influence the dynamics of the issue or project at hand. The purpose of stakeholders mapping is to identify opportunities to improve a system's overall performance by, for example, strengthening weak connections or filling gaps in the system.
The first step in the mapping process is to identify the topic for the map and set boundaries around that topic. Preparing in advance for a live actor mapping session is important for its success. The facilitator or facilitation team plays a crucial role in this, as in the case of the EVALUAB research group, who structured the map according to the time available for its creation and the level of knowledge of the participants in the project area

workshop. It consisted of funders, actors, institutional actors, direct and indirect beneficiaries, activists, and a “non-human” section that included environment, heritage, etc.

The facilitation team guided the workshop participants in building the map using guiding questions. Through answers and discussions, in a completely collaborative manner, a first draft of the scheme was created, which the workshop participants continued to refine within their respective working groups.

The participants in the workshop were engaged in a collective session of critical elaboration, first analyzing the thematic division of the actor map, and openly questioning the meaning of each particular category, with the opportunity to ask for clarifications to both other participants and session facilitators. Through group activity, it was possible to examine the opinions and beliefs of the participants regarding the different qualities of the actors, and thus collaboratively identify and propose appropriate actors for each area of the map.

The category of “financial actors” includes all agents with high interest and the ability to exercise decision-making power through financing transformation; consequently, possible public financiers were identified, such as the Municipality of Naples, the Government, and the European Union, as well as private investors, including the railway company “Trenitalia” (which operates the railroad crossing San Giovanni a Teduccio area), and “Apple Academy”. “Institutional actors,” on the other hand, represent the subjects and institutions with the highest decision-making power and the greatest ability to influence decisions, so among them the City of Naples, the European Union, the Government, the Campania Region, and UNESCO were identified (as the historic center of Naples is listed as a World Heritage Site). In the central part of the actor map (Fig. 7), two categories of transformation beneficiaries are found: “direct beneficiaries” who are directly involved in the transformation as active protagonists in the project area; and “indirect beneficiaries” who have a lower level of involvement as temporary and displaced agents. The first class of beneficiaries includes residents of the

San Giovanni a Teduccio neighborhood and citizens' associations in near urban areas; the reuse of the ex-Corradini as a local market would also allow small entrepreneurs, traders, consumers, producers (e.g., farmers, fishermen, etc.), and generic users to be recognized as active and direct beneficiaries. The second class includes users in areas adjacent to the ex-Corradini who could be positively influenced by the project's impact, such as traders, occasional visitors, tourists, but it is particularly interesting to note the recognition of the possible added value produced in the real estate market, linked to an urban regeneration project.
In the category of "activators" sports, cultural, volunteer associations, non-governmental organizations were identified, thus implementing regeneration from a social and not just material perspective. In this case, the meetings and experiences conducted during the survey phase were crucial in directing participants' awareness towards the key role that associations and foundations such as "Art33" and "San Carlo Theatre" can play within broader urban redevelopment interventions.
The last category considers "non-human actors," aiming to draw attention to and evaluate the effects produced by transformation in terms of neither purely economic nor social outcomes. In this case, natural elements such as flora, fauna and marine ecosystem; anthropic elements such as artistic and cultural heritage, which typically characterize the Mediterranean coastal context, were listed.

Developing a Sharing Strategy

The collaborative session carried out as previously described made it possible to identify the different actors involved in the transformation, making explicit the importance of looking for inclusive and shared strategies able to overcome potential conflicts between agents, aspiring to define a set of collective and democratic values.
Developing a shared strategy for urban regeneration enables, on the one hand, the optimisation of material and immaterial resources and services, in a logic of an efficient and circular economy; on the other hand, it affirms the importance of participation, involving stakeholders that have

Fig. 7. Actors map of San Giovanni a Teduccio (diagram: Evaluab).

often been ignored and marginalised, preventing specific interests from being pursued to other actors' disadvantage. In this sense, considering the totality of interests and actors involved represents an indispensable source of knowledge in promoting a sustainable development strategy that simultaneously considers the various objectives of the 17 SDGs formalised in the United Nations 2030 Agenda.

Moreover, the definition of an articulated set of transformation players provides a clear picture of the different interests involved in the process, which belong to the social, economic and environmental dimensions, equally assessing the positive and negative effects that the transformation could produce at different levels. Participation and involvement are essential to draw on all the resources implied in the transformation, to achieve not only a physical requalification of the area, but directly activating the community in a broader regenerative process.

Fig. 8. The Decision Canvas for a Regeneration Strategy (diagram: Evaluab).

Decision Canvas Composition

Using a decision canvas as a guiding tool (Fig. 8), participants worked together to define the key objectives of the project, identify available resources, and plan the necessary actions to achieve the desired results. The canvas, provided to each group, defined a clear and concise methodological framework, very useful for organizing ideas and information during the strategy development process. Through brainstorming sessions and guided discussions, participants explored different alternative options and considered the implications of each strategic decision (Osterwalder & Pigneur, 2009; De Nicola et al., 2020).

During this phase, potential key stakeholders involved, representatives from the local community, and industry experts were also identified to ensure a diversified and inclusive perspective in the decision-making process. This methodological approach enables the development of innovative and sustainable solutions for urban regeneration of San Giovanni a Teduccio waterfront. The use of the decision canvas also facilitated communication and collaboration among participants, allowing

Fig. 9. The Priority Ranking Chart (diagram: Evaluab).

them to visualize the overall strategic plan of the project clearly and immediately. By the end of the workshop, each group devised a strategy that included objectives, actions, responsibilities, serving as a roadmap or starting point for the development of a collaborative regeneration process.

Ranking of Priorities

A Priority Ranking chart is a tool used in collaborative workshops to visualize and rank different priorities. This chart is often utilized when there are various alternative options or ideas to assess and rank based on their importance or urgency (https://vibe.us/blog/bulls-eye-diagram/; https://miro.com/templates/bulls-eye-diagram/).

During the collaborative workshop, participants can vote or assign scores to different options based on established criteria. This process enables a clear understanding of shared priorities within the group and can assist in guiding decisions and resource allocation.

In this collaborative workshop, a circular Priority Ranking chart was used (Fig. 9), providing a visual representation of priorities where options are arranged around a circle, and the distance from the center of the circle represents the level of priority. Options with higher priority are positioned closer to the center of the circle, while those with lower priority are placed further away. This type of chart offers an intuitive way to visualize priorities and can be especially helpful when dealing with numerous options and aiming to provide a clear indication of relative priorities.

During a collaborative workshop, participants can contribute to placing options along the circle based on their perception of priorities. This process results in an immediate shared visual representation within the group and can facilitate discussion and decision-making on actions to be taken.

Following the Priority Chart partition, workshop groups have been questioned about the opportunity to set the general objectives and goals identified in the previous Canvas into a three values scheme. Within

each circle there is a different level of priority, intended both in terms of the hypothetical feasibility of the intervention (e.g. actions that are easy to carry out because they are simple and low cost, or challenging and difficult to carry out), but also referring to the perception of less or greater effectiveness towards the general objective of urban regeneration. Groups then evaluated the actions outlined in the Canvas based on a priority scale, selecting at least three actions that best represented their proposal, with the intention of incorporating them into the diagram.
The objectives with the highest priority perception are clearly those aimed at the re-appropriation of the area and its accessibility, in order to ensure immediate availability of space for cultural and social activities. The creation of a Community Centre as well as welfare and educational facilities are considered highly required to improve services and the quality of life in the neighbourhood, while the realisation of an urban park and public swimming pools along the coast would enable a meaningful utilisation of the coastal public space.
In areas of medium and low priority, on the other hand, objectives related to the creation of the neighborhood market and spaces for socialization have been located. In particular, it can be noted that the design of the market is placed at a lower level of priority, as it is recognized to have a more complex and less immediate feasibility, depending on the collaboration of multiple stakeholders.
Finally, it can be affirmed how this particular analysis referred to the set of objectives previously identified, pointing out the general prioritisation of public space reclaiming and coastal area redevelopment, stressing the urgency of activating specific functions and services for the community of San Giovanni a Teduccio.

Conclusions

The structured collaborative decision-making process within the BIP course has enabled the activation of an interaction pathway among international students, Italian students, and the San Giovanni a Teduccio neighbourhood. The different phases that were implemented proved

particularly effective in allowing for a direct understanding of the territory and its specificities, in outlining an immersive pathway capable of contributing to the formation of a conscious knowledge regarding the potentials and criticalities of the neighbourhood.
In particular, Urban Exploration has enabled the exploration of the San Giovanni a Teduccio neighbourhood, visiting the most significant spaces and places that testify to both ongoing challenges and transformation processes, highlighting the changes that have occurred over time. At the same time, Urban Exploration has allowed for an understanding of some of the most relevant local actors who have been promoters of social and cultural innovation processes, contributing to the incremental growth of a significant network of associations, institutions, and universities. With their testimony, they have instigated significant transformations, serving as a catalyst for both bottom-up and top-down regeneration actions.
The Collaborative Workshop represented the second stage of the didactic actvity and was particularly useful in stimulating a discussion of ideas and reflections, starting from the knowledge gained during the Urban Exploration.
The organization of the Collaborative Workshop was designed in four main stages, each utilizing appropriate tools to support every phase of the decision-making process.
The Mapping Project Key Actors allowed students to reflect on the decision-making role of the stakeholders encountered during the Urban Exploration, as well as to include other significant actors who might play key roles in the neighbourhood regeneration process. It also facilitated reflection on potential conflicts and alliances.
The phase related to Developing a Sharing Strategy enabled the exploration of the objectives of a strategy capable of considering the diverse needs identified during the Urban Exploration and incorporating the issues expressed by the encountered stakeholders. It also aimed to identify innovative components for the development of a strategy attentive to sustainability, social inclusion, and cultural and economic innovation.
The composition of the Decision Canvas was a particularly effective

exercise because it allowed student groups to articulate the key components of the strategy identified in the previous phase. The Decision Canvas facilitated the analysis of proposed strategies by identifying the target users for whom they were developed, as well as the actors willing to promote the actions by investing both economically and in terms of human resources, and to activate alliances and collaborations. Furthermore, the Decision Canvas allowed for the explicit delineation of both the costs and benefits considered from economic, social, cultural, and environmental perspectives.

The Priority Ranking chart allowed for the prioritization of different actions, taking into account the territorial requirements identified in the previous stages of the decision-making process. The construction of a ranking articulated in three levels, built through dialogue and comparison among different groups, allows for highlighting which actions are collectively recognized as urgent and relevant. The Priority Ranking chart allows for synthesizing the level of priority of the identified actions, as well as for delineating a shared territorial strategy capable of integrating tangible and intangible actions.

The proposed and tested methodological process with the group of international students has facilitated the interaction between scientific knowledge, technical expertise, and common knowledge, and structured potential regeneration strategies for the San Giovanni a Teduccio neighbourhood that are attentive to local specificities and needs, yet open to innovation. It recognises the central role of the local community in developing sustainable, inclusive, and situated strategies.

References

Bull's Eye Diagram Overview. (2022). <https://vibe.us/blog/bulls-eye-diagram/> (accessed 12 May 2024).

Bull's Eye Diagram Template. <https://miro.com/templates/bulls-eye-diagram/>(accessed 12 May 2024).

Cerreta, M., Giovene di Girasole, E., Poli, G., & Regalbuto, S. (2020). Operationalizing the Circular City Model for Naples' City-Port: A Hybrid Development Strategy. In *Sustainability*, Vol. 12, No. 7, 2927.

De Nicola, A., Giovinazzi, S., Guarascio, M., Rizzi, P., & Villani, M. L. (2020). Gamified Decision Making for a Participatory Post-Crisis Recovery: A Model based Process. In P. Baraldi, F. Di Maio & E. Zio (Eds.). *Proceedings of the 30th European Safety and Reliability Conference andthe 15th Probabilistic Safety Assessment and Management Conference*, pp. 1937-1943. Singapore: Research Publishing.

Gopal, S., & Clarke, T. (2017). *Guide to Actor Mapping. Reimaging Social Change*. <https://www.fsg.org/tools-and-resources/guide-actor-mapping> (accessed 12 May 2024).

Jones, P., & Arun Kumar, P. (2023). Formative Interventions for Healthcare Sustainability: A Developmental Design Agenda. In M. A. Pfannstiel (Ed.). *Human-Centered Service Design for Healthcare Transformation*, pp. 177-195. Springer, Cham

Osterwalder, A., & Pigneur, Y. (2009). *Business Model Generation*. Hoboken, New Jersey, Stati Uniti: John Wiley & Sons.

Rigillo, M., Russo Ermolli, S., & Galluccio, G. (2021). Digital rule-based compliance processes. The urban regeneration of ex-Corradini, Naples (IT). In *AGATHÓN. International Journal of Architecture, Art and Design*, No. 10, pp. 120-131.

Sacco, S., & Cerreta, M. (2022). A Decision-Making Process for Circular Development of City-Port Ecosystem: The East Naples Case Study. In O. Gervasi, B. Murgante, S. Misra, A. M. A. C. Rocha & C. Garau (Eds.). *Computational Science and Its Applications – ICCSA 2022 Workshops. ICCSA 2022. Lecture Notes in Computer Science*, Vol 13378, pp. 572-584. Springer, Cham.

The 17 GOALS. Sustainable Development. <https://sdgs.un.org/goals> (accessed 7 May 2024).

Ventre, S., & Cerreta, M. (2023). Participatory Art and Co-creation Methodology in the "Viale delle Metamorfosi" Project. In O. Gervasi et al. (Eds.). *Computational Science and Its Applications – ICCSA 2023 Workshops. ICCSA 2023. Lecture Notes in Computer Science*, Vol. 14108, pp. 277-294. Springer, Cham.

Urban regeneration

The territory that changes: from spaces of degradation to spaces of culture. The associations as motor for places regeneration

Anna Teresa Alfieri

Contexts and Neapolitan stereotypes. San Giovanni a Teduccio, a land between fire and water

Naples, like many other large cities, has its challenges and problematic areas. The most disadvantaged neighborhoods often suffer from a combination of poverty, unemployment, crime, and poor urban management. However, it is important to avoid reducing Naples to its negative stereotypes. The city has a rich history, a vibrant culture, and a beauty that transcends its problems, but despite this, the narrative of the places often boils down to stories of degradation of all kinds, with a particular focus on some areas of the city.

Here are some places often associated with degradation and Neapolitan stereotypes.

The Spanish Quarters, located in the heart of Naples, are famous for their narrow streets, dilapidated buildings, and social problems. However, they are also known for their authenticity, vibrant neighborhood life, and unique atmosphere. The Scampia neighborhood is sadly known for being one of the main centers of the Camorra, the Neapolitan mafia. The presence of drug trafficking and organized crime has created a reputation of degradation and danger for this peri-urban area.

The Rione Sanità, too, has been affected by organized crime, but in recent years, it has seen a process of urban and cultural revitalization. Despite past problems, it is now known for its cultural and social initiatives.

Fig. 1. San Giovanni a Teduccio's Bronx (photograph: A.T. Alfieri).

In addition to these, there are many other areas identified as particularly degraded areas of the city, often characterized by abandoned buildings, accumulated waste, and poor hygiene conditions.

Within the experience of the BIP project, the experimentation focused on only one neighborhood of the city. San Giovanni a Teduccio is a neighborhood located in the eastern outskirts of Naples. It is a popular and densely populated neighborhood, with a varied population and a complex history. Like many other urban areas, it has its challenges and problems, but it is also rich in life and community.

Over the years, San Giovanni a Teduccio has been associated with problems such as unemployment, poverty, crime, and urban degradation. However, it is important to emphasize that the neighborhood cannot be reduced to these negative stereotypes. It also has a strong community identity, with a lively neighborhood life and many local initiatives aimed at improving living conditions (Santangelo & Visconti, 2006, p. 55).

Urban peripheries are often associated with degradation issues, although it is important to understand that this generalization does not apply to all peripheries and that there are many facets to consider. Suburbs of cities can become degraded areas for a variety of reasons - of which the most common are listed as results of laboratory experiences and comparisons with local communities - and are found not only in the neighborhood of San Giovanni a Teduccio but also in many other peri-urban areas of the city (Fig. 1).

Among the main causes is poor urban development.

Many suburbs may suffer from a lack of adequate infrastructure and public services, such as roads, public transport, parks, and recreational areas. Poor urban development is one of the main causes of degradation in cities. When cities do not grow sustainably or are not adequately planned, a range of problems can occur that can lead to urban degradation. In this perspective, the lack of infrastructure, such as roads, public transport, aqueducts, and sewers, can become inefficient and unsafe. Poorly maintained roads, for example, can encourage the degradation of surrounding areas and negatively affect the quality

Fig. 2. San Giovanni a Teduccio waterfront (photograph: A.T. Alfieri).

of life of residents. Even disorganized expansion, and therefore the absence of a coherent urban plan, can contribute to urban degradation, making areas underdeveloped and highly vulnerable to crime and lack of essential services.
Even the quality of construction, in the case of buildings of poor architectural value, leads to a rapid deterioration of spaces contributing to the degradation of the surrounding areas.
Communities in areas poorly served by essential public services such as schools, hospitals, parks, and recreational centers can become isolated and devoid of the resources needed to thrive.
Addressing urban degradation requires a holistic approach that considers urban planning, investments in infrastructure, promotion of social and economic equity, and community participation. Only through coordinated and sustained commitment can degraded urban areas be transformed into safe, livable, and inclusive spaces.
The concentration of poverty presents an additional problem in these

Fig. 3. Engagement with local cultural associations (photograph: A.T. Alfieri).

peripheral areas. Lack of economic and social opportunities in these areas can lead to unemployment, crime, and degradation of the urban environment.

Regarding the physical conformation of the eastern neighborhood, San Giovanni a Teduccio can be identified as a strip of land that separates the inland from the sea (Fig. 2). The neighborhood could boast a lively coastal life, with activities such as fishing, tourism, or maritime trade influencing its identity and development. However, today, due to the environmental conditions of the waters, the sea is totally denied to the people. Local residents almost no longer remember being naturally a maritime community, and for this reason, the eastern sea of Naples is identified only as another of the city's environmental problems, which requires long reclamation times and very high costs. Given its coastal location, San Giovanni a Teduccio could have port or supply structures linked to the maritime and commercial industry of the past.

Fig. 4. University Campus and Apple Academy in San Giovanni a Teduccio (photograph: A.T. Alfieri).

But if on one side this strip of land is bathed by the sea, on the other side it is scorched by fire.

The fire of this land should be seen from different points of view. From a panoramic point of view, San Giovanni a Teduccio has a perspective towards Vesuvius, which makes this strip of land full of charm. At the same time, fire also represents the associational and regenerative fervor of this neighborhood. Unfortunately, however, among the various considerations, one cannot help but think of fire in terms of places of abandonment characterized by sleeping giants. Indeed, there are numerous abandoned factories that have dominated the area's development for decades. The industrial archaeology of San Giovanni a Teduccio represents an interesting and significant aspect of the neighborhood's history and the city of Naples as a whole. This term refers to the study, conservation, and recovery of the material remains and evidence of past industry and manufacturing production.

Fig. 5. University Campus and Apple Academy in San Giovanni a Teduccio (photograph: A.T. Alfieri).

The neighborhood has a long industrial tradition dating back to the 19th century when the area became an important industrial hub for the production of ceramics, bricks, glass, textiles, and other manufactured goods. These activities had a significant impact on the local economy and urbanization of the neighborhood.
The industrial archaeology of San Giovanni a Teduccio may include disused or ruined factories that represent tangible evidence of the neighborhood's industrial past (Iannelli & Morreale, 2006, p. 25). These buildings may retain unique architectural elements and may be of interest for historical preservation. Surviving chimneys and industrial plants may constitute part of the urban landscape of San Giovanni a Teduccio, testifying to past manufacturing activity and technology used. Among the exemplary buildings and symbols of abandonment, the Ex Corradini is now remembered as a former brick and ceramics factory,

mainly active in the 19th and 20th centuries. Its foundation dates back to 1853 when the Corradini brothers started the manufacturing activity. Over the years, the site expanded and played an important role in Naples' manufacturing industry, producing bricks, tiles, and other ceramic goods. In recent years, there have been efforts by local authorities and other stakeholders to redevelop and enhance the Ex Corradini. These efforts include projects to reuse the buildings for cultural, artistic, or commercial purposes, as well as restoration interventions to preserve its historical and architectural significance.

The Ex Corradini represents an important part of Naples' industrial heritage and its historical identity. Its redevelopment and enhancement offer opportunities to renew and regenerate the San Giovanni a Teduccio neighborhood, contributing to its socioeconomic and cultural development.

Industrial archaeology is not limited to physical elements but also includes historical research and documentation, including archives, vintage photographs, company documents, and oral testimonies of residents.

The degradation in San Giovanni a Teduccio requires commitment from local authorities, institutions, and the community itself. Urban redevelopment programs, investments in infrastructure and public services, as well as initiatives to promote community participation and empowerment, can contribute to improving the neighborhood's conditions and transforming places of degradation into safe and welcoming spaces for all residents.

Preserving and enhancing the industrial archaeology of San Giovanni a Teduccio is important not only to preserve the memory of the area's industrial past but also to promote historical awareness and the cultural identity of the local community.

This is only a part of the complex reality of Naples. The city is also home to cultural treasures, such as its museums, churches, and archaeological sites, as well as a lively culinary and artistic scene. Reducing Naples to its problems means ignoring its wealth and potential.

The culture that saves places: educating to live spaces

The eastern periphery of Naples represents an important exemplary case study on the condition of many Italian suburbs: these are areas of the city physically, socially, economically, and politically distant from the center, often abandoned to degradation but with initial attempts at redevelopment projects despite years of industrialization and illegal construction. In recent years, San Giovanni a Teduccio has seen some efforts in urban and social redevelopment, with projects aimed at improving the urban environment, promoting employment, and combating crime. Additionally, the neighborhood hosts various cultural and social institutions that play an important role in community life.

Like in many other urban neighborhoods, there are challenges to face, but there is also great potential and a determined community willing to improve its conditions.

Despite the historical fame of the neighborhood, it is important to emphasize that not all areas are degraded and many of them are vibrant and vital places, with strong communities and cultural and social resources. Therefore, while some urban suburbs may suffer from degradation problems, it is crucial to avoid generalizations and consider the diverse realities and facets of suburban communities, as in the case of San Giovanni a Teduccio.

In this neighborhood, degradation and culture represent two different aspects of urban life, and they often conflict with each other.

Urban degradation refers to conditions of physical, social, and economic decay in an urban area. This can include abandoned buildings, dirt, vandalism, crime, unemployment, and poor quality of life.

Culture, on the other hand, concerns the set of values, traditions, practices, art, and creative expressions of a society or community. Culture can manifest in many ways, including art, music, theater, literature, culinary traditions, and religious practices; it can enrich community life, promote social cohesion, stimulate creativity, and provide a sense of identity and belonging.

However, there is a complex relationship between degradation and culture: culture can be a resource to fight urban degradation. Cultural initiatives, such as festivals, art exhibitions, theatrical performances, and urban art projects, can transform urban spaces into vibrant and welcoming places, helping to counteract degradation and improve quality of life (Fig. 3).

At the same time, degradation can undermine the cultural fabric of a community. Degradation conditions, such as lack of security, poor maintenance of public spaces, and abandonment of historical buildings, can hinder the promotion of culture and discourage community participation and involvement.

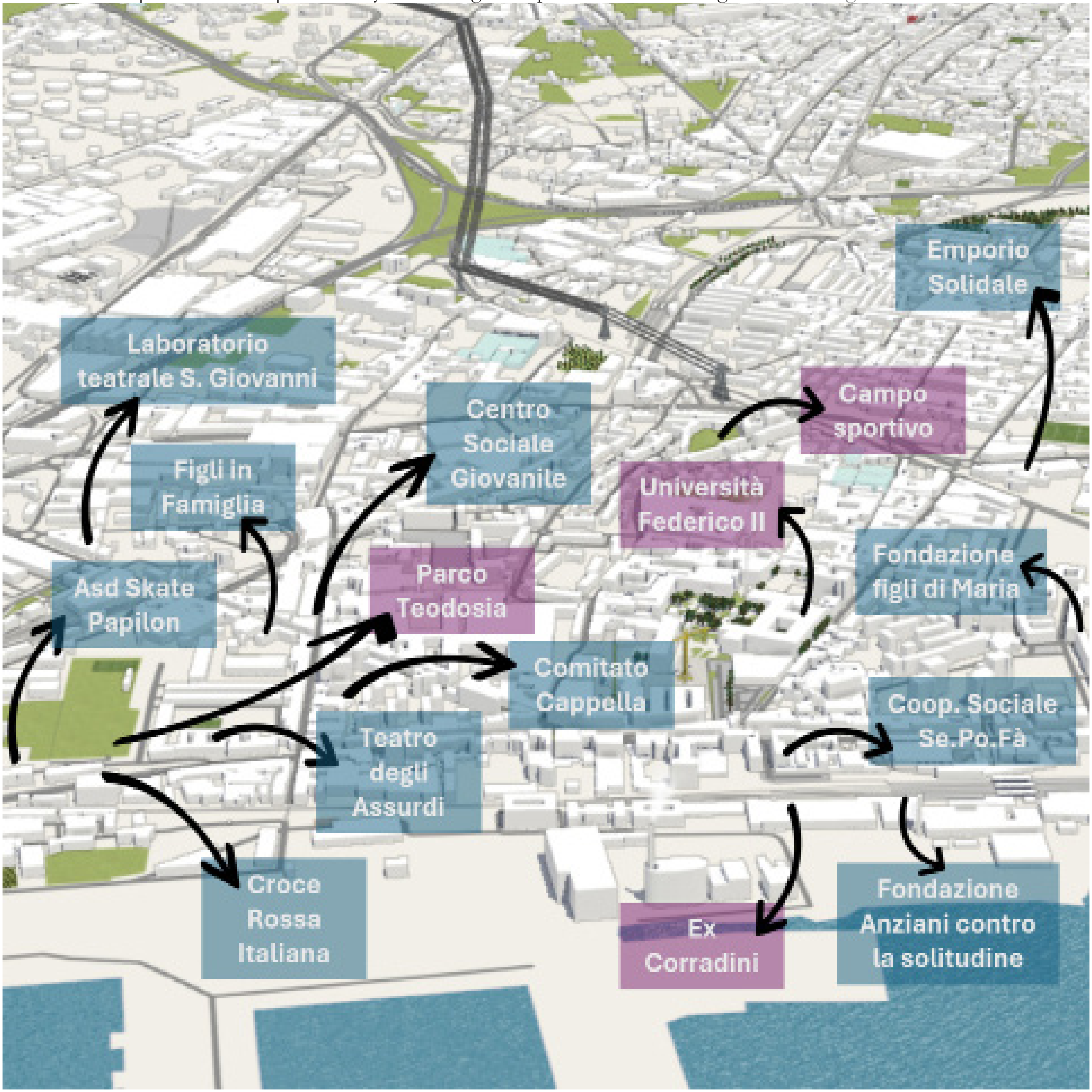
Cultural actions play a significant role in improving degraded places, transforming them into more vibrant, welcoming, and inclusive spaces. Organizing cultural events such as festivals, concerts, art exhibitions, theatrical performances, and film screenings can attract people to degraded places away from tourist flows, bringing new life and energy. These events can also help promote the identity and cultural diversity of the local community.

Urban art, in the form of murals, graffiti, and artistic installations, can transform the gray and anonymous walls of buildings into public works of art. These creative expressions can add color and vitality to urban spaces, as well as convey meaningful cultural and social messages.

Involving artists and architects in the design and implementation of public space redevelopment interventions can improve the aesthetic and functional aspects of degraded places. For example, creating parks, public gardens, recreational areas, and event spaces can transform abandoned areas into welcoming and pleasant places.

Offering cultural and artistic workshops to the local community can provide opportunities for learning, creative expression, and active participation. These workshops can involve people of all ages and backgrounds, encouraging social cohesion and collaboration among residents.

Valuing the historical memory of places through documentation, storytelling, and preservation initiatives of cultural heritage can help


Emporio Solidale
Laboratorio teatrale S. Giovanni
Centro Sociale Giovanile
Campo sportivo
Figli in Famiglia
Università Federico II
Parco Teodosia
Fondazione figli di Maria
Asd Skate Papilon
Comitato Cappella
Coop. Sociale Se.Po.Fà
Teatro degli Assurdi
Croce Rossa Italiana
Ex Corradini
Fondazione Anziani contro la solitudine

reconnect people with their environment and promote a sense of belonging and local identity.
Recognizing oneself in space is fundamental to learn to take care of it. This identification process is very important to develop a sense of belonging: when people identify with a space, they develop a sense of belonging to it. This sense of belonging can motivate people to take care of the space, preserve it, and work together to improve it.
Recognition develops a sense of shared responsibility: people feel responsible for the space and for the other people who share it. This can lead to greater attention to the well-being of the place and commitment to keeping it clean, safe, and welcoming.
Recognition and responsibility are senses that arise through active participation. When people identify with a space, they are more likely to actively participate in its care and management. They can offer their time, resources, and skills to improve the space and enrich it with cultural, social, and economic activities.
Creativity and innovation are at the basis of these processes to feel part of a space and be inspired to build actions of beauty. People can develop new ideas and solutions to improve the place, encouraging social innovation and urban regeneration.
All this leads to personal and community growth.
The process of identification with a space can lead to greater self-awareness and awareness of others, promoting personal and community growth. Interpersonal relationships strengthen, and a sense of mutual trust, cooperation, and solidarity develops.
To promote space recognition and identification with it, it is important to actively involve the local community in the planning and management process of the place. Creating opportunities for people to express their opinions, needs, and aspirations for the space can foster a sense of belonging and involvement, thus contributing to creating more inclusive, resilient, and sustainable places.
Territorial associations are key actors in fighting urban degradation and promoting sustainable development of local communities.

Fig. 6. Virtual model for identifying local associations (rendering: A. T. Alfieri).

Their commitment and ability to mobilize and engage the community can make a difference in transforming degraded places into safe, welcoming, and prosperous spaces for all residents.
Although degradation and culture are often in conflict, culture can be an important resource to fight degradation and regenerate urban communities. Investing in culture can help create more vibrant, inclusive, and sustainable urban environments (Munafò, 2010, p. 105).
It is essential to actively involve the local community in decision-making and implementation of cultural actions. Involving people who live and work in degraded places ensures that cultural initiatives respond to the needs and aspirations of the community, thus promoting a sense of ownership and responsibility towards neighborhood development.
Cultural actions play a crucial role in the recovery of degraded places, transforming them into more vibrant and meaningful spaces for the local community.
In the San Giovanni a Teduccio neighborhood, all this is already visible. In fact, there are numerous cultural associations in the area that have taken care of some abandoned places, turning them into places of rebirth and reference for the entire community.
Cultural initiatives promoted by associations can contribute to local economic growth, attract visitors and tourists, and support the tourism industry, creating opportunities for employment and economic development for the community (Poli, 2019, p. 120).
The urban regeneration of San Giovanni a Teduccio could be a complex and multi-phase process involving various coordinated actions to improve the quality of life and socioeconomic development of the neighborhood.
An initial process of urban regeneration, indeed, takes its first timid steps, but it shows interesting signs and prospects. In an attempt to mend the fabric of a post-industrial suburb with the center of a vast metropolitan area, the strategic choice of the Federico II University, whose rector at the time was the current mayor of Naples Gaetano Manfredi, was to bring in Apple Academy, Cisco, Deloitte, and Aspi

(Figg. 4-5) into the new university center of San Giovanni a Teduccio, thus attempting to establish a driving force of culture, technology, and development in the urban laboratory of East Naples. The success of the technological hub of San Giovanni a Teduccio is emblematic of the path that the eastern area of Naples must take to advance a serious process of urban regeneration: to mend this piece of the city through the interaction between companies, institutions, residents, third sector, universities, because places with disused areas can become attractive places to live, study, work, and innovate starting from listening to the territory (Angrisani, 2018, p. 74).

Learning to look at space with new eyes: community projects for the representation of places

In contrast to the numerous negativities described so far, there are just as many actions that, from the perspective of territorial rebirth, are lifting up East Naples.

There are many groups of cultural associations and volunteers that have been working in the last decade to transform the territory, but not only. The participation of local residents in these activities is positively influencing the success of the projects.

A methodology widely adopted by associations initiating projects for the regeneration of places is the cartographic representation of the territory, with the aim of highlighting the strengths and weaknesses of the places (Coraglia & Garena, 2008, p 52). In particular, these are community maps drafted by users and local stakeholders to analyze various themes that can be considered as autonomous and self-managed solutions to combat degradation and abandonment of spaces.

Place co-design is an approach that actively involves the local community in the process of designing and developing urban spaces. When it comes to representing places using co-design, there are various ways through which the community can actively participate and contribute to creating an authentic and meaningful image of the places themselves. Among the outcomes of the co-design workshops conducted with associations

and communities in East Naples (as part of a research aimed at exploring the methods of representing changing territory, conducted in the last three years), community maps have been created representing significant places, resources, and challenges of the neighborhood. These maps include places of historical, cultural, and social interest, as well as strengths and weaknesses of the community.
At the same time, guided tours of the neighborhood conducted by the community itself have been organized to offer an opportunity to tell personal stories, traditions, and curiosities related to the places visited, allowing residents to reclaim their local narrative (Amirante, 2008, p 45).
Some of the associations involved in the project have engaged artists and community members in creating artistic installations to represent the identity and history of the places, creating public and ephemeral works of art that reflect local experiences and perspectives.
The drafted maps are accompanied by photographs taken by residents, a significant photographic survey project in which people were invited to capture images of the most significant or representative places according to their vision of the neighborhood, offering an authentic and varied representation of the places.
In the field of surveying, data collection also implies a selection of them, while their representation involves the possibility of using different languages, verbal, visual, and/or numerical, to transfer the collected information. In the same perspective, storytelling workshops have been accompanied by graphic workshops during which the community has been able to share stories and memories related to the places to contribute to creating a collective narrative of the neighborhood that reflects its complexity and diversity. Gathering interviews and testimonies from the community can provide an in-depth perspective of the places, allowing for a better understanding of the experiences and feelings associated with them. Organizing participatory events such as neighborhood parties, picnics, or public meetings can be a way to bring the community together and discuss together about the places,

challenges, and opportunities they present.

The images of this laboratory experience are not included here as the results of the recently conducted research have not yet been published, but what is described nevertheless represents a valid typological framework for addressing urban degradation through active community collaboration.

All bottom-up processes that now strongly oppose top-down processes, which are widely considered inadequate for territories that show signs of every urban and human condition, remain indispensable.

Although bottom-up and top-down processes represent two complementary approaches to the representation of territory, which can be integrated to obtain a more complete and inclusive view of places, it is not always desirable to apply both.

Integrating the two approaches, combining the involvement of the local community with the action of institutions, can lead to a more inclusive, participatory, and sustainable representation of the territory, taking into account the needs, perspectives, and aspirations of all actors involved.

In summary, place co-design offers a valuable opportunity to involve the local community in the representation and enhancement of their own spaces, allowing for the creation of a shared and inclusive vision of places that reflects the experiences and aspirations of the community itself (Fig. 6).

Conclusions

The case study of the eastern outskirts of Naples illustrates how a serious urban regeneration cannot ignore a social regeneration that rethinks territories as places that develop around people, even with projects that start from the grassroots and involve entrepreneurs, educators, professionals, and residents. The axis of this new vision revolves around knowledge, listening, networking, and putting the skills of different actors at the service of projects that transform peripheral areas into vital links with the consolidated city.

It is clear that the central point of this new vision must still focus on the real needs of residents: poor settlement quality, lack of services and public facilities, absence of gathering places and local identity, spatial fragmentation, illegality, unemployment, school dropout, and delinquency are the first and most evident signs of degradation in many Italian suburbs.

This urban malaise can be countered by territorial and urban planning that forms the basis for good governance of the territory. However, planning must involve a complementary system where participation and sharing ensure the quality of decisions. Clearly, the biggest problem to solve is precisely this: the lack of a decision-making process that truly involves all stakeholders - first and foremost the interested citizens - sparking a sincere debate on urban and territorial issues. It is a rebirth that must necessarily start from the grassroots, where there are still people interested in changing the status quo.

References

Amirante, M. I. (2008). *Effetto città stare vs transitare: la riqualificazione dell'area dismessa di Napoli est*. Firenze: Alinea.

Angrisani, M. (2018). *Il caso dell'Hub Federiciano di San Giovanni a Teduccio (SGH): un'esperienza di Knowledge Transfer e University "Engagement"*. Roma: Edicampus.

Coraglia, S. & Garena, G. (2008). *Complessità, organizzazione, sistema: mappe di orientamento nei servizi alla persona e alla comunità*. Santarcangelo di Romagna: Maggioli.

Iannelli, F. & Morreale, V. (2006). *Il destino di Napoli est: Dai progetti di delocalizzazione industriale e riqualificazione ambientale alla costruzione della nuova centrale turbogas di Vigliena*. Napoli: Palazzo Marigliano.

Munafò, M. (2010). *Rappresentare il territorio e l'ambiente*. Acireale; Roma: Bonanno.

Poli, D. (2019). *Rappresentare mondi di vita: radici storiche e prospettive per il progetto di territorio*. Milano; Udine: Mimesis.

Santangelo, M. & Visconti, F. (2006). *La trasformazione delle aree periferiche nella dimensione metropolitana della città: il caso-studio di Napoli est*. Napoli: Edizioni Scientifiche Italiane.

Urban regeneration

Urban Regeneration proposals

Lucas Fernández-Trapa

The blended intensive Program organized by the Department of Architecture of the University Federico II in Naples has been a success. Structured in three phases, two of them online and one workshop week in Naples, the course aimed to confront different approaches to industrial heritage and to generate initiatives for the urban regeneration of the site of Ex Corradini in San Giovanni a Teduccio.
After an initial Online Phase comprising lectures concerning the redevelopment of industrial states across Europe, the students had the opportunity to work intensively on site. The strategy chosen was built around three main tasks:
1. they had to develop a comprehensive study of the built infrastructure and the existing buildings in order to analyse, comprehend and represent the state of fact, as well as researching historical documents to establish a timeline. The result of this workline was the creation of a GIS, supported by interactive maps and a digital "industrial-state library" summarizing the existing buildings and their characteristics, as well as issues with conservation and potentials for transformation.
2. The results of the survey (which had previously been done with drones and laser scanners) was rendered into CAD drawings. The students then proceeded to build models (physical as well as digital) of the territory and the industrial complex. This proved to be very valuable in understanding the constraints of the railway and the detachment of S. Giovanni to the Sea.

Fig. 1. Proposal team 1_ Hochshule Koblenz. Concept. Image by Kevin Bollerhey, Jana Doorn, Julia Erben, Tamara Frey, Hendrik Heuser, Sophia Weidert.

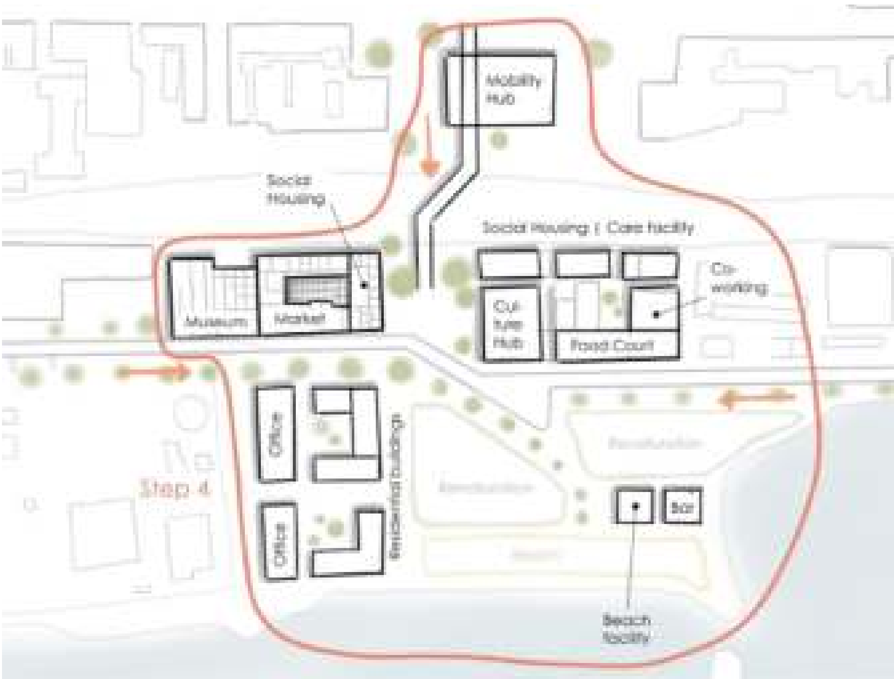
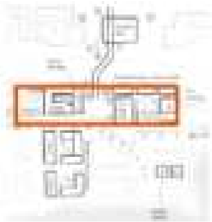


Fig. 2. Proposal team 1_ Hochshule Koblenz. References. Image by Kevin Bollerhey, Jana Doorn, Julia Erben, Tamara Frey, Hendrik Heuser, Sophia Weidert (source: (above) Active Streetscape, Levitt Bernstein; Markthal Rotterdam, MVRDV: Anaheim Packing House Food Hall; COHABS Coliving. (below) Pedestrian Bridge, ATRIUM; Park'n'Play, JaJa Architects: Mobilityspeicher, Scheffler Helbich Architekten; Skovbrynet BaseCamp, Kragh & Berglund Landscape Architecture and Urban Design).

Urban Regeneration proposals

Lucas Fernández-Trapa



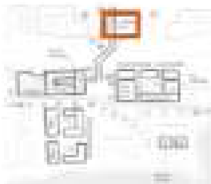


Fig. 3. Proposal team 1_ Hochshule Koblenz. References. Image by Kevin Bollerhey, Jana Doorn, Julia Erben, Tamara Frey, Hendrik Heuser, Sophia Weidert (source: Henriksdalshammen, AJ Landskap; Pop Brixton Market; Azatlyk Square, DROM; Maison ECO 3, ECO Entreprises; Chicago Riverwalk, Ross Barney Architects).

The physical models were built in scale 1:2.500 to have a better understanding of the territory and 1:300 to be able to plan in Detail the urban regeneration strategies.
3. The Students of Spain, Italy and Germany collaborated in groups to define the parameters of the urban regeneration together and exchanging different approaches regarding industrial heritage. The site visit, which comprised not only a walkthrough, but also interviews and conferences with some of the associations and stakeholders (Art33, Teatro S. Carlo, Campus Unina) and citizens of San Giovanni a Teduccio, was pivotal in providing insight into the realities of the area. The students learned about the history, the social structure and the political agenda in this particular area and drew conclusions for their own urban regeneration proposals.

At the end of the course the students had to group again and develop

Fig. 4. Proposal team 1_ Hochshule Koblenz. References. Image by Kevin Bollerhey, Jana Doorn, Julia Erben, Tamara Frey, Hendrik Heuser, Sophia Weidert (sorce: COHABS Coliving; Coworking; Tietgen Dormitory, Lundgaard&Tranberg Architects; Co-Housing Madrid, Keizerkoopmans).

a concrete design involving the transformation and recovery of the Ex Corradini Area. All students understood very well that the railway splitting the site and separating San Giovanni a Teduccio from the sea represented the main challenge, and set on to reconnect the City with its most attractive potential. Ideas were developed to cross the railway line and form itineraries for all kinds of users, from families to young proffesionals. This people-focused approach to project design could be seen across the proposals, which had a strong social component regarding the integration of the local population in the transformation of the buildings; social housing, interactive and multidisciplinary spaces, open and covered markets, parks and amenities, swimming pools and access for all were present in the considerations. Transportation and the link to Naples and into the Campania region was also an aspect that the students were keen on researching, the use of walkways, bicycle lanes, promenades

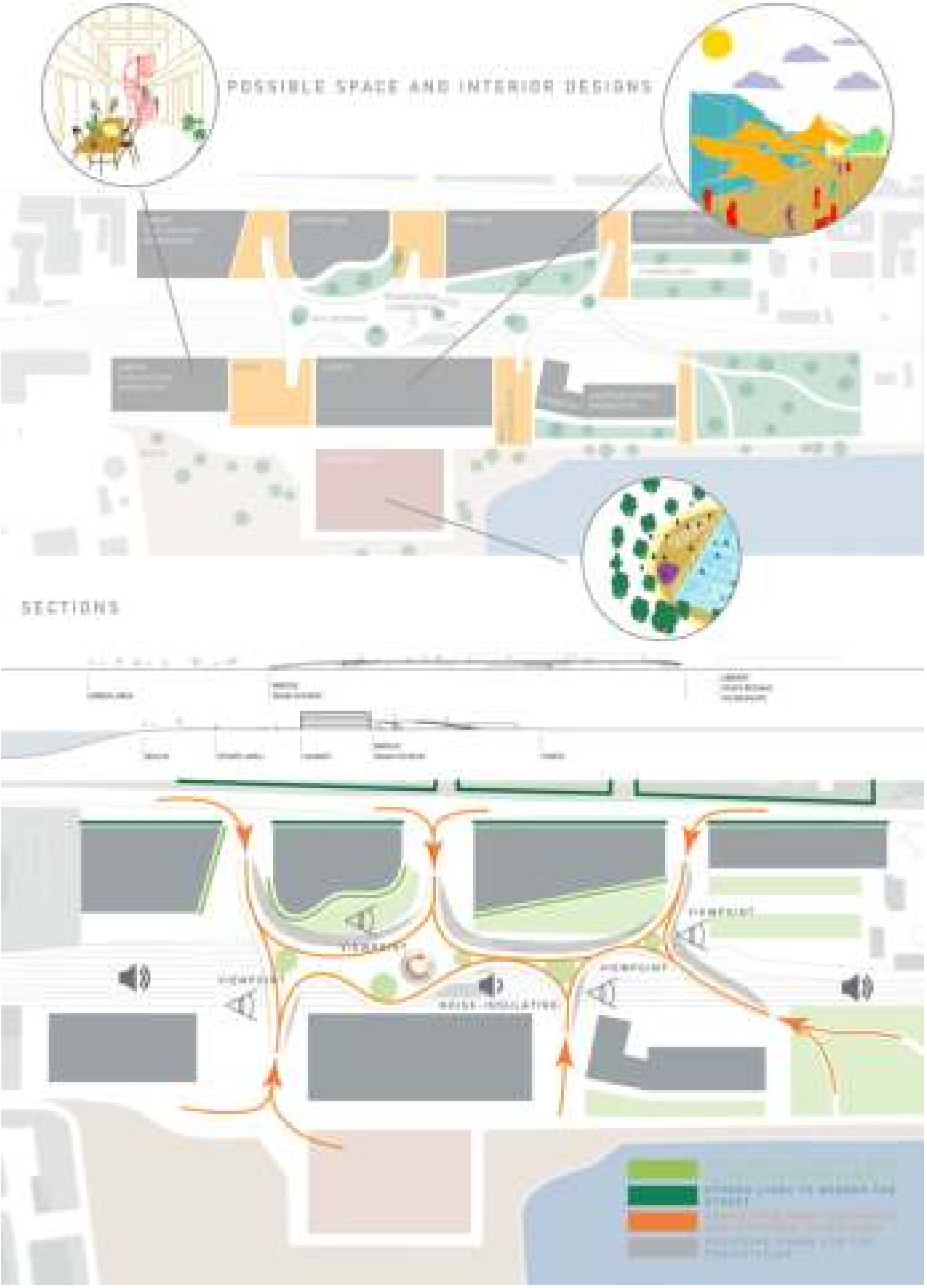
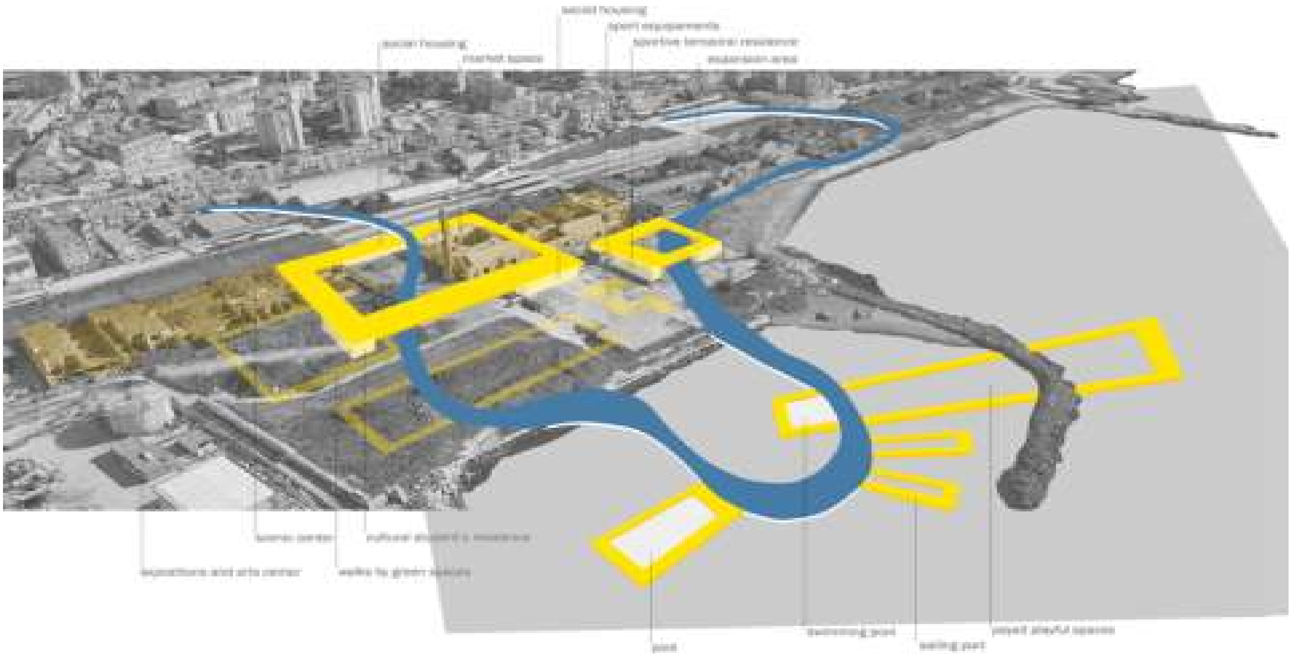

POSSIBLE SPACE AND INTERIOR DESIGNS
SECTIONS
VIEWPOINT
VIEWPOINT
VIEWPOINT
VIEWPOINT
NOISE-ISOLATING

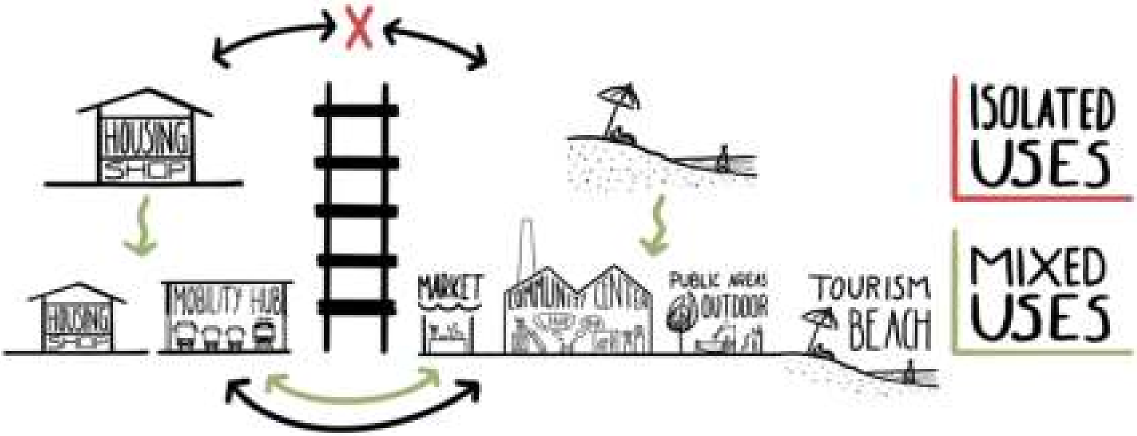
Fig. 6. Proposal team 2_ Hochshule Koblenz. Concept. Image by KLisa Baus, Ida Heid, Eva Werner, Laura Kaweck, Oliver Otto, Adrian Schellhorn.

and, in a bigger scale, the implementation of a transportation hub to connect into the Rail and the tram lines were ideas worth considering. Lastly, the importance of sustainable architecture and green spaces was stressed, urban gardening discussed and networks of parks acting not only as leisure areas but also as temperature regulators were put forward; phenomena like water scarcity and water management, clean energy generation and environmental consciousness found a way into the urban regeneration proposals. As a conclusion, can be said the multidisciplinary and multicultural workshop regarding the regeneration of San Giovanni a Teduccio, although not always easy, confronted the students with a challenge regarding a wide array of topics that they mastered brilliantly and will serve them good in their future careers.

Fig. 5. Proposal team 2_ Hochshule Koblenz. Concept: 3D view. Image by KLisa Baus, Ida Heid, Eva Werner, Laura Kaweck, Oliver Otto, Adrian Schellhorn.



MIXED USES TO ENCOURAGE MIXTURE OF PEOPLE



Urban regeneration

Exploring opportunities: innovative proposals for the urban regeneration of ex Corradini

Noelia Galván Desvaux

The proposals presented here are the result of the work carried out by the students of the workshop, after analysing the site and holding various approaches, in which they addressed the problem of the area occupied by the former warehouses and buildings known as ExCorradini. This analytical method enabled the students to understand the problems of this group of buildings, which are in a very poor state of conservation, in the San Giovanni a Teduccio district.

The main problems the students worked on had to do with the lack of connection between the area and the neighbourhood, due to the railway tracks, which prevent direct access to the buildings, as well as the lack of connection with the sea, which is also hide, behind the ex Corradini warehouses. However, there were also many other issues that the urban regeneration project could address. Issues that would not only directly affect these old warehouses, but could influence the daily life of the inhabitants of the neighbourhood, through actions that would social, cultural and economically improve the neighbourhood. The strategies followed by our workshop students' proposals, which we describe below, reflect all these issues.

1. Linking City and Nature (#streetlife, #topography): These projects considers the importance of integrating natural elements into the urban environment, and creating spaces that promote neighbourhood life, taking advantage of the topographical characteristics of the place to

Fig. 1. Proposal team 3_ Universidad de Valladolid. Concept. Image by Ricardo Orive, María Calvo, Gonzalo Grijalba, Gabriel Garzo, Laura Sánchez.

Fig. 2. Proposal team 4_ Universidad de Valladolid. Concept. Image by Deva Leal Vázquez, Gloria Llorente Sánchez, Patricia Romero López, Lydia Rodríguez Villarragut, Celia Rodríguez Viñas.

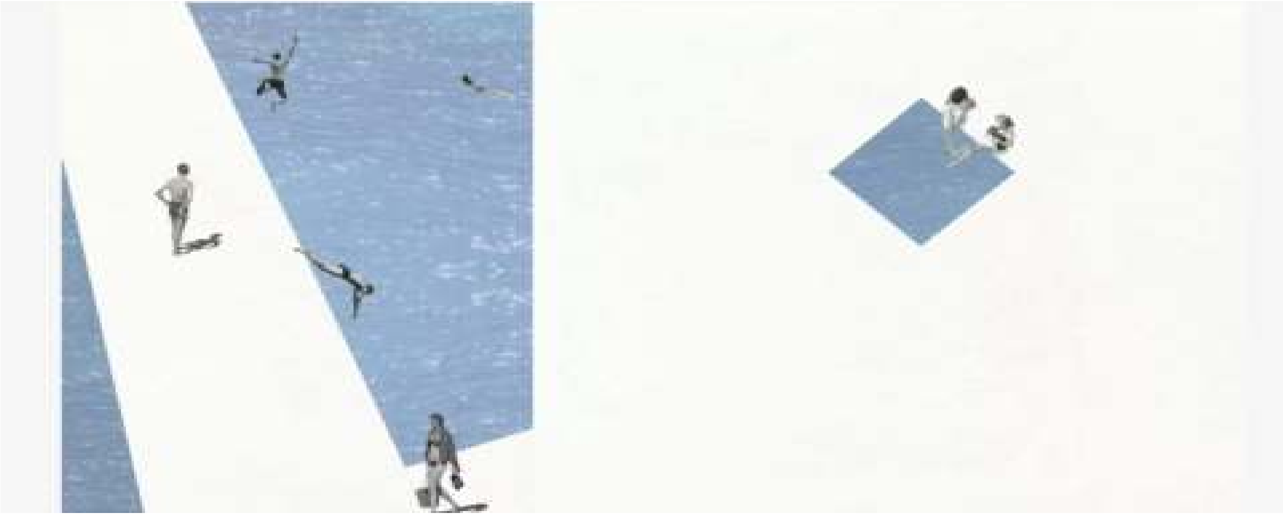


Fig. 3. Proposal team 3_ Universidad de Valladolid. Recovering the beach. Image by Ricardo Orive, María Calvo, Gonzalo Grijalba, Gabriel Garzo, Laura Sánchez.

improve the quality of life of the inhabitants.

On the one hand, the idea of recovering the beach as an urban landmark and a space usable by the community. The projects proposed various methods for beach recovery, including purified seawater pools, sports spaces, and even extending the existing beach with a new artificial one. These initiatives aim to provide a safe and healthy recreational space for the community.

Beach reclamation could also serve as a platform for organising educational activities and awareness-raising programmes on the pollution problems of the Naples coastline. Furthermore, in the various proposals, the beach becomes an economic engine for the area. By attracting tourists and visitors, it would create additional demand for tourist services, such as restaurants, shops and accommodation, which would stimulate local economic activity.

2. Revitalise the Collective Space (#landmark, #collaboration): On the other hand, there is a need to introduce green spaces that connect the ex Corradini area with the neighbourhood. Parks will play a crucial role

Fig. 4. Proposal team 3_ Universidad de Valladolid. Work action. Image by Ricardo Orive, María Calvo, Gonzalo Grijalba, Gabriel Garzo, Laura Sánchez.

in the proposals developed in the workshop, as multifunctional public spaces that promote social interaction, recreation and community well-being. These green spaces offer green areas for recreation, playgrounds for children and families, as well as zones for cultural events and outdoor activities.

3. Rethink the Programme (#reuse, #inputs): The need to redefine the programme of uses of the industrial buildings, incorporating new uses

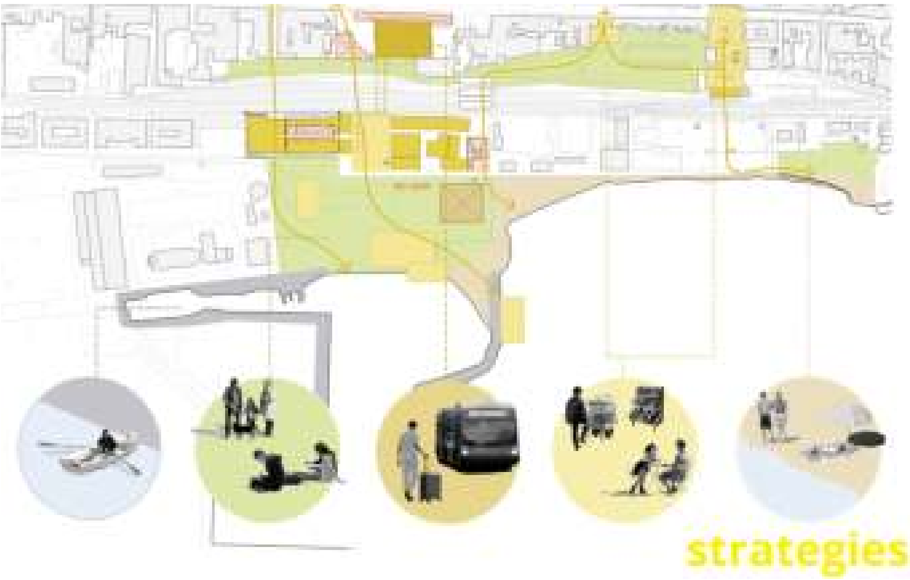


Fig. 5. Proposal team 3_ Universidad de Valladolid. Strategies. Image by Ricardo Orive, María Calvo, Gonzalo Grijalba, Gabriel Garzo, Laura Sánchez.

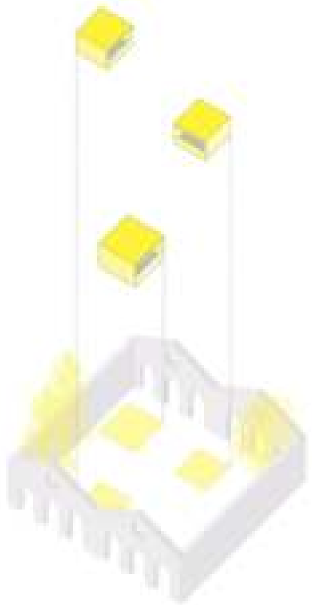


Fig. 6. Proposal team 3_ Universidad de Valladolid. Existing buildings regeneration. Systems of intervention: a) Interior boxes.Image by Ricardo Orive, María Calvo, Gonzalo Grijalba, Gabriel Garzo, Laura Sánchez.

and facilities that make the site more attractive to new inhabitants, while preserving the identity and historical value of ex Corradini.
The possible uses proposed by the students are twofold, one economic with commercial and market spaces, as well as a coworking area and offices, and the other more social with a community and cultural centre, as well as recreational and sports areas. In response to the need to bolster the neighborhood's social fabric, repurposing part of the warehouses for community centers is suggested. Additionally, fostering economic development and local job creation, along with supporting itinerant trade, can promote a bustling hub of commercial activity.
Some proposals also include the possibility of providing social or cooperative housing, providing an affordable housing option for low-income families and helping to improve diversity and inclusion in the neighbourhood.

4. Transform by Intensifying (#intermodal, #interconnected): Similarly, exploring the significance of rethinking existing infrastructure and revitalizing urban mobility to enhance environmental functionality and sustainability. The proposals address the problem of the railway track as a barrier in the connection between the ex Corradini industrial building area and the surrounding neighbourhood.
Elevated pedestrian walkways over the railway track are a common feature in most proposals, providing a direct link between the new area and the neighbourhood. Additionally, there is a suggestion to establish a transport interchange on the opposite side of the intervention area. This approach aims to reclaim urban space currently occupied by deteriorating buildings, creating a new structure and a network of open spaces linked to the footbridges, facilitating pedestrian movement across the area.

5. Constructive intervention (#adaptiverehabilitation, #sustainabletechnologies): Given the current state of deterioration and abandonment of the Corradini buildings themselves, architectural intervention systems are a key point of the proposals. For sections of

the buildings retaining structural integrity but exhibiting deterioration, restoration strategies and reinforcement of structural elements are preferred.
Many proposals advocate for adaptive rehabilitation, preserving the architectural identity while accommodating new uses and functional needs. They envision new architectural elements as lightweight and mobile, leveraging the preserved structures as containers and guardians of the site's memory. The proposals also seek to take the opportunity to incorporate sustainable technologies and work on energy efficiency, with the installation of renewable energy systems, the collection and reuse of rainwater and the use of environmentally friendly building materials.

6. Social and Economic Impact (#senseofbelonging, #communityinvolvement, #economicrevitalisation): In addition to considering the physical and environmental aspects, the proposals developed in the workshop, have tried to address the social and economic impact of urban regeneration. By promoting the creation of local employment, the development of commercial and cultural activities and the improvement of the quality of life of the inhabitants, it contributes to the comprehensive revitalisation of the neighbourhood and the strengthening of its social and economic fabric. The positive transformation of the area could attract additional investment and funding for future projects, stimulating long-term economic and social development.
It is important to highlight the students' focus on citizen participation as a fundamental component of the urban regeneration process. By actively involving the inhabitants of the neighbourhood in decision-making and the implementation of solutions, we strengthen the community's sense of belonging and autonomy, laying the foundations for a more equitable urban development.
In conclusion, to the work presented below, we can affirm that all the groups have approached the urban regeneration project of the ex Corradini area in an innovative and comprehensive way. The proposals address specific

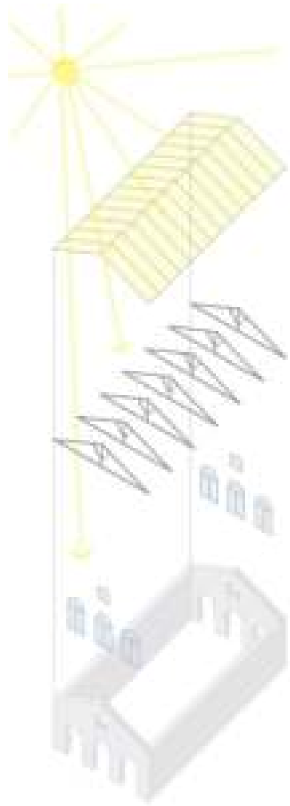
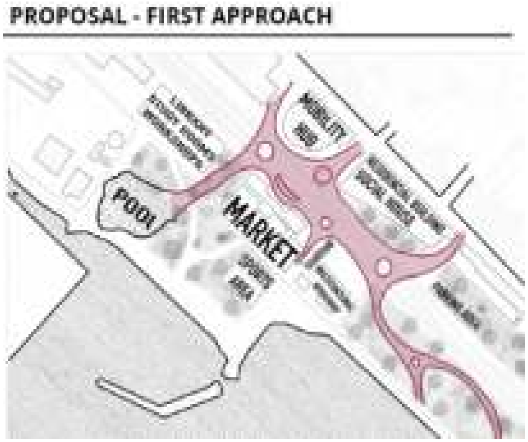


Fig. 7. Proposal team 3_ Universidad de Valladolid. Existing buildings regeneration. Systems of intervention: b) new elements addition. Image by Ricardo Orive, María Calvo, Gonzalo Grijalba, Gabriel Garzo, Laura Sánchez.



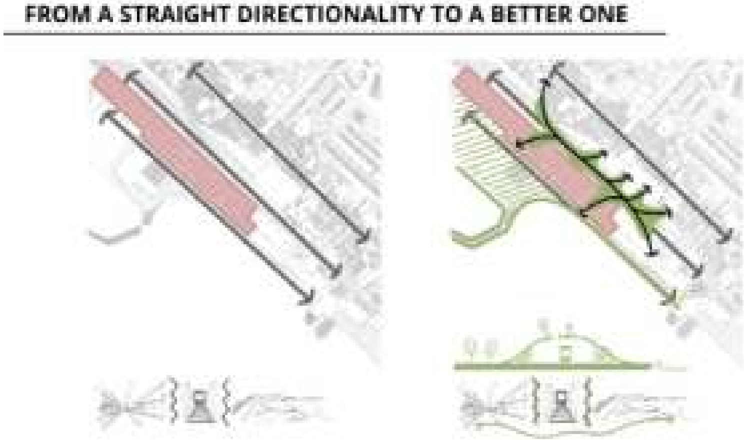


Fig. 8. Proposal team 4_ Universidad de Valladolid. Concept. Image by Deva Leal Vázquez, Gloria Llorente Sánchez, Patricia Romero López, Lydia Rodríguez Villarragut, Celia Rodríguez Viñas.

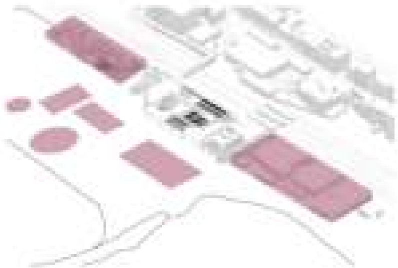
Fig. 9. Proposal team 4_ Universidad de Valladolid. Mixed used attivation actions. Image by Deva Leal Vázquez, Gloria Llorente Sánchez, Patricia Romero López, Lydia Rodríguez Villarragut, Celia Rodríguez Viñas.

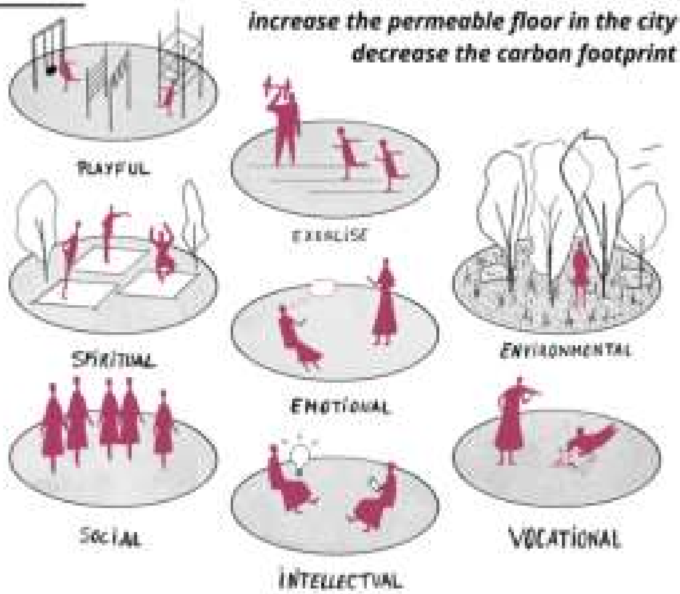
problems of the area, such as the degradation of the neighbourhood, the lack of connectivity due to the railway and the problems of funding for the realisation of the project. Through various strategies and keywords mentioned above, the students propose solutions to revitalise the space and connect it with the community. The integration of natural elements, like the sea and the reclamation of the beach, propose to improve the life of the neighbourhood. The idea of redefining the programme of use of the industrial buildings, incorporating a new functionality while preserving their historical value. The projects presented express citizen participation, environmental sustainability and social and economic impact, demonstrating a holistic understanding of the principles of urban regeneration. The approach to constructive intervention on rundown buildings, incorporating sustainable technologies, and prioritising the needs of the community is very interesting.

In addition, the students have used a dynamic graphic system in their proposals, combining hand-drawn sketches with computer-generated images to visualise their ideas quickly and efficiently. We have used a variety of tools, from 3D models and point clouds to GIS software, to analyse and understand the ExCorradini building area and its surroundings. However, we have not relied solely on digital methods: we

PUBLIC OUTDOOR SPACE

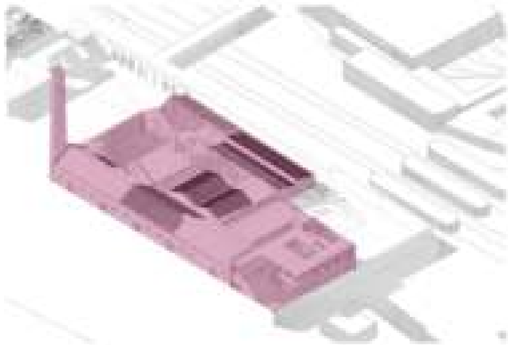
- Sport centre
- Library
- Study areas
- Workshops
- Natural spaces
- New paths
- Natural Swimming pool





MARKET

- Grocery stores
- Workshops handcrafts
- Picnic area
- Kindergarten
- Ambulant market
- Food court
- Soup kitchen



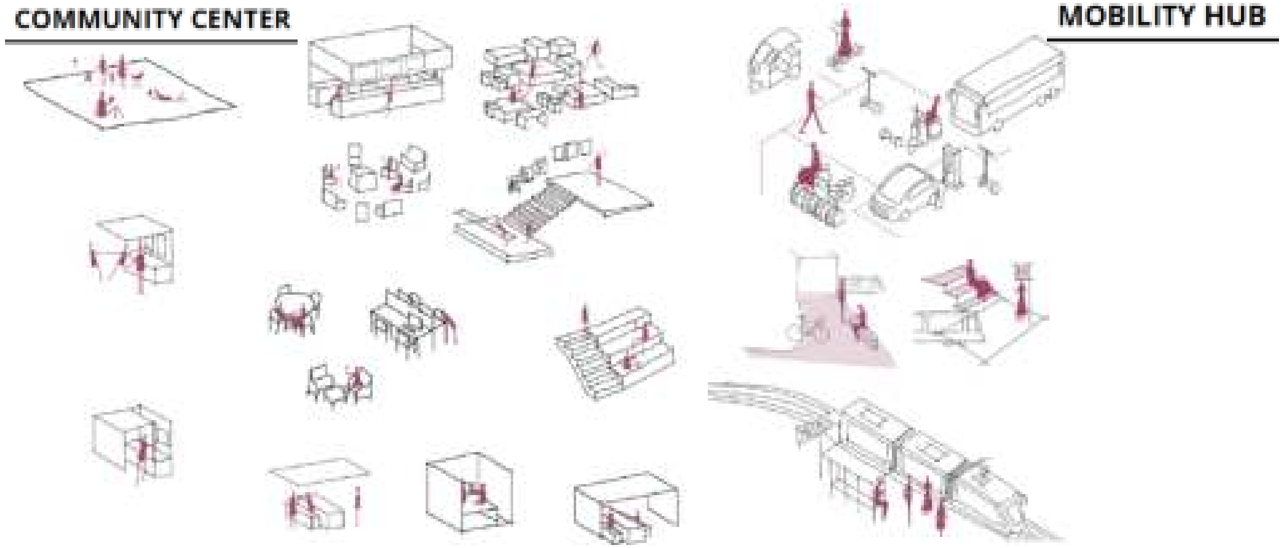


Fig. 10. Proposal team 4_ Universidad de Valladolid. Revitalise the Collective Space. Image by Deva Leal Vázquez, Gloria Llorente Sánchez, Patricia Romero López, Lydia Rodríguez Villarragut, Celia Rodríguez Viñas.

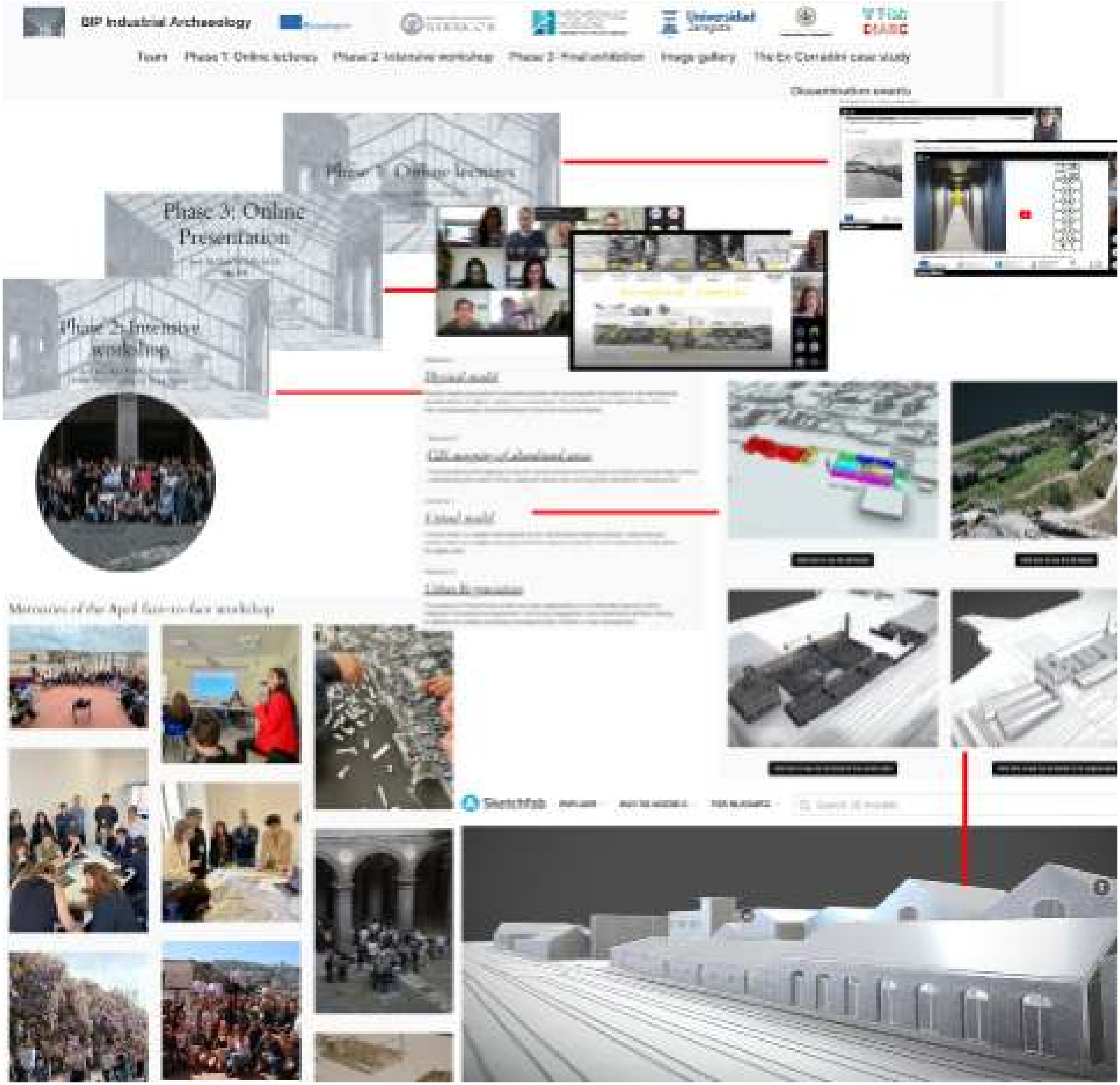
Fig. 11. Proposal team 4_ Universidad de Valladolid. Proposal. Image by Deva Leal Vázquez, Gloria Llorente Sánchez, Patricia Romero López, Lydia Rodríguez Villarragut, Celia Rodríguez Viñas.

Fig. 12. Proposal team 5_ Universidad de Zaragoza Image by Beatriz Lozano Aguilar, Sara Navarro Cozcolluela, Khaddouj Titah, Nataly Alina Stoica.

have complemented this approach with diagrams, physical models and hand drawings. The graphic system has been essential in his projects, as a generator of ideas and a means of conveying them.

Lastly, approaching the constructive intervention of the Corradini industrial buildings in a careful and planned way will ensure their long-term preservation and their positive contribution to the revitalisation of the San Giovanni a Teduccio district.

Let us think about recovering lost spaces from the times of reflection on the city. These projects carried out in the workshop sets out a path in which it is not a question of solving everything, but of working in recognition of what we have learned. Giving empty spaces, such as ExCorradini, a new life full of opportunities and meaning for the community.


BIP Industrial Archaeology
Universidad Zaragoza
Team
Phase 1: Online lectures
Phase 2: Intensive workshop
Phase 3: Final exhibition
Image gallery
The Ex Corradini case study
Dissemination events
Phase 1: Online lectures
Phase 3: Online Presentation
Phase 2: Intensive workshop
Memories of the April face-to-face workshop
Sketchfab

CHAPTER 5
Conclusions _ Sharing _ Future researches
Mara Capone

The Ex Corradini in Naples presents a compelling case study in industrial archaeology. Currently, the abandoned old factory suffers neglect, further aggravated by the presence of asbestos rendering the site unsafe for public access and generating a physical and emotive barrier that severs the connection between the community, the city and the sea.
Despite these challenges, the future of the Ex Corradini might not be entirely bleak. Community engagement initiatives, though currently lacking public confirmation, could play a crucial role in shaping the site's future. Social media campaigns and citizen advocacy groups could emerge to champion the revitalization of the Ex Corradini. However, simply raising awareness is just the first step. A comprehensive framework is needed that goes beyond horizontal engagement with local groups: a broader range of decision-makers, including elected officials, community leaders, and local governments, must be involved. Stakeholder engagement, particularly considering user needs, requires different levels of participation; community and user consultations are crucial for designing an effective and inclusive revitalization plan. This ensures participation from marginalized populations, who are often the most impacted by neglected architectural sites.
Furthermore, the absence of early consultation with the local community can lead to the unplanned omission of key stakeholders with indispensable cultural and historical knowledge. This incoherence can produce a misalignment between conservation efforts and the community's core

Fig.1. BIP website structure edited by Federica Colella, Aurora Bonora https://bipindustrialarchaeology.wordpress.com/ (image by Mara Capone).

Fig. 2. Testing Youtube : sharing online presentations. Day1: https://www.youtube.com/playlist?list=PLnTCS-N4yS1s0Vpklksc6ypopBvY2t9MiQ Day2: https://www.youtube.com/playlist?list=PLnTCSN4yS1s2qrLp-GiJC3mkM_OjMfN3ME (Image by Mara Capone).

interests, thus impeding their active participation and ownership in heritage preservation endeavours. It is up to all stakeholders to address these strategic shortcomings for the optimal implementation of heritage conservation programs.

Future step should follow a co-production model, involving stakeholders in the development of digitization strategies. Data dissemination and engagement platforms ensure open communication. These principles ensure that the project maximizes its impact, empowering communities and promoting social inclusion and sustainable development. Engaging

Fig. 3. Phase 2 Intensive workshop: frpm theory to practice (Image edited by Mara Capone).

communities in the decision-making process allows organizations and governments involved in project development to gain invaluable insights, strengthen relationships, and enhance the overall impact and acceptance of their initiatives. Effective engagement ensures that decisions and actions align with the interests and aspirations of those they affect, ultimately leading to more equitable and inclusive outcomes. This will be instrumental in transforming the Ex Corradini from a symbol of neglect into a lively space that reconnects the community to the city and the sea. In this way, valuable local knowledge can be incorporated into heritage conservation projects from the outset, ensuring a successful and inclusive revitalization.

Future goal is to follow up with participants after the workshop to provide additional resources, share presentation materials, and maintain engagement. Consider opportunities for ongoing collaboration and knowledge sharing beyond the workshop. To preserve and update knowledge, a website has been set up, complemented by social media, it can be highly effective in sharing structured information and reaching a broad audience.

The BIP Industrial Archaeology website allows you to see the BIP Phase 1 online lessons, the BIP Phase 3 students presentations and the BIP Phase 2 activities that we have done during in intensive workshop in presence. By using the specific links, that we created, you can explore 3D digital models that we have done to represent the transformation of the ex Corradini during the time and to compare the original configuration with the current state. It could be a very important starting point to define and evaluate different urban regeneration and design hypothesis.

We have created a YouTube channel for video content like online lessons, presentations and so on. We are going to use others social media platforms like Facebook, Twitter, Instagram, LinkedIn to share updates, articles, information about Industrial Heritage and regeneration processes.

Dissemination activities are crucial for sharing knowledge, raising awareness, and engaging stakeholders in the transformation of industrial heritage we have planned some specific actions like public presentations

Fig. 4. Exploring San Giovanni district (Image by Mara Capone).


1. ex Corradini
Railway station
Meeting place
Napoli San Giovanni Barra
6. Apple Academy-Unina
exploring San Giovanni District
4. Taverna del Ferro complex
2. Industries Beach
3. Art33
5. San Carlo Workshops

and talks at community meetings, conferences, and events to share progress and gather feedback on the industrial heritage site transformation. We will present the BIP publication in Spain, in Valladolid University Zaragoza and in German, in Hochshule Koblenz, and we are going to organize an exhibition in University of Naples to display physical models of San Giovanni District an ex Corradini sites and all the linked media that we connected with. These events will include seminars aimed at educating stakeholders about the industrial heritage site's cultural, historical, and architectural value, presentations by experts to engage the public and encourage participation. These sessions can explore topics such as heritage conservation principles, adaptive reuse strategies, and community engagement approaches.

The aims of these dissemination activities are: reflect on the achievements of the workshop in relation to its goals and objectives, acknowledge any milestones reached, innovative ideas generated, or collaborative efforts undertaken by participants; revisit the initial goals and objectives of the workshop to assess the extent to which they were met and evaluate the workshop's success in addressing the identified challenges and advancing knowledge in the field.

First digital edition: june 2024
ISBN: 978-88-6887-234-2
DOI: 10.6093/978-88-6887-234-2

http://www.fedoapress.unina.it

Mara Capone

University of Naples
Italy

Architect, PhD. Associate Professor of Drawing at the University of Naples Federico II. She teaches in Architecture and Design degree programs and is member of PhD Teachers College in Architecture. She is member of the scientific Committee of the journal EGA. She is involved in many Heritage funded research projects and she is responsible for international relations with institutions like UFPB (Brasil).

Noelia Galván Desvaux

Universidad de Valladolid
Spain

PhD in Architecture, Associate Professor in Graphic Expression at UVA, researching drawing's architectural heritage through the @archimnemosyne_uva project. Active in research groups GIRDARPA (UVA) and AIRASM (UA). Lecturer in Spain and Italy. Expertise in post-war American domestic architecture. Collaborates in the integration of design and architecture through drawing.

Luis Agustín-Hernández

Architect in ETSA of Barcelona (1993), PhD (2013), Associated Professor in Architectural Graphic Expression.
Head of the Department of Architecture at the Universidad de Zaragoza, guest lecturer at international universities.
Reference researcher, from the GRAPHyC group, Research lines: Architectural heritage, Photogrammetry, Laser scanner, HBIM.

Universidad de Zaragoza
Spain

Lucas Fernández-Trapa

Studied architecture in the ETSA Madrid and TU Berlin, graduating as an Architect in 2008. Currently an assistant lecturer & researcher at the Department of Architecture University of Applied Sciences in Koblenz, he is specialized in Industrial Heritage & Design. He also runs the award-winning architectural practice Beltwerk architekten BDA.

HS Koblenz
Germany

The book collects the contributions of an interdisciplinary work carried out during a BIP (Blended Intensive Program) funded by the European community. The topic is related to the abandoned industrial sites that are protected for historical interest. Starting from a comparison between the different approaches based on the study of the best practices and the different methods and tools of analyses, some premises have been defined for the representation of the site and the development of transformation hypotheses for reusing of the ex Corradini in S. Giovanni. Stimulating the cultural debate, dealing with different cultural realities, defining replicable methodological paths are the main objectives of this work.

9 788868 872342

ADAM . Architettura, Disegno, Arte e Modellazione
Architecture, Design, Art, and Modeling