Mastres Degree in Architectural Heritage
Politecnico Di Torino

Revitalizing Minet El-Basal: Strategic Approaches to Industrial Heritage preservation as a Resource for Egypt.

A.y.2024-2025
February 2025 Graduation Session

Supervisor:
Mattone Manuela

Co-Supervisor:
Vigliocco Elena

Candidate:
Omar Mohamed

Index Outline

ACKNOWLEDGEMENT

I am deeply appreciative of Prof. Mattone Manuela and Prof. Vigliocco Elena for their significant contributions, which considerably influenced and enhanced my thesis. Their insightful critiques and feedback have significantly added depth and richness to this academic work. Their meticulous attention to details has significantly shaped this dissertation.

My sincere appreciation is extended to my instructors for their constant support and mentoring during my academic tenure in the Architecture Department at Politecnico di Torino.

Words cannot express my gratitude to my cherished family. Your constant support and firm confidence in my capabilities have supported me throughout my academic endeavor and have been the foundation of this scholarly journey. Your unwavering love and sacrifice have constituted the bedrock of my perseverance and achievement.

I like to express my gratitude to my classmates for their companionship and their thought-provoking conversations that motivated me along my academic path. I am grateful for my friends, who offered both entertainments, when necessary, moral and emotional supports at challenging times, rendering my journey not only feasible but also pleasurable.

I extend my gratitude to ANPIEMED Foundation personnel for assisting me to compile the necessary photographs of my case study location.

Abstract

This thesis investigates strategic methods for preserving and adaptively reusing industrial heritage, with a specific emphasis on the Mina El-Bassal district in Alexandria, Egypt. The study is framed within the broader context of industrial heritage conservation, addressing the global challenges and methodologies for preserving industrial sites. Key themes include the historical evolution of conservation practices in Egypt, the unique industrial heritage of Alexandria, and the socio-economic and environmental implications of repurposing abandoned industrial buildings.

The research delves into the reasons for the abandonment of industrial buildings and examines the role of industrial archaeology in safeguarding these sites. A significant portion of the study is dedicated to the adaptive reuse strategies, with a detailed case study of Mina El-Bassal. The case study provides a territorial analysis, reviews previous conservation proposals, and suggests new adaptive reuse strategies, drawing parallels with successful examples from European cities.

The proposed project to transform abandoned cotton presses in Mina El-Bassal, Alexandria into a dedicated educational facility for chip production is a commendable initiative that aligns well with the community's needs. By focusing on chip production, the project addresses both the global demand for technology and local needs for vocational and technical training that can lead to immediate employment opportunities.

The thesis highlights the potential of industrial legacy as an asset for the promotion of environmentally city planning, aiming to balance economic viability, social equity, and environmental integrity. It advocates for a conservation economy model that integrates the cultural and historical values of industrial sites into the fabric of contemporary urban life.

Chapter 1

Introduction, Objectives and Methodology

Introduction

Industrial heritage sites are invaluable assets that represent the industrial revolution's socio-economic and technological advancements. Industrial legacy encompasses locations, edifices, industrial landscapes, and associated machines, materials, or documents that demonstrate historical or contemporary industrial activities. Besides sites designated for social events pertaining to business and manufacturing, like employee residents. These sites, however, face numerous challenges, including abandonment, deterioration, and the threat of demolition. To avert their abandonment or destruction, several mining sites, production facilities, tools and manufacturers have been formally submitted to the World Heritage registry. (Michael Falser, 2001)

Alternatively, industrial buildings have the ability to be repurposed and serve new roles, to ensure their ongoing development. (Cramer, J., Breitling, S., 2007) They typically have a structural design that facilitates the process of adaption. (Ackermann, K., Aicher, O., 1991). This adaptation allows future generations to find value in these buildings (Bateman, H., et al, 2005). The adaptive capacity of a building includes those characteristics that enable it to sustain functionality in response to changing demands and conditions, directly correlating with its flexibility and ability to meet developing user needs. (Geraedts, R., et al, 2014)

Among the earliest Middle Eastern nations to prosper a wide range of contemporary industries was Egypt. Mohammed Aly Pasha oversaw the process when it began in the early 19th century (r. 1805-1848). Consequently, it possesses a substantial and captivating legacy of industrial architecture, but this architecture has not been systematically documented or researched in a concentrated and thorough manner. Even the Egyptian heritage file's classification of heritage does not cover the country's industrial past. The existence of industrial sites is not recognized on the UNESCO list of Egyptian legacy sites. (S.M. Amin and colleagues, 2020) Creating an operational strategy for Egypt's industrialized legacy could help to preserve and improve the country's cultural legacy.

Alexandria is a coastal city which was designed to serve as a crucial link between the Greek World and the fertile Nile Valley. It was a prominent commercial port in the Mediterranean region mainly for cotton and wheat trade. So, the predominant industrial legacy of this region are warehouses, cotton pressing factories, textile factories and windmills for wheat grinding. Mina Al-Basal is situated at the mouth of the Mahmoudiyah Canal, adjacent to the Western Harbor gate at Alexandria Port. It was strategically established as a commerce hub for Egyptian exports to European nations. (Abd El-hakim, 2007; Khalil, 2009) The area is divided into two separate halves by the canal. The eastern bank characterized by a cluster of massive manufacturing facilities and industrial edifices, while the western bank comprised small-scale residential buildings occupied by factory workers.

Alexandria possesses a substantial amount of industrial heritage, which presents tremendous potential for reutilization. By repurposing these structures and reintegrating them into the broader urban framework of the city, they will preserve their cultural heritage, enhance the urban landscape, and enhance the standard of living.

The aim of this thesis is to explore how industrial heritage conservation strategies have evolved historically in Egypt, evaluate the current condition of industrial heritage in Alexandria, and suggest tactical methods for the adaptive reuse of industrial edifices. By examining Mina El-Bassal as a case study, the research provides a comprehensive analysis of the district's historical significance, current challenges, and potential for redevelopment.

Objectives

The primary objectives of this study are:

1. To review the progression of the conservation methods concerning industrial legacy in Egypt.
2. To identify and analyze the causes for the abandonment of industrial buildings.
3. To assess the present condition of industrial legacy in Alexandria, with an emphasis on Mina El-Bassal.
4. To conduct a comprehensive analysis of the Mina El-Bassal district.
5. To propose sustainable adaptive reuse strategies for some edifices of the Mina El-Bassal district, drawing on successful examples from European port cities.

Case Study: Mina El-Bassal

Mina El-Bassal, a district of Alexandria, was chosen as the case study because to its historical, economic, and social significance. The district houses several industrial buildings and facilities that date back to the 19th and early 20th centuries, reflecting Alexandria's rich industrial history. Despite its potential, Mina El-Bassal faces significant challenges, including economic decline, environmental degradation, and social issues.

The case study includes a full analysis of the district's strengths, weaknesses, opportunities, and dangers. It also reviews previous conservation efforts and proposes new adaptive reuse strategies for two of these historical industrial structures aiming the revitalization of the area. The study offers practical recommendations for sustainable development.

Methodology

This thesis employs a multi-phased, systematic approach to investigate the adaptive reuse of industrial legacy in Egypt, emphasizing Alexandria and specifically Mina El-Bassal. The methodology is structured to cover the broad spectrum of industrial heritage conservation, delve into industrial heritage, examine adaptive reuse and protection mechanisms, identify and analyze a primary case study, and finally propose a project based on global adaptive reuse strategies.

The methodology blends qualitative research methods (archival research, semi-structured interviews with experts and local stakeholders, and case study analysis) with quantitative methods including surveys and spatial analysis. This mixed-methods approach ensures a thorough understanding of the complicated interplay between industrial history, urban development, and adaptive reuse schemes.

The design specific objectives were based on the needs assessment. The proposed architectural design aims to the reuse of the two buildings, focusing on functionality and sustainability. The designs integrate with and contribute to the surrounding urban area including sustainability measures. The expected potential impacts and benefits are both educational and economic on the local community as well environmental impact.

Each phase of the study is detailed below:

- Exploration of Industry legacy: The research begins by focusing upon industrial heritage worldwide, examining its definition, significance, and the challenges it faces today. This involves a literature review, analysis of existing frameworks, and exploration of the historical evolution of industrial heritage conservation efforts.
- Adaptive Reuse and Protection Strategies: Building on the understanding of industrial heritage, this phase investigates strategies for its adaptive reuse and protection. The research analyzes global case studies to identify successful practices and lessons that can be applied to the Egyptian context.
- Identification of Industrial Heritage in Egypt: Shifting the focus to Egypt, this part of the methodology involves identifying significant industrial heritage sites across the country. This includes a review of existing inventories, tracing the evolution of the cultural conscious about this industrial heritage and efforts for its conservation reuse.
- Detailed Study of Alexandria's Industrial Heritage: Alexandria, with its rich industrial past, is the primary case study for this thesis. This phase includes detailed documentation and analysis of Alexandria's industrial heritage, selection of key sites for detailed study and identifying potential sites for adaptive reuse. This was accomplished through a library research method that focused on locating and analyzing site records, illustrations, plans, literature, and governmental documents concerning Alexandria's urban growth over the ages in connection to the shore, marina, Mahmoudiyah Canal, and Mina El-Bassal, most of which were preserved at Egypt's Bibliotheca Alexandrina.
- Focus on Mina El-Bassal: The research further narrows down to Mina El-Bassal, a specific area in Alexandria with notable

industrial heritage. This part involves an in-depth study of the area's history, current state, and potential for adaptive reuse, informed by fieldwork and stakeholder interviews.

- Adaptive Reuse Project Proposal: Utilizing the insights gained from the previous phases, the thesis proposes an adaptive reuse project for some of Mina El-Bassal industrial buildings. This proposal is grounded in global adaptive reuse strategies, tailored to the local context, and aimed at demonstrating the potential for sustainable development through heritage conservation.

Chapter 2
Challenges of Industrial World Heritage in the 21th Century and Global Strategy

The Industrial Revolution had an important impact on both society and the environment. It led to major changes in how raw materials were extracted and agricultural products and minerals were exploited. This, in turn, resulted in the construction of impressive structures and notable accomplishments. Industrial structures are significant historical indicators, embodying both the destructive and creative potential of humanity. They are responsible for both negative consequences and advancements. They represent the aspiration for an improved existence. Over the past five decades, there has been a growing recognition of the significance of industrial history in comprehending cultural legacy.

Not only locations, buildings, and complexes make up industrial heritage, but also manufacturing regions, landscapes, equipment, things, records that prove the existence of manufacturing processes, raw substance extraction, product transformation, associated energy and transportation infrastructures. Housing, museums, educational sites, religious worship are examples of locations used for industrial-related social activities and also considered as industrial legacy. These structures encompass values from diverse fields, emphasizing the interdisciplinary nature of industrial heritage (Xie, P.F., 2015; Douet, J., 2016).

The strong interaction between human culture and the natural environment is mirrored in industrial heritage. The function, style, and development of industrial heritage sites are extremely variable. Ancient industrial structures are valuable for their constructional, historical, and financial worth. Every industrial structure has a story, a specific identity, and a piece of cultural history. Some mining sites, industrial facilities, forges, and manufacturers have been officially included to the World Heritage registry due to their exceptional importance and to avoid their abandonment or destruction. (Michael Falser, 2001)

2.1. Causes for the abandonment of industrial buildings

Deindustrialization is a multifaceted process that has severe negative impacts on working-class communities, affecting their socio-economic, cultural, and political aspects. The rapid progression of technology and the depletion of specific resources have made the majority of industrial locations outdated. Not only do the mines, mills and factories close, but neighboring residential districts are hollowed out as businesses, schools, union halls, bars, post offices, even churches, begin to close. Industrial ruination results in significant physical and cultural obliteration. On a local scale, industrial structures are either abandoned and deteriorate or demolished thus resulting in enclosed areas of polluted land. This erasure encompasses even the realm of documentation history, as corporations in the process of leaving destroy or relocate their old industrial records. (High, S., 2022).

Various factors lead to the disposal and abandonment of industrial buildings, including significant shifts in the economy, contamination, and environmental issues, urbanization, innovations in technology, and decentralization or relocation of these structures.

- The primary reason for abandonment is the cessation of the building's initial production, rendering it no longer compliant with current criteria and resulting in its disuse. (Geraedts, R., 2014).

- The high rate of technological developments during the 1960s and 1980s led to the abandonment of many European manufacturing structures. (Lepel, A., 2006) The outdated facilities and production machines were not able to be modified to accommodate this technological shift.

- Environmental variables pertain to the influence of certain industrial activities on the location, resulting in a transition from a hazardous industrial model to an ecologically sound and non-polluting manufacturing model. (Kim, M., Ben-Josep, E., 2013).

- Metropolitan considerations significantly influence the process of abandonment. As due to population growth and the expansion or development of metropolitan areas, the industrial zones were gradually integrated into the expanding cities. The gradual relocation of these industrial activities beyond the new city boundaries left old buildings abandoned within the city centers (Lakatos, A.E., 2015).

2.2. Industrial Archeology (IA) and organizations dedicated to the study and preservation of industrial legacy.

The cultural legacy of a region includes its industrial heritage. Additionally, it contributes to the identity of a place by serving as tangible proof of advancement and notable accomplishments (Alfrey, J., Putnam, T., 2003).

The International Committee for the Conservation of the Industrial Heritage (TICCIH) and national groups such as the Associazione Italiana per il Patrimonio Archeologic Industrial (AIPAI), TICCIH's official representative in Italy, are dedicated to studying and protecting these objects. These endeavors are motivated in part by a desire for innovation and creativity, as well as attempts to address irreparable loss (Alfrey, J., Putnam, T., 2003).

The methodical study and assessment of structures and relics from the industrial sector is known as industrial archaeology. Tangible and intangible evidence pertaining to records, artifacts, stratigraphy, buildings, human settlements, and both urban and rural landscapes are all part of the industrial archaeology's multi-disciplinary investigation of the past. This evidence pertains to activities and objects associated with industrial processes.

It is an interdisciplinary field that includes archaeology, architecture, construction, engineering, historic preservation, museology, technology, and urban planning. Its goal is to reconstruct the history of previous industrial operations. The Industrial Archaeology sector encompasses a broad spectrum of issues, from prehistoric ironworks and water-powered mills to modern large-scale corporations, along with other related locations and buildings including infrastructures, storage facilities, and labor residences

The emergence of industrial archaeology transpired in the year 1950 in the United Kingdom, as many ancient manufacturing facilities and artifacts, such as the notable Euston Arch in London, have been demolished. During the 1960s and 1970s, industrial archaeology emerged as a separate branch of archaeology, mostly driven by the increasing national cultural heritage movements. This field placed significant importance on the preservation of industrial sites and artefacts. It originally gained prominence in Great Britain and then spread to Europe, the United States and other regions globally. By this time, the first organized national initiatives to document industrial legacy had begun, including the Industrial Monuments Survey in Britain and the Historic American Engineering Record in America.

During the 1970s, when many industrial facilities in the North American and European continents collapsed rapidly, industrial archaeologists began to focus on documenting and safeguarding closed sites. One notable accomplishment of that era was the prosperous conversion of Sloss Furnaces outside Birmingham, Alabama, into an outdoor industrial gallery following its closure in 1971. Sloss Furnaces were named a National Historic Landmark (NHL) in 1981. The museum was founded in 1983 and provides a range of academic and social initiatives. (Crowewrite, C., 2009)

The national statutory designation context was significantly impacted by the removal of the Firestone Building's façade in west London in 1980. This event coincidentally made the existing practices of the Survey outdated and prompted an accelerated Re-Survey of Historic Buildings. As a result, thousands of historic industrial sites were protected through this process. The international acknowledgment of the subject has greatly advanced through the inscription of industrial sites as independent World Heritage Sites. The UK has actively contributed in this recognition. In 1986, the Ironbridge Gorge was officially recognized and designated in the UNESCO World Heritage listing. This nomination marked Britain's pioneering effort to seek recognition for a vast industrial environment, rather than just a single location. (Keith Falconer's, 2006).

In addition, various regional and national organizations dedicated to Industrial Archaeology were established, such as the Society for Industrial Archaeology in North America in 1971 and the Association for Industrial Archaeology in the UK in 1973. That year, the inaugural International Conference on the Preservation of Industrial Monuments took place at Ironbridge, Shropshire. (Falconer, 2006). The 1973 meeting, culminated in the establishment of The International Committee for the Conservation of the Industrial history (TICCIH), a global entity committed to promoting the safeguarding of industrial legacy. (TICCIH, SIA, 2014) Typically, the individuals belonging to these, and other industrial archaeology organizations consist of a varied combination of experts and enthusiasts who have a shared goal of advancing the examination, admiration, and safeguarding of industrial legacy assets. (SIA, 2014) TICCIH hosts a conference every three years. The North American Society for Industrial Archaeology (SIA), the British Association for Industrial Archaeology (AIA), and the French Comité d'information et de liaison pour l'archéologie, l'étude et la mise en valeur du patrimoine industriel (CILAC) are all involved. Other national societies are also represented. Since 2000, TICCIH has assessed industrial areas for potential inclusion on the World Heritage Listing and has served as an expert advisor to ICOMOS on industrial legacy. The organization has developed a collection of instructional materials that cover canals, railways, bridges, and coal mines. A collection of major industrial heritage sites from throughout the world has been included to the UNESCO World Heritage collection. The Wieliczka Salt Mine in Poland was the inaugural industrial heritage location designated for inscription to the UNESCO World Heritage List in 1978. Meanwhile, among the recently added industrial sites to the World Heritage list: Ivrea, an industrial City of the 20th Century in Italy and the "Water Management System of Augsburg" in Germany, which were added in 2018 and 2019, respectively.
(https://en.wikipedia.org/wiki/List_of_industrial_heritage_sites, 2024)

Industrial Archeology (IA) topics often belong to one of four categories:

- Extractive industries, usually referred to as "basic materials," encompass activities such as mining, quarrying, petroleum extraction, and logging.
- Manufacturing industries that entails the operation of manufacturing facilities, plants and their associated energy sources and equipment.

• Basic public services such as water, sewer, electricity, gas, and schools.
• Transportation infrastructures (such as canals, railways, highways, bridges, and tunnels).

Industrial archaeologists have helped to raise public awareness of industrial heritage by building industry museums and adding sites to national and international historic cultural registers around the world. Industrial archaeologists' painstaking labor is also demonstrated by the preservation and repurposing of industrial sites into flats, public spaces, or museums rather than dismantling them.

A large number of preserved industrial sites have evolved as an important component of historical tourism. So, in 1999, the European Route of Industrial past (ERIH) was established to highlight a web of European industrial historical landmarks as part of an information initiative for the tourism sector, with the goal of generating interest in Europe's industrial past and legacy. Building on the success of the Route der Industriekultur in Ruhr, Germany, the ERIH has expanded its reach to include sixteen routes spanning seven nations and is actively researching concepts for further routes in other countries. (ERIH, 2014)

There is still a lack of widespread recognition among the general population regarding the significance of industrial heritage in many regions. The neglected or abandoned industrial sites due to insufficient funding can carry unfavorable connotations, encompassing adverse social, economic, and environmental repercussions. Furthermore, a large number of these sites are routinely destroyed due to neglect, fire, or demolition. The Nizhny Tagil Charter was ratified by TICCIH at its XII Congress in Nizhny Tagil, Russia in 2003. The worldwide standard covers the evaluation, recording, protection, and explanation of industrial heritage. The Nizhny Tagil Charter for Industrial Heritage (ICOMOS-TICCIH, 2003) formalized the concepts of industrial heritage and industrial archaeology. This occurred when the International Council on Monuments and Sites (ICOMOS) designated The International Committee for the Conservation of Industrial Heritage (TICCIH) as one of its expert advisors. The essay underlines the importance of documenting the physical qualities and state of industrial historical artifacts, especially within industrial sites. It advises that such documentation be kept in a publicly accessible archive since it provides evidence of previous activities, tells stories, and improves our perception of identity and understanding of diverse cultures. The TICCIH charter provides guidelines for documenting this form of legacy, including "written details, illustrations, photos, and video footage of things in motion, as well as references for promoting documentation." The charter also emphasized the significance of establishing robust legislation to protect the industrial legacy. The preservation and protection of industrial heritage is dependent on maintaining the functional condition of these objects. The TICCIH charter acknowledges the possibility of restoring and adapting industrial sites to ensure their preservation. However, this is only permissible if the location has considerable historical or cultural significance, and the earliest forms of activities associated with this type of legacy are preserved. Every architectural design, landscape, manufacturing structure, or equipment have a distinct identity that should be maintained during any modification, rehabilitation, reconstruction, or restoration process. (Ministry of Culture of Spain, 2011).

2.3. The World Heritage list and Tentative Lists

In 2001, the World Heritage Centre of UNESCO undertook an investigation as part of the "Global Strategy" effort. This investigation sought to harmonize the World Heritage Listing, identify underrepresented categories, and locate Industrial legacy sites on the preliminary list. (Michael Falser, 2001)

Each State Party was required to furnish, in accordance with the Operational Guidelines, a detailed inventory of cultural and natural assets on its territory that are deemed part of the heritage, known as the State Party's Tentative inventory. The Committee receives nominations for potential World Heritage sites. In 2001, there were 690 sites on the World Heritage List.

The classification of sites into cultural (including industrial), natural, and mixed categories revealed a high occurrence of cultural sites across all areas with the exception of the African continent. Europe/North America contributed to three hundred and two out of the overall five hundred twenty-nine cultural sites. Of the 690 inscribed sites, 28 were categorized as "Industrial Heritage." These locations accounted for 4.3 percent of all World Heritage Lists and 5.3% of all cultural sites. Twenty-two of these locations were in Europe and North America, four in Latin America and the Caribbean, and two in Asia and the Pacific. Meanwhile, there were no industrial facilities in Africa or the Arab States. The Industrial Heritage Sites have a similar "Euro-centric" layout as recognized by ICOMOS for all heritage sites. (Michael Falser, 2001)

Table 2.1. Number of sites included on the World Heritage Register based on type and region (Michael Falser, 2001) https://whc.unesco.org/archive/ind-study01.pdf

Region	Cultural	(Industrial legacy Sites)	Natural	Mixed	Total
Africa	21	0	30	2	53
Arab States	48	0	3	1	52
Asia/Pacific	90	(2)	36	9	135
Europe / North America	302	(22)	42	8	352
Latin America / Caribbean	68	(4)	27	3	98
Total	529	(28)	138	23	690

Although, "Industrial Heritage" category are more included in the world list than previously, yet the industrial heritage is still inadequately represented as result of the continuous inclusion of a large number of other types of heritage sites in the list.

Twenty-two African nations have submitted preliminary lists comprising 99 prospective sites. Of these, 74 were cultural, 16 were natural, and 9 were hybrid. Five of the cultural sites have been classified as having a confirmed Industrial World Heritage significance, and an additional 7 sites have a related industrial value. Given the absence of any industrial heritage site on the Heritage List, it is noteworthy that these 12 tentative sites indicated a promising trend for future industrial sites in Africa.

Among the five tentative sites recognized as having industrial significance are Burkina Faso's iron ore mine, South Africa's gold mining town, and Uganda's salt production hamlet. In addition to the Madagascar's town that cultivates rice crops featuring a hydraulic irrigation system, and Togo's grotto system meant for food preservation.

A harbor city in Tanzania, which was part of the old German East African colony, is one example of an industrially valuable site.

In 2001, a total of nine Arab states have submitted provisional lists with eighty-six potential locations. Among these, there were 80 cultural sites, 6 natural sites, and no mixed sites. Three potential sites with confirmed industrial significance and eight sites with related industrial value have been discovered. Meanwhile this region lacked any industrial legacy recognized on the World Heritage Registry.

Three potential industrial sites have been identified: A trading hub for the metallurgical industrial sector, specifically for gold, iron, and copper, in Mauritania; a remarkable water wheel system in Hama, Syria; and a ground and subsurface canal system known as the "Fajal" in Oman. Related industrial value sites included various aqueducts in Jordan and Lebanon, as well as an Egyptian lighthouse. (Amin, S. M. et al, 2020)

Fig.2.1. Water wheel system in Hama, Syria

https://www.tripadvisor.co.uk/Attraction_Review-g295418-d324923-Reviews-Norias_Water_Wheels-Hamah_Hamah_Governorate.html

Fig.2.2. Ground and subsurface canal system known as the "Fajal" in Oman.

https://www.shutterstock.com/image-photo/irrigation-system-aflaj-ruined-village-birkat-2300113591

Saudi Arabia holds the distinction of being the inaugural Arab nation to establish an association dedicated to the conservation of Industrial legacy. This organization's principal goal is to raise public awareness about the cultural and historical relevance of industrial landmarks in the Arab world. The Ministry of Culture Saudi Arabia announced the organization's objectives on July 14, 2019. The concept included holding seminars and launching initiatives to raise consciousness in partnership with Arab industry companies. The association's policy focuses on conserving and recording industrial memorials in partnership with global entities.

The Asia/Pacific area has a total of 23 countries that have provided tentative lists, consisting of 218 potential sites. Among these sites, 182 were cultural, 21 were natural, and 15 were mixed sites. Among cultural sites 7 sites were confirmed with industrial value and 1 site had a related industrial value. Considering the World heritage list, only two Industrial Heritage sites have been officially recognized and inscribed the Asia/Pacific region.

The Europe/North America area has 40 nations that had 480 sites listed on their tentative lists. Out of these, 352 were cultural sites, 96 were natural sites, and 32 were mixed sites. Thirty-eight sites have been identified to have industrial significance and 17 other sites were recognized to have related industrial value and all of them were considered as potential candidates for inclusion in the World Heritage List. Meanwhile, the World Heritage list of this region had a total of 22 Industrial heritage sites.

The axis running from northwest Europe, starting with England and passing via the Netherlands and Germany, to central-eastern Europe, which includes the Czech Republic, Austria, Slovakia, and Hungary, contains the highest number of potential industrial sites in Europe. France, Italy, Greece, and Turkey did not have any industrial sites listed on their tentative lists. (Michael Falser, 2001)

A total of 18 nations from the Latin America/Caribbean region had provided preliminary tentative lists of heritage sites. These lists include a total of 91 sites, out of which 59 were cultural, 23 were natural sites, and 9 were mixed sites. Additionally, there were 8 tentative sites that have been assessed as having significant industrial importance, and 4 other sites with related industrial value. Their World heritage list comprised only 4 industrial historic sites.

Table 2.2. Number of sites on Tentative Lists according to type and region (Michael Falser, 2001)

	Cultural Property	Natural Property	Mixed Property	Tentative Industrial World Heritage Sites (TIWH)	Tentative Sites with Associated Industrial Value (TAIV)	Total
Africa (22)	74	16	9	(5)	(7)	99
Arab States (9)	80	6	0	(3)	(8)	86
Asia / Pacific (23)	182	21	15	(7)	(1)	218
Europe / North America (40)	352	96	32	(38)	(17)	480
Latin America Caribbean (18)	59	23	9	(8)	(4)	91
Total (112)	747	162	65	(61)	(37)	974

In conclusion:

- There was a total of 974 sites listed on the global tentative list. 747 of them had cultural properties. Tentative Industrial Sites accounted to 61 while 37 sites had industrial importance.
- Provisional industrial legacy accounts for 8.2% of all Provisional Cultural sites and 6.2% of all Tentative World Heritage Sites.
- Europe possessed the greatest quantity of prospective industrial locations, with 38 sites. Other regions had between 3 and 8 prospective industrial sites.
- The preliminary list comprised several industrial sites with the potential for integration into the worldwide network of industrial history. Notable industrial heritage sites of considerable local and worldwide significance included water wheel systems in Syria, celadon kiln sites in Korea, a rocket launch complex in North America, and sodium nitrate offices in Chile.

- Extractive industries had a major presence on both the World Heritage List and the tentative list.
- The World Industrial Heritage List didn't include sub-themes such as: Bulk Products Industries, Manufacturing Industries, and Utilities. However, few sites related to these sub-themes could be found on the tentative list, making them potential candidates for future submissions.
- The 20th century architecture constructions as: Communications, Building Technology, were absent from both the World Heritage List and the tentative list.

Each year, a number of new sites are added to the global industrial heritage list. The following figure displays the annual count of newly established industrial properties in various nations from 2005 to 2019 that were added to the World Heritage list, as reported by the UNESCO World Heritage Center. (Amiri, E., 2020)

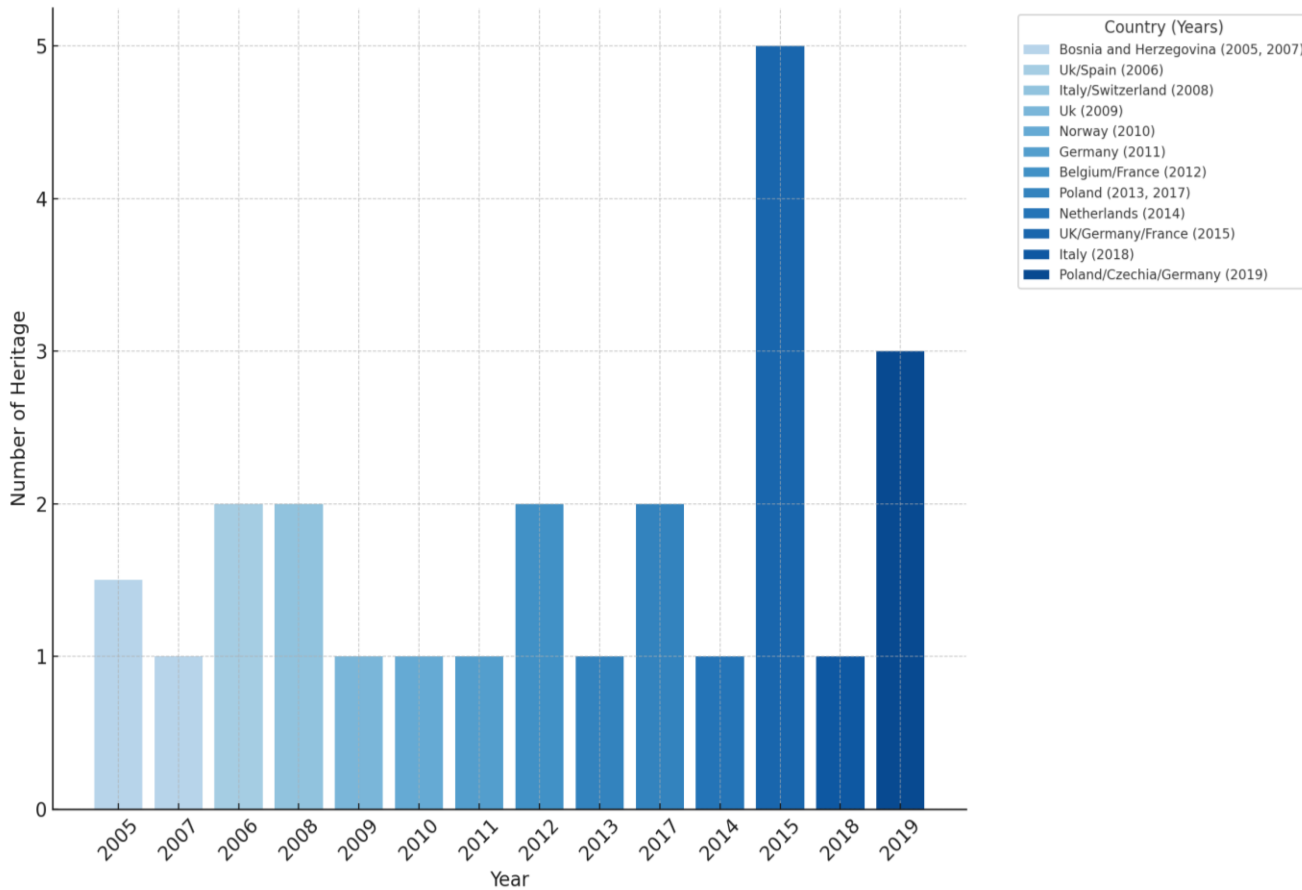


Fig.2.3. Newly nominated locations on the Industrial Heritage listing across European continent between 2005 and 2019, UNESCO World Heritage Centre. (Elina Amiri, 2020)

In July 2015, the World Heritage board met in Bonn, Germany, then added 24 cultural locations to the world heritage list; one-quarter of these newly inscribed cultural items were industrial or transportation related. Such subjects, according to committee members, remained underrepresented on the list.

According to a study conducted by Ishizawa M. and Westrik C. (2021) and commissioned by the World Heritage Centre, cultural sites accounted for 66% of all sites on Tentative Lists, compared to 77.5% (869/1121) cultural sites inscribed on the World Heritage Listing in 2021.

Cultural sites from European and North American continents continued to dominate the number of total sites, accounting for 25% of all sites on Tentative Lists, which is comparable to the percentage of cultural properties from European and North American continents inscribed in the 2021 World Heritage List (25.8%).

Comparing World Heritage listings from 2001 to 2021 reveals that the number of natural assets has climbed from 138 to 213, representing a 54% increase, while cultural properties have increased from 529 to 869, representing a 64.3% increase. Mixed properties have expanded from 23 to 39, representing 69.6% increase.

The number of Industrial heritage and 20th Century heritage were 51 and 30 on the World Heritage list respectively and were 36 and 23 and respectively on the Tentative Lists.

Table 2.3. Number of sites on the World Heritage Listing based on the type and the region (February 2021)
https://whc.unesco.org/en/documents/187906

Region	Cultural	Natural	Mixed	Total	%
Africa	53	38	5	96	8.6
Asia and the Pacific	189	67	12	268	23.9
Arab States	78	5	3	86	7.7
Europe and North America	453	65	11	529	47.1
Latin America and the Caribbean	96	38	8	142	12.7
Total	869	213	39	1121	100
%	77.5	19	3.5	100	%

Table 2.4. Number of sites on Tentative Listings based on the type and the region (February2021)
https://whc.unesco.org/en/documents/187906

Region	Cultural	Natural	Mixed	Total	%
Africa	153	94	49	296	17
Asia and the Pacific	289	115	50	456	26
Arab States	140	33	8	183	10.5
Europe and North America	439	115	55	601	34.5
Latin America and the Caribbean	140	42	35	211	12
Total	1161	395	197	1753	100
%	66	22.5	11.5	100	%

Table 2.5. Number of sites of other categories on the Tentative and the World Heritage Listing. (February 2021)
https://whc.unesco.org/en/documents/187906

Categories / typologies	Number of sites Tentative List	Number of properties World Heritage List
Itineraries (Heritage routes)	11	46
Canals and water management systems	11	16
Vernacular heritage	35	53
Industrial, including mining sites	36	51
20th Century heritage	23	30

In 2011, ICOMOS-TICCIH highlighted the importance of conservation and repurposing in fostering sustainable urban development. Conservation of industrial history can help achieve local, national, and global sustainable development goals by prolonging the lifespan of current buildings and preserving the intrinsic energy within them. Historical buildings are critical in generating patterns of urban redevelopment because they represent distinctive components that add to the character and worth of a place, while also maintaining its identity. (Lakatos, A.E., 2015). Since then, the dominant goal in Europe has been to repurpose industrial structures for cultural and touristic purposes, resulting in a greater appreciation for these places and their architecture among the public. Central Europe has almost 40 years of knowledge in the process of changing industrial areas; nevertheless, other regions in Europe and other continents have just lately begun to repurpose their own industrial sites, with a timescale of only one or two decades. The rapid trend of globalization, combined with advances in communication, transportation, and digitization, had a profound impact on the worldwide evolution of the construction environment during the twentieth century. ICOMOS, in conjunction with the Getty Conservation Institute (GCI), has launched The Twentieth-Century Historic Thematic Framework (Marsden & Spearritt, 2021) as a device for identifying novel categories of edifices, areas, and landscapes. These newly developed typologies embrace industries and industrial locations that are distinguished by both more enhanced mechanical and digital procedures, as well as corporate, functional, and rational architecture. Architects Schupp and Kremmer created the Zollverein Coal Mine Industrial Complex in Essen, Germany, which was constructed between 1928 and 1931. It was named a UNESCO World Heritage site in 2001, and it is recognized as the first fully modern industrial complex. Germany has added two more modern industrial sites to the World Heritage list: the Fagus Factory in Alfeld in 2011 and the Speicherstadt and Kontorhaus District, which includes Chilehaus in Hamburg, in 2015. The other significant instance is the Van Nelle Factory in Rotterdam, The Netherlands, which was legally recognized and added to the list of inscribed properties in 2014.

Chapter 3

Adaptive reuse of Industrial Heritage

Following deindustrialization, several industrial structures and locations, worldwide, were abandoned and deserted in urban areas (as evident in the following figures). Until the late 1990s, industrial infrastructures were regarded as impediments and hindrances that needed to be eliminated. Industrial buildings might be regarded as a challenge in urban areas. They might quickly transform into a vulnerable or detrimental aspect within their local community and undergo deterioration until completely obliterated over time. Inadequate preservation of buildings can lead to their deterioration and eventual transformation into ruins. The demolition of unused and neglected buildings without preservation is regarded as an ecological waste because it undermines the architectural integrity of the space. (Cramer, J., Breitling, S., 2007)

Fig.3.1. The ruined Eridania brewery in Ferrara From 1938 to 1967 in Scalambra
https://www.storiedipianura.it/territorio-e-cultura/urbex-e-luoghi-abbandonati/218-la-distilleria-eridania-di-ferrara-alla-salute.html

Fig.3.2. The decommissioned Volklinger Ironworks facility in Volklinger, Germany, https://whc.unesco.org/en/list/687/

Fig.3.3. The abandoned Hartford Mill industrial structure near Oldham, United Kingdom,

https://blog.mechanicallandscapes.com/2020/06/02/564-hartford-mill-3/

Fig.3.4. The deserted ELBI electricity-related production facility in Collegno, Italy. Olegs Belousovs, 2008.

https://olegs.be/gallery/abandoned-elbi-electrical-components-manufacturing-factory-collegno-italy/

Fig.3.5. The ruined coal operation of Hazard de Cheratte in Belgium.

https://www.urbex.nl/s-a-charbonnage-du-hasard/

Fig.3.6. The disused Kelenföld Power Station located in Budapest, Hungary.

https://www.pinterest.com/pin/188306828155089051/visual-search/?x=16&y=16&w=532&h=389&surfaceType=flashlight

Alternatively, industrial buildings have the ability to be repurposed and serve new roles, resulting in a completely different outcome. They may establish a link between the past and today, and by maintaining and making accurate decisions, can also be utilized for future generations. Changing the use of a building is the most straightforward method to ensure its ongoing development. (Cramer, J., Breitling, S., 2007) Reusing these buildings is a much more sustainable option compared to expending energy on demolishing them, transporting fresh materials for construction, and building whole new structures.

The repurposing of industrial legacy denotes the modification of an industrial historic site for a new function. This activity typically entails alterations, particularly in the internal spatial planning. The equilibrium between modifications (maintenance, modifications, and additions) and the conservation of elements that reflect the site's historical, cultural, technological, and architectural significance determines whether the action is sustainable or detrimental.

Proper adaptive reuse is the most common and typically most environmentally friendly approach for preserving industrial heritage assets or structures. Novel applications must honor essential materials, elements, and trends in circulation and activity. Expertise is essential to guarantee that the heritage significance is acknowledged and preserved in the management of the sustainable utilization of such industrial historic locations and facilities. Reusing buildings is a strategy in the field of built environment that helps society find a balance between living standards and environmental impact in order to meet the current high demand for residential housing. (ICOMOS – TICCIH, 2011)

The procedure of reusing industrial heritage has undergone numerous transformations since the late 1970s. Initially regarded as a heretical and rare type of preservation in the 1980s, the re utilization of industrial heritage became prevalent across the majority of Western European nations during the 1990s and thrived during the initial years of the 21st century, coinciding with a favorable economic climate in Europe. However, this affluent era was not destined to endure. In 2008, the economic downturn impacted Europe, leading to economic and social instability across many nations, which subsequently caused significant changes in the heritage sector.

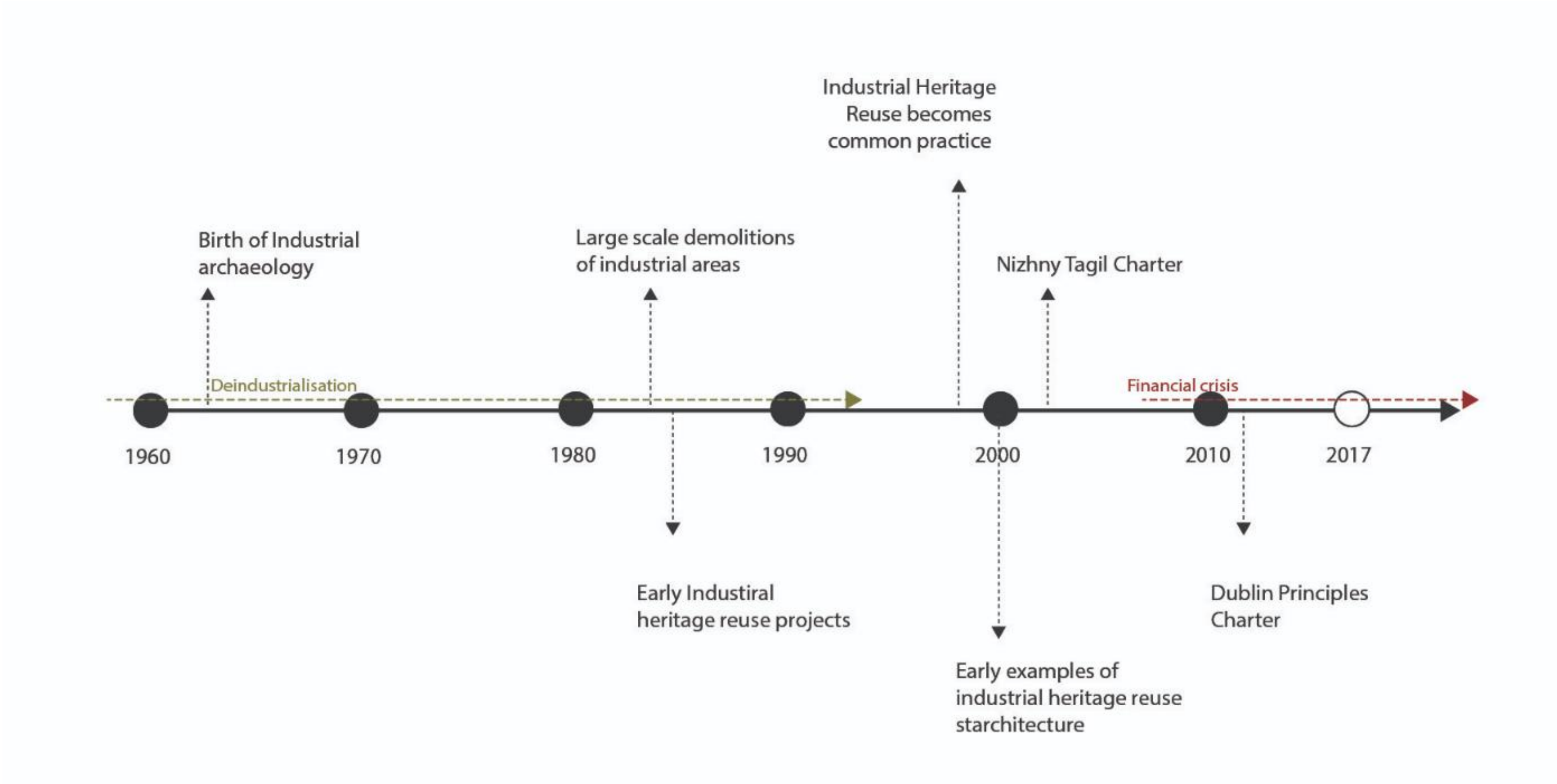


Fig.3.7. Industrial heritage: global strategy changes. (Elaborated by author)

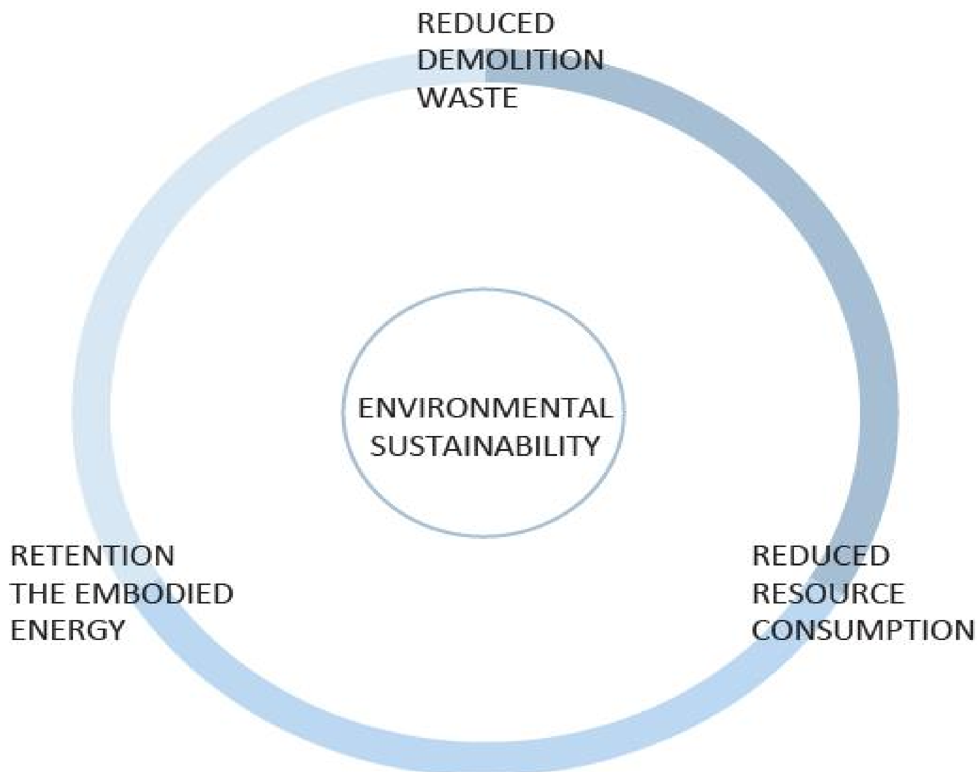


Fig.3.8. Schematic representation of the main advantages, in terms of environmental sustainability, deriving from adaptive reuse

By boosting the practice of adaptive repurposing of structures, we can provide a huge prospect for the construction sector and society as a whole to reduce carbon emissions related with our built environment. Efforts should be undertaken to alter existing buildings so that they can reduce carbon emissions to the greatest extent possible, while also prioritizing the preservation of culturally or historically significant buildings to safeguard our history. In 2018, adaptive structures repurposing was recognized as an effective interventional technique during the European Year of Cultural Heritage. This approach is not limited to historical buildings; it can be used to any existing structure. [Della Spina L. 2021] Several major cities, particularly in Western Europe, scored high on the proposed Adaptive Reuse of Cultural Heritage (ARCH) rating. It is proposed that these cities serve as appealing hubs for cultural and creative centers. [Foster G.]

Old buildings possess various types of value, including architectural, historic, and economic, which must be preserved during the process of reuse (Lepel, A., 2006).

Industrial buildings are well recognized for their distinctiveness and, when properly renovated, can serve as powerful catalysts for socio-cultural and economic development. Industrial structures possess a high degree of versatility and offer commendable elements for adaptability. Preserving the memory and identity of the location is crucial while attempting to fulfil novel criteria.

Industrial buildings typically have a structural design that facilitates the process of adaption. These buildings can be classified into two types based on their structure: multi-story frames and large sheds (Ackermann, K., Aicher, O., 1991). Frames were mostly utilized for manufacturing plants and storehouses, while sheds were used to provide cover and enclosure for heavy work. Industrial buildings are characterized by their large size, ample space, and opportunities for distribution.

These structures were specifically designed to accommodate industrial operations, large machinery, and activities of significant scale. As a result, they offer ample space that can be easily repurposed for various functions, such as cultural hubs, museums, gallery spaces, educational facilities, libraries, public institutions, and exhibits. These spaces are particularly suitable for activities that demand extensive areas. These industrial building constructions were also specifically designed to accommodate substantial loads and facilitate rigorous activities. Typically, these buildings feature brick walls or metal frames can support heavy loads. They were built to have a volume that matches their intended purpose, and often include technical rooms to house equipment. These buildings are specifically constructed to optimize the use of space. Typically, they possess ample access to abundant natural sunshine, which is crucial for any potential future use as well. In the construction of industrial buildings, natural ventilation and shade are important considerations that are carefully taken into account. In 1975, Serban Cantacuzino observed that buildings are often repurposed over time to maintain a perception of constancy and steadiness within the surroundings, as their structure tends to outlast their original function. This adaptation allows future generations to find value in these buildings (Bateman, H., et al, 2005).

Embodied energy refers to the energy and materials already used in the construction of a building. It encompasses all the energy consumed during the various processes involved in building. Repurposing buildings preserves their inherent energy, and the elements typically found in a structure suitable for repurposing are often the most energy-intensive components. Reusing building materials typically results in a conservation of around 95 percent of the energy that would otherwise be lost.

Two Primary Challenges Must Be Considered:

- Determining the appropriate form of action.
- What are the most suitable instruments to achieve an effective outcome?

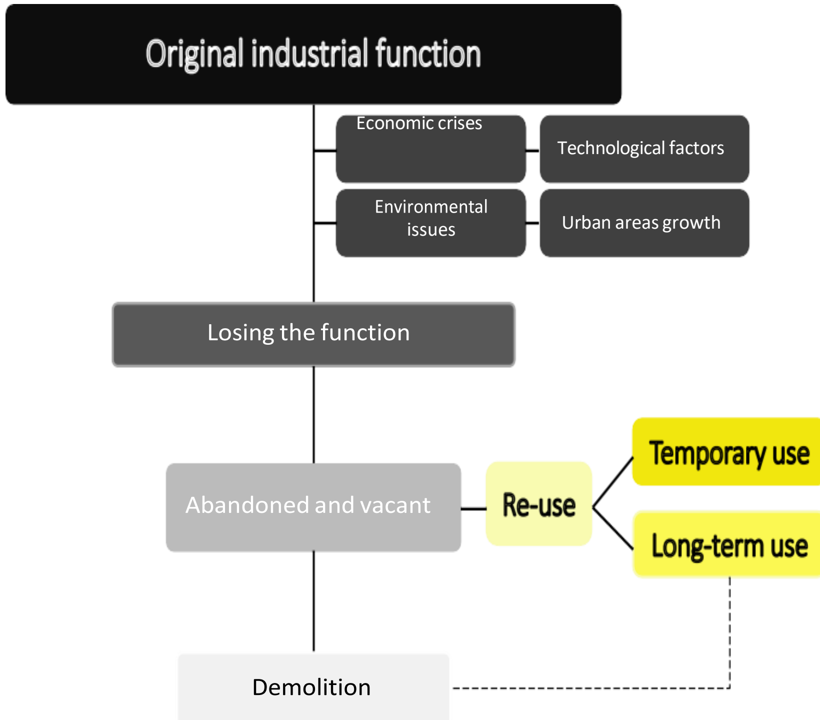


Fig.3.9. Schematic representation of the alternative paths that the decision-making process can take. (Elina Amiri, 2020)

Adaptive reuse which is the practice of repurposing sites, buildings, or infrastructures that have become obsolete and abandoned over time, by making minimal changes to accommodate new activities. Adaptive reuse revitalizes a site instead of attempting to preserve it in a specific period in history. (Robiglio, M., 2017).

3.1. Approaches

Four primary approaches can be identified:

Typological, Technical, programmatic and strategic approaches. (Plevoets, B. & Van Cleempoel, K., 2011)

- **Typological approach:** It is evident that the purpose of adaptive re-use is the primary change, but other modifications can also be done to the edifice, including adjustments to the circulation route, orientation, and spatial connection. Additionally, new extensions may be constructed while certain portions may be removed. Many researchers have approached adaptive reuse by scrutinizing case studies using the typology of the host space.

-**Technical approach:** Unlike the aforementioned researchers, some individuals have regarded building adaptation as predominantly a technical matter and have become even less theoretical in their approach. Their attention is primarily on how to modify a building to optimize its ability to accommodate a new purpose. Highfield, 1987, distinguished between domestic and non-domestic buildings. He then proceeds to outline a technical approach, discussing the necessary improvements for adapted buildings in terms of:

1. fire resistance
2. thermal performance
3. acoustic properties
4. prevention of dampness
5. condensation
6. timber decay

Subsequently, he broadened the scope of technical matters that the designer must address while modifying existing structures to encompass concerns related to sustainable redevelopment. (Highfield, D. 1987) The designers of these newly adapted facilities have faced increasingly intricate technological hurdles due to ecological imperatives in recent years. (Carswell, A. 2011) The act of reusing old buildings is inherently sustainable because it typically requires fewer resources compared to constructing new buildings. The growing preoccupation within the design community on environmental challenges led to a surge in the development of theories and research, as documented by Giebeler, Rabun, Greenan, Carroon, and Gelfand. (Plevoets, B., & Van Cleempoel, K., 2013) The perspectives on adaptive re-use presented by those focused on the technical aspects of re-use often view the existing space as a mere vessel that may be modified to serve functional, financial, and technological purposes.

-**The programmatic strategy** is another method of reusing. This method entails choosing a certain function or program as a starting point and then modifying the host building to accommodate it. This approach primarily focuses on contemporary design and interventions in recently constructed structures, rather than giving special consideration to buildings with historical significance. (Powell, K., 1999) This strategy adjusted its perspective to include older structures, resulting in a growing trend of repurposing historic buildings for various commercial purposes, such as retail, leisure, sport, care, or domestic. The programmatic approach diverges from the previous two methods by placing less importance on 'physical structures' and instead prioritizing the social aspect. However, it fails to acknowledge the artistic possibilities of adaptive re-use. (Plevoets, B., & Van Cleempoel, K., 2013)

- **Strategic approach:** According to Machado, the work of remodeling should not only focus on creating a new shape or function, but also on understanding and incorporating the significance of the past. The architect or designer's approach to the past is crucial in this process. He asserted that throughout the process of remodeling, the past holds a greater significance as it serves as the material to be modified and reshaped. Additionally, it supplies the marked plan on which each subsequent remodeling will occur. Therefore, the past is regarded as a collection of meaning that can either be embraced (preserved), altered, or rejected (denied). (Gelfand, L. and Duncan, C., 2012) Accordingly, Robert introduced seven **'concepts of conversion'**:

(1) Constructing within,

(2) Constructing over,

(3) Constructing around

(4) Constructing alongside

(5) Reusing materials or remnants

(6) Adapting to a new purpose,

(7) Constructing in the same style.

Each of these principles is related to a distinct physical intervention, however it retains elements of Machado's theories. These ideas have resurfaced by Brooker and Stone, 2008, who analyzed various architectural solutions for repurposing buildings and enumerated three strategies: intervention, insertion. Installation. They emphasized that a designer or architect can enhance, modify, and revitalize a space by comprehending the essence of a location and the specific contextual environment in which a structure is situated. Every preexisting structure is inherently connected to its environment; it possesses distinct characteristics that are exclusive to that specific context. The designer can examine and utilize these attributes as the foundation or framework for the subsequent phase of development. (Brooker, G. and Stone, S., 2008)

The goal of reuse is to analyze the building's limitations and capacities and offer the best layout that connects the new function, users, and the existing space. So, architects during the reuse process should evaluate all prospective options, imagine the future, engage different partners, evaluate the state of the building, consider recycling, urban development, and financing. (Robiglio, M., 2017)
Tan et al. (2018) conducted feasibility research that examined 33 factors impacting adaptive reuse. These characteristics were both positive and negative in nature.

Table 3.1. Essential Success Variables and the Key elements of Adaptive Reuse. (Tan et al. 2018)

Critical Success Factors (CSFs)
Market demand
Building ordinance/regulations (plot ratio, fire safety, acoustic and thermal insulation, daylight and lift/escalator etc.)
Land lease control
Location, transportation and accessibility
Conversion cost and lifecycle cost
Offifial planning and zoning

Principal Components (PCs)	Average mean per factor
The market	4.14
Legal and regulatory	3.98
Economics & governance	3.91
Ease of adaptation	3.61
Location and neighborhood	3.60
Culture and public interests	3.41
Physical condition of building	3.36
Sustainability	3.25

The table featured six Critical Success Factors (CSFs). PCA was used to reduce all of the elements into eight essential elements. The average value in each essential element group was used to determine the relative relevance of each component. The study indicated that the aspects classified as'renewable' and 'structural integrity of the edifice' tend to have lesser levels of relevance in comparison to the factors classified as 'the marketplace', 'legal & legislative', and 'finances & administration'.

Xuereb K & Parkin I. P. (2016) and Hernandez P. & Kenny P. (2010) identified, in their studies, the key attributes of existing old buildings that make them future-proof. They emphasized the significance of the construction material and the durability of their structure in enabling adaptation to meet new requirements. Anderson J. (2013) supported this view and argued that highly optimized building construction limits adaptability, making any necessary changes costly and disruptive. Wilkinson et al. delineate the criteria for the adaptation of existing buildings based on their ages, situation, dimension, encompass and covering, framework, infrastructure, inner design, versatility for various applications and practical supplies, specifically designed structures (excluding speculative designs), setting, perceived heritage significance, access, acoustic isolation, user desires in addition to aggressive policy formulation or laws including guidelines for construction and design, as well as fire requirements. They advocated using a multicriteria decision-making (MCDM) approach to examine all elements and assign weightings that define a building's adaptability. Black A. et al.'s research, 2019, examined the factors that influence building adaptability positively or negatively. The prominent qualities are either a "loose fit," which refers to vast and open regions, or properties that help to extend the structure's lifespan, such as persistent durability and maintenance proficiency. The factors discovered by Black et al. and their impact on 16 projects, as well as their frequency and categorization as positive or negative, are summarized in the accompanying figure. (Black A. et al., in 2019)

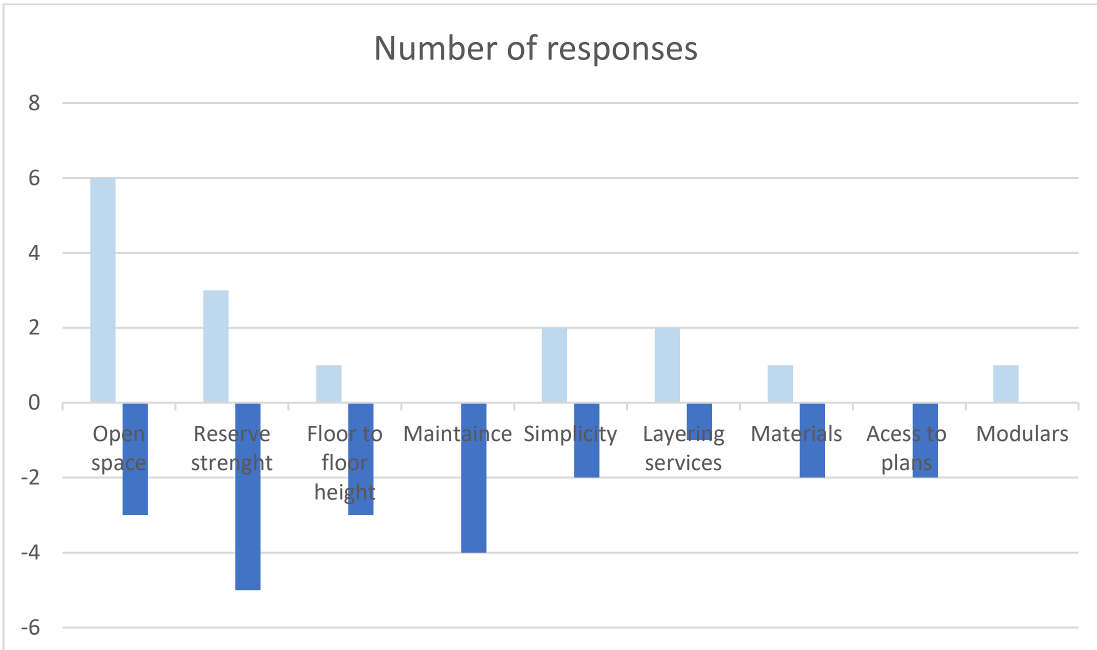


Fig.3.10. The variables that favorably and adversely influence building adaptation, (Black et al. 2019)

Additionally, they remarked that several choices for building adaptation are frequently available, and certain physical attributes may facilitate diverse adaption strategies. According to the study conducted by Xuereb K.& Parkin I. P. (2016), old buildings constructed with masonry and timber are more easily adaptable compared to modern buildings constructed with steel and concrete.

A significant portion of the research on adaptive reuse has indicated the potential influence of policies and standards. These are commonly used mechanisms in the construction industry to facilitate comprehensive engagement of partners and comprehension of the various factors associated with project and planning decisions. The government should provide advisory services to property holders seeking adaptive reuse of their industrial structures in order to encourage the reuse of these facilities. It is critical that lawmakers and municipal planners have a decision-making tool to help them prioritize structures. The adaptive reuse of buildings is an important aspect for policymakers and planning authorities because it can encourage urban regeneration and draw developers and investors to emerging areas. It is necessary to evaluate existing laws and policies in order to enhance the practice of repurposing buildings in various countries. Moreover, the collaboration of stakeholders is crucial for the success of any adaptation project. (Tan Y, et al, 2018)

In the context of adaptive reuse, many financial considerations as tax incentives, town planning, and building rules, which exhibit significant variations among nations, play a significant role. Under certain conditions, constructing a new structure can be more cost-effective than modifying an existing one. [Wilkinson S J, et al., 2009] However, the study conducted by Foster G. & Saleh R. (2021) shown that adopting adaptive reuse as an investment strategy not only contributes to urban regeneration but also yields immediate financial advantages. Enhanced understanding of a building structure's actual performance might lead to improved adaptive reuse possibilities. Adaptive reuse is expected to face significant obstacles mostly because to the limited availability of data. A data collection method involves engaging with construction companies through questionnaires, workshops, or focus groups. However, this strategy is contingent on enterprises' willingness to submit information or insights regarding the endeavor, as well as on the data's usefulness for the adaptive reuse project. However, it is possible to gain firsthand information from persons or groups active in the construction industry.

According to Xuereb K. & Parkin I. P. (2016), buildings have the ability to undergo remodeling and can endure longer than civilizations. Over time, they undergo transformations and changes. When renovating a structure, the existing quality is integrated with the intended future purpose. The number of buildings undergoing renovation has risen, and this action is being approved based on the recognition of the detrimental effects of urban decay (Brooker, G. & Stone, S., 2004). Over time, people have become increasingly interested in the city centers. Consequently, abandoned and deserted industrial buildings began to be repurposed and transformed to meet the needs of users. Remodeling presents a potential solution for the sustainable utilization of pre-existing structures. (Brooker, G. & Stone, S., 2004) The design concept is derived from the preexisting structure. Renovation can be carried out both internally and externally on the current structure. During the process of remodeling, a building may be transferred due to either an addition or demolition. Buildings can be analyzed in four distinct areas, as outlined by Brooker and Stone (2004):

1- Form and structure area: that aims to gather data regarding the structural integrity of a building, as well as any patterns or connections between the spaces within the building. Accordingly old buildings can be classified into two types of constructions: Load-bearing and framed structures, which were constructed in a conventional manner. The heavy weight-bearing edifices consist of massive, strong stone walls having a restricted span, resulting in compact and tiny areas within the building. On the other hand, frame structures are utilized in larger-scale buildings. These structures allow for walls and floors to be completely separate without any restrictions. (Brooker, G. & Stone, S., 2004)

2- Historical and utilitarian area: It is important to consider the historical significance and original use of a building when determining its reuse, as these factors can influence the conceptualization and design of the new function. Buildings can undergo transformations over time, as they adapt and their purposes shift according to changing demands. (Brooker, G. & Stone, S., 2004)

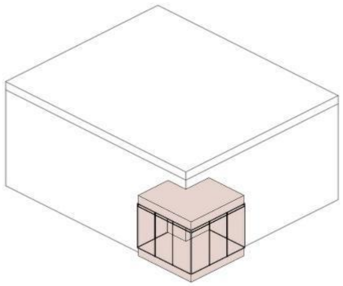
3- The context and environment of the current edifice, including its actual sitting and its relationship with the neighborhood, should be taken into account during the process of reusing it. Climate is an additional component that can influence the concept of remodeling and adaption. (Brooker, G. & Stone, S., 2004)

4- Proposed function: A crucial step in the process of reusing anything is to understand the requirements and needs of the new purpose. This understanding allows for establishing a relationship between the new and old functions. Additionally, it is important to understand the users' expectations for renovated structures in order to fulfil their specific needs and establish a link between the previous and current eras. (Brooker, G. & Stone, S., 2004)

3.2. Strategies

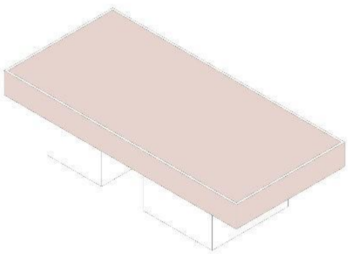
The relationship between new and old buildings is critical in the strategic assessment of any structure. In the context of the hosting property—an older construction—three ways are available to include structures repurposing and novel features: (Brooker, G. & Stone, S., 2004)

1. Intervention: refers to a process of transforming and renovating a building, where the new and existing components are completely interdependent. The existing structure provides information on the reuse direction, section placement, their relationship, size, and scale. The intervention categories are listed as follows: Wall, gate, new growth potential, divider/buffer, boundary, bridge, zipper, filter, new face, feature building, infill, skyline pattern, porch, protector, plaza/underground, space maker/marker, new interior, invisible structure/underground, edge reinforcement, umbrella, hat/roof, and parasite...Figures (3.11–3.16) depict the many examples of remodeling efforts.



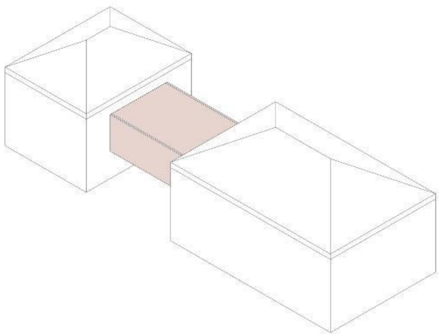
(Elaborated by author)

Fig.3.11. Parasite intervention. In the case of Ipervasi in Nicosia, Cyprus by Constantinos Kalisperas Architectural Studio https://architecture.constantinoskalisperas.com/installations/ipervasi



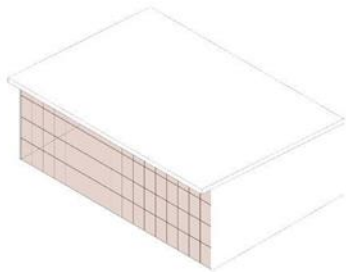
(Elaborated by author)

Fig.3.12. The rooftop intervention. The storehouse at South Bund / Neri & Hu Designing and Researching Bureau features a Cor-Ten steel structure that references passing ships along the nearby river. The architecture was designed by NHDRO https://www.archdaily.com/263158/the-waterhouse-at-south-bund-neri-hu



(Elaborated by author)

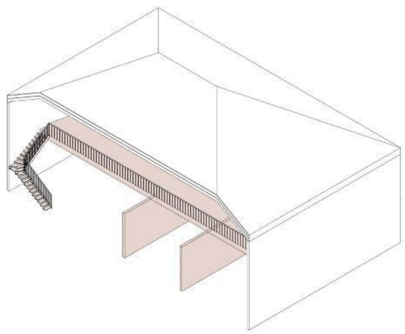
Fig.3.13. The Bridge Intervention. Refurbishment Viaduct Arches in Zurich, Switzerland, which was carried out by EM2N.
https://www.archdaily.com/629237/refurbishment-viaduct-arches-em2n/554d4d67e58ecece5c00006c-refurbishment-viaduct-arches-em2n-photo



(Elaborated by author)

Fig.3.14. Skin intervention. Kraanspoor, meaning craneway, is a lightweight, glass office structure with three levels, constructed on a concrete craneway. Architects: OTH Architecten, 2007

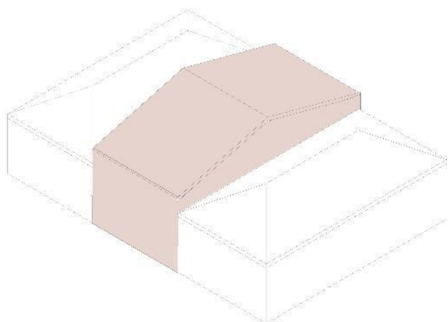
https://www.archdaily.com/2967/kraanspoor-oth-ontwerpgroep-trude-hooykaas-bv



(Elaborated by author)

Fig.3.15. Interior intervention The Yooshinjae Office project included an interior intervention and was designed by Yooshin Architects & Engineers, Yongsan-Gu, South Korea.

https://www.archdaily.com/989339/yooshinjae-office-yooshin-architects-and-engineers



(Elaborated by author)

Fig.3.16. Wall intervention Octapharma Brewery / Joliark offices, restoration Stockholm, Sweden Architects: Joliark

https://www.archdaily.com/598517/octapharma-brewery-joliark

2. Insertion: The subsequent strategy for remodeling is the act of inserting something. Insertion refers to the incorporation of a new component within a building, either between or adjacent to the preexisting framework. The implanted component can function autonomously or as a singular element on a significant magnitude, with the possibility of utilizing various materials. The size and proportions of the primary framework typically influence the design of insertion. The host building must possess a robust structure to accommodate the installation of the additional components. During the insertion process, both the new and old components can maintain their distinct characteristics in a robust, independent and autonomous manner.

3. Installation: This refers to the process of adding new components to an existing building in a separate and distinct manner. Components included in the installation phase typically possess a restricted size or duration of usefulness, although they have the potential to amplify the influence of the structure. Installation refers to the process of uncovering and restoring the latent or neglected aspects of a preexisting structure. These endeavors are undertaken by architects or artists who employ their unique styles and techniques.

Remodeling tactics: refer to the methods used to effectively implement a remodeling strategy by managing various elements. These tactics can be categorized into six sectors, each sector is focusing on a distinct aspect of utilizing elements in remodeling and their correlation with the structure. These sectors are: (Brooker, G. & Stone, S., 2004)

1. Light: It controls spaces and forms.
2. Surface materials: They exhibit the character of a building, and each material possesses distinct textural qualities. The manner in which material is utilized can provide distinct ambiance and emotional tone.
3. Openings in buildings: They serve not only as sites for light and movement, but also have other functions such as ventilation and guiding circulation.

4. Movement in building: They can be facilitated through many means such as staircases, ramps, corridors, bridges, balconies and lifts. Mobility facilitates entry into various locations and areas inside a building. They possess the capacity to imbue space with artistic expression.

5. Plans: They are the primary components for the regulation of design. Plans can encompass walls, floors, façades, and screens. They have the ability to establish boundaries for spatial and personal seclusion.

6. Objects: They can be intentionally positioned in space with specific significance. Objects can exhibit a range of sizes. The item can either be a singular entity or a collection of multiple components. The objects provided evidence of the building's previous utilization.

3.3. Adaptive capacity and Flexes

The adaptive capacity (AC) of any structure encompasses all traits and attributes. Schuetze defines this notion as the ability to easily adapt to different roles or evolving demands by using elements and goods that facilitate reconfiguration and recycling with minimum exertion and reduction in standards (Schuetze, 2009). Wilkinson claims that a strong relationship exists between a structure's adaptive potential and its sustainability (Wilkinson, S. J., H. Remoy, 2011). The adaptive capacity of a structure indicates its worth and ability to withstand future changes. Certain buildings possess a long-term utility value that allows them to adapt to various users and functions over their lifespan, ensuring their future use. (Geraedts, R., et al, 2014) There are three groups that could require to modify a building: the owner, users, and society. The AC technique prioritizes the adaptability of a structure during its operational phase, with the objective of identifying and converting requirements into three distinct levels: location, building, and units. (Geraedts, R., et al, 2014)

Decision-making and economic feasibility: Despite the seeming efficiency and profitability of adaptive reuse in most circumstances, it often proves to be an expensive solution, particularly when the region is contaminated or the buildings are hazardous and defective. The economic viability of reusing assets in such situations is determined by factors such as the assets worth, land value, and other economic conditions. The financial analysis may exert a more significant impact on the viability of one type of reuse compared to another. It is crucial to consider the increasing maintenance costs when planning budgets.

FLEX: Assessing a Building's Ability to Adapt

A building's adaptive capability encompasses all features that allow it to maintain performance in response to changing needs and conditions across its technical lifespan while being sustainable and financially reasonable. Market trends indicate a growing need for adaptability and environmental consciousness among building users and owners. The durability of a building's usefulness is strongly related to its adaptability and ability to meet changing user needs. In 2014, a method called FLEX 1.0 was introduced at the International Union of Architects World Congress. This method aims to measure the adaptable ability of buildings by utilizing a comprehensive set of 147 flexibility indicators, each with its corresponding assessment values. The approach integrated existing expertise on adaptability and ecological soundness. A total of 36 unique criteria were created to analyze the spatial and operational resilience of a building for its owner, along with 49 separate criteria established for assessing the structural and technological flexibility of the building. A total of 29 indicators were established to assess the spatial and functional flexibility attributes for building users, along with their respective values, while 33 indicators were created to evaluate the construction and technical flexibility characteristics. A total of 147 indicators were identified to evaluate the capacity for adaptation of a structure, considering the viewpoints of both landlords and tenants. (Geraedts, R., et al, 2014)

The double flexibility indications for both the building owner and user were merged and organized into five layers, resulting in the creation of FLEX 2.0. This instrument is now more accessible and user-friendly. The quantity of flexibility variables has been reduced from 147 to 83, categorized into five groups: Location, The framework, Skin, Services, and Space plan/Finishing.

FLEX 2.0 LIGHT was a modified iteration of FLEX 2.0. The lite variation was introduced at the CIB symposium in 2015. The objective of this version was to identify a restricted set of key indications. This strategy entails allocating scores to each evaluative aspect of flexibility indicators of achievement. This tool comprises a total of 17 indicators, making it a very efficient and user-friendly instrument for evaluating the adaptive capacity of a building. Each of the 17 indicators has been allocated a grade in relation to the others, varying from 1 (not significant) to 3 (very significant). Additionally, each indicator undergoes examination, is categorized into four levels (assessment level 1 - 4). A total Adaptability score is computed by adding the scores provided to each indicator. The minimum score is 17, while the maximum score is 204. (Geraedts, R., Matthijs, P., 2015)

The third iteration is the outcome of two distinct research initiatives, aimed at examining the status of educational institutions development. The findings were displayed at the CIB World Building Conference in Tampere in May 2016. (Geraedts R., Prins M., 2016). Carlebur, O. F. D. research in 2015 focused on office buildings, while that of Stoop, J. (2015) investigated educational structures. Experts in the educational industry identified and ranked 21 measures of flexibility effectiveness based on their importance. In contrast, the tool for office edifices implements "Transformation dynamics" and "User dynamics “rather of assigning some weight to the various flexibility indicators(Stoop, J.,2015) FLEX 3.0 is the production of the three previous versions of the FLEX approach, resulting in a total of 44 indications across several building layers. All 44 flexibility performance indicators can be used to evaluate the changes happening in a building, while 32 of them are specifically suitable for evaluating how users interact with the building. Further research is necessary to investigate the financial implications of implementing flexibility measures, particularly in order to persuade building owners and developers. Certain indications may necessitate lesser initial investments compared to others. An analysis of the correlation between investments and the level of adaptive capacity must be conducted to make a more informed decision regarding the financial commitment to invest in adaptive capacity.

The latest version of the framework, FLEX 4.0, shares similarities with FLEX 3.0 in terms of its structure, which is built upon three distinct components:

1. The FLEX 2.0 Light version featuring 17 indicators. (Geraedts, R., Prins, M., 2016).
2. An evaluation of the school premises carried out by Carlebur, O. F. D. (2015)
3. A comprehensive assessment of an office structures done by Stoop, J. (2015).

FLEX 4.0 is separated into two sections. The first section is referred to as generally relevant indicators, which includes indications that may be utilized for all types of buildings. The first category consists of 12 performance metrics related to flexibility, sometimes referred to as the support category. The second section of the evaluation table is labeled as "specifically applicable indicators." This categorization consists of 32 flexibility markers drawn from the activities seen in office and educational edifices, usually known as the infill categorization. (Geraedts, R., 2016) The assessment table is thoroughly described, including its layers and sub-layers.

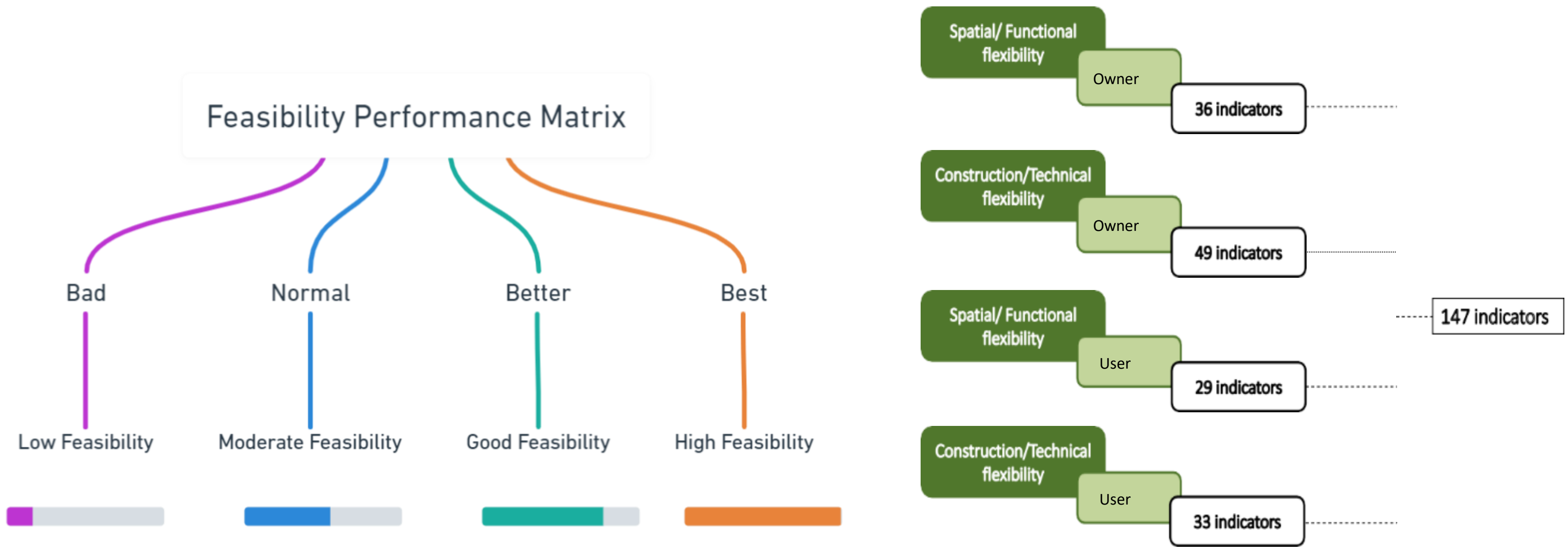


Fig.3.17. Flex 01(Geraedts, R., & Matthijs, P., 2015)

Table.3.2. Flex 02 Flexibility performance indicator and class table (Geraedts, R., & Matthijs, P., 2015)

Flex light 2.0				Weighting	Assesment value				Score
Layer	Sub layer	Nr	Flexibilty preformance indicator		Bad	normal	Better	Best	
1.Site/Location		01(2)	surplus of site space	1			3		3
2.Structure	2.1Measurment	02(5)	surplus of building space/floor space	2		2			4
		03(11)	surplus free of floor height	3				4	12
	2.2 Access	04(17)	acess of building:location of stairs, elevators	2	1				2
	2.3 Construction	05(21)	surplus of load bearing capacity of floors	3			3		9
		06(29)	Extendible building / unit horizontal	3		2			6
		07(30)	Extendible building / unit vertical	1	1				2
3.Skin	3.1 Façade	08(42)	Dismountable facade & control	3				4	12
4.Facilities	4.1 Measurement & control	09(53)	Customisability and controllability of facilities	2	1				2
	4.2 Dimensions	10(56)	Surplus facilities shafts and ducts	2	1				2
		11(57)	Surplus capacity of facilities	3	1				3
		12(65)	Disconnection of facilities components	2			3		6
5.Space plan/Finishing	5.1 Functional	13(70	Distinction between support - infill (fit-out)	3		2			6
	5.2 Access	14(73)	Access to building: horizontal routing, corridors, gallery	1		2			2
	5.3 Technical	15(77)	Removable, relocatable units in building	3	1				3
		16(78)	Removable, relocatable interior walls in building	3			3		9
		17(79)	Disconnecting/detailed connection interior walls; hor/vert.	3				4	12

Total adapdability score	95
Adapdavity class	3

Class Table Adaptivity score	Score Range
Class 1: Not adaptive	17-54
Class 2: Hardly adaptive	55-92
Class 3: Limted adaptive	93-130
Class 4: Good adaptive	131-168
Class 5: Excellent adaptive	169-204

Table.3.3. Flex 03 Illustration of the table assembling: The comprehensive integration of the three designed devices to evaluate the adaptive ability of buildings, encompassing a total of 44 flexibility performance characteristics. (Geraedts, R., & Prins, M., 2016)

FLEX 3.0: COMBINATION OF 3 ADAPTABILITY ASSESSMENT INSTRUMENTS				INSTRUMENT			DYNAMICS		
LAYER	Sub-layer	Nr	Flexibility Performance Indicator	1. Light	2. Schools	3. Offices	T	U	
1. SITE		1	Surplus of site space	x			x		
		2	Expandable site / location		x	x	x		
		3	Multifunctional site / location			x	x		
2. STRUCTURE	Measurements	4	Surplus of building space / floor space	x	x	x	x	x	1
		5	Available floor space of building			x	x	x	
		6	Size of building floors			x	x	x	
		7	Surplus free of floor height	x	x	x	x	x	2
		8	Measurement system; modular coordination		x		x	x	
		9	Horizontal zone division / layout			x	x	x	
	Access	10	Access to building: location of stairs, elevators, core building	x	x	x	x	x	3
		11	Presence of stairs and/or elevators			x	x	x	
		12	Extension / reuse of stairs and elevators			x	x	x	
	Construction	13	Surplus of load bearing capacity of floors	x		x	x		
		14	Shape of columns			x	x	x	
		15	Positioning obstacles / columns in load bearing structure		x	x	x	x	
		16	Positioning of facilities zones and shafts			x	x	x	
		17	Fire resistance of main load bearing construction			x	x		
		18	Extendible building / unit horizontal	x	x		x		
		19	Extendible building / unit vertical	x	x		x		
		20	Rejectable part of building / unit horizontal		x		x		
		21	Insulation between stories and units			x	x	x	
3. SKIN	Facade	22	Dismountable facade	x		x	x		
		23	Facade windows to be opened		x	x	x	x	
		24	Day light facilities		x	x	x	x	
		25	Location and shape of daylight facilities		x		x	x	
		26	Insulation of facade			x	x		
4. FACILITIES	Measure & Control	27	Measure and control techniques			x	x	x	
		28	Customisability and controllability of facilities	x	x	x	x	x	4
	Dimensions	29	Surplus of facilities shafts and ducts	x	x	x	x	x	5
		30	Surplus capacity of facilities	x		x	x	x	
		31	Modularity of facilities		x	x	x	x	
	Distribution	32	Distribution of facilities (heating, cooling, electricity)			x	x	x	
		33	Location sources of facilities (heating, cooling)			x	x	x	
		34	Disconnection of facilities components	x	x		x	x	
		35	Accessibility of facilities components			x	x	x	
		36	Independence of user units			x	x	x	
5. SPACE PLAN	Functional	37	Multifunctional building		x		x		
		38	Distinction between support - infill (fit-out)	x	x	x	x	x	6
	Access	39	Access to building: horizontal routing, corridors, gallery	x	x	x	x	x	7
	Technical	40	Disconnectible, removable, relocatable units in building	x	x		x		
		41	Disconnectible, removable, relocatable interior walls	x	x		x	x	
		42	Disconnecting/detailed connection interior walls; hor/vert.	x		x	x	x	
		43	Possibility of suspended ceilings			x	x	x	
		44	Possibility of raised floors			x	x	x	
				17	21	35	44	32	

3.4. Examples of adaptive re-use of industrial buildings.

1. The Bankside Power Plant: was a former facility for generating electricity positioned at the southern shore of the River Thames, in the Bankside region of the Borough of Southwark, London. It produced energy from 1891 to 1981. Starting from year 2000, the building has been utilized as a venue for the Tate Modern art museum and gallery.

Fig.3.18. Bankside Power Platform, London, England, about 1985 which was subsequently transformed into the Tate Modern art exhibition. https://en.wikipedia.org/wiki/Bankside_Power_Station#/media/File:Bankside_Power_Station.jpg

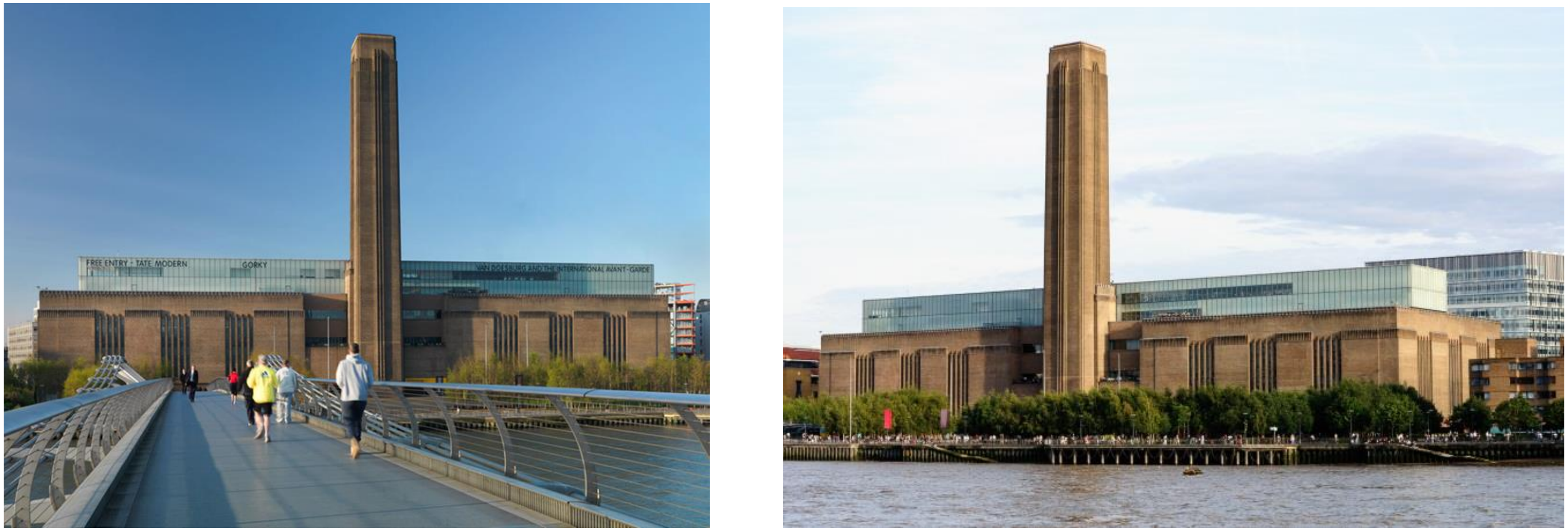


Fig.3.19. The actual Tate Modern museum.

https://brownandmason.com/projects/bankside-power-station-current-tate-modern/

2. The gasometers: are four decommissioned gas storage tanks, each with a capacity of 90,000 m³. They were constructed between 1896 and 1899 as a component of the Vienna municipal gas works, known as Gaswerk Simmering. These tanks were utilized as gas storage containers from 1899 to 1984. Following the transition from town gas to natural gas from 1969 to 1978, the facilities were rendered obsolete and were deactivated. Only the facade's brick external walls were maintained. Vienna initiated a renovation and rejuvenation of the preserved landmarks and in 1995 solicited proposals for the structures' new utilization. The selected designs were finalized from 1999 to 2001. The gasometer was partitioned into distinct sections, with residential flats occupying the upper levels, working offices situated on the middle floors, and entertainment and shopping facilities located on the ground floors. The shopping mall levels within each gasometer are interconnected by skybridges. The venerable external wall was preserved

Fig.3.20. Gasometers, Vienna 1932 Fig.3.21. Gasometer city, Vienna 2016
https://www.google.com/imgres?q=Gasometers%2C%20Vienna%201932&imgurl=http%3A%2F%2Fwww.wiener-gasometer.info%2Fimages%2Fhistorisch%2Fgasometer6.jpg&imgrefurl=https%3A%2F%2Fwww.reddit.com%2Fr%2FArchitecturePorn%2Fcomments%2F5kkpj2%2Fgasometer_town_vienna_c1899_converted_2001%2F&docid=VKcWYGQJPkAZjM&tbnid=77F5-cnkH1xB8M&vet=12ahUKEwiI_emgheKJAxWnR6QEHcEZCtEQM3oECEwQAA..i&w=550&h=295&hcb=2&itg=1&ved=2ahUKEwiI_emgheKJAxWnR6QEHcEZCtEQM3oECEwQAA

3- The Studio Macola project: is integral to a plan aimed at revitalizing a previous manufacturing location on Murano Island. The newly constructed condominium buildings (A. 36 apartments, B. 18 apartments) are constructed within the repurposed manufacturing facility, portions of it are retained. This residential units' endeavor aligns with the existing urban fabric of the neighborhood.

Fig.3.22. Studio Macola in Venice Italy which is renovated residential edifice.
https://www.archdaily.com/779040/residential-building-refurbishment-studio-macola/5673782ee58ece85c7000085-residential-building-refurbishment-studio-macola-photo?next_project=no

4- **Leszno project:** entails the repair and expansion of three old farm structures at the Leszczynski Antoniny manor to transform them into a hospital and housing campus for the elderly. This building compound comprises also a rehabilitation facility that offers medical care, complemented by hotel and a restaurant, aesthetic activities, an underground parking garage, and all necessary infrastructure.

Fig.3.23. healthcare facility, residential accommodation, adaptive repurposing Leszno, Poland.
https://www.archdaily.com/781567/leszczynski-antoniny-manor-intervention-na-no-wo-architekci

5- The Domino Sugar Refinery was constructed to integrate three operations within three interconnected structures: the filtration, panning, and refining of sugar. In 2017, PAU developed plans for the renovation of the Refinery building. PAU implemented a strategy by integrating a new edifice within the existing framework, maintaining a 10- to 12-foot separation between the recently constructed and the prior structure.

Fig.3.24. Adaptive repurposing of Domino Sugar Refinery, Brooklyn, United states into commercial real estate and office edifices.

https://www.archdaily.com/1007905/domino-sugar-refinery-pau

Chapter 4

Tracing the Roots: The Evolution of Conservation Practices and Industrial Heritage in Egypt

4.1 Development of conservation concept and legalizations in Egypt

Prior to the renaissance and the appearance of the notion of "cultural legacy," civilizations in the Middle East, particularly Egypt, had cultivated an awareness to identify and delineate their heritage as "memory." This was manifested through the principles and customs that characterized the different dynasties or specific communities. (Szmelter, I., 2013) The practice of restoring monuments has been a longstanding tradition in Egypt, encompassing the ongoing maintenance of these structures. Nevertheless, the practice of conservation, in its scientific sense, was not implemented in Egypt until the present century. (Price, N., et al., 1996)

Ancient Egyptians possessed knowledge and employed many preservation procedures and techniques, which were mostly utilized in significant locations such as funerary temples and artefacts. Our knowledge regarding these enigmatic procedures and the materials employed is limited. However, historians are aware that the intention was to establish a specific ambiance and establish a connection with their tombs. The maker's intention is clear: they want the preservation of all items to aid them in the afterlife. According to Keck (1996), the concept of "eternity" motivated them to store things in pristine condition after being repaired, prior to burial. Another significant tenet in preservation was the stringent safeguarding against deliberate harm by rival sovereigns or criminals.

Following the ancient Egyptian dynasties, the Islamic period represents another epoch of preserving cultural heritage. During the Mamluk era in Egypt, Muslim monarchs gained significant influence and as a result, several types of public buildings were constructed around the Islamic capital, Cairo. This typology is known as "Waqf," which is exclusive to Muslim countries and is primarily focused on sustainability. The non-profit Al-Awqaf institution, oversees Waqf assets in Muslim nations, and its designated guardians will ensure the safety and proper maintenance of any structure so long as it consistently fulfils its designated purpose and serves individuals without hindrance. The concept of Waqf ensures that architects are always available to address any issues and carry out frequent restoration work. (El-Murri, T., 2019) The scientific discussion of the conserving activities done by this typology was originally introduced in the Lahore charter in 1980.

There exist three categories of Al-waqf-:

1. User-initiated Waqf, such as the establishment of graveyards.

2. Waqf under the concept of "Mashrutul-Khidmat" (in the context of providing a service). It comprises 93% of the total Islamic heritage structures, it is characterized by its ability to generate a consistent income and financial support. These buildings are designed to serve a specific purpose, such as a Wikala or Kuttab, and can also be adapted to accommodate additional functions in order to enhance their income-generating potential.

3. Waqf established by a donor for the welfare of their relatives. This type is typically reliant on and receives funding from the second type. This particular sort of structure possesses a static purpose and remains unaltered, similar to a mosque or Sabil (Hathaway, J., & Barbir, K. K., 2008).

The preservation of national monuments in Egypt thrived throughout the Mamluk era in response to important events that inflicted substantial harm upon notable structures. Tarek el Murri, a cultural conservation expert, stated that Egypt has three primary commissions specifically focused on restoration. (El-Murri, T., 2019)

The initial commission was initiated by the Mamluk Soultan El-Nasir Mohammed Ibn Qalawun during the period of 1310-1341. Following an earthquake during that time, he issued a directive to repair the majority of the damaged structures. He established the "Diwan Al-Emara" administrative body to oversee the construction projects and founded "The Rawk." His restoration endeavors encompassed the al-Nasiri Mosque and the reconstruction of the Rashidah mosque. (Al-Harithy, H., 2000) The second restoration took place from 1481 to 1482 during the rule of the Mamluk Soultan Qaytbay. During this period, Qaytbay made significant contributions to the restoration efforts in Egypt and Palestine.

The third event occurred in 1750 when Abdulrahman Katkhuda, a highly skilled architect of his era, initiated a drive to renovate damaged buildings in Cairo and expand the Al-Azhar Mosque. (El-Murri, T., 2019)

The process of colonizing and modernizing Egypt had a profound influence on the population's mindset and the strategies employed for conservation in the country. (Mahdy, H., 2017).

Napoleon's incursion into Egypt from 1798 to 1801 involved the enlistment of 150 scholars from many disciplines to conduct a "scientific expedition". They successfully created accurate renderings and illustrations for extraordinary architectural structures and natural environments. The commissioners collaborated with the Egyptian aristocracy, who possessed a cultural awareness together with orientalist perspective, supported the restoration and maintenance of buildings in Islamic Cairo.

Mohamed Ali's dynasty was marked by his aim to transform Cairo into a modern nation-state through extensive urban projects. This was a continuation of Napoleon's efforts to alter the traditional identity of the country. Two substantial modifications were implemented that fundamentally transformed the cityscape. The initial change involved the construction of a broad boulevard that across the historical core of the city, resulting in the demolition of numerous monuments and buildings. The second action involved the discontinuation of the conventional management of "Al-wqaf" and the implementation of a new centralized management system called "Public Work." So, the government rendered Al-wqaf structures inactive, leading to their decline and disconnection from their neighborhood. Gradually, these buildings depreciated in societal significance and were neglected by successive governments, including the secular ones. (Haysam, N., 2012)

The establishment of the "Comité de conservation des monuments de l'Art Arabe" in 1881 was a watershed moment in the repair of historic structures. The institution was responsible with preserving heritage edifices. The majority of the committee members were Europeans, and their European perspective influenced their approach to Islamic heritage. The orientalist perspective dominated during the colonial era and persisted for about 80 years. (Mahdy, H., 2017) According to Tarek El-Murri, the committee adhered to the restoration method of "in style of". They defended the superiority of Viollet-le-Duc's restoration theory over preservation, disregarding authenticity, the importance of buildings' function, social, and cultural qualities. (El-Murri, T., 2019) Egyptian workers in the committee who used to serve as assistants to foreigners lacked a deeper understanding of the underlying knowledge and philosophy behind their work resulting in a detrimental impact on certain buildings. (Aslan, Z., 2016)

Gamal Abdul-Nasser formed a new nation that embraced secularism and promoted the values of the "pan Arabism" era. The secular minority ascended to power and exacerbated the rift between the religiously motivated traditional lifestyle and the more formalized modern lifestyles. Nevertheless, the well-educated minority substituted the European members of the committee; the management system remained unchanged, and they adhered to the identical strategy. So, as a result of these governmental interventions and limited financial resources, the historic Cairo suffered further deterioration and neglect.

An event of great significance in Egyptian history that had a further detrimental impact on the preservation of legacy in Cairo was the war in 1965, which resulted in the forced displacement of the indigenous population living near the Suez Canal. The authority allocated the households migrating from Sinai to various residences in historic Cairo. As a result, the restoration efforts came to a complete halt until the mid-1980s.-[Mahdy, H., 2017]

The establishment of national administrations began during the colonization period. The initial national institution dedicated to the preservation and renovation of historical structures was the "agency of antiquities". The agency was founded in 1858 by Said Pasha, an Ottoman viceroy of Egypt. For over a century, it was overseen by French administrators until 1953. Its primary objective was to regulate the illegal trade of Egyptian antiquities. Following the revolution in 1952, Egyptian members assumed control of the agency, which subsequently came within the authority of the Ministry of Culture from 1960 to 1971. During this period, the Egyptian members decided to rename it as "the Egyptian Antiquities Authority." In 1994, the "supreme council of antiquities" was founded, operating under the minister of culture. (Haysam, N., 2012) According to UNESCO (2010), the Supreme Council of Antiquities (S.C.A.) established two permanent committees. One committee concentrates on artifacts of medieval Egypt, Greece, and Rome, while the other focuses on landmarks of Islamic, Coptic, and Jewish heritage. In 2011, the supreme council of antiquities gained autonomy and established the "ministry of antiquities" with Zahi Hawwas, an Egyptian archaeologist, serving as Egypt's inaugural minister of antiquities.

As per Law No.117 of 2010, a monument or historic building can be classified as an "antiquity" if it is a result of Egyptian civilization or any other civilizations that have contributed to art, science, literature, or religion on Egyptian lands since prehistoric times up until 100 years ago, especially if they possess archaeological, artistic, or historical importance. (The Antiquities' protection Law no.117. 2010) However, following the listing process, the supreme council of antiquities possesses the authority to remove a listed building from the list, either in its entirety or in part. The lack of cooperation between the administrations and the ambiguous listing process leads to confusion and uncertainty when evaluating and perceiving historical buildings, particularly in relation to their age and worth.

Specifically, when classification is applied to buildings that are less than 100 years old. These buildings are supervised by the "civilization coordination service." However, after they reach 100 years, they are transferred to the ministry of antiquities in accordance with Egyptian law. This provides an indication of the age of the structures that can be readily renovated and repurposed, as well as those that are too antiquated to be operational. (Abdul-Aziz Osman, 2018). To further control and protect Egypt's modern architectural legacy, two more statutes were passed in twentieth century.

1- The law referred to as Law No. 119 of 2008 (unified building law) is a comprehensive legislation that:

- Standardizes the regulations and procedures for dealing with all heritage structures.
- Employs a consistent approach and evaluation process that prioritized the inclusion of historical houses based on their structural soundness, resulting in numerous neglected properties that are at risk of being legally demolished.

2- The legislation known as "Law No.144 of the year 2006" pertains to the demolition of buildings that are not at risk and the preservation of architectural heritage. There is an ambiguity in this law-that enables owners or investors to improperly use their registered heritage buildings. They take use of the law to remove these buildings from the heritage list or unlawfully demolish them, using the excuse of "unsafe structure". Consequently, a significant number of about 1163 historical structures in the western and central parts of Cairo were destroyed, despite their status as well-preserved residential villas and palaces with significant architectural and societal importance. (Riyad, H., 2018) Furthermore, these rules lack clarity about the allocation of responsibilities for acts such as site delimitations, regulation of preserving urban and architectural characteristics, and the implementation of protective measures for each site. (urhcproject.org, 2014).

The National Organization for Urban Harmony (NOUH) Authority, a leading organization in Egypt that specializes in conservation, was created in 2001. (Nassar, D., 2016) The primary objective of NOUH authority is to reduce the disparity between the legislations and the community, and to define the city's identity by enacting rules and regulations pertaining to the preservation of heritage structures. The obligations of NOUH, as stipulated by statute No. 119/2008, are as follows: (Nassar, D., 2016).

- Implementing visual standards to ensure the aesthetic appeal of urban areas and supervising construction projects.
- Compile comprehensive documentation of all buildings possessing aesthetic value and establish regulations to govern their preservation plans.
- Compile an inventory of structures that warrant classification as heritage sites.
- Enforce strict regulations to prevent encroachments and infringements in urban areas and historic structures.
- Implement regulations for urban open space planning and ensure the preservation of the original design of historic squares.
- Adhere to global standards when it comes to regulating pedestrian areas and ensuring accessibility for individuals with physical disabilities.

- Enforce regulations regarding street signage, advertisements, and building exteriors.

-Amend the legislation and tackle rules that contribute to the attainment of urban harmony.

NOUH also attempted to establish a categorization of patrimony based on the degree of intervention, however their classification is rather broad and lacking specificity:

- Class A: This category requires restoration, with only minor alterations allowed in the interior or exterior.
- Class B offers a certain degree of flexibility for making alterations and improvements to the inside.
- Class C refers to a level of flexibility that allows for either the demolition of buildings while preserving the outside structure, or the retention of merely the major exterior façade with a rehabilitation plan, or the complete renovation of the inside of the building.

One of NOUH's specific recommendations is to identify urban regions based on their important buildings and suggest a conservation strategy for them. These valuable sites are always unregistered or unlisted, making them more susceptible to vandalism and demolition. (Mohiey Eldin and Abo-Ghazala 2010).

The quandary of who is accountable for this inheritance has been deteriorating. Currently, the ministry of al-wqaf possesses 80% of the heritage buildings included in the national inventory, which make up 40% of all the historic assets in Cairo. (Haysam, N., 2012) The ministry of Al-wqaf is not participating in the regeneration programs conducted by the UNESCO heritage center in Cairo. The ministry asserts its ownership of the buildings, but the ministry of antiquities is the responsible for their conservation plans. (Hassan, Y., 2017) The Al-wqaf ministry is currently still embracing the unfavorable mindset of conservation methods from the 19th century. The Cairo Heritage Preservation General Administration, founded in 2013, is responsible for overseeing conservation initiatives in historic Cairo. However, its jurisdiction is significantly restricted when it comes to heritage structures recognized under Al-Awqaf. The lack of administrative continuity and constant partnerships among the many parties exacerbates the situation. [Hassan, Y., 2017]

The presence of numerous unrelated laws and institutions, all of which had shared obligations, and lack of continuous coordination among them, in addition to the state's vulnerability especially after the revolution in 2011, facilitated the exploitation of the legacy by individuals. Numerous historical structures have been subjected to acts of vandalism, deliberate fires, and even demolition. So, during the period from 2011 to 2014, Egypt experienced a loss of around 75% of its heritage structures. (Team, T., 2019) Moreover, the revolution led to prolonged periods of social and political instability, with complete halt in funding and termination of foreign commissions leaving several projects incomplete. (Aggour, H., 2017) In addition to the civil instability, Egypt has witnessed a significant number of illicit buildings. The regulations and rules proved ineffective in preventing the unauthorized encroachments and construction activities in historic districts, particularly in Cairo. (Fahmy, H. and UNESCO, t., 2013)

Recently, in an effort to strengthen its economy, Egypt sought to rely on tourism and implemented an ambitious privatization strategy for national properties, which included valuable and historically significant structures. Real-estate corporations are increasingly interested in purchasing heritage buildings in order to implement comprehensive conservation plans and repurpose them. For numerous significant structures, this presents an opportunity for their preservation and reintegration into everyday existence, contingent upon the establishment of comprehensive guidelines for their proper restoration. In fact, law No. 114/2006 permits the leasing and sale of heritage sites to both Egyptian citizens and non-Egyptian individuals. However, there are currently no rules in place that regulate the levels of intervention and the parties responsible for carrying out these interventions. (Abdul-Galil, H., 2018) The current committee from the ministry of antiquities in Egypt is recommending for the potential utilization of heritage palaces situated in various governorates. The committee aims to transform these palaces into boutique hotels, cultural centers, or tourist attractions, with the primary objective of generating greater economic income. As a part of the effort to restore and renovate historic Cairo, the government ministries are relocated to the "new capital" and the currently occupied administrative palaces are vacated. The presidential residences are seen as a "mild economic force". The debate concerns the capacity of the internal structure of these palaces to adapt to and support new innovative purposes. (El-Dakhakhny, F., 2018)

However, there are still numerous historical buildings in all Egyptian governorates that have not been officially documented or recognized, and remain unknown to the general public. The majority of these buildings have been used for other purposes that may not be ideally suited to their original design. (Salama, M., 2018). So recently, UNESCO issued warnings and provided advice to the Egyptian authorities, urging them to cease the activities of destruction, looting, and illegal construction. Even, it issues a warning to remove historical Cairo from the global Heritage list due to the deterioration of its urban structure caused by neglect, particularly following the inspection conducted by the global heritage committee in 2017. (The news, 2018)

One of the significant but often overlooked challenges in conservation in Egypt is the process of identifying the value of cultural heritage. The challenge arises from the ongoing disagreement between the involved groups and individuals, as well as the absence of historical records and papers, in addition to the inadequately qualified professionals who are unable to accurately assess the value of historical structures. Riegl proposed two classifications of values: "paste values" and "present values." According to him, when a building reaches the age of 60, it acquires an "age value." But he evaluated buildings not only based on their age value, but also considered their contribution to multiple values. Present value is determined by the evolving preferences of the community, the relative worth of art, and the expectation that a building could serve practical purposes or could be updated or reconstructed in order to appear new. (Lamprakos, M., 2014)

As per the New Zealand charter, authenticity refers to the reliability and veracity of the existing evidence and the awareness of the cultural importance of a location. The assessment of authenticity relies on the discovery and analysis of pertinent facts and information pertaining to its cultural context. (ICOMOS, 2010) Authenticity ensures the continued existence of intangible heritage, such as traditions, customs, and skills, by identifying and emphasizing them in a well-designed conservation plan that makes their preservation achievable. (Alho, C., et al., 2010) The lack of techniques for assessing the qualities of buildings or monuments has produced a significant gap in determining their authenticity. Despite the development of many authenticity criteria by multiple conservation entities over the years, these criteria cannot be applied without first identifying the values. The study "Authentic criteria in the conservation of historic buildings" successfully developed a scientific indicator of five components, namely: material, design, workmanship, setting, in addition to the "function/use" aspect, which is closely linked to social activity and intangible heritage. (Alho, C., et al., 2010) Egypt was trying to register and submit the authenticity standards, along with the other documents, to UNESCO. Nevertheless, this initiative was discontinued during the 2011 revolution, mostly due to a dearth of competent and professional conservators and stakeholders accountable for the preparation of these records. (El-Murri, T., 2019) The lack of clarity and uniformity in the regulations related to historic conservation led to several issues among the different directorates undermining their effectiveness. (Fahmy, k., 2012) The laws are formulated based on economic and political perspectives, but they fail to address the practical needs of the community and its development plans. (Abdul-Aziz Osman, K., 2018) Furthermore, any comprehensive conservation plan should incorporate scientific examination, insights from past projects, and international initiatives. The progress of restoration is contingent upon the public's response to its accomplishments, (Philippot, 1996). So, this methodology seeks to include the local stakeholders, who are typically overlooked in conservation efforts in Egypt.

Despite the historical development of authorities and formal institutions responsible for conservation management in Egypt, they have not yet achieved a clearly organized framework comparable to international standards.

Architecture pertaining to industrial structures.

The existence and continuation of industrial production relies heavily on interconnected global networks of knowledge, financial resources and the widespread distribution of goods through various locations. This distribution is facilitated by transportation and mobility infrastructures and practices.

The decrease in industrial output at numerous original sites has resulted in the rise of an entirely novel potential and significant responsibility in many cities and regions globally to convert and reuse these historical industrial complexes.

The development and preservation of industrial heritage have been influenced by both national and international factors and agendas. The acknowledgment and handling of industrial heritage sites, including their safeguarding and adaptive repurposing, are closely linked to the promotion of consciousness, strategic planning, and preservation methods, as well as community involvement. The preservation of contemporary industrial legacy includes not only technological and architectural advancements made by various industries, but also acknowledges that factories and infrastructures have for centuries and is still currently exerting a crucial role in many metropolitan regions and should be recognized as valuable assets in promoting sustainable development. Several European countries have previously classified and reused several manufacturing heritage structures, yet the erosion of this legacy is equally frequent (Meyer et al 2022)

Middle Eastern and North African historical industrial sites show how the Global North and Global South traded goods and ideas productively in the last decades of the nineteenth and early twentieth centuries. Scientists had devoted minimal consideration to the region's industrial history, which is a prime example of a contentious legacy on a worldwide scale. Historical industrial structures have a significant impact on the local settings of Middle Eastern cities today and can be advantageous to local communities through efficient development and re-utilization. Nevertheless, as a result of the exponential increase in population and the expansion of municipal boundaries, industrial heritage sites have been frequently situated in strategic areas for urban rehabilitation initiatives. However, the relative youth of these industrial buildings and a lack of valuing modern architecture, particularly when compared to the abundant historical structures in the area, appear to hinder a more extensive discussion about preserving and utilizing these buildings. As a result, the remaining structures and the cultural significance they represent are now at risk of decay, either from neglect or deliberate destruction to accommodate new urban projects.

Egypt, for example, has only recently begun to understand its industrial past. The preservation of industrial historic sites in Egypt presents considerable challenges, demanding the development of novel conservation strategies. There are strong ancestral connections between Egyptian and European contemporary manufacturing legacy. These connections could help current and future cooperation efforts to protect and utilize these assets. The significance is to raise awareness of Egypt's industrial legacy and advocating for the establishment of a government-backed organization to organize the recording, preservation, and marketing of models aimed at rescuing Egypt's industrial heritage from its current state of neglect.

4.2. Industrial structures in Egypt

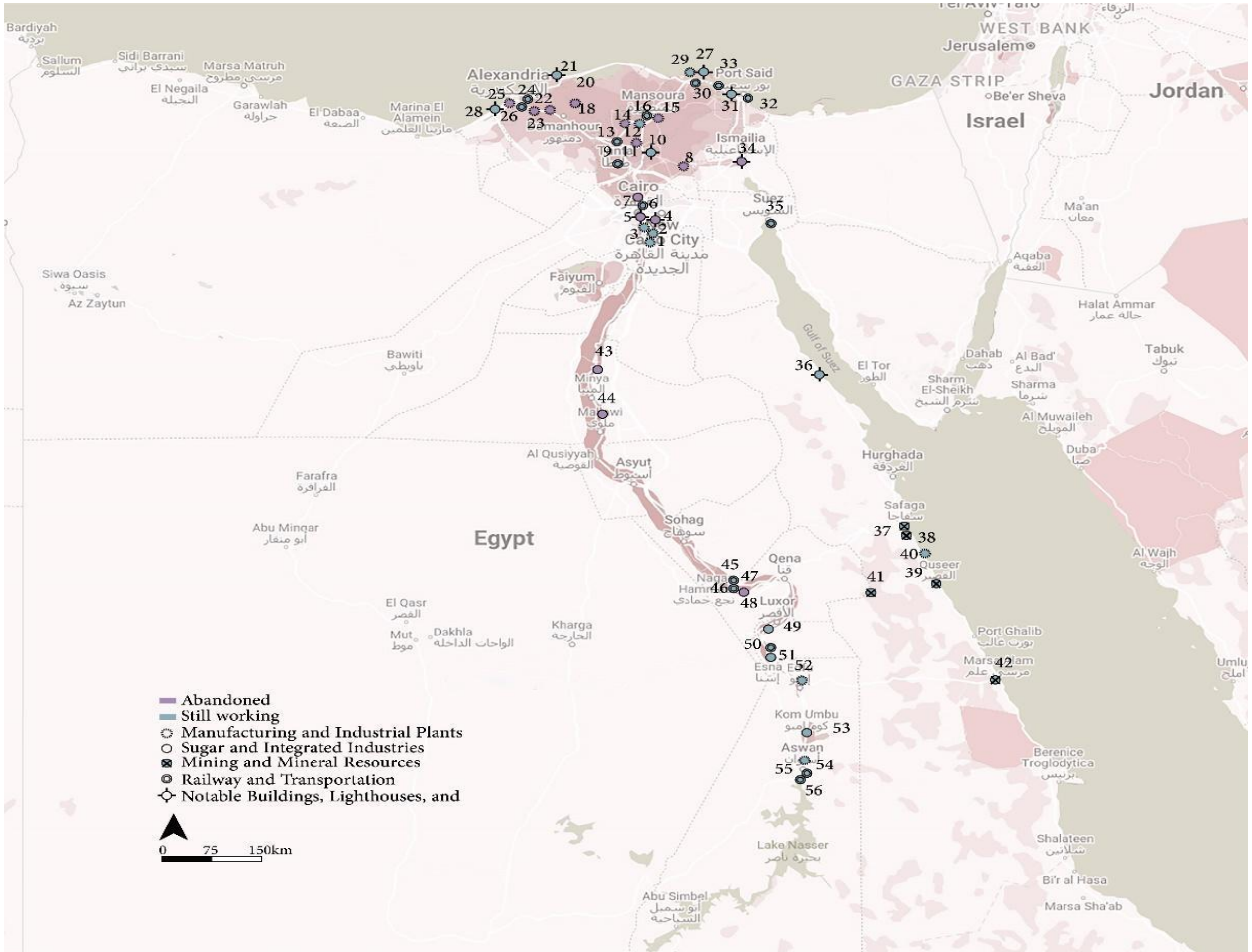


Fig.4.1. The map is displaying the locations of industrial sites that have been documented in Egypt. (Elaborated by author)

Cairo Area

1- Iron and steel manufacturing facility in Helwan
2- Victory Automobile Assembly Factory located near Helwan
3- Masr Sugar and Incorporated Industrial Organization (Hawamdiya, Giza)
4- The currency Home (Mohamed Ali Fortress, Cairo)
5- Home of Kaaba Drape Production in Khurunfish
6- Ramses Train terminus (Cairo)
7- Victory Ceramic and Gemstone Enterprise

Delta Area

1- Egypt Cotton Spinning Factory (Zaqaziq)
2- Egypt Shebin El Kom Knitting and Textile Company
3- North Delta Electrical Supply Agency (Mit Ghamr)
4- Zefta Bridge (Met Ghamr - Dakahlia)
5- Tanta Oil and Soap Factory
6- Tanta Railroad terminus
7- Egypt Textile and Knitting Industry (El Mahalla El Kobra)
8- Egypt Cotton Spinning Factory (Mansourah)
9- Mansoura Railroad Bridge
10- Mohamed Ali Cotton Mill in Fowa
11- Fez industry (Fowa)
12- El kanater El Khaireya Cotton Mill

13- Edfena Aqueducts
14- Rasheed Pharos
15- Egypt Knitting and Textile Factory Sabbaghy El-Bayda, Kafr El-Dawwar
16- El Siouf Knitting and Textile Enterprise
17- Sidi Gabr Train terminus
18- Cotton Makbas Masr, Makbas EL-Nasr, and MakbasEL-Tarīkh.
19- Qabbary Train terminus

Suez Canal and Red Sea Areas

1- Ras El Bar Pharos
2- Ezbet El Borg Pharos
3- Edfina Facility for Conserved Foodstuffs (Ezbet El Borg - Damietta)
4- Damietta Railroad Viaduct
5- The Port Said Pharos
6- Port Said Navy Arsenal
7- Suez Canal Administration edifice (Port Said)
8- Mansion Ferdinand de Lesseps
9- Suez Canal Directorate Headquarters (Suez)
10- Ras El Bar Pharos
11- Safaga Mining Dock (Abu Tartour)
12- Safaga Phosphate Factory Employees' Residents (Umm Al Huwaytat)
13- Victory Mining Industry (Hamrawein Port)

14- Victory Mining Industry (Phosphate Company in Al Quseir)

15- Misr Mining and Resources Development Organization (Al-Fawakher Goldfield)

16- Al Dakkak Gold Refinery (Marsa Allam)

Upper Egypt Area

1- Masr Sugar and Incorporated Industrial Enterprise (Matai, El Meniaa)

2- Masr Sugar and Incorporated Industrial Enterprise (Abou Kourkas, Minya)

3- Nagaa Hammady Aqueducts

4- Nagaa Hammady Viaduct

5- Masr Sugar and Incorporated Industrial Enterprise (Nagaa Hammady, Qena)

6- Masr Aluminum Factory Egyptalum (Nagaa Hammady, Qena)

7- Masr Sugar and Incorporated Industrial Enterprise (Armant, Luxor)

8- Esna Barrages

9- Masr Sugar and Incorporated Industrial Enterprise (Waburat Al Matanah, Luxor)

10- Masr Ferro Alloys Factory – EFACO (Edfu - Aswan)

11- Masr Sugar and Incorporated Industrial Organization (Kom Ombo, Aswan)

12- KIMA - Masr Petrochemical Factories

13- Aswan Low Dam

14- Aswan High Dam

Egypt was among the pioneering countries in the Middle East to create extensive contemporary industries. The procedure began in the beginning of the nineteenth century, during the leadership of Mohammed Aly Pasha (from 1805 to 1848), and Egypt continues to be a nation with a strong and diverse manufacturing field. Egypt's contemporary industries are distinguished by their many sectors and their dispersal across the country. In addition to its historical, technological, socioeconomic, and sociopolitical elements, its worth is attributed to their different architectural designs and urban layouts. Egypt, similar to other nations that have an extensive heritage of industrialization, has a significant and intriguing legacy of industrial architecture. Unlike the industrialized nations, particularly those in Western Europe and North America, this legacy was not thoroughly documented or investigated. Nonetheless, only a few studies have examined the architectural characteristics of the 19th century's industrial sector, particularly those of the Mohammed Aly era. This could be attributed to the growth of Islamic art and architecture history, which includes 19th-century material culture. Thus, few considerations for the preservation or repurposing of industrial structures from the nineteenth and twentieth centuries are accessible.

4.2.1. Industrialization during Mohammed Aly Pasha

1- Bulaq arsenal (Cairo)
2- Citadel aesenal (Cairo)
3- Silk spinning and weaving factory (Cairo)
4- cotton-spinning and weaving factory (Cairo)
5- Linen factory and the renowned tarbush (fez) plant (Fuwwa)
6- Rosetta arsenals (Alexandria)

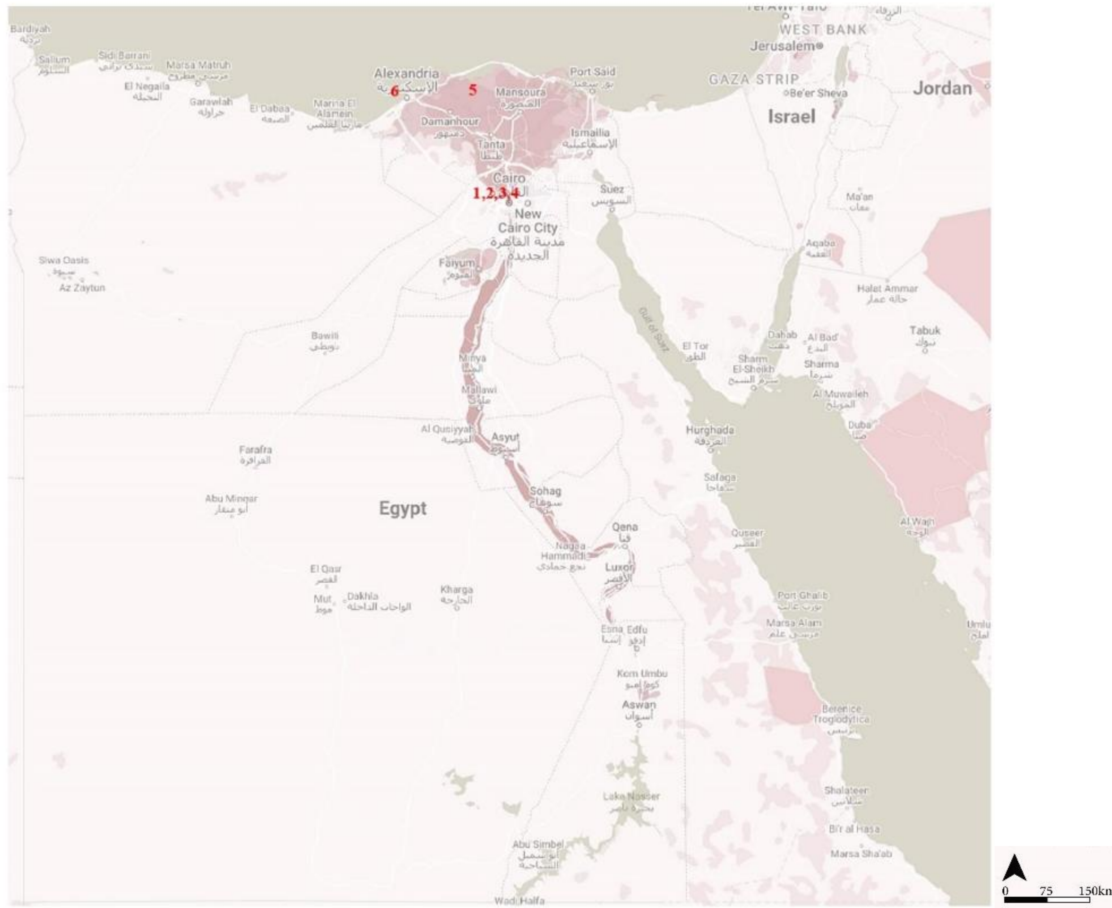


Fig.4.2. Industrialization during Mohammed Aly Pasha (Elaborated by author)

The onset of Egypt's initial phase of industrialization may be traced back to the time frame from the middle of the 1810s to the end of the 1830s. Originally, it was intended to assist Mohammed Aly in his efforts to develop a contemporary military force. However, by the 1820s, its focus had switched to reducing reliance on foreign manufactured goods. (Roger Owen, 1993) His primary aim was establishing direct control of Egypt's resources. As a result, Mohammed Aly gained complete control of textile manufacturing in cities, forcing the closure of minor workplaces and coercing artisans to operate in his manufacturing facilities. He strengthened his influence over rural agriculture and commerce, the sugar business, and significant portion of the construction sector. Additionally, he was engaged in a rapid construction campaign of factories, receiving significant assistance from foreign experts and advisors recruited from France, Italy, and other countries. In 1810, he founded an arsenal in Bulak, a port suburb of Cairo, for ship building and metal manufacturing. Around 1815, he also established a second arsenal in the citadel of Cairo for manufacturing weapons and military equipment. In 1816, he established the garment industry for silk whirling and looming located in the al-Khurunfush neighborhood of the historic Cairo. Soon after, the establishment of more textile industries, as well as facilities for bleaching and printing were launched in Cairo and many other locations. One notable establishment was a cotton-spinning and weaving factory near Bulak known as "Fabrikat Malta," named for the Maltese background of the skilled employees. (Al-Asad, M.2010) After the efficient implementation of cotton with a lengthy fiber, also known as "Jumel" in 1820, Mohammed Aly instructed the establishment of the establishment of 14 further cotton plants in the Delta area from 1821 to 1826, and 9 in Upper Egypt from 1827 to 1828. (Owen, Roger. 1993) Additional textile manufacturing facilities were established for the production of wool, silk, linen, and felt. Among these facilities were the Fuwwa linen factory and the well-known tarbush (fez) industry, both constructed in 1824. Both of these are among the rare industrial structures from that era that have survived intact to this day. (Scharabi, M. 1992). Mohammed Aly also established major state-owned agricultural processing plants. These included three sugar refineries, nine indigo enterprises, rice processing facilities, and leather tanning factories. Additionally, more armories and weapons production facilities were constructed. (Roger Owen, 1993) In addition to the arsenals at Bulak and the Cairo fortress, two further armories were built in Rosetta and Alexandria. Between 1829 and 1831, de Cerisy, a designer from France, established the Alexandria armory. By the late 1830s, the arsenal was much above world standards as it had fifteen workshops and a workforce of four thousand employees. By that time, it manufactured twenty-two navy vessels, nine of which were deadly cruisers equipped with more than one hundred artillery pieces. (Abd al-Rahman and Rafi'i, 1982). Beginning in the late 1800s, powder factories and saltpetre works were established in various locations across Cairo, Middle and Upper Egypt. Monsieur Baffi, an Italian chemical engineer, with his assistant, Pascal Coste, a youthful architect from France, carried out these projects in 1878.

During the 1830s boom, there were between 30,000 and 70,000 people working in a variety of industries. Women and children were among them, as is typical in newly industrialized countries. Furthermore, unlike in industrialized countries, a significant proportion of these people were subjected to forced labor. (Scharabi, M., 1992; Owen, Roger, 1993). Poor working conditions caused many workers to become ill, injured, or killed on the job. Furthermore, factories were frequently damaged or destroyed by fire. (Scharabi, M. 1992). It has been noted that during the 1830s, the machinery was mostly powered by animal and human labor, with only a few steam engines (no more than seven or eight) being used. However, later on, Egyptian carpenters, smiths, and turners began to build machinery locally using imported models and under the supervision of foreign specialists. Despite many attempts, these machines could not be consistently dispersed around the country due to a lack of some crucial components. In addition to these challenges, there is the arduous duty of supervising serious mismanagement, inefficient use of people and material resources, and quick depreciation of machinery. Thus, the unsuccessful Mohammed Aly's industrialization plan resulted in the shutdown of the majority of manufacturing facilities. This failure can be attributed to intrinsic structural issues, the global financial downturn of 1836-1837, and a series of legislation changes, decentralization of administration, and financial cutbacks which occurred in Egypt towards the end of the 1830s. (Owen, Roger. 1993)

The dramatic fall in the preservation of Mohammed Aly's industries from 1830s to 1850s, whether through abandonment, demolition, or sale, is a major contributor to the scarcity of remaining architectural structures. However, certain remains continue to serve as evidence of that industrialization age. The arsenal on Cairo's Citadel is the only manufacturing facility that has retained its original architectural characteristics, allowing a clear portrayal of its initial design.

The armory situated within Cairo's Fortress

The massive complex is located on the western part of the fortress extending from the space beneath Bourg El-Rafraf and Kasr El-AblaK, which currently houses the Mohammed 'Aly worship space, to Bab El-'Azab region in the north. Although the fabrication of weapons and military equipment on the Citadel most likely predates 1806, construction of the arsenal undoubtedly began in 1817. (Scharabi, M. 1992). An inscription panel over the entrance gate indicates that the gun factory, a notable part of the complex, was founded in 1820. (Khalid Azab, 2007) The establishment had a foundry, cannon boring mechanism, resonant furnaces, and other necessary equipment. (Felix Mengin, 1823; James Bell, 1832; Abd al-Rahman Rafii, 1982) In 1824, a huge fire caused by the detonation of an explosives' storage facility in the fortress is said to have caused significant damage to numerous portions of the complex. It also killed roughly 4,000 people and destroyed about fifty adjoining dwellings. The arsenal was later renovated and extended. Huge workshops were established beside the foundry to manufacture guns, swords, lances, copper plates (used in the construction of warships), and powder boxes, and numerous other military gears. (Rafii, Abd al-Rahman, 1982) The British army repurposed these arsenal structures from 1882 to 1946, and the Egyptian army did the same until 1984. As a result, numerous of these buildings were modified and expanded. Currently, the precise shape and purpose of its various components remain unknown. (Khalid Azab, 2007)

Fig.4.3. The workshop space adjacent to the cannon foundry at the Fortress Arsenal, showing the wooden ceiling adorned with a malqaf.

https://ticcih.org/wp-content/uploads/2022/07/2022_Booklet-MHFL-Egypt_web.pdf

Nevertheless, the overall arrangement remains distinguishable: a series of wide, linear streets are flanked on either side by single-story structures featuring tall limestone walls and arched entrances. Certain buildings contain segmented windows or windows with circular arches on the ground storey, while some simply include tiny rectangular panes positioned higher up on the façade. In the southern sections of the arsenal, the predominant structures are spacious halls with flat ceilings. These halls are constructed using timber girders and beams supported by wooden posts, stone pillars, or stone arcades.

Fig.4.4. & Fig.4.5. Citadel Arsenal, middle area, perspective of a manufacturing hallway featuring

an inside entrance constructed in the Rumi design

https://ticcih.org/wp-content/uploads/2022/07/2022_Booklet-MHFL-Egypt_web.pdf

The roof is constructed with wooden paneling that is coated with a sleek layer of mud. The roof is equipped with wind catchers, known as malqafs, which are slanted wooden structures with apertures pointing north. These wind catchers serve to offer both light and ventilation. Subsequent changes conceal the structures' original appearance. Certain roofs have been visibly renovated: as skylights with glass panes have supplanted several former malqafs of the late 19th century; windows, doorways, and gateways have been modified or incorporated; extensive sections of walls appear to be reconstructed. Moreover, a steel-truss metal roofing was built throughout the southern part of the main street during the era of British governance. (Khalid Azab, 2007)

In addition to the halls, another form of buildings can be seen in the armament compound. These edifices have rectangular courts that are surrounded with simple masonry arches. These arcades support flat wooden roofs, which are also held up by wooden props. This construction approach is shared with the hall

Fig.4.6. Citadel Arsenal, northern portion, perspective of a courtyard-style workplace

https://ticcih.org/wp-content/uploads/2022/07/2022_Booklet-MHFL-Egypt_web.pdf

Rooms are positioned in a row at the back of the galleries, with entrances that lead to the galleries through arched gates that have small square windows on top. (Khalid Azab, 2007) In contrast, the halls serve as early examples of attempts to construct expansive indoor areas with as few supporting columns as possible. In this context, we can also witness the limited implementation of methods that were previously employed in the construction of mosques that included spacious halls.

Despite being a factory specialized in forging and manipulating iron, as well as different kinds of metallic substances, its construction did not include any iron components. The factories were constructed during a period when the construction industry in Egypt had already become a very cosmopolitan enterprise, with builders from diverse origins and backgrounds. As an example, the saltpetre factory that was designed and constructed in Badrashin by Pascal Coste who was initially employed by Mohammed Aly and overseen by M. Moustache, a scientist from Italy. Coste recruited native plasterers and builders in Cairo. He developed and constructed a gunpowder manufacturing facility on the island of Rawda in Foustat, Cairo. Arab laborers built the stonework, while Greeks, Italians, and Maltese craftsmen completed the mechanical, woodworking, and carpentry activities, which were directed by a Greek supervisor. (Gaston Wiet, 1959). We now lack any information to determine the identities of the architects and builders who designed the arsenal and the majority of the other factories. However, we can conclude that based on the structural architecture of the arsenal buildings. The previous description of the walls and roofs' structural arrangement indicates that the materials utilized were primarily restricted to what was accessible in the local area or, as in the example of timber supports and paneling, obtainable by frequent importation. The fundamental design of outdoor constructions and hallways, as well as the methods utilized to build them, were based on well-established practices used by competent local masons and carpenters, whether local or Rumi. The building plan and embellishment of the armament structures reflect the close collaboration between local constructors and Rumi (frequently misidentified as "Greeks"). The overall exterior style is simple, with long partitions accented only by slender friezes, uniformly placed windows on the higher levels, and occasionally larger arched windows on the ground floor. The gates are embellished with exquisite stone ornamentation, as represented in the pictures below.

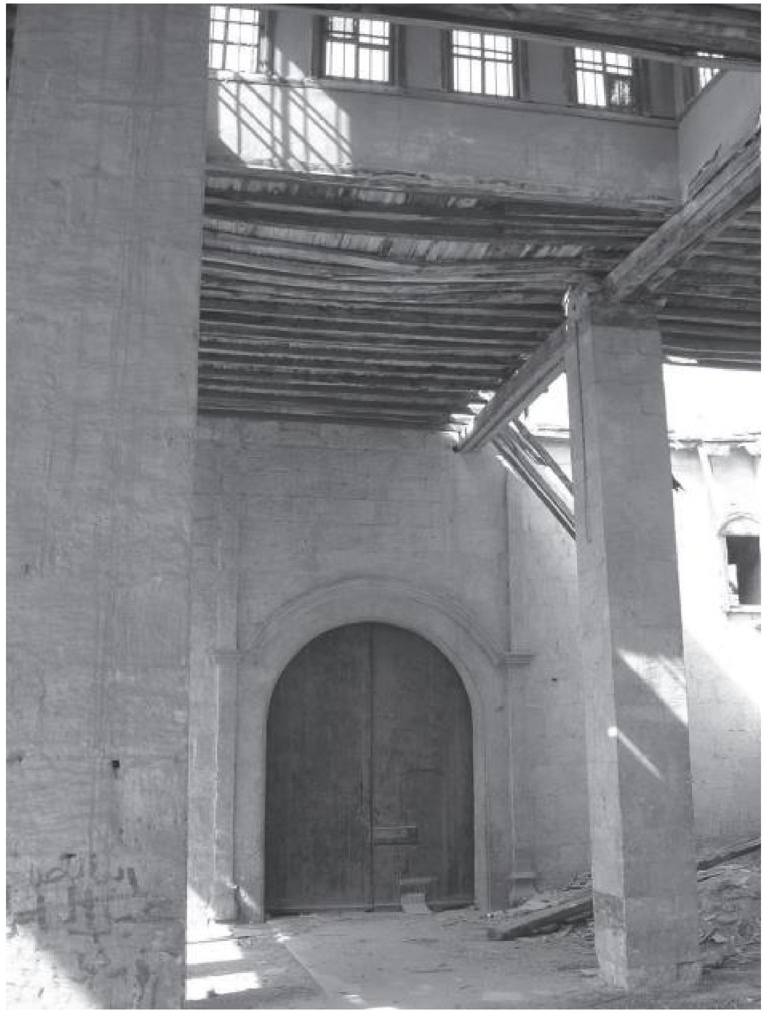


Fig.4.7. Central part of Citadel Arsenal, featuring a fabrication hallway with an internal door designed in the Rumi architecture.

https://ticcih.org/wp-content/uploads/2022/07/2022_Booklet-MHFL-Egypt_web.pdf

Within this context, we observe the presence of circular or segmented arches adorned with embellished archivolts, surrounded by slender pilasters and curved cornices. These architectural elements are distinctive features of the Rumi style. The Rumi builders created a local form of Ottoman baroque style that Mohammed Aly and his family chose when building their mansions. In addition to the Rumi-structure design of the entrances, we can see arches ornamented with curved and weave moldings, as well as bands exhibiting arabesque embellishments that are indicative of the 'Abd al-Rahman Katkhuda trends. This design, distinguished for its ornate ornamentation, was popular in Cairo in the mid-18th century. The presence of decorative motifs on the large factory gates demonstrates the important contribution made by native masonry workers to the architectural design of Mohammed Aly's workshops. Furthermore, it suggests that local creative traditions endured for a lengthier period throughout the reign of Mohammed Aly, who occasionally included important elements of Egyptian culture into his enterprises. (Behrens-Abouseif Doris, 1992; Behrens-Abouseif, Doris. 2006; Williams, Caroline, 2018)

The presence of buildings that have towers and upper levels, as well as the utilization of decorative elements in conspicuous areas of these buildings, aside from the entrances emphasize the intended purpose of being visually striking and monumental. Furthermore, the complex relationship between the functional and impressive characteristics of the building may be discerned by the location of some industries, such as those in Fuwwa or Alexandria. These structures were constructed either alongside the river or a canal in order to have convenient access to river transportation. Simultaneously, they conspicuously displayed their major facades and magnificent gates facing the shoreline.

Fig.4.8. Fuwwa, Fez Manufacturing plant, Textile Manufacturing facility, primary entrance (1824). (Bibliotheca Alexandrina)

Fig.4.9. The entrance to a textile enterprise in Rosetta, dating back to the Mohammed Aly era, in 1820s or 1830s.

(Bibliotheca Alexandrina)

4.2.2. Industrialization during the period from the 1850s to the 1880s

1- Rayramun, Saquiat Musa, al-Rawda, Damaris, al-Minya, Farshut, and Armant sugarcane industries. (upper and middle Egypt)
2- Textile mills in Bulaq and Shubra (Cairo)
3- Paper factory in Bulaq (Cairo)
4- Brick manufacturing facility (Qalyub)
5- Glass production plant (Alexandria)
6- Leather processing plant (Alexandria)
7- warehouse complexes (Alexandria)

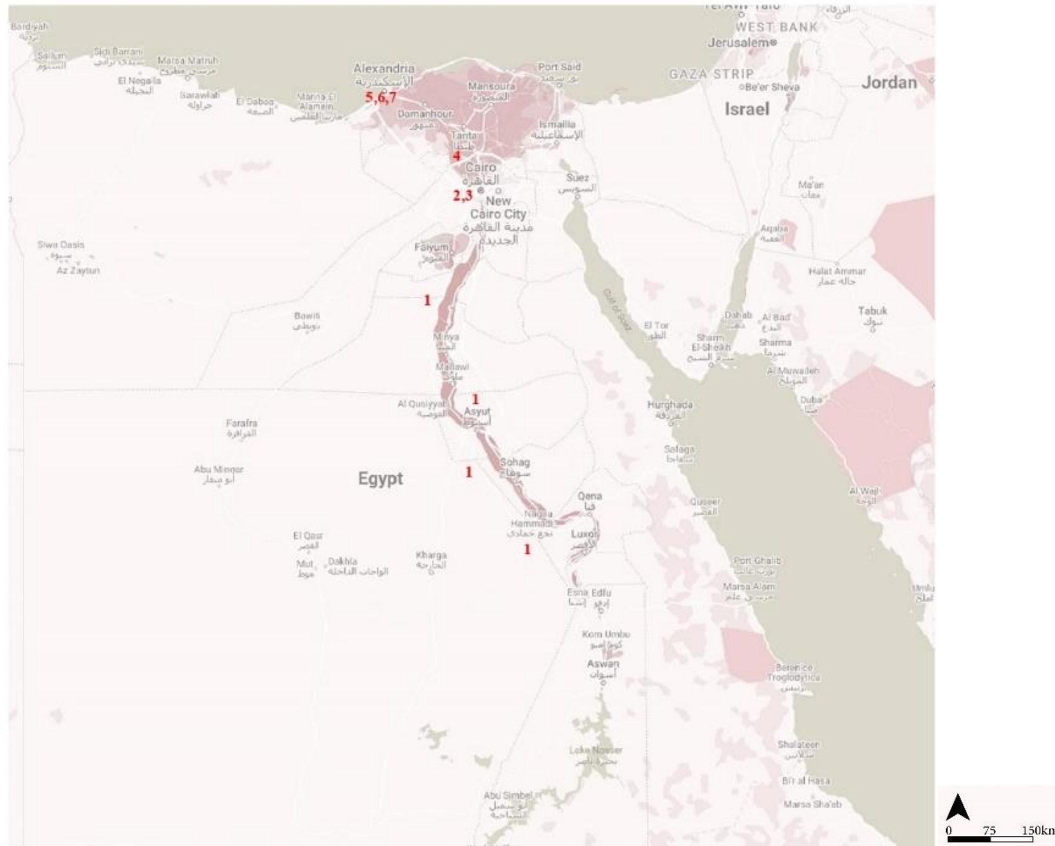


Fig. 4.10. Industrialization during the period from the 1850s to the 1880s (Elaborated by author)

This period and until the 1919 revolution were characterized by a significant reduction and stagnation in the industrial capacity in the country. The actuality is more intricate. On one hand, there was a progressive cessation and closure of factories founded under the authority of Mohammed Aly and "Abbas Pasha," who succeeded him and even a nearly cessation of the government-operated factories that had been established under the leadership of Saiid Pasha. The later implemented a policy that involved the deliberate removal of properties and destruction of existing factories or selling and leasing these factories to private individuals and businesses. On the other hand, and also under the reign of Saiid Pasha (1854-1863), several industries thrived as a trial to revive the economy. This comprised silk and cotton textile, indigo dyeing, brass production, leather tanning, and footwear making in Cairo, as well as wool fabrication in Fayyoum. (Scharabi, M. 1992). Furthermore, he restarted the activities of previously shuttered industries, such as the Fez industry in Fouwwa and the sugarcane manufacturing facilities in Bany Suwaef, which were closed by his predecessor, 'Abbas Pasha. Furthermore, he established new factories dedicated to the extraction of cotton-seed oil, which was utilized in the making of soap and candles.

In consequence of the Egyptian participation in the Crimean Warfare (1853-1856), the armaments manufacturing had a resurgence and arsenals were brought back into operation. This led to the manufacturing of guns, rifles, and sabers in Cairo, and the establishment of shipbuilding facilities in Alexandria. (Zayn al-‘Abidin, Shams al-Din Nagm, 2007) Simultaneously, the process of building railways commenced in Egypt. The establishment of the Alexandria - Cairo railway link took place from 1854 to 1856. Subsequently, the railway network was progressively extended to encompass a significant portion of the Delta region, reaching south as distant as Asyut in 1870s. (Rafii, `Abd al-Rahman, 1982). The implementation of railway transit in the country facilitated the exploration of additional sites for industrial operations. A goods railway was constructed in the 1850s in Alexandria to cater to the needs of the western hub. The construction of the Mahmoudiyah Channel, which was already completed by Mohammed Aly, along with the current project, has stimulated significant industrial growth in this region. (Marc Crinson, 1996).

Another significant measure implemented under “Said’s” reign was the elimination of Mohammed Aly’s administrative monopolistic framework, resulting in expansion of manufacturing and trade by foreign investors. Consequently, there has been a substantial rise in the quantity of foreign businessmen, who settled in Alexandria and down the Nile as far as Cairo. They formed firms primarily focused on exploiting Egypt's agricultural resources for European industries, with a particular emphasis on cotton. (Zayn al-'Abidin, Shams al-Din Nagm, 2007) A significant number of automated cotton ginning mills were established from the mid-1850s, with a total of eighty mills reached by 1863. Undoubtedly, cotton ginning has been recognized as the paramount industrial undertaking throughout the reign of Said Pasha. (Owen, Roger. 1993) Egypt's agro-industries experienced further growth during the reign of Khedive Ismail (1863-1879). European and Khedival investment continued to prioritize cotton cultivation and processing. The cotton boom in question was sparked by an interruption in cotton supply from the USA as a consequence of the outbreak of the American Civil War. (Roger Owen, 1993) Sugar manufacturing was another business that expanded rapidly, albeit it was initially limited to the operations of cane pressing and molasses manufacture until the 1880s. The Egyptian sugarcane manufacturing sector began in the early half of the nineteenth century with the establishment of eight production facilities in Middle and Upper Egypt: Rayramun, Saquiat Mousa, El-Rawda, Damaris, El-Minya, Farshout, and Armant. All were possessed and operated by the government. The technical support and management were mostly provided by French enterprises, with minimal input from British companies.

Starting in 1855, French enterprises essentially acquired exclusive control of the technological and building aspects of growing the sugarcane farming industry via the Daira Saniyya initiative, led by Khedive Ismail, who held approximately 20% of Egypt's total cultivated land. Building a number of factories in Middle and Upper Egypt along the Nile was part of the project. In addition to modernization and retooling of both the al-Rawda and Armant sites in 1869. (Meyer, Martin, et al 2022)

Additional sectors that prospered during Ismail's reign were arms production facilities and military supply plants, including two textile facilities in Boulaq and Shoubra. Furthermore, several manufacturing complexes were constructed to satisfy the demands of a growing government, like the paper manufactory in Boulaq. In addition, he founded a brick manufacturing business in Qalyoub, a glass production plant, and a leather processing plant in Alexandria. Additionally, there were minor privately-owned companies that manufactured food, household goods, and other machinery, alongside steam-powered grain mills. [Abd al-Rahman al-Rafii, 2000] In contrast to the early 19th century, industrial structures in the modern factory sector between 1850 and 1880 were built via the monarch and the government, as well as by independent companies and businessmen. Indeed, the vast majority of private corporations were tiny, family-owned businesses. In actuality, the bulk of industries and workshops were likely tiny in size and not necessarily long-lasting, clustering together in urban settings in a geographically loosely-defined fashion that can still be seen today, such as Boulaq and Sabtiyya in Cairo. (Scharabi, M. 1992) However, there were larger-scale privately held industry facilities, such as mechanized ginning mills or steam-powered wheat mills. It is worth noting that the majority of these financiers were either international, or non-Egyptian "local foreigners." These different international experiences helped significantly the development of a more cosmopolitan approach to building design for Egyptian manufacturing facilities. The role of independent firms in building these industrial structures continued to grow till it was taken over by the government of Gamal Abdel Nasser in 1956.

The latter part of the 19th century witnessed a significant metamorphosis in Egyptian architecture, encompassing both architectural aesthetics and building methodologies. Stylistically, there is a growing preference for European-inspired historicist and eclectic architectural styles. This trend is driven by European architects employed by the ruling family, as well as by international residents and local Egyptians and Turkish aristocracy. Iron and then steel construction techniques started to emerge, albeit first in an irregular manner. Examples of this can be seen in various architectural structures, such as palaces and bridges. Notable examples include the railway bridges built by Robert Stephenson in 1854 to span the Nile at Banha and Kafr El-Zayyat. Another notable example is Cairo's Qasr al-Nil bridge, built between 1869 and 1871 by Linant de Bellefonds and the French business Five-Lilles. Additionally, Gustave Eiffel, noted for his prolific work, built a miniature suspended bridge (1873-1875) over a puddle in the Giza Royal Landscaped regions, now known as the Giza Zoological Gardens. (Andre Raymond, 2000). These metallic fabrics were imported from other foreign countries. While the usage of steel in fences, terrace barriers, and window screens gained popularity in residential design, the application of iron and steel for structural elements, including flooring and ceilings, and rooftops building, was unusual up to the late nineteenth century. (Edouard Mariette, 1875)

Only a small number of industrial buildings from the period between the 1850s and the 1880s have been survived. Nevertheless, it is worth noting that certain antiquated textile plants in the Delta and a number of obsolete cane-pressing operations in Upper Egypt still retain traces of their initial establishment.

In locations where industries continue to operate, the process of technical upgrading and modernization has had a negative impact on old structures. Factory abandonment frequently resulted in their collapse or reconstruction. However, there are various architectural frameworks that might help us get a basic grasp of industrial architecture throughout this historical period. The distinctive warehouse construction located in Alexandria's Mina El-Bassal area, near to the Old Bridge over the Mahmoudiyah Canal is an example. It is present near to the junction of the canal and the western harbor. During the era of Mohammed Aly, this region had already witnessed the growth of industrial and port-related endeavors.

Architectural description of the warehouse building in the Mina El-Bassal area of Alexandria

Fig.4.11. The middle of the nineteenth century harbor and warehousing structure in Mina El-Bassal area, Alexandria. (Bibliotheca Alexandrina)

Fig.4.12. Storehouse composite's gatehouse, Mina al-Basal District, Alexandria. About 1860s or 1870s. (Bibliotheca Alexandrina)

The structure is a rectangle, two-level structure with a flat roof and a base floor made of sandstone ashlar. The top level is made of cemented brick and transversal wood supports incorporated into the brickwork. Every ceiling is made of timber. As a result, we are dealing with materials and techniques that have been in use for an extended period of time. The structure's peculiarity originates from the pediment front walls. The eastern and principal frontage, that spans the roadway and waterway, as well as the modest southern frontage, comprise of a two-level portico featuring curving arches ornamented with contoured archivolts and imposts supported by square columns. The exteriors are also adorned with neo-Renaissance characteristics, like corner rustication, a first-floor string course, and a cornice with concave moldings, all made of white limestone. The existence of seams in the brickwork indicates that the arches were once unlocked, but were subsequently enclosed by walls. In addition, some of these arches included gateways or windows. On the basis of the building characteristics, it seems that such modification has taken place in the late nineteenth century. Chambers with doorways accessing the back sections of the construction are right now inaccessible and are positioned behind the arcades on both floors. Currently, the specific date and purpose of the building are still uncertain. The construction techniques and decorative elements indicate that the dating falls somewhere between the early and mid-1800s. (Meyer, Martin; et al, 2022) This building likely represents the sole surviving structure of the aforementioned warehouses, known as "magazines," which could account for its distinctive arcaded design. The original arcades exhibit stylistic similarities to 18th-century İstanbuli khans, characterized by a combination of limestone and brick. This reveals the involvement of Rumi builders and a likely date in the early half of the nineteenth century. It could also represent the continuity and the unique adaption of Khan style until the mid-nineteenth century. Currently this structure is deserted.

The gate house is potentially a part of the same previous warehouse complex. The 1860s or 1870s are the likely years of construction for this two-level building based on its architectural design. The architectural features of the building include the rough-cut ashlar masonry, the curved gate and windows, the decorative columns, the horizontal beam above the columns, and the ornamental molding at the top, as well as the plaster covered higher floor featuring rectangular windows and an angled triangular structure surrounding a stucco floral design, which incorporate elements of Ottoman Baroque, neo-Renaissance, and Classicist styles. These features align with the prevailing architectural trends seen in Egypt palaces. The Citadel arsenal in Cairo features manufacturing gates of a comparable design.

Fig.4.13. Northern part of **Citadel Arsenal, featuring a combination of neo-Classical entrance adorned with castle-design crenellations, likely originating from the 1850s or 1860s.**

https://ticcih.org/wp-content/uploads/2022/07/2022_Booklet-MHFL-Egypt_web.pdf

These gates, feature a combination of Classicist pilasters and architraves, Baroque cartouches, and Citadel-design battlements. They are easily recognizable as upgrades and refurbishment that were made during the reign of Said and Ismail. (Bodenstein, R. in Mohammad Al-Asad's, 2010)

Fig.4.14. Fuwwa, a spinning plant adjacent to the Fez Manufacturing facility, perhaps from the 1850s-1860s; a structure with two levels located near the eastern extremity of the building.
https://kiliim.com/the-mystey-of-fowwas-geziret-el-dahab-2/

Fig.4.15. Ginning plant near to the Fez edifice, eastern primary frontage of the truss-roofed workplace structure.
https://kiliim.com/the-mystey-of-fowwas-geziret-el-dahab-2/

Architectural depiction of the Fuwwa industrial building, an early ginning mill.

Another edifice, perhaps constructed between the 1850s and 1880s, is a manufacturing facility situated in Fuwwa. This industrial building is positioned on the west shore of the Nile, adjacent to the tarbush factory. The courtyards of this desolate complex is encircled by a towering workplace building on the west and a building average in size of two level floors on the east, along with other tiny ancillary structures.

The application of charred-brick combined with timber roofs, posts, and pillars lacking iron elements suggests a construction era before the 1890s, possibly dating back to the 1850s or 1860s. The intricate design, formally classified as a monumental structure near the end of 1990s, has been distinctly designated as a textile plant. It is believed to have begun during the Mohammed Aly era, although this appears improbable since it would be too soon for a ginning mill. The factory hall situated in the western area is the most intriguing. This represents the first documented instance of an elongated rectangular hallway including sloping walls and a dual-pitched roof built using trusses, and a monitor (clerestory). The outer walls are built with plastered brick masonry and are about the height of two stories. The outside features large round-arch windows, and the gable wall is decorated with a rounded window enhanced by geometrically ornamented timber latticework. The joist rooftop, constructed of lumber, extends across the whole breadth of the structure. The existing roofing is made of panels of curved metal, suggesting that the former rooftop covering was probably wooden panels. As a result, the design combines conventional "low-tech" construction supplies and recently adopted techniques of joist rooftop systems to create a spacious, one-story lobby that includes one passage and generous space, free from any columns or supports that might block the view. The hall with a truss roof was a common architectural style in Europe and the United States in the 19th century. By the century's conclusion, it was a commonly adopted design for industrial halls, particularly for ginning mills, throughout Egypt. The joist roof-toped hall in Fouwwa, originating in the 1850s or 1860s, serves as significant proof of its early application in Egypt. (Bodenstein, R. in Mohammad Al-Asad's, 2010)

In conclusion, during the period from the 1850s until the 1880s, Egypt's manufacturing building progressively embraced European design principals and building practices. The irregular advancement of construction was affected by elements like regional circumstances, dependence on local workforce, and the shortage or elevated costs of modern building materials like steel and iron. As a result, a blend of conventional construction methods and modern approaches was utilized. Therefore, innovative construction methods were implemented for wooden structures, but the utilization of metal components seems to have remained uncommon. Before the 1890s, no industrial edifices employed the modern steel building techniques that were theoretically available.

4.2.3 Industrialization during the period from the 1890s to the outbreak of the First World War:

1- Al-Hawamdiya sugar refinery facility (Giza)
2- Nag' Hammadi, Sugar Factory (Qena)
3- The Salvago ginning mill (Qalyub)
4- Al- Ahram (Stella) brewery (Giza)
5- The railway telegraph storage facilities (Cairo)
6- Water pump house (Giza)
7- The leather tannery (Cairo)
8- Spiro Spathis Soft-Drinks Factory (Cairo)

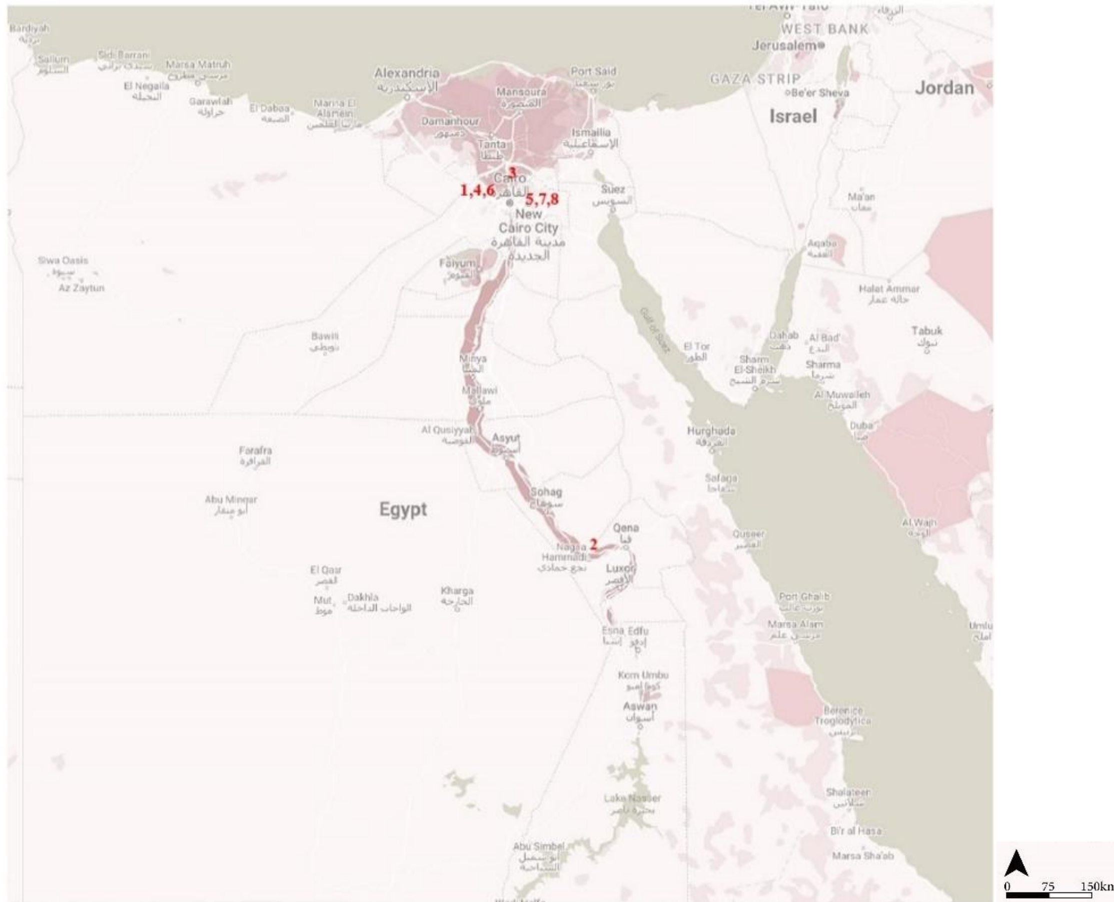


Fig.4.16. Industrialization starting in the 1890s till the commencement of the World War I (Elaborated by author)

Unlike earlier eras, the two centuries preceding the start of "World War One" resulted in a substantial quantity of industrialized edifices. The layout of the design of these structures also grew significantly intertwined with global advancements in industrial architecture. The growth of the Egyptian industry was somewhat sluggish during this particular period. The British government, which was founded during the British colonization in 1882, prioritized the development of the agricultural field. The scope of industrial investment was restricted to agro-industries that was engaged in the preparation of cotton and sugar, mostly for exportation as raw materials to industries in Britain and other countries. As a result, local industrial production was of subordinate significance. (Owen, Roger, 1993).

Nevertheless, there was a substantial surge in international and domestic investment in business and industry, prior to the onset of the Egyptian economic downturn in 1907. As a result, new companies were created and there was a consolidation of capital in the hands of wealthy individuals who owned large amounts of land. These individuals, both locals and local foreigners, partnered with foreign capital to invest in various sectors such as cotton and sugar processing, as well as manufacturing industries that aimed to replace imported goods. They also invested in transportation infrastructure, urban services, land development, and banking. (Robert Vitalis, 1995) In Egypt during that time, there were investor associations called the Suarès group and the Salvago group, which consisted of Egyptian Jewish families and Alexandrian Greek families. These associations were actively involved in nearly all significant capitalist ventures in Egypt. (Robert Vitalis, 1995).

The Suarès group constructed the initial sugar refinery facility in al-Hawamdiyya, located south of Cairo, in 1881. Nowadays, based on the exterior appearance of the refinery, it is evident that the facility has undergone extensive modernization and expansion, and it is quite likely that the original buildings from 1881 are no longer present.

Fig.4.17. A perspective of the northeastern area of Al- Hawamdiyya Sugar Refinery, established in 1881; displaying structures that dated from the early to late 20th century. (Centre d'Études Alexandrines – CEAlex)

In 1894, most (eighty percent) of Egypt's raw sugarcane was exported to Europe, mainly to France, for refinement purposes. Afterward, the processed sugar was returned to Egypt and marketed as white sugar. A notable instance of financial consolidation in that era is the founding of the French firm, Société Générale des Sucreries et de la Raffinerie d'Égypte (known as SGSRE) in 1897, which primarily dominated the sugarcane sector.

In 1898, the combination of this corporation with another French-Egyptian sugar firm overseen by Suarès led to the establishment of a novel facility in Nagaa Hammady, situated in Upper Egypt. Moreover, in the early 20th century, they took over an additional nine cane-processing plants in Egypt, along with sugar plantations and a Series of farming railroads from al-Da'ira al-Saniyya, partnering with the international financier Ernest Cassel. (Owen, Roger, 1993) Numerous companies assumed control of the Daira Saniyya as it entered liquidation. Prior to its merger in 2006 with the Egyptian Sugar and Integrated Industries Company (ESIIC), the SGSRE underwent nationalization in 1956. (Bodenstein, R., 2015)

Nagaa Hammady, Sugar Factory

The photograph of the Nagaa Hammady refinery depicts the original manufacturing complex from 1897. It showcases a sprawling layout consisting of lengthy single-level and dual-level courts. These spaces feature massive rectangular apertures, gabled partitions, and dual-sloped roofing, probably built employing joist building methods. The backdrop includes multiple raised buildings with flat tops and three tall smokestacks. The structure showcases a straightforward and practical design, reflecting the late-19th-century "international industrial style."

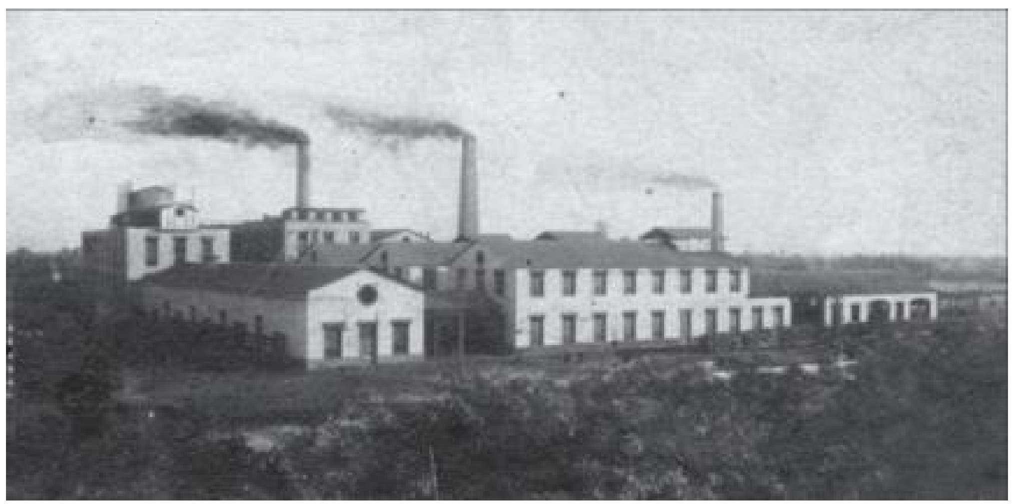


Fig.4.18. A postcard showing Nagaa Hammady, Sugar Manufacturing Facility Founded in 1897 (Bibliotheca Alexandrina)

Armant Sugarcane Factory

El-Rawda and Armant sustained their individual roles even with the emergence of additional sugarcane plants. Each of these companies underwent renovations and updates in the early 20th century, featuring a design for city development, as shown by the present sugarcane factories.

The sugar mill in Armant is situated in the Nile valley, near the railway tracks. Alongside, the manufacturing factories structures and facilities, that are crossed by freight rail tracks, there is a carefully designed residential zone for staff. This settlement features opulent villas for engineers, landscaped gardens, and diverse leisure facilities, including a theater, a café, and a community association. Before its nationalization, the Armant facility was of great significance among Egypt's sugar producers, together with Sheikh Fadl, Nagaa Hammady, Kom Ombo, and El-Hawamdiah factories. Armant possessed the greatest operational processing capability of all until the mid-20th century. At present, the Armant sugarcane plant is physically maintained intact with its historical edifices and also exists in a non-physical sense through the work, housing, and social interactions of its workforce.

Egypt's industrial architecture experienced significant advancements from the 1890s until the commencement of the World War I. This encompasses the incorporation and application of innovative materials, construction methods, and types of buildings. Also remarkable is the emergence of “high-architecture” structures, alongside the growing utilization of industrialized facilities as deliberate ways in which manufacturers and businessmen portray themselves to the community. (Bodenstein, Ralph, 2010)

A diverse range of modern industries emerged during this time. Additionally, apart from sugarcane and cotton processing procedures, there were also facilities for oil and soap, food goods, concrete and construction supplies, apparel and fabrics, fertilizers, smoke and cigarettes in addition to mineral extraction. Aside from the cotton, sugar, and tobacco export industries, these sectors contributed to the growth of the domestic Egyptian market. (Owen, Roger, 1993)

The structures of these industrial organizations built during this era were greater in size and more technically sophisticated, enabling them to withstand subsequent technological advancements, which may be one reason many of them are still present today. It was in this time frame that specialized architects started to have a more important role in the design of industrial structures. Since these structures were constructed for influential capitalist investors, this resulted in what is referred to as "corporate monumental architecture." The employment of such monumental architecture in industrial construction (which had previously belonged solely to rulers and the state) demonstrated the emerging influence of private capital in Egypt. An example of such buildings is the Salvago ginning mill. (Bodenstein, R. in Mohammad Al-Asad 2010)

These monumental historicist-designed industrial structures did not stop with commercial structures or privately owned industries. They were likewise identified in railway facilities and shops, like the railroad telegraph granaries located in Cairo's Sabtiyia area, set up in the early years of the 20th century. The historic pumping building for the Giza water treatment plants, constructed in 1896, built in 1896, serves as another instance of monumental historicist architecture completed as public works.

Overview of the construction of the Salvago ginning plant

The Salvago ginning facility is a sizable establishment founded throughout the last decades of the nineteenth century via the Salvago Family close to the Delta Barrages (El-Qanatir El-Khayriyya), the Qalyub area, in the northern part of Cairo. The plant was nationalized in the late 1950s but continued to function till it ceased operations in the middle of the 1990s, and was later deprived of a significant portion of its apparatus. In the 1930s, under the management of the Associated Cotton Ginners of Egypt Ltd., and probably during its early construction, the mill was considered one of the largest mills in Egypt. It was recorded that the mill ran 148 rolling gins, two hydraulic presses, and one steaming press. (Bodenstein, R. in Mohammad Al-Asad 2010)

The mill is strategically situated on an expansive rectangular plot (about 28,000 m²), bordered by the Nile on the west and an adjacent railroad on the east, providing sufficient available area for storing cotton bags open area for the storage of cotton bags. It consists of the textile ginning facility, the chimney, the management premises, three resting dwellings, and a greenery area that served as an arena for horses. The whole area's buildings are surrounded by a fence and reachable through a uniquely constructed entrance, articulated by three observatory-towers of varied heights. While the specific year of the mill building is still not confirmed (between 1894 and 1897), the accomplishment of the administrative and gate buildings was dating to 1895. Probably they were designed by Antonio Lasciac, a Slovenian with Austro-Hungarian residency, and the main designer of the Khedival royal residences during the reign of ‘Abbas Hilmi II (1907-1914).

The edifices used for administration and the gateway structure of the Salvago ginning plant illustrate a charming rendition of the Castle Style. These constructions create a linked series along the western boundary of the mill complex, oriented toward the Nile and the Delta Barrages. The most notable aspects of the building are the trio of towers, each differing in height and design. They are built from red brick featuring sandstone highlights, and are decorated with a vibrant array of buttresses, arching openings, crenellations, arching cornices, battlements, corner turrets, and small link bridges, all fashioned in a neo-Gothic style. Between the two towers, there exists a gate embellished with a large pointed arch, crenellations, and chains of openings. The second row includes three administrative and residential structures that display comparable neo-Gothic features in their windows, such as stone mullions, blind arches and niches, battlements, and verandas made of lumber. The guesthouse, the northernmost of the trio of buildings, was constructed after 1895 yet possesses the same decorative features as the other edifices. Inside the Salvago mill complex, there existed a tiny "villa" set aside for the director.

Fig.4.19. Salvago Ginning Mill, guesthouse, after 1895. (The Alexandria and Mediterranean Research Center)

Fig.4.20. Salvago Ginning Mill, director’s house, Antonio Lasciac, 1895. (The Alexandria and Mediterranean Research Center)

It is important to note that this was the sole Egyptian architectural endeavor in the context of manufacturing that Lasciac ever executed. The Salvago mill's towers and gate closely resemble the adjacent gateway towers of the Delta Barrages, built in 1862, that evidently acted as Lasciac's main source of inspiration.

Fig.4.21. Al-Qanatir al-Khayriyya, eastern gate tower of the Delta Barrage, 1862. (Dar al Wathaiq al- Qaumiyyah (DWQ)

The construction of the ginning mill probably occurred ten years before Lasciac's administrative buildings. Nonetheless, there exist additional annexes and supplementary structures, some of which were erected concurrently with the primary building, whereas the construction of others were completed later, in the twentieth century. This segmented and mixed architectural style is common in many industrial facilities across Egypt. The factory's main structure, referred to as the main building, serves as an excellent illustration of an elongated, single-aisle hall made of plastered brick masonry. It showcases a double-pitched rooftop constructed with timber-truss building methods. The roof trusses are strengthened structurally by iron tie rods. The segmentally-arched lateral windows featuring iron sash bars and a monitor roof facilitate the entry of light and air. The structure showcases the unique features typically found in ginning mills throughout Egypt. It features a spacious and well-aired ginning hall raised on a base of short parallel walls. These walls feature arched openings that span the entire extent of the bottom floor.

These walls were designed to uphold the timber main floor (which has been dismantled in the instance of the Salvago mill and to support the weight of the gins, arranged in linear sequence. The substructure built at the ground level also contained the seed channels, which served to transport the extracted cotton seeds from the gins situated above. Furthermore, components of the gins' driving mechanism were also found in this location. (Moritz Schanz, 2007). With two ginning courts connected by a steam press room located within the unusually long main building, the Salvago mill stands out as unique among mills globally. At the western end of the hall, a four-storey section of the building features a hip-shaped roof and a range of windows topped with segmented domes. The building features four levels with wooden flooring, upheld by cast-iron columns on the ground floor and timber supports on the upper floors. These stories act as workplaces for repairing items. The steam boiler, which is a steam engine combined with an electric generator (produced by the Swiss firm Oerlikon in 1902), was located in the extensions on the northwest side of the ginning hall.

The engine hall has a wooden-truss roof that matches the ceiling of the primary ginning hall. The floors are built on level brick vaults that are positioned between iron beams. This highlights the utilization of the jack arch system, which grew more prevalent in Egypt by the late 19th century. The boiler room is encircled by an intricate brick chimney featuring a cubic foundation with corner pilasters and a dressed stone string course. The chimney features an extended octagonal brick column and a top adorned with a broad rounded molding crafted from dressed stone. The chimney was subsequently fortified with concrete supports, concealing its original artistic appeal. These aspects indicate several modifications that impact the building exteriors. The existence of masonry elements revealed in the harmed sections of the plaster, along with the still-visible Tuscan capital in a hidden corner of the façade, implies that the four-story structure and possibly the ginning halls were previously embellished with external pilasters and string courses. The present look of the facades, defined by a grid layout of straightforward horizontal and vertical stripes, appears to result from restoration work undertaken in the latter part of the first half of the 20th century. Clearly, the primary facility structures were initially built in a design influenced by history, showcasing intricate embellishments. This is evident from the lovely wooden cut lambrequins that continue to decorate the edges of the monitor roofs. Clearly, Salvago and his architect originally aimed to create a facility that served not merely as a practical entity but also as an emblem of affluence and authority. The Salvago structures employed a larger quantity of iron elements, including iron sash bars, cast-iron columns, iron beams, and iron staircases, in contrast to the earlier industrial buildings examined in this study. Consequently, it can be deduced that in the late 19th century, prefabricated industrial materials, regardless of being imported or manufactured locally, were increasingly utilized in factories across Egypt.

In 1999, soon after its closure, the Salvago cotton gin was appointed by the Supreme Council of Antiquities (now the Ministry of Tourism and Antiques). Although it was officially accredited two decades ago, the property remains unincorporated in any preservation plan. The halls of the complex were the solely and entirely filled with old machines, while the entire area is, in fact, deserted. (Meyer, Martin; et al., 2022)

Fig.4.22. Salvago Ginning Mill, main ginning hall with workshop block, c. 1890. ((Bibliotheca Alexandrina)

Fig.4.23. The internal perspective of the main ginning hall at Salvago Ginning Plant showing the framework that supported the building before the main floor was demolished.
((Bibliotheca Alexandrina)

Fig.4.24. The concrete reinforcement that was later installed to the Salvago Ginning Plant smokestack

(Bibliotheca Alexandrina)

Al- Ahram (or Stella) brewery in the Bayn al-Sarayat.

Another illustration of "high" industrial design characterized by a very noticeable monumental attributes is the Al- Ahram (Stella) brewery in the Bayn al-Sarayat area of Giza.

Fig.4.25. A detailed perspective of the front of the center building of the Brasserie des Pyramides Brewery.

(Dar al wathaiq al- qaumiyyah. DWQ)

Fig.4.26. A perspective of the western extension and the core building of the Brasserie des Pyramides Brewery.
(Dar al wathaiq al- qaumiyyah. DWQ)

This facility was established at the beginning of the 20th century on a wide area originally preoccupied by Prince Hassan Pasha's mansion and garden. It was founded by the Belgian-Egyptian Société anonyme Brasserie des Pyramides, in 1898. Its name was changed to Al-Ahram Beverages Company in 1953. Its main product was Stella beer. A state firm, nowadays, controls the factory that isn't currently operating and has been deprived of its equipment.

The main building of the initial factory is large, has a symmetrical construction of cuboid blocks that stretch from east to west. It-is formed of a central structure of three-story levels bounded each side by shorter two-story premises. The central building is framed by two rectangular towers having battlements. Moreover, two identical smaller towers surround each side of the building, making the facility to look like a magnificent citadel. This appearance is accentuated by the rough, undressed-stone construction paired with horizontal courses of brick, the slightly arched niches define the façades, and the presence of battlements that extend on arched corbels akin to machicolations. Alongside the stacked rows of rectangular and arched windows in the central section, the whole structure resembles a blend of Byzantine palace and Tuscan castle design. It was, and remains, a notable structure. The lower stories of the central block feature reinforced concrete flooring, and their design along with the exposed hoop-iron stirrups indicates that this is among the initial uses of the Hennebique concrete building technology in Egypt. The Hennebique system, developed by François Hennebique in 1892, is regarded as a forerunner to contemporary concrete construction with reinforcement methods. Furthermore, it represented the first documented instance of its application in the field of the Egyptian industrial building. (Bodenstein, R. in Mohammad Al-Asad 2010)

The railway telegraph storage facilities located in Cairo's Sabtiyia district

The railway telegraph infrastructure in Cairo's Sabtiyya area was developed by the early 1900s. The structures present plain facades of exposed stone and brick along the roadway. However, the interiors of the property, especially on the northern side of the rectangular building that houses the office spaces situated on two levels, display ornate plaster fronts. (Clerget, Marcel. 1934) The remainder of this construction is a basic instance of an expansive hall featuring a north-light roofing (commonly referred to as saw-tooth roofs) constructed of metal. This is an innovative roofing design for industrial buildings in Egypt that facilitated the construction of greater covered areas while ensuring adequate illumination and ventilation.

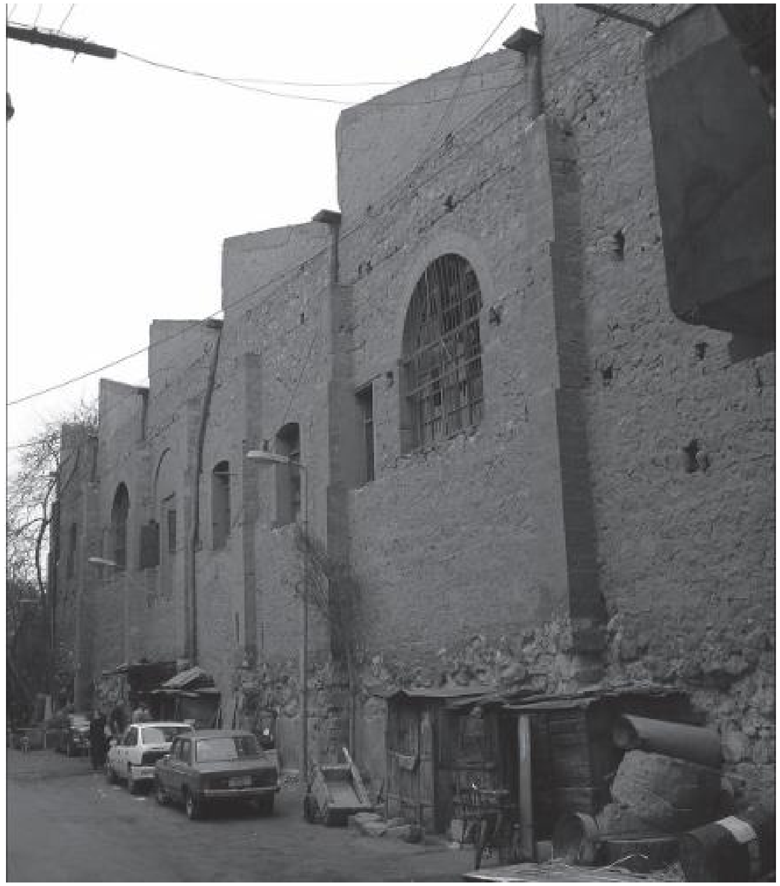


Fig.4.27. the picture depicts the western street frontage of the Railroad Telecommunication Shops Located in Cairo's Sabtiyia Area, at the start of the twentieth century. (Dar al wathaiq al- qaumiyyah, DWQ)

Fig.4.28. Railway Telegraph Stores, view of northern facade. (Dar al wathaiq al- qaumiyyah DWQ)

The antiquated pump facility at the Giza waterworks

An additional illustration of monumental historicist designs in civic based projects is the antiquated pumping building for the Giza waterworks, purportedly constructed in 1896. The pump is a sophisticated cubic neo-Renaissance edifice constructed of red-brick masonry and adorned with artistic yellow stone features. Additionally, it is topped with a metal-truss roof. (Bodenstein, Ralph, 2010)

Fig.4.29. Giza, Waterworks, pump house, 1896. (Dar al wathaiq al- qaumiyyah. DWQ)

However, in the beginning of the 20th century, vernacular forms of industrial design began to gain prominence in Egypt. It was called the "'ambar with street façade" layout because it incorporates a decorative street façade (the style of which depends on the period of the construction and the preferences of customers and constructors) with a simple utilitarian "ambar," which is a one-story workshop hall, encompassed with a truss or concrete ceiling. This layout was prevalent across the cities of Egypt and was included within a diverse array of architectural forms, from enormous railroad terminals and storage facilities, to carpenters' workplaces and automobile showrooms.

Cairo leather manufacturer in Magra El-'Uyun Road, 'Ayn El-Sira district.

The leather tannery located on Magra El-‘Uyun Road in the 'Ayn El-Sira neighborhood of Cairo exemplifies the vernacular industrial architecture of that era.

Fig.4.30. Cairo, ‘Ayn El-Sira Area, Leather Tannery on Magra El ‘Uyun Road, 1907. (Dar al wathaiq al- qaumiyyah. DWQ)

Ayn al-Sira district became a highly desirable place for leather manufacturing enterprises during the late-19th century due to the presence of a nearby large-scale abattoir. The aforementioned leather tannery was constructed in the year 1907. The building is described as a lengthy, unadorned structure consisting of two stories. It is comprised of two distinct sections that are divided internally, with a central entrance. The construction method used in this building includes rubble-stone masonry, complemented by brick and/or ashlar masonry for the angles, in addition to the casings of the doors and windows. (Bodenstein, R. in Mohammad Al-Asad's 2010) This method is the same as that employed in the al-Ahram brewery and the telegraph warehouses of the railway. The window frames, jack-arched floors, and ceilings of the majority of rooms were built using iron double-T columns. This regular use of iron is significant. This stylish approach is clearly unlike what is employed in the ceiling of the building's top-floor hall. The cast-iron columns uphold a fundamental structure of double-T steel beams, which act as a foundation for a rather 'rudimentary' roofing. This ceiling is made with roughly cut timber beams, wooden boards, and a top coating of mud. These substances and construction method were commonly employed in factories during the Mohammed Aly era. This leather tannery demonstrates the integration of sophisticated and relatively basic construction techniques that defined the architectural style of vernacular industrial structures during that time.

The Spiro-Spathis beverage manufacturing facility

The Spiro-Spathis fizzy beverages manufacturing facility, located in Cairo's Bab El-Hadid area to the south of the Ramsis Railroad Platform, serves as a prominent illustration of vernacular industrial architecture.

Fig.4.31. A perspective of the road's frontage of Spiro Spathis Fizzy Beverages Factory in Bab El-Hadid Area, Cairo, during the first decade of the 20th century. (Dar al wathaiq al- qaumiyyah. DWQ)

Fig.4.32. The interior expansion of the Spiro Spathis Soft-Drinks Manufacturing facility done in 1926, included stone pillars and a monitor ceiling. (Dar al wathaiq al- qaumiyyah. DWQ**)**

The building was constructed in the early 1900s and later acquired by Greek industrialist Spiro Spathis in the 1920s. Subsequently, the building had noticeable modifications and expansion especially towards the back. (Bodenstein, R. in Mohammad Al-Asad 2010) The initial exterior of the building is made of plastered brick and adorned with neo-Classical decorations. At the back, there is a rectangular space featuring brick walls and two lines of stone columns that hold up double-T beams. These beams act as the structural support for the existing flat reinforced-concrete roof, which features a detector positioned over the central corridor. The base floor of the building is filled with mixing equipment, filling machines, and a storage section. Moreover, workrooms and laboratories were added as mezzanine floors in the frontal and middle sections of the structure.

4.2.4, The period from 1914 to 1956: The era of Modernism.

1-Water infrastructure of Tanta, (Gharbiyya)
2- Tanta Waterworks, ice factory.
3- Tanta, Generator Building
4- The Misr Factory for Tobacco and Cigarettes.
5- Abdel-Meguid Barakat Ginning Mill (Damanhur)

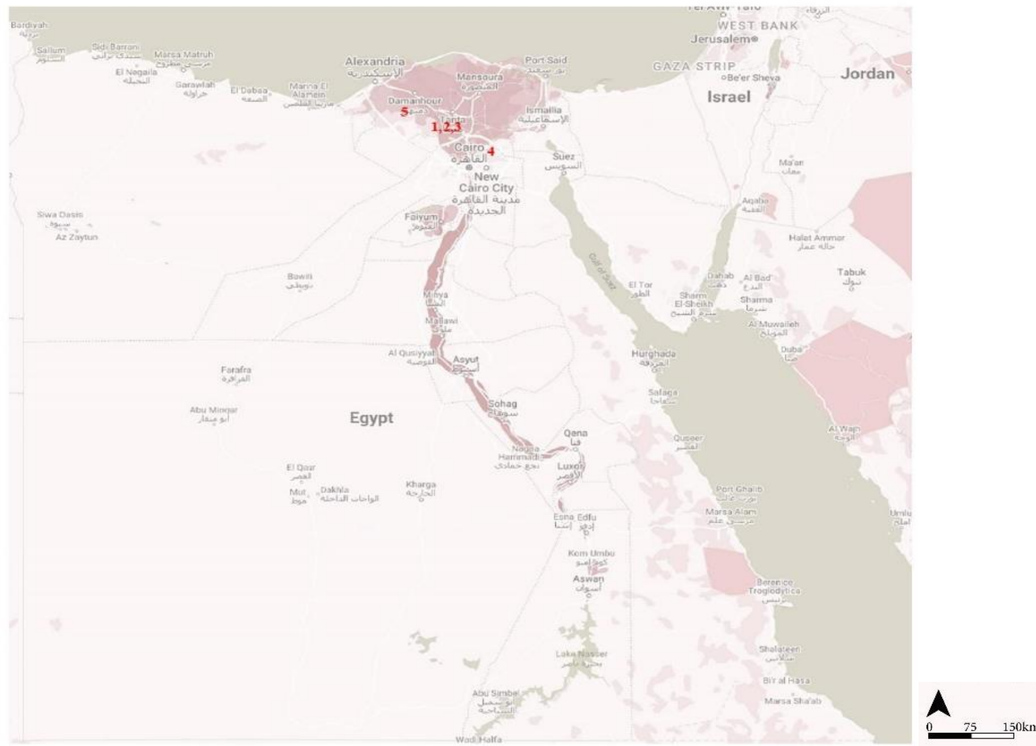


Fig.4.33. Industrialization during the period from 1914 to 1956 (Elaborated by author)

It is characterized by the perception of the industrial edifices as a mechanized entity.

The World War I significantly influenced the progress of the Egyptian industrialization. The shortage of products and resources from European continent, along with the rise in the number of British soldiers, sparked a rise in the need for local industry. After the war ended, the 1919 autonomy rebellion and the British proclamation of Egypt's official independence in February 1922 resulted in the rise of a new leadership. This leadership included not just the governmental and skilled elites formed during British colonial rule, but also prosperous landlord-financiers from the prewar period, along with those who gained wealth via warfare prospects and were eager to invest in the manufacturing field. (P.J. Vatikiotis, 1991) In 1918, Ismail Sidqy and Talaat Harb acknowledged the development of economic and industrial sectors as essential for the struggle for national reform and independence. Bank Misr was founded in 1920 by Talaat Harb to mobilize Egyptian capital for the growth of local industries and reduce the influence of foreign entities in finance, trade, and manufacturing. In 1922, regulations concerning industrial borrowing was enacted. The Organization of Industries was founded and subsequently rebranded as the Federation of Egyptian Industries.

The Association's membership included both Egyptians "local foreigners" such as Salvago and Suarès, in addition to internationals from other nations as Baron Empain. The industrial sector in Egypt is mainly defined by an increasing interconnection among various enterprises, the prevalence of financial capital, a notable influx of foreign investment, and the collaboration of financial capital with the government. (Tony Cliff, 1946)

The industrial growth is apparent in the magnitude of the manufacturing workforce, which increased from about 250,000 in 1919 to more than 1 million in 1939, and close to 2 million by 1952. (P.J. Vatikiotis, 1991) The notable rise during this time can be linked to both the considerable number of emerging businesses and the growth of current ones, despite several being highly automated operations.

The architectural evolution during this period was characterized by a shift from historicism to modernism. (Awad, 2015; Godoli & Giacomelli, 2016). Industrial building design continued to employ historicist approaches up to the late 1920s, when more contemporary vocabularies began to take over. This included variations of the international designs, which frequently incorporated Art Deco elements and lasted until the 1940s.

The enduring presence of historical architectural approaches in the 1920s and early 1930s can be displayed by two significant instances: the waterworks of Tanta and the generator hall in Tanta.

The growing participation of highly experienced architects performed an essential part in the advancement of industrial architecture throughout this era. Frequently, these individuals were Egyptians or refugees from Syria who settled in Egypt. A significant number of them received education overseas and had a crucial role in bringing in and adjusting new techniques and architectural trends in Egypt. (Mercedes Volait, 1988) From the 1930s forward, the modernist and functionalist architecture approach became more prevalent than historistic industrial architecture. Egyptian architects: Sayyid Karim, the founder of an Egyptian architectural journal “Al- Imara”, and Ali Labib Gabr, they received training in Zurich and Liverpool respectively, were renowned figures in the Egyptian Modernist movement. They made significant contributions to Egyptian industrial architecture during that time and had a profound influence on many later-on architects. (Mercedes Volait, 2007)

Sayyid Karim declared that architects have abandoned their previous perception as "artists" and have assumed responsibility for designing factories, a role that was previously exclusive to engineers. He supported this by presenting a set of designs for “Misr Factory of Tobacco and Cigarettes” containing flowcharts that illustrated the movement of raw materials and products inside the facility. (Sayyid Karim, 1941)

Notably, the neo-Mamluk and neo-Pharaonic architectural styles linked to the Egyptian nationalist movement at that time, did not influence industrial architecture. This could be due to fact that the Egyptian architects, constructing factories, had already embraced Modernist style as the most suitable design for Egypt, particularly for its factories.

Water infrastructure of Tanta, in the Gharbiyya district of the Delta.

Fig.4.34. A perspective of the western façade of the filtration and pumping station, Tanta, Water Treatment Plants, 1926.
(The Alexandria and Mediterranean Research Center)

Fig.4.35. A perspective of the interior of the filtration and pumping station, Tanta, Water Treatment Plants.

(The Alexandria and Mediterranean Research Center)

Fig.4.36. Tanta Waterworks, ice factory. (The Alexandria and Mediterranean Research Center)

The construction of these buildings was carried out in 1925 by the architect “Mohammed ‘Irfan Bey” and the construction developer “Taverna” from 1925 until 1929. Mohammed 'Irfan Bey was serving as the leader of the administrative divisions and Local directorates. (Mercedes Volait, 2007) The complex primarily consists of three elongated structures, two of them were running parallel to each other on the northwestern edge of the site, and the third one was extending southeastward, adjacent to a line of the rounded precipitation tanks. All edifices are made with red-brick masonry, featuring architectural brick details like pilasters, arched windows, blind arches, and overhanging cornices on their fronts. While using a historicist design was typical during that period, the distinctiveness of these edifices was evident in their innovational roofing design. The two adjacent halls in the northwest feature elongated cylindrical shell roofs constructed from reinforced concrete. These roofs have curved concrete beams that reach out on both the exterior and interior sides of the shell. Moreover, iron tension rods are utilized to link the ends of the ribs inside the hall. These roofs are not truly a shell design; instead, they are barrel-vaulted roofs supported by concrete-and-iron trusses. Nonetheless, this design was deemed experimental within the Egyptian framework, even though it was progressive on a global scale. (Peter Morice and Hugh Tottenham, 2011). It is important to mention that although one hall used to function as an ice facility, the initial purpose of the other hall is still unknown. The third structure in the southeastern extension maintains its initial role as a pumping and filtration station. The pump house, akin to a two-story tower, is built with reinforced concrete pillars and slab supports provided by girders. The connected filter hall is elongated and slender, incorporating a mezzanine level constructed with a steel structure and a sloped roof upheld by steel trusses.

The generator hall located in Tanta.

This is also an example of the going on use of historical styles during the 1920s and early 1930s. Indeed, the structure was originally part of the waterworks complex mentioned earlier and is situated on a neighboring site more towards the north. (Bodenstein, R. in Mohammad Al-Asad 2010)

Fig.4.37. Tanta, Generator Building, 1931(The Alexandria and Mediterranean Research Center)

The structure, which is currently disused, is most often referred to as wabur al-nur, which is a direct translation of the Arabic word for a steam engine or power generation. The emergence of generator halls as a novel architectural category coincided with electrifying Egypt’s urban areas throughout the early 20th century. The enormous size and beautiful design of Tanta's generator hall are very outstanding. The rectangular hall, built in 1931 conforming to the conventional architectural principles, has a sloped steel-truss ceiling and red brick brickwork. Nevertheless, the structure exhibits characteristics such as: the corner posts that encircle the building's triangular facade; the western elevation facing the main thoroughfare features a pair of elongated columns with Art Deco spires; the "over-sized" yet streamline cornice, which is embellished with small tooth-like projections and an ornamental group of blue ceramic roofing materials; and the huge brick arch, which contains an impressive but plain central stone. These features collectively create a structure that lies between machine hall and temple architecture. The structure also evokes both the architectural style of Renaissance shipyard buildings from the mid-16th century, such as the Medici arsenals in Pisa, and the grand Classicism style of late-18th-century architects as Claude-Nicolas Ledoux and Friedrich Gilly architects. The prominent incorporation of Art Deco components serves as a clear indication of the transition towards Modernist design, which was already in progress during the construction of the generator hall.

The Misr Factory for Tobacco and Cigarettes.

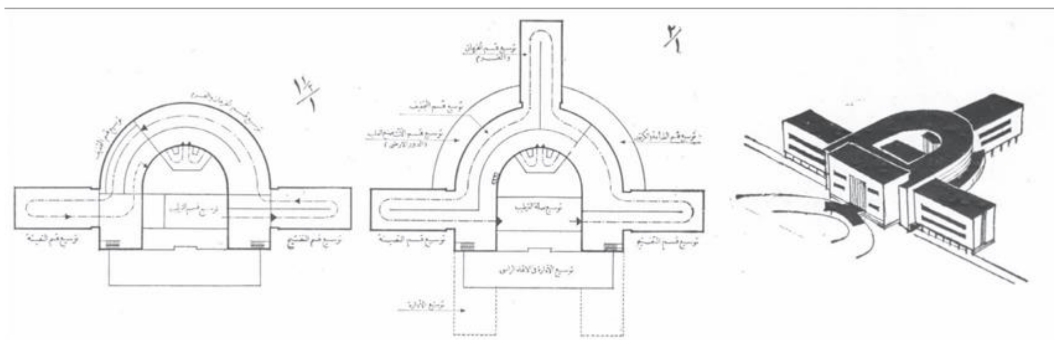


Fig.4.38. Egypt manufacturing facility for Tobacco and Cigarettes' Conceptual layout, with sketches of prospective expansions.

(Bibliotheca Alexandrina)

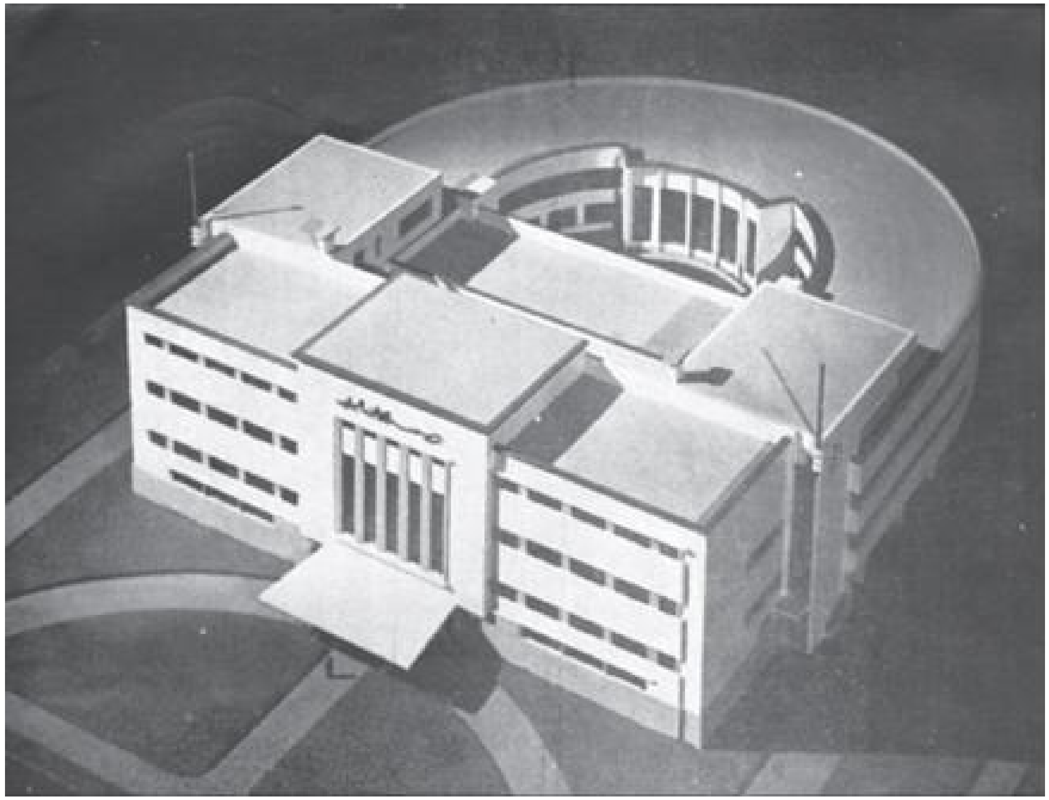


Fig.4.39. The architectural layout of the Egyptian Tobacco and Cigarettes Manufacturing plant carried out by Sayyid Karim in 1941. (Bibliotheca Alexandrina)

Sayyid Karim is the designer in charge of creating this building. The layout guarantees clear spatial separation between the movements of products, employees, management personnel, and guests. It also includes plans for future growth. Apart from the obvious focus on a utilitarian arrangement, the layout also reveals additional underlying issues. The facade of the structure features a balanced administrative section. The main section is elevated and features a spacious window façade supported by pillars resembling a portico.

Above the main entrance, there is a roof that extends upward, and in front of it, there is a semicircular driveway. This design can be viewed as a Modernist interpretation of a palace's main structure, symbolizing a novel approach to showcasing corporate authority and identity. The edifice's uniquely contemporary design, marked by its endless horizontal rows of windows and the curved workplace unit situated behind the office section, embodies the ideas of progress, a tech-savvy community, and active participation in current affairs. The incorporation of a lounge for staff members on the higher level of the main building, located directly above the reception and exhibition space on the second floor, indicates a dedication to social change, especially in offering services for staff. These represented multiple features of the contemporary industrial nature that factory structures in Egypt started to embody.

The expansion of Abd El-Meguid Barakat ginning plant in Damanhur, Delta zone.

Fig.4.40. The interior of Abdel-Meguid Barakat Ginning Mill (Damanhur) dating back to the early 20th century, featuring the initial timber platform and the operational rolling gins. The mill is still in service today. (Bibliotheca Alexandrina)

Fig.4.41. Residential complex for workers of the Abdel-Meguid Barakat Textile Mill, about the middle of 1940s. (Bibliotheca Alexandrina)

The construction of these extensions took place following the acquisition of the earlier ginning mill by Ibrahim Barakat, the father of Abdel-Meguid, in 1934. Not all additions have endured as the weaving mill constructed in 1935 was recently destructed. The remaining structures exhibit a distinct preference for Modern style. The manager house, located at the western edge of the property, features an Art Deco architectural style from the mid-1930s. In the mid-1940s, a Modern building with two stories was constructed alongside the curvature of the western and northern contours of the location. The bottom floor of the building included workshops that could be accessed from the street, while the upper floor housed flats for employees. During this period, it was common to have a director's villa on the factory premises, especially when the owner original residence is far from factories. This was also necessary to provide a suitable area for hosting business partners and guests. Consequently, these villas are more commonly associated with companies situated in regions not in the central urban areas of Cairo and Alexandria.

Employee housing also became a significantly important element in factories’ premises during this period. The Barakat ginning mill comprises multiple units, which consist of two- and three-room flats including individual toilets, as well as single-room flats with common toilets. These units are accessible from an open veranda that extends alongside the whole span of the structure.

Significant workers' housing developments were found to be implemented around major industrial facilities by that time, such as the Misr Company for Spinning and Weaving in El-Mahalla El-Kubra, founded by Talaat Harb, and 'Abboud Pasha's sugarcane processing facility in El-Hawamdiyya. This pertained to the pressing necessity of supplying accommodation for a rapidly expanding workforce, particularly in provincial cities that underwent unparalleled industrial growth. Furthermore, it can be considered as attempts of the government to mitigate the significant level of worker and labor union involvement, especially in urban areas such as Cairo and Alexandria. The deliberate establishment of new industrial hubs in locations distant from these two cities, together with government-funded initiatives for workers' and social housing, were closely intertwined, particularly from the late 1930s onwards. (Mercedes Volait, 2007)

An exemplary instance of Modernist industrial architecture may be observed in the comprehensive industrial facility cluster of the Egyptian Filature National enterprise located in the Muharram Bey zone of Alexandria, and the Société Générale de Pressage et de Dépôts situated on either side of the Mahmoudiyah Canal in the Mina El-Bassal area of Alexandria in addition to the complex of the Selected Textile Industry Association (STIA) in Alexandria's Hadra area.

The waterworks in Tanta, which were built in 1926 and the generator hall in 1931, respectively, exhibit historicist layout, while the buildings in 1934 display a distinctive Contemporary style. This exemplifies the rapid evolution of manufacturing architecture in Egypt.

However, architects in Egypt were grappling with a continuous internal conflict between Classicism and Modernism during this transitional era. As evident when comparing the first design of the STIA works in 1946 and later extensions built in the mid-1950s. The original building is reminiscent of Sayyid Karim's Misr Tobacco Factory from 1941, having a distinct blend of pragmatic industrial layout and a strong inclination towards monumental Classicism, symmetry, and ornamentation. On the other hand, the extensions of STIA implemented novel technical elements. The combination of prominent Modernism and overt demonstration of corporate influence in this design may be attributed in part to the preferences and requirements of the customers.

4.2.5. Post-1952 revolution, and the significant shift in industrial architecture.

1- industrial complexes around Cairo
2- New industrial cities around Cairo: the 10th of Ramadan City, the 6th of October City, and Madinat al-Sadat.
3- STIA multi-level textile mill (Alexandria)
4- El Nasr Automotive Manufacturing Company in Helwan (Cairo)
5- El Nasr Mining Company (El Quseir)
6- The Egyptian Iron and Steel Company (Helwan)
7- The hydraulic power station (El Faiyum)
8- military factories in Helwan
9- Misr Spinning and Weaving textile factories (El Gharbeya)
10- Cotton factory & laboratory for ginning cotton (Qalyubia)
11- textile manufacturing industry in Akhmim (Sohag)
12-Al-Qattan Carpet Factory in Cairo

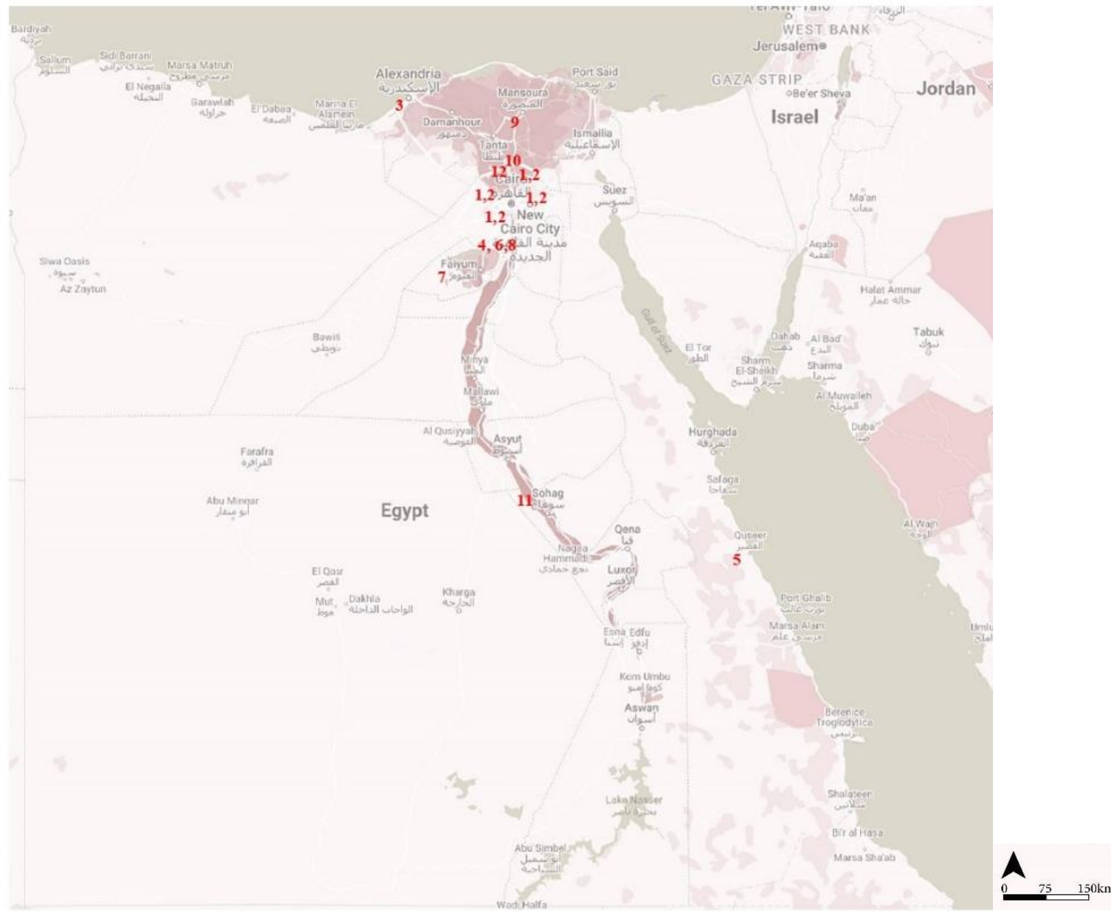


Fig.4.42. Industrialization post-1952 revolution

The new government originally prioritized agricultural reform and the development of infrastructure and societal services. Additionally, they upheld a liberal approach that fostered private sector and international investment. The implementation of a new policy, characterized by heightened government involvement in economic affairs and the promotion of capital-intensive industry, occurred only after the 1956 Suez War. However, it was intended that private capital would finance light industries at this stage, while state-financed expansion would be limited to the underdeveloped heavy industries. The process of seclusion and nationalization of non-native assets in Egypt commenced in 1956, initially targeting all British and French corporations. Due to the inadequate performance of private investments in industrial growth, the government proceeded to nationalize other private firms, including those of Egyptian origin. Owing to the banks' substantial investments in the industrial sector, the 1960 nationalization of Bank Misr was a watershed moment in which the state gained a stronger stake in this sector.

The Aswan High Dam was constructed between 1960 and 1964 to provide power, while the Red Sea, Delta, and Mediterranean regions were further developed for oil and gas extraction. These efforts were intended to provide power for the rapidly industrializing grandiose strategy. The industrial sector's contribution to Egypt's Gross National Product (GNP) increased from 10% in 1952 to over 20% in 1962. Helwan, Madinat Nasr, Shubra al-Khayma, and Imbaba are just some examples of the places in Egypt that saw the construction of massive industrial edifices.

Moreover, the preexisting factories underwent extensions and embellishment subsequent to their nationalization. Nevertheless, the substantial decline of private sector activities and its substitution with an economy under authority in the 1960s, had significant adverse impacts on Egypt's manufacturing. This was due to the absence of competitors, intricate administrative processes, excessive personnel, and decreased in the production process.

The catastrophic Arab-Israeli war of 1967 and the subsequent economic depletion of the government resulted in a decline in the output and even the brief inactivity of major enterprises. However, industry progress experienced a resurgence following President Anwar El-Sadat's in 1970, particularly due to his implementation of the Open-Door Policy (Infitah) in 1971. This policy facilitated the establishment of an open to trade economic status, its primary goals promoting venture capital growth, inviting international investment, and revitalizing the public domain via competitiveness. The previous initiative of extensive state-funded industrialization was abandoned in favor of a more equitable approach that promotes both agrarian and industrial progress. (Robert Mabro, 1972; Ezzat Molouk Kenawy, 2009) However, the government's support for public-sector business continued, as seen by the establishment of the new STIA facility. Novel cities like Madinat al-Sadat, the 6th of October City, and the 10th of Ramadan City were strategically established and developed in the desert areas surrounding Cairo as a result of the country's continued involvement in industrial expansion. These urban projects were initiated in the late 1970s. The establishment of these big industrial zones was intended to actually attract substantial investment and new companies from the expanding private sector. (Günter Meyer, 1988) The growth of these industrial zones is still ongoing. Despite Sadat's Infitah policy, state-owned industries were meticulously constructed and structured to function as representations of advancement and growth, serving as prominent symbols of authority attributed to the state rather than corporate capital. The expansions of El-Shirka El-Ahliyya (formerly known as Filature National), constructed in 1962, and the newly established STIA multi-level textile mill, constructed between 1971 and 1974, serve as illustrations of industrial structures following the revolution. These structures demonstrate the ongoing development and refinement of contemporary designs of the Egyptian industrial construction throughout this era. These tasks were carried out by local designers and architects.

4.2.6. Additional Egyptian industrial legacy settings:

El Nasr Automotive Manufacturing Company

The creation of the El Nasr Automotive Fabrication Firm was a component of a national five-year initiative aimed at fostering a significant industrial revival through commercial and industrial interchange. The inception of this project was undertaken in 1956 by the Ministry of Industry under the leadership of former president Gamal Abdel Nasser.

The company’s site had an area of 114-acre located in Helwan, in Cairo. The site comprised four primary facilities: the press factory, gears, and Lorrie’s plant, the technical devices factory, and the automobile assembly facility. It was established in 1960. The firm’s performance was facilitated through arrangements done with international manufacturers such the German Klöckner-Humboldt-

Deutz (now Deutz AG), the Italian FIAT, and the Yugoslavian tractor maker IMR. The company's operations were characterized by the presence of assemblage lines for the production of Lorries, buses, agricultural tractors, and passenger automobiles. At the start, the company employed a workforce of 290 individuals. The manufacturing industry experienced its peak in the early 1980s, as it was employing more than 12,000 skilled technical individuals. Ten years later, the company was unable to keep up with the extensive variety in the worldwide vehicle industry. This resulted in a decrease in revenues and the implementation of an "early retiring" strategy, which involved releasing approximately 2500 employees. The firm maintained its operating activities until 2000, when it came under the control of the Holding Company for Metal Industries and was subsequently divided into two separate lines of production. The manufacturing of buses, Lorries and agricultural tractors was segregated into a distinct entity called the Engineering Company for Car Manufacturing. Meanwhile, the 2nd manufacturing line, known as "El-Nasr Company," remained dedicated to the production of passenger automobiles till 2009. The company assets were placed under monitoring following the liquidation, but they remained vacant. Reviving El-Nasr organization through its incorporation into the Ministry of Military Productions was the goal of a 2013 study project. (Hefzy, S., 2020).

El Nasr Mining Company

In order to sell its minerals to Western countries, Egypt set up a number of mining companies between the late 1800s and the middle of the 1900s. The majority of these enterprises were situated in the Red Sea region.

The industrial complex of El Nasr Mining Company, dedicated to the extraction and processing of phosphate, is situated in the town of El Quseir. It is established in 1912 by Italian private entrepreneurs in the municipality of Agordo, its production began the following year. "Egyptian Phosphate Mining and Commercial Corporation" was the original name of the firm. The Bank of Rome provided initial funding, and the Italian Industrial Reconstruction Institute (IRI) took over management. Using cable cars, about 400,000 metric tons of phosphates were brought in every year from seven different mines, handled, and then sent out through El Quseir harbor.

The factory utilized industrial equipment dating back to the 19th century for Phosphate manufacture. A total of forty buildings made up the industrial complex. Among these were an Italian college, a cathedral, a religious’ housing, an office building, storage rooms, workshops, a roundhouse for locomotives, staff residences, and a café. Additionally, there were other outdoor amenities, including a cinema, a tennis court, and King Farouk's rest house. (Cabassi, A., 2012) The company was renamed "Misr Lil Fosfāt" in 1958 after it was nationalized and re-titled "El Nasr Lel Ta'dīn" twenty years later.

Several years after the cessation of the site's industrial operations, the gear was in extremely poor shape, and the owning corporation has resorted to selling it as scrap. (Amin S. M., 2020) Additional industrial equipment can be found within the confines of El-Quosyer citadel, a historic fortress constructed during the Ottoman period under the rule of Soultan Selim II to safeguard pilgrims and trade caravans. An exhibition showcasing antiquated mining equipment, specifically highlighting the phosphate firm of El-Quosyer is present at the vicinity of the eastern tower of the citadel.

Moreover, the site's facilities were mostly divested of their metallic buildings and historical records. So, the majority of the company's buildings are abandoned with the exception of: the church, which has been renovated to cater to the Coptic community; the administrative building which was reused to showcase geological samples from the region; the nuns' house which is currently accommodating the corporation's personnel and staff in addition to the educational institution which now functions as a police station. The vast location lately became embroiled in significant conflicts between advocates of preservation, on one side, and advocates of destruction on the other, in order to use the area for investment ventures. Although the site has a wide range of buildings, the National Organization of Urban Harmony (NOUH) recognized only three of them in 2022: Rest house of King Farouk, the Italian educational institution and managerial edifice. The future of residual structure that that enhance the inherent importance of this business is still uncertain. These structures are being disregarded and a few of them are in a state of significant deterioration. (Pellegrini, I., 2011).

Fig.4.43. One of El-Quosyer's former phosphate plants: actual situation (Shreen Mohmed, 2020)

Fig.4.44. The El-Quosyer fortress wagons that carried phosphates at the outset of the twentieth century. (Shreen Mohmed, 2020)

The iron industrial sector in Egypt.

It was initiated in 1948, followed by the establishment of nitrogenous fertilizer production in 1951. These industrial endeavors were mostly driven by the private sector, including Banque of Egypt that was founded in 1920. (Shura Council, 1985) From 1948 onwards, many endeavors were made to produce iron and steel, resulting in the establishment of three companies: “Misr copper firms, the Delta Steel firms, and the National organization for Metal Industries. The Egyptian Iron and Steel Corporation was the inaugural entity that transformed Egypt's iron sector, by utilizing iron metal as its principal material, it was founded in 1956.

It was founded by the ex-President Gamal Abdel Nasser in the Helwan district of Al-Tebeen. The initiative began on a vast land exceeding 2,500 acres. This region includes the factories, residential area, and the nearby mosque. The agreement was finalized with Demag Duisbergn, a German firm referred to as East Germany, to set up the production facilities and offer the requisite scientific knowledge. Meanwhile, El-Dekheila hub was used to provide the required coal for the functioning of the kilns. Furthermore, a railroad link was created from the port to Helwan, and another railroad line was built to carry iron ore from the oases to Helwan. The project made use of iron ores that were abundantly available in the Aswan mines, which spanned an approximate area of 1,250 square kilometers. In that time frame, the factory's output reached about 210,000 tons, later rising to 1.5 million tons in the 1970s. The steel manufactured was as sheets of various dimensions and thicknesses, bars, iron flanges, railway flanges, along with angles, beams, iron sheets, pipes, oil storage, and additional products. Furthermore, it acted as a major provider of raw materials for the Al Nasr Auto facility situated in the Wadi Hof region. The Iron and Steel Company has consistently focused on obtaining assistance from specialized skillful global individuals. In 1961, an agreement was established with the (former) Soviet Union to enlarge the facility and augment steel output from three hundred thousand up-to one and half million tons per year. In accordance with the commitment, the utilization of ore from the Aswan mine and El-Wahat El-Bahariya mine for the whole complex was stopped. Nonetheless, the use of these ores has presented several challenges because of their harmful impurities. On January, 1991, it was declared to be an Egyptian corporation aligned with the Holding Organization for Metallurgical Industries and subjected to the rules specified in the legislation 203 of 1991.

Fig.4.45. El Nasr Automobile Firm & the Iron and Steel Corporation

(Gamal Abdel-Nasser Foundation in cooperation with Bibliotheca Alexandrina)

The El-Sabeeh Library and Print Edifices.

It is a notable establishment located on El-Azhar area. The printing equipment utilized in the printing firm of El-Sabeeh Library exemplifies the significance of the manufacturing apparatus employed in 18th century Egypt. The activities of El-Sabeeh Library involved the use of a printing machine from the 19th century. This machine is currently overseen by the Historic Cairo Project Directorate of the Ministry of Tourism & Antiquities of Egypt.

The hydraulic power station.

It is another example of industrial legacy in Egypt, it is present in El Faiyum, a city in Middle Egypt. It was constructed in 1936, and it commenced electricity production by 1940. The station formerly provided energy to numerous villages and facilitated the irrigation of approximately 5,000 agricultural plots for Mohammed Aly Pasha's family. The station harnesses a total power output of 33 kilowatts from seven waterfalls to create electricity. The station remained operational until 1971, housing various facilities such as warehouses, workshops, and transformer rooms for electricity generation. The turbines were powered by flowing water, which in turn produced electricity. Additionally, the station is equipped with a DC battery compartment that serves the purpose of illuminating the station during maintenance work or in the event of a malfunction. The El Faiyum location provides access to both new and historic turbines, as documented in figures on the Meet Fayoum's Hidden Waterfalls! website in 2019.

Fig.4.46. El Faiyum Energy Station showing the old and the modern turbines. (Explore Fayoum, https://fayoumegypt.com/explore-fayoum-with-fayoumer/)

Military factories.

Under the presidency of Gamal Abdel Nasser, the military played a pivotal role in Egypt's industrial endeavors. An ambitious endeavor was undertaken by Egypt, India, and the previous Yugoslavia in the beginning of 1960s to build a manufacturing venture for weaponry, missiles, jet engines, and airplanes. The Helwan HA-300 aircraft was produced at Helwan, with Egypt overseeing the production of the initial pair of missiles. The Ministry of Military Production has constructed multiple military factories to fulfil the needs of the Egyptian Armed Forces.

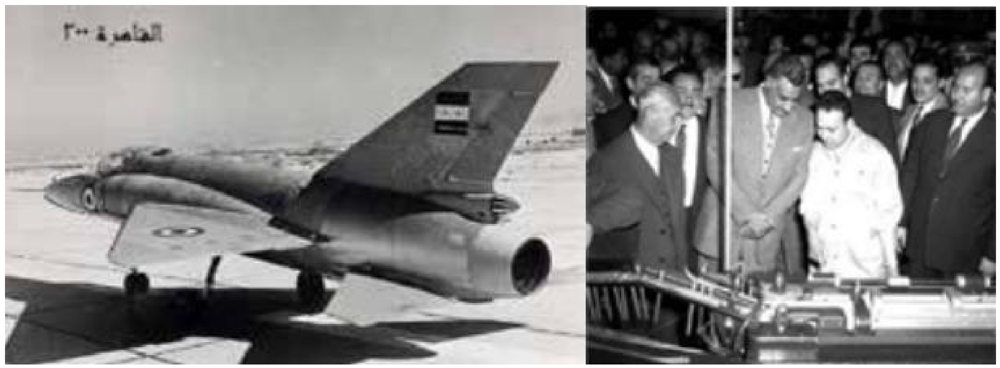


Fig.4.47. A Helwan military facility and the first inaugural jet aircraft to take off from Cairo Source: President Gamal Abdel Nasser website. (http://nasser.bibalex.org/home/main.aspx?lang=aR)

Textile manufacturing factories.

They are mainly located in El Mahalla El Kobra, in the El Gharbeya Governorate. Fabric mechanization industry dates back to 1927 with the establishment of Misr Spinning and Weaving, a firm under Banque Misr formed by "Talaat Harb" in 1920. Production at Misr Spinning and Weaving, which included six spinning plants, commenced in 1930. Among the many vintage industrial implements housed at El Mahalla El Kobra are ginning gear that dates back to 1875 and spinning wheels that date back to 1810. In 2019, the Egyptian Ministry of Public Business Sector announced its plan to establish the textile plants in El Mahalla El Kobra. As part of Egypt's Ministry vision for 2025, there are strategies to create new comprehensive cities dedicated to textile industry in order to enhance and support the sector. These plans encompass the establishment of four additional plants, the modernization of outdated equipment in current factories, and the provision of training for personnel. (Amin S. M., 2020) Another industrial legacy, situated in the Qalyubia governorate, encompasses factories dedicated to cotton production, together with cotton ginnery equipment that have been abandoned in a deteriorated state.

Fig.4.48. The antiquated cotton plant and workshop for cotton spinning in Qalyubia Governorate.

(Shreen Mohmed, 2020)

Akhmim, a city in the Sohag Governorate in Upper Egypt, is renowned for its textile manufacturing industry, in which conventional producers utilize mechanical looms to produce textiles. Additionally, the city serves as a significant textile hub. The Handmade weaving business was included in the 2020 Intangible Cultural legacy Listing requiring prompt protection (15.COM). (The UNESCO Culture Intangible Heritage Lists for the year 2020).

Fig.4.49. Mechanical looms in Akhmim. (https://markazstore.com/blogs/blog/reviving-ancient-traditions-master-weavers-of-akhmim)

Another comparable example of the Hand-woven manufacturing can be found at El-Qattan Carpeting Facilities in Cairo. This factory has been producing artisan-crafted rugs with weaving machinery since its inception in the 1930s. The Egyptian Ministry of Culture formally documented it in the "Register of Egyptian and Coptic Antiquities" and is currently under the jurisdiction of the Ministry of Tourism and Antiquities, together with the proprietor of the factory. Mr. Ahmed Al-Qattan, the proprietor, bought an antiquated palace in the Old Cairo region and undertook its refurbishment and preservation. Subsequently, he inaugurated it as a facility dedicated to the production of artisanal carpets. He established a school dedicated to instructing young Egyptians in the art of carpet weaving, with the intention of ensuring the factory's continuity through successive generations. As a result, the business has managed to maintain its original structure. (The Oriental Carpet School in Egypt, May 2023).

Fig.4.50. The traditional looms &Al-Qattan Carpet Factory (https://en.majalla.com/node/124411/cultureegyptian-factory-throwing-down-gauntlet-persian-carpet-makers)

The industrial machines' archival photos illustrate the historical aesthetic significance of this Egyptian heritage. These archive images serve as a historical documentation of the Egyptian machinery's operations throughout the 18th and 19th centuries.

The Voice of Cairo (Soot El kahira) Corporate for Audio and Video.

The composer Mohamed Fawzy developed the primary vinyl corporation in the Middle East on April 30, 1959. It was named "Masrafon" and became the inaugural record- maintaining enterprise in Egypt. He also possessed a strong interest in the Egyptian film archive and handled the initiative of preserving the gathered array of the vintage negative slide images (Frishkopf, M., 2008).

Fig.4.51. Vintage photographs of artifacts featuring antiquated industrial apparatus. (Egypt archive)

Chapter 5
History of industrialization in Alexandria and its industrial heritage

Upon the arrival of Alexander the Great in Egypt, his conquest was previously establishing new domains in strategically important armed and commercial establishments along the Mediterranean Sea, extending as far as Afghanistan and India. The location he selected in Egypt, was a humble fishing village called Rhakotis, extending along the coastline. Five villages were dispersed in its south, between Lake Mariout and the Mediterranean. Additionally, the Island of Pharos which was located close off the coast, vanished later on, provided exceptional geological defense against maritime invasions. The closeness of Rhakotis to neighboring villages facilitated access to industry and other services, hence facilitating the establishment of the city. This coastal city was strategically designed to face the north, about thirty km away from the Delta east tip and serving as a crucial link between the Greek World and the fertile Nile Valley. It was intended to be a prominent commercial port in the Mediterranean region. Mina El-Bassal, located on the city's westernmost border, directly fronted the Island of Pharos. The ancient city subsequently expanded eastward, to establish proximity to the Nile River and major trade routes. The most significant infrastructural advancement, by that time, was the construction of an artificial bridge that linked the adjacent Island of Pharos with the mainland. The structure was constructed on a massive scale, measuring around 1,260 meters in length. The expansion of the landmass into the waterways, resulted in the accumulation of sediment and waste and created two bays with a harbor on each side. These harbors, known as the Eastern Harbor and the Western Harbor, both of them still exist till the present time. After Alexander's demise, Alexandria assumed the role of the novel capital and the principal city of Greece. In the Byzantine era, the bustling port area of Alexandria was considered a major military and naval hub, as well as a center for trade, particularly in wheat.

The economy of Alexandria flourished as a result of the burgeoning industry and trade with other Mediterranean ports. To facilitate Egypt's international trade, the country focused on developing its ports. One of them the Western port of Alexandria which was subjected to one of the earliest revival projects because of its superior mooring capacity and being closed to Europe, while the Eastern port was disregarded. The restoration of the Western harbor facilitated the arrival of larger and more numerous ships, in contrast to the eastern harbor which frequently faced adverse winds blowing from the northeast. The consular offices and houses of the merchants were situated at the southernmost point of the eastern harbor. (Wiet G. 1959).

In general, the geographical distribution of industrial activities in Alexandria can be summarized as:

1- The vicinity surrounding the Seaport was mainly for the storage of imported and exported commodities. The region evolved as a consequence of Egypt's financial expansion and flourishing from the middle of the nineteenth to the middle of the twentieth centuries. Warehouses and cotton presses dominate this area.

2- Many factories and companies were strategically located near the banks of the Mahmoudiyah canal because of its closeness to the main route that links Alexandria to the remaining regions of Egypt. This area first arose in the center and then spread eastward in the late half of the twentieth century.

3- Workshops and factories engaged in non-polluting industries, such as food manufacturing, are dispersed across the city mainly in its central business districts.

Fig.5.1 Geographical distribution of Industrial sites in Alexandria as depicted on a satellite imagery of the city.

(Google Earth's base map)

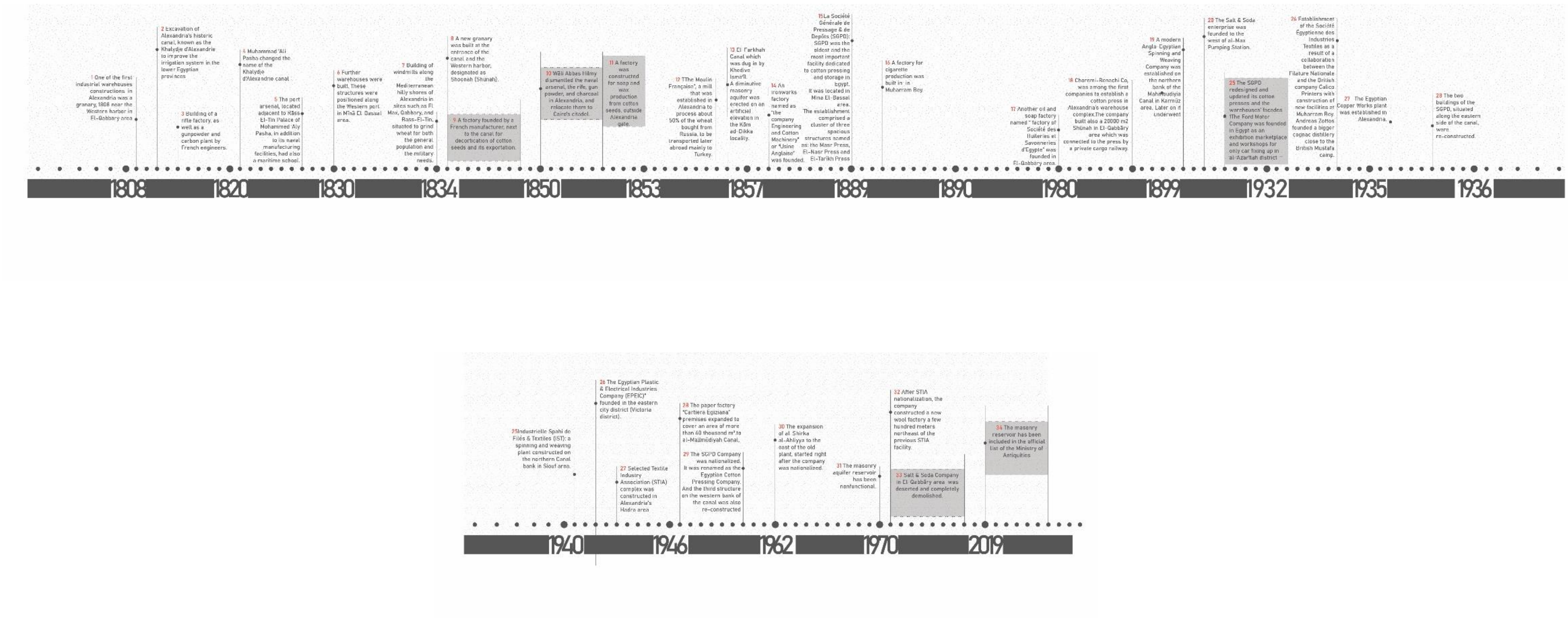


Fig.5.2. Alexandria industrialization time line.

5.1. Industrial sectors serving military strategies in Alexandria.

Mohammed Aly Pasha effectively convinced designers from France to develop an ammunition manufacturing facility, as well as a gunpowder and carbon plant, they were founded in 1819. The port arsenal of Alexandria was located adjacent to Rās El-Tīn Palace, which belonged to Mohammed Aly Pasha. It was positioned at the northernmost point of the Western harbor and served as a prominent hub for Egypt's shipbuilding industry. Additionally, it encompassed the manufacturing of ship ropes (rope factories), along with the creation of sails, tin smithing, woodworking, turning, large metal and wooden gunnery & cannon manufacturing, and storage facilities for wooden products. The arsenal was overseen with the help of experienced artisans from Toulon and Malta. (Schoelcher 1846) Besides its naval production facilities, the arsenal also featured a maritime academy. In 1850, Wāli Abbas Hilmy ordered the dismantling of the naval arsenal in Alexandria and its relocation to the citadel in Cairo. It was similarly implemented in the manufacturing of rife, gunpowder, and charcoal (Al-Gamal and Abdel-Rāziq, 1997; Najm 2009). Moreover, three state-owned tanneries were set up to meet the military needs: one in Assiut, Upper Egypt, another in Roseta, situated in the Nile Delta, and a third in Alexandria. The tannery in Alexandria was situated right next to the Place des Consuls. The Roseta tannery was moved to Alexandria in 1850. (Sainte-Marie, 1974)

5.2. Windmills construction

Starting in 1833, Mohamed Ali commissioned the construction of windmills throughout Egypt to grind wheat for both the general population and the military needs. These windmills were strategically built in sites such as El Max, Qabbary, and Ras-El-Tin, situated alongside the Mediterranean hilltop shorelines of Alexandria, specifically in locations where winds could be easily harnessed. Until 1880, 50% of the wheat was bought from Russia, to be processed in a wheat mill then transported abroad mainly to Turkey. This mill, known as “The Moulin Française”, was established in Alexandria in 1858 on an area of 30000 m2 mill. (Saul 1997) Windmills are a distinct form of industrial heritage. The structures were constructed using stone or red bricks, and had round cylinder shapes with conical timber roofs. Other windmills in Alexandria were located in Mandara and Montazah Palace, but neither of them is operating anymore and they have been officially designated as archaeological sites.

Fig.5.3. Mandara Windmill is the sole surviving windmill in Alexandria.

(The Alexandria and Mediterranean Research Center, Bibliotheca Alexandrina)

5.3. Industrial activities related to cotton boom.

The storage facilities of Alexandria emerged as its primary manufacturing edifices to face the cotton boom. They evolved from a storage within a vendor's domicile - Wikālah - to a standalone voluminous edifice detached from the vendor's dwelling. The majority of the warehouses were utilized for the storage of exported and imported commodities, notably cotton and timber. They were built in significant numbers in the second part of the nineteenth century and the first part of the twentieth. They were strategically positioned near the harbors and alongside the Mahmoudiyah shores to ease the movement of commodities to various regions of Egypt. Warehouses were comprised of expansive one or more storeys structures. The vast edifices had ceilings constructed from timber beams and embellished with reddish bricks. The walls were load-bearing structures constructed from either white sandstone or red bricks. Later on, these storage facilities were constructed using concrete reinforcement structural panels and un-plastered redbrick infill, commonly referred to as "brick-style."

One of the first industrial warehouses constructions was a granary, perhaps built around 1808 near the West side of the seaport and the southern shore of the Khalydje d’Alexandrie, known as El-Qabbary. In the 1830s, further warehouses were built. These structures were positioned in a stretched manner along the Western port, situated in the region that extends from the canal's northern edge (formerly known as Khalydje d'Alexandrie) to the Arab wall. This particular place was called Mina El-Baṣṣal. The granary contained an assortment of crops such as cotton seeds, corn, wheat, beans, and vetches, which were brought from Upper Egypt via the canal. When arriving at the granary, these goods were purified, kept, and prepared for leaving (St. John 1834). In 1834, a new granary was constructed at the entrance of the canal and the Western harbor. Formally recognized as Shoonah (Shūnah). The structure is expected to have large proportions, with walls made of limestone and a flat roof built from wood. The framework is supported by long rows of more than 450 large rectangular columns. Shuwan were possessed by aristocratic people, familial enterprises, and banking institutions example Choremi, Benachi and Amin Bey. Choremi-Benachi and Co, was the first company to establish a cotton press in Alexandria’s warehouse complex. The press covered an area of 7000 m2. Furthermore, in 1898, the firm constructed a 20000 m2 Shūnah in the El-Qabbary region because of the crowded conditions around the press, which was linked to the Shūnah by a dedicated freight railway. (Glavanis 1989)

Additional warehouses were built until 1843, maintaining the same architectural characteristics mainly parallel to the canal however some were built within the residential area as that of Dahan grains Storing Facility. The warehouse structures varied in size from 100 m2 to 20000 m2. Since Mīna El-Baṣṣal and El-Qabbary were separated by the canal, a bridge was constructed to connect these regions. It was called Kubrī al-Tarīkh, translating to "bridge of history." As additional warehouses were established alongside the canal, an increasing number of bridges and major roads were constructed to link them and the commercial area to Mina El- Bassal, across the canal towards El-Qabbary. (Gabriel Baer 1968)

The early 19th century was the era where mainly wood was utilized in construction of buildings, railway works, shipbuilding, and carpentry. The initial part of the nineteenth century experienced the use of timber in architecture, railroad design, naval construction, and woodworking. Timber was primarily brought in from Italy, Anatolia, and Syria to be kept in yards or depositos. These depositos consisted of timber roofs with pitches supported by stone pillars with exposed wall sidewalls.

Fig.5.4. Two kinds of warehouses are seen, the left one with Supporting walls while the right one shows a concrete reinforcement frame featuring visible slabs of concrete and redbrick filling. (The Alexandria and Mediterranean Research Center, Bibliotheca Alexandrina)

Fig.5.5. The Northeast perspective of the remaining upright eight thousands m^2 warehouse of Amin Bey, intended for cotton. (ANPIEMED)

Fig.5.6. The frontage of a sugar storehouse belonging to al-Dā'irah as-Sunnīyah (ANPIEMED)

Fig.5.7.The deserted Choremi-Benachi Mill referred to as Shūnah Choremi (Author & ANPIEMED)

Fig.5.8. Aerial image of the Cotton Warehouse Edifice of Choremi Benachi and Co. in El-Qabbary. (Archives CEAlex).

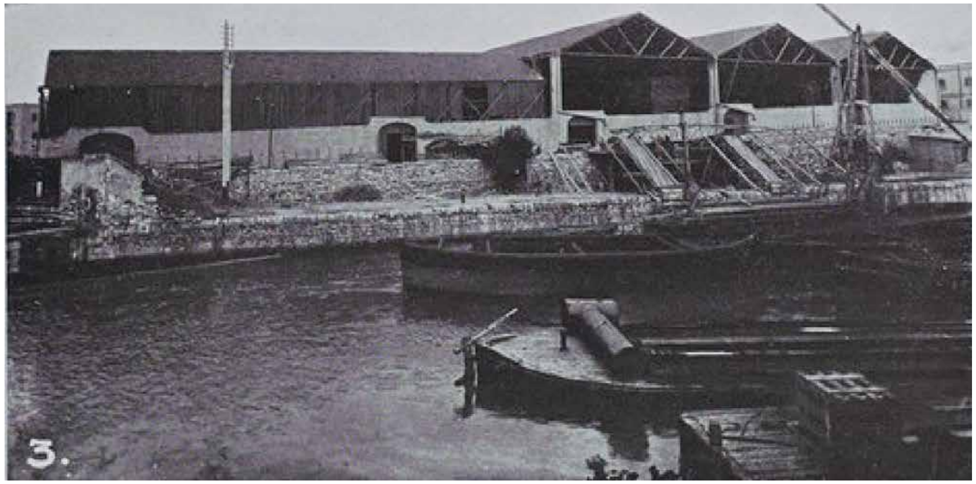


Fig.5.9.The wood deposito of Giovanni Stagni by the north shore of the Canal, 1909**.** (Archives CEAlex).

Fig.5.10. Storehouse Dahan is largely blended with Arab houses, distinguished by its angular, upwards projecting façade. The edifice overlooks the inaugural bridge linking both banks of the Canal. The bridge is known as Kobrī at-Tarīkh, (Late nineteenth century and early twentieth century. (*Dar Al-Watha'iq al*-Qawmeia)

The transition in the economy from exporting cotton globally to processing it locally was evident in Alexandria. This change was noticeable in the rise of local textile factory establishments. In the late 1830s, twenty-nine textile factories were set up, alongside various other kinds of production establishments. The equipment needed to run the established plants was mainly sourced from France, Austria, and Italy. (Najm 2009)

La Société Générale de Pressage & de Depôts (SGPD): SGPD was the most antiquated and the most important facility dedicated to cotton pressing and storage in Egypt especially following the First World War. It was established in 1889 and its administration primarily consisted of British and German citizens. The primary facilities of the establishment comprise a cluster of three spacious structures situated on either side of the Mahmoudiyah Canal in the Mina El-Basal area. By the early 1920s, the SGPD redesigned its cotton presses and the warehouses' facades to update their manufacturing constructions. So, two buildings, situated along the eastern side of the canal, were re-constructed in 1936, seemingly as replacements for previous structures. The third structure, on the western bank, was also re-constructed, following the same architectural style, after the company's nationalization by mid-20th century. The trio of buildings were conceived by a British designer Noel Dawson. (Meyer, Martin et al. 2022)

The trio cotton presses were identified as: the Misr Press (also known as the Egypt Press), the an-Nasr Press (also known as the Victory Press), and the at-Tarīkh Press (also known as the History Press). Despite the first two were shuttered for the previous 30 years, the third one continues to process cotton, albeit to a lesser degree. The sturdiness of the three structures is on display. The initial milling equipment, purchased from Manchester in the 1920s, is still in operation. Attempts to include the three buildings into a sustainable urban preservation project have not been effective, in spite of their formal recognition as components of the storehouse complexes listed on the National Organization of Urban Harmony's (NOUH) inventory. These buildings, which were taken out of service several years earlier, were utilized by other firms for warehousing reasons. (NOUH, 2017)

The renovated SGPD buildings were characterized by their huge multileveled cubature (three-story edifices), in contrast to the surrounding low-levelled buildings. Its frontages facing the Canal revealed the obvious use of reinforced concrete and red-brick. The columns and girders are visible and create a grid-like pattern on the façade. In place of window ribbons, the building has slender horizontal rectangular windows on the ground level and tall elliptical windows on the top level. One defining aspect of this layout is the arrangement of longitudinal steel platforms that run from the ground floor towards the loading entrances found on each floor of the cotton processing and storage edifices. The architecture is characterized by its simplicity and practicality as it is devoid of any decorative elements, The design evidently fulfilled its intended purpose effectively that epitomized functionalism in its most fundamental form. That is why the Egyptian engineers, who constructed the third structure faithfully copied it, paying meticulous attention to every detail. This distinctive design expressed the strength of SGPD. (Politis 1930)

Fig.5.11. A perspective of the Société Général de Pressage et de Dépôts, cotton-pressing and warehouse

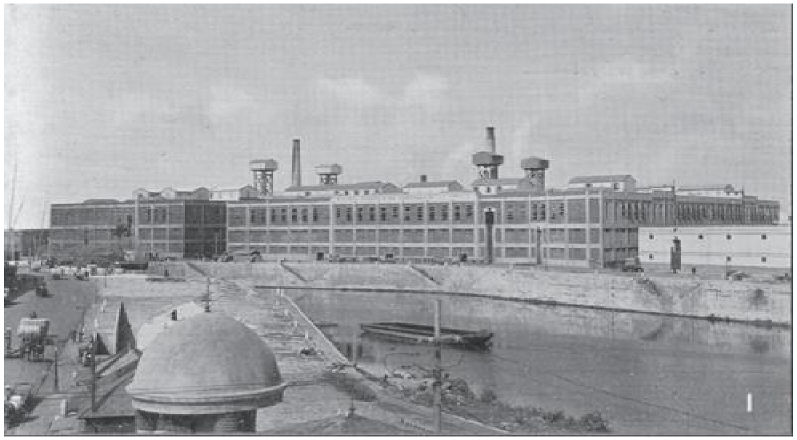


Fig.5.12. An archival picture (1936) of the cotton-pressing and warehouse of the SGPD.

(The Alexandria and Mediterranean Research Center)

Fig.5.13.The pair of the currently operating Société Général de Pressage et de Dépôts cotton presses, (2019). (Author & ANPIEMED)

<u>Industrielle Spahi de Filés & Textiles (IST):</u> Built by Sapahi family in Seyouf area in 1940. It was established on one hundred and fifteen thousand m ^{2} area, it contained several expansive edifices. Each edifice was one to two- story and sounded like a cuboid in shape. The 3- story administrative edifice is placed at the south-eastern section of the plant. It is connected to a corner staircase having the shape of a vertical polygonal tower. The architectural neo-Morish stylistic forms evident in the administration edifice is also obvious in the three-leveled minaret. A rhomboidal shaped embellishment was seen on the frontage of the administration building. The IST was the first industrial plant to comprise a mosque within its buildings. This mosque was constructed in an identical manner to the administration edifice including its minaret/ tower adaptation. (Bodenstein 2010)

Fig.5.14. A perspective of the IST. (1940). (The Alexandria and Mediterranean Research Center)

Fig.5.15. El Siouf Fabric Enterprise administration structure, which was once the Sepahi Factory. As emerging Islamic design gained popularity by that time, industrial construction began also to include architectural elements of such design. (The Alexandria and Mediterranean Research Center)

Fig.5.16. Polygonal staircase tower of the managerial edifice of the Société Industrielle Spahi de Filés et Textiles and Spahi Villa semicircular terrace. (The Alexandria and Mediterranean Research Center. Alex Med)

<u>Filature National d’Egypte:</u> A modern textile corporate was established in Karmuz area on the north bank of the Mahmoudiya channel in 1899. It was the most ancient and extensive Egyptian diversified textile conglomerate. The head of Egypt's Greek community, Michel C. Salvago, was the president of the organization while its director was Linus Gasche, who was a renowned textile expert from Switzerland. (Robert Tignor, 1987). The company was dismissed in order to accommodate a residential development, but it underwent privatization and ultimate closure. By 1911, it was re-founded as the Filature National d’Egypte also known as El-Shirka El-Ahliyya lill-Ghazle well-Nasig which evolved later on into the Egypt’s leading textile company. (Müller 1992) The new facilities were constructed at Muharram Bey in 1934, as a result of a collaboration between the Filature National and the British company Calico Printers. This partnership led to the establishment of the Société Égyptienne des Industries Textiles, which operated as a fully integrated enterprise involved in cotton spinning, weaving, and printing. (Tignor, R., 1987).

The corporate originally comprised structures designated for weaving and printing operations, an admin workplace, gatehouse, an energy facility, a minor medical institution. The workshops for weaving and printing comprise three long cubic buildings, each extending over three levels. These blocks are arranged in parallel lines and connected by bridge-like structures that extend across the highway between them. The structures are built on a foundation made of strengthened concrete, featuring spacious workshop spaces on every level and plain façades with uninterrupted window strips. The structures feature a straightforward and practical design that is somewhat redundant, yet this is balanced by the management edifice, which is linked to the corporate’s central block. The structure is a four-level building that adheres to a uniform design and building style. Nonetheless, it sets itself apart with a curved corner and a noticeable stairway and elevator tower that spans the entire facility. The tower prominently features the company's emblem and concludes with a ribbed Art Deco spire topped by a flagpole. Each floor's offices feature spacious and brightly lit open-plan areas for employees, alongside independent spacious directors’ office suites with reception areas. This organization of "functional" separation is frequently seen in other factory management structures from that time period. Although the medical center was a modest, one-level structure with a plain Art Deco aesthetic, it emphasizes a unique approach by providing an unusual social amenities for employees.

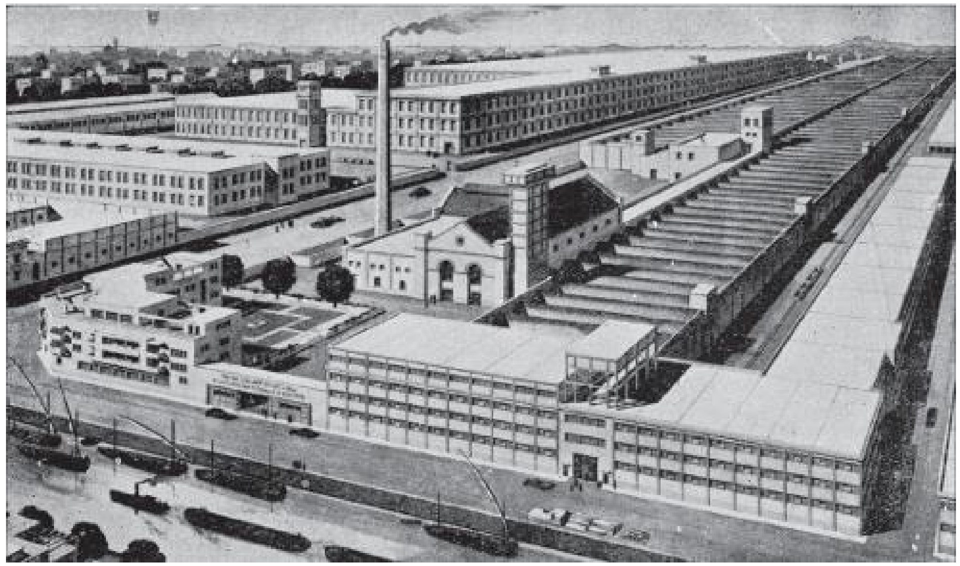


Fig.5.17. The Filature National d'Égypte, the ancient facility in Alexandria's Karmuz District, was founded in 1911 and has since undergone numerous expansions. (Alex Med)

Fig.5.18. The newly constructed workplace of the Filature National d'Égypte, with the elevator shaft and the western industrial edifice.

(Alex Med)

Fig.5.19. Internal perspective of the industrial hall of the novel structure of the Filature National d'Égypte.

(The Alexandria and Mediterranean Research Center)

The expansion of El-Shirka El-Ahliyya commenced in 1962, right after the corporation was nationalized. The extension took place on a land (about 15-33 feddans that equal to 63,000- 138,600 meters) situated to the east of the old plant.

The newly constructed facilities consisted of a textile staining mill for cloth and a textile staining mill for threads, encompassing a total area of 20,000 square meters. Additionally, there were repair workshops and a building dedicated to generators. The purpose was to increase production capacity in accordance with the old company's initial integrated spinning, weaving, and dyeing operations. These new structures exhibit significant architectural diversity. The cloth staining plant is a substantial, rectangular single-story structure featuring thirteen overhanging cylindrical shell rooftop components. It is made of reinforced concrete and has outside walls filled with red bricks. The building also features shell-roofed monitors. The yarn dying mill is a smaller structure that shares a nearly identical external design. However, it includes a ground floor that is specifically designed for housing mechanical installations that serve the workshop hall located on the higher floor. The edifice features six cylindrical-overhanging ceilings with monitors on the upper level, stabilized by masonry supports. The cylindrical ceilings include large, semicircular apertures akin to Diocletian or thermal windows. This exquisite detail evokes connections not just with the ancient bathtubs of Rome but also with early Contemporary architecture.

The two dyeing mills stand out from other manufacturing halls of the period due to their exceptional roof architecture. However, other sections of El-Ahliyya expansions in 1960, incorporate ceiling techniques which became more prevalent throughout that era. An instance of this is the utilization of a north-facing saw-tooth roofing structure made of concrete reinforcement for the expansion of the fabric staining rooms. Another roofing style is employed for El-Ahliyya's new generator building which is a gently curved multi-barrel shell-roof design that does not have monitors. With the addition of the windows' stacked brise soleil elements, which bear a resemblance to cooling fins, making the construction particularly suitable for a generator building.

Fig.5.20. The inside perspective of the newly established dyeing facility for fibers, El-Shirka El-Ahliyia**.**

(The Alexandria and Mediterranean Research Center)

Fig.5.21. The new bleach facility for fabrics, with an inside perspective of the overhanging shelled roofing, El-Shirka El-Ahliyya.
(The Alexandria and Mediterranean Research Center)

Fig.5.22. Al-Shirka al-Ahliyya, perspective of the 1962 expansions, featuring novel coloring processes for fabrics (right) and for fibers (left). (The Alexandria and Mediterranean Research Center, Alex Med)

Fig.5.23. El-Shirka El-Ahliyya expansion in 1962; Novel bleaching procedures for fibers including apertures resembling thermal windows. (Alex Med)

Fig.5.24.The new staining facility for fabrics of El-Shirka El-Ahliyya, 1960s expansion featuring north-facing sawtooth rooftop. (Alex Med)

Fig.5.25. Al-Shirka al-Ahliyya, Expansions from 1962; perspective of the turbine edifice featuring a wavy multi-cylindrical shelled rooftop. (Alex Med)

<u>The manufacturing facilities belonging to the Selected Textile Industry Association (STIA)</u>

Unlike the plainness edifices mentioned earlier, the manufacturing compound of STIA represented a distinct aspect of Modernist industry construction in Egypt at that period. The (STIA) company managed the facility. The building's construction started in 1946 in the Hadra region of Alexandria. It was established by combining with the existing "Standard Egyptian Textile Industry" (SETI). The executive team was made up of people from Greece, Egypt, and various other nations. Architect Ferdinand J. Debbané created the new building to include the procedures of spinning, weaving, dyeing, and finishing for cotton, wool, and synthetic clothes. The architectural design he produced for STIA undoubtedly stand out as one of the most refined manufacturing edifices. The facility was clearly built to create a significant impact, as shown by its mention in the 1949 edition of “Egypt Today”, which referred to it as a "very advanced textile factory".

The original complex, excluding subsequent expansions, consisted of a couple of rows of edifices positioned on an approximately triangular parcel that has a lengthy linear northern boundary and a southeastern boundary curved inward. The north section is characterized by its elongated rectangular shape and single-story structure. The administrative edifice spans four stories height while the southern unit is trapezoid in shape and features a gracefully curving frontage. The expansive industrial halls are constructed using a concrete-framed layout with a monitoring flat-rooftop. Additionally, there are uninterrupted window ribbons running around all sides of the building. The exteriors exhibit a strong emphasis on aesthetically pleasing elements such as curved edges, ornamental window frames, decorative moldings, air vents, and roof drainage systems. In contrast to the horizontally designed factory premises, the administration building, stands out due to its vertical structure, characterized by its memorial front and expansive windows framed by rounded columns, like a portico. The inside of the entryway is adorned with luxurious granite and colorful stone insert, along with other intricate elements that exhibit a nearly neo-Baroque style of Art Deco. Subsequent expansions’ construction begun in the middle of1950s on the residual portions in the western areas of the plot, as well as on a land bought along its eastern side. These structures were multi-level and were also developed by Ferdinand Debbané. They were maintaining the original plant's architectural features but with implementation of novel technical elements, including the utilization of concrete pillars featuring mushroom crowns to support the floor slabs of the new wool factory. This design was selected to support the substantial loads and vibrations generated by the wool-weaving looms in the six-story building. The implementation of cylindrical shell roofs was another element of modernization. The roof of the wool mill was a one-barreled cover, together with incorporated cemented frames. Additionally, the freshly built second storeys topping some previous single-storey structures were constructed using multi-barreled covers. These technical advancements and trends were used in industrial architecture worldwide. (Sutherland, 2001; Bodenstein, R. in Al-Asad, 2010)

Fig.5.26. The wool plant operated by STIA, established by Ferdinand Debbané in the middle of1950s;

the inside shows mushroom pillars. (Alex Med)

Fig.5.27. A perspective showcasing the northern building of STIA operates with the managerial structure bordered by plant corridors; the 2nd storey of the industrial corridors has been constructed in the middle of 1950s. (Alex Med)

Fig.5.28. STIA operates, road frontage perspective of the southern sections. (Alex Med)

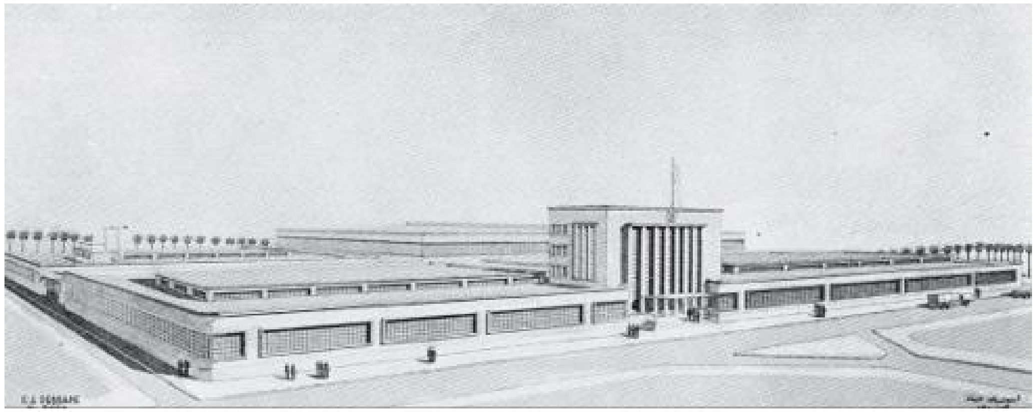


Fig.5.29. The southern structure of STIA edifice showing its street frontage perspective. (Alex Med)

Fig.5.30. A perspective of the STIA operates, which includes the multileveled wool-plant facility on the right and the office complex and the outer rooftops of the second-story factory-corridors extensions on the left. (Alex Med)

Following nationalization, the STIA facility underwent a name change to El-Nasr Wool & Selected Textiles Company. However, the company retained its original acronym as a well-known brand name. This highly successful government-owned corporation constructed a new wool factory, between 1971 and 1974, on an empty property situated a few hundred meters northeast of the previous facility. The new edifice was designed to consist of a multi-level main structure connected to an administration building, along with single-level wool dying facilities, repair workshops, storage halls in addition to water and power supply installations. Moreover, a sport club catering specifically to workers and employees was established on a neighboring piece of land. The prevalence of such social infrastructure increased notably among public-sector businesses during the 1970s. Of all these, the main structure was undoubtedly the most captivating and was previously regarded as ground breaking during its era. This structure, created by the architectural studio of Abu al-Fadl, Hadari and Khuli from Alexandria, features a core cubic block made of five stories. The construction is made of a prominent concrete structure which is proportionally flanked by two recessed extensions. These annexes are covered in red-brick cladding and obviously follow the design style of previous Modernist constructions from the 1930s and 1940s, featuring spiral windows and striking curving side walls. Remarkably, the extensions comprise nine storeys, yet they are of equivalent elevation to the five-floor central building. The reasons for this can be attributed to both functional and structural factors. Functionally, the annexes serve as housing for various facilities such as offices, restrooms, freight lifts, stairwells, sanitary rooms, and additional service amenities. On the other hand, the central block is exclusively dedicated to large workshop halls, each occupying an entire floor. Structurally, the industrial halls possess an elevated ceiling position and utilize a unique floor construction method specific to minimize the number of columns in the halls while maintaining sufficient load-carrying capability for massive gear such as jennies, looms, "Sulzer" diesel generators, and others. A dual-level or sandwich layout was implemented which consists of double concrete blocks featuring combined girder-and-beam frameworks, upward joined by closely spaced concrete columns. The distance within the interconnecting flooring panels is approximately 1.5 meters, creating a concealed mezzanine floor that is utilized for pipes and installations.

The STIA building exemplifies creative engineering and also signifies the perpetuation of "monumental" design within a manufacturing setting. The structure is situated on a triangular parcel of land on the northwestern aspect of a popular circuitous, known as Medan Sirry Pasha. The annexes are positioned in alignment with the roadways, while the three-level administrative structure is curved to match the design of the roundabout. The curvilinear form of the structure may allude to the architectural style of Oscar Niemeyer, who served as an influential inspiration for Egyptian architects during the 1960s and 1970s. STIA wool manufacturing edifice shares a distinctive resemblance to the Mougammaa edifice, a massive administrative structure located in central Cairo's Medan al-Tahrir. (Bodenstein, R. in Mohammad Al-Asad's, 2010)

Fig.5.31. The western perspective of the trapezoidal auxiliary and the core manufacturing building of the new wool manufacturing facility of STIA. (Alex Med)

Fig.5.32. The novel wool facility of STIA company in Hadra District, Alexandria (Abu al-Fadl, Hadari, and Khuli in 1974); a perspective of the southern frontage of the administrative edifice and the central industrial complex oriented towards Sirri Pasha Square. (Alex Med)

5.4. Industries related to infrastructure development.

In the pursuit of broadening international ties, the telegraph was implemented as the inaugural telecommunications sector. All necessary machinery and instruments were supplied from France. A total of nineteen stations were built along the route connecting Cairo citadel and Alexandria. The telegraphic facility in Alexandria was situated independently beyond the eastern city gate. (Crouchley's, 1938).

In the early 19th century, the first maritime services powered by steam were introduced. The oldest company was that of the Lloyd Company, established in 1836. The advent of vessels operated by steaming on the Nile facilitated the transfer of goods, particularly from Upper Egypt to Alexandria. Consequently, Alexandria facilitated the crucial excavation of the Khalydje d'Alexandrie, a key infrastructure project that paved the way for advanced agricultural, industrial, and commercial growth, as well as the construction of additional warehouses. (Nasr ElDin 2006) Mohammed Aly Pasha, in 1818, made the decision to excavate Alexandria's historic canal, known as the Khalydje d'Alexandrie to improve the irrigation network in the lower Egyptian governorates, namely in areas where cotton cultivation is prominent. The canal project also enhanced the transport of crops, which were cultivated in both Upper and Lower Egypt, for worldwide exports through the Western port at Alexandria. So, recovering Alexandria's water supply system was a measure taken to safeguard Egypt's naval facilities. The project was fulfilled by December 1820, and Mohammed Aly Pasha subsequently changed the name of the canal to El-Maḥmoudiyah Canal, as a gesture of reverence towards the Ottoman Soultan Mahmoud. (Abd El-Raḥman M., 2006; Coste P., 1998)

As result of The Cotton Boom, the harbor works became beyond capacity with the inconvenience of the dockyard passes. By the late of 1860s, Khedive Ismaail agreed to upgrade of the current western outer harbor by constructing a semi-enclosed outer harbor that is nearly entirely surrounded by breaking waves that spread to the arsenal with extending the railroad jetty, storage facilities and docks along the western harbor. The project was carried out from 1870 to 1880. (Hastaoglou-Martnidis 2014, Reimer 2019)

Previously, Alexandria once had a very complicated water delivery scheme. The network was composed of subterranean water channels that diverged from the Mahmoudiyah canal and the Nile, as well as water storage tanks, cisterns, and a distribution canal for urban water supply. The cisterns were built in a piled arrangement of a number of domed rooftops that looked like curved bridges. Mohamed el Falaki, 1872, documented over 700 cisterns in Alexandria. The foundation of the Alexandria Water Corporate in the latter part of the 19th century led to a proliferation of cisterns.

Fig.5.33. El Nabih Cistern (The Committee for the Conservation of Arab Art Bulletins, 1898)

During the 1850s and 1860s, contemporary utilitarian water and gas services were implemented, alongside the sanitation system originally developed by Clot-Bey under Mohammed Aly Pasha's reign. The concession was awarded to initially set up the company and its pipeline system in Alexandria. In 1865, the company broadened its operations in Cairo. A contemporary water distribution system ultimately substituted the cisterns and wells in Alexandria's water sector. The closeness of the water pumping station to El-Farkhah Canal resulted in the area's designation as Wābūr al-Miyāh, a name that is still used today. Pumping facilities and engines were established at various points across the El-Maḥmoudiyah Canal and its tributary, the El-Farkhah Channel, which was dug in 1860 by Khedive Ismaail. A diminutive masonry aquifer was erected on an artificial hilltop in the Kōm ad-Dikka area. In 1879, the Alexandria Water Corporation substituted the concrete aquifer with a 2,000 square meter iron container, adorned with a brick exterior. The masonry reservoir has been nonfunctional since the 1970s and has been included in the official list of the Ministry of Antiquities since late 2019. ("Egypt Today", 1935)

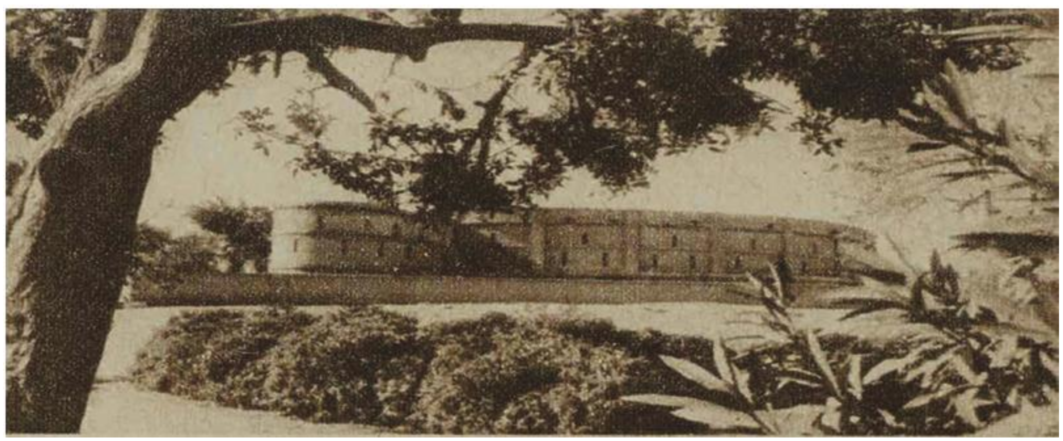


Fig.5.34. A south perspective of the concrete aquifer constructed in 1865 in Kōm ad-Dikka area. (Archives CEAlex).

Excessive water from Mariyūṭ Lake used to submerge the south- eastern part of Alexandria and agricultural hinterlands. In order to solve this problem a drainage channel (called Bāb al-‘Arab ditch) was excavated between the lake and the Mediterranean Sea in al-Maks area. Consequently, El-Maks pumping plant was established on the junction between the channel and the lake. The pumping station site involved a boiler edifice, an engine hall, and 3 mansions for highly designated staff in addition to small rectangular residential units on both sides of the ditch for workers, the station is functioning up till now. (Raafat 1974)

A gasworks: was built in Alexandria in 1865. In 1873, the firm extended its manufacturing activities by constructing gasworks in Cairo and in 1875 at Port Said. (Lebon and Cie 1947) The site in Alexandria was situated near the El-Maḥmoudiyah Canal in the Karmūz area. By 1895, the gaswork in Alexandria expanded from 10000 m2 along the Canal to reach 43000 m2. The site was including multiple masonry chimneys, two gas-gauges, an electrical promoting facility, a gas producing platform and residences for architects. The steam devices were, later on, substituted incrementally by four stoves and four transformers appliances. (As-Sirūgī 2010)

Fig.5.35. A picture illustrating the gaswork in Alexandria at the north shore of the canal and its different edifices (Archives CEAlex).

By 1872, the principal roads in Mohammed Aly's palace, all city's quays and warehouses were lightened to make the packing and discharging tasks easier during night hours. (Lebon and Cie 1947; Saul 1997) Several lighthouses (including the well-known lighthouse of Alexandria) were existing throughout the city; they have served as navigational aids along its coastlines for over a century. A total of six lighthouses are found in the city today; however, just four of them are actually functioning.

Fig.5.36. Alexandria's surviving lighthouses. From left to right: Low Max (1908), Max Old (1890), Ras el Tin lighthouse, (1848), Montazah lighthouse (1940's) (The Alexandria and Mediterranean Research Center, Bibliotheca Alexandrina)

5.5. Miscellaneous industrial activities:

Apart from the infrastructural industries mentioned above, a number of pioneering industries were established in Alexandria, in order to modernize the industrial zone. Included amongst these sectors are the leather, chemical, foodstuffs, and metalworking enterprises. Excepting the leather fields, these enterprises were located adjacent to gasworks along the northern side of the Canal.

Apart from the state's tannery which served the army, two private tanneries were constructed at the middle of the nineteenth century. They worked by steam- power, and they manufactured shoe-leather for publics. Although the primary location of these tanneries was unknown, yet both were relocated in 1870 next to the abattoir, beyond the eastern city boundary, in El Maks area. Tanneries Moderne was the most famous tannery by that time. More tanneries were established in Al-Maks, on an area of approximately 9000 m^2, around the later part of 1800s. (Polits 1930)

An ironworks factory named as “the company Engineering and Cotton Machinery” or “Usine Anglaise” was founded, between 1865 and 1868, on the northern bank of El-Maḥmoudiyah Canal. It produced agro-industrial machinery needed for the cotton ginning mills. (Polits 1930)

Chemical industries:

Andriel, a French manufacturer, founded, in 1846, a factory outside Alexandria's city gate, next to the canal. It was engaged in the process of decortication of cotton seeds for the purpose of exporting them to Marseille for the production of soap.

After 1850, Abd El-Halim Pasha sold the grant he received from his brother Said Pasha to Mr. Yasher who, with the assistance of Greek specialists, constructed a factory in Alexandria for soap and wax production from cotton seeds. The soap was mostly used by the armed forces, and the wax was sold in numerous locations in Egypt. (Najm 2009)

“Huileries Antoniadis”, the most famous oil mill in Egypt, was established in Karmūz by the northern Canal bank. It extracted oil, from linen and cotton seeds, to be used by local citizen. (Levernay 1873). On an area of 18,000 square meters, an additional oil and detergent plant called the "factory of the Society of oils and soap manufacturing of Egypt” was founded at El-kabbārī in 1890 near the southern shore of the Canal. The site included boilers edifices, oil mill and a purifying building. The factory produced vegetable oils and cakes, soaps, chemicals, etc. A pitched roof warehouse was found stretched out in the middle of the site to store both the cultivated cotton seeds and the processed oil reservoirs. (Zoides (a) 1935) The factory was replaced by the Salt & Soda Company in 1905. Later, it was deserted and completely demolished in 2019.

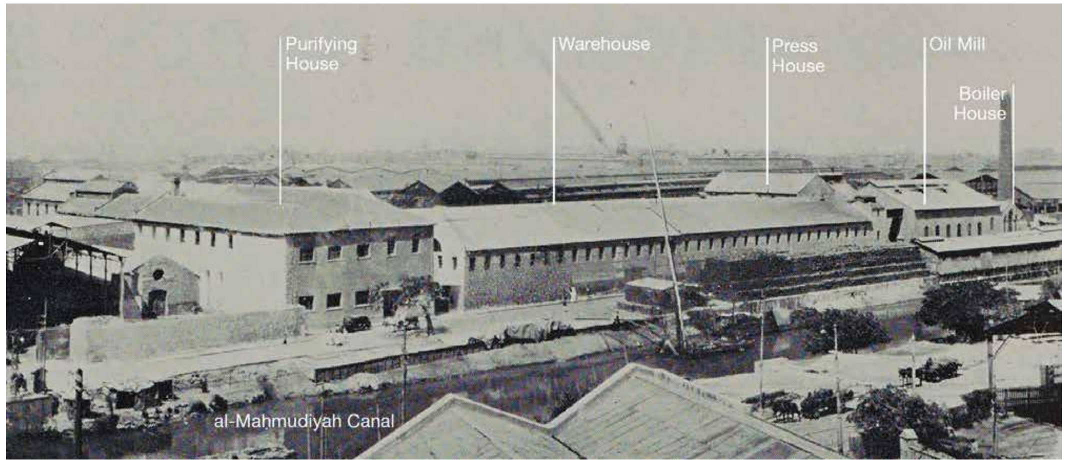


Fig.5.37. A westward overview of the Salt & Soda Corporation subsidiary located near the Canal in Karmūz, (Archives CEA).

The saltworks was the only extractive activity that was available in Alexandria. The Salt & Soda enterprise was founded to the west of El-Max Pumping Platform in 1899. The firm carried out two industrial activities; the first was salt extraction and processing, located in Mariyūṭ Lake. The second facility focused on cotton seed processing and was based at El-Qabbary adjacent to the southern shore of the El-Maḥmoudiyah Waterway. Like Al-Maks Pumping station, the site for salt activities contained only a rectangular pitched roofed edifice and workers' houses. (Polit, Elie I. 1952)

Starting from 1890, petroleum was imported and stored in El-Qabbary. The site has an area of 5 thousand m^2 and at the start it included 10 large petrol tanks. With the start of the 20th century, more tanks were established overlooking the sea. (Polits 1930)

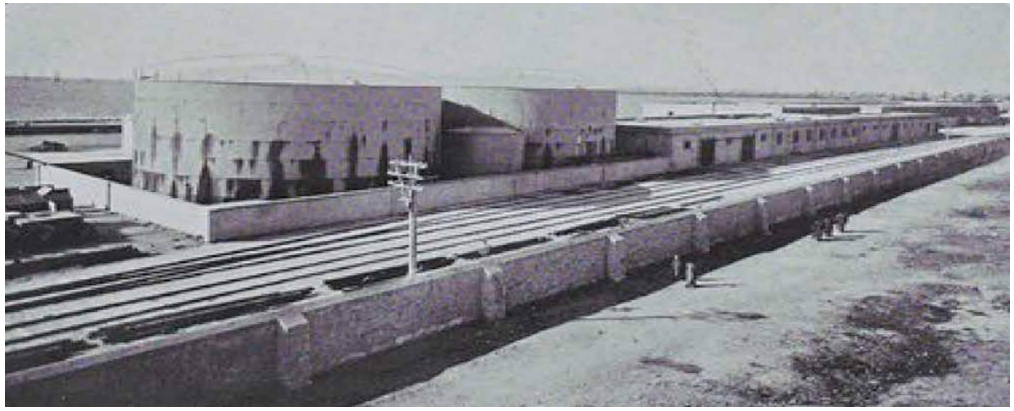


Fig.5.38. Image of the Socony Filtration facility at al-Qabbary depicting railroad delivery of oil using reservoir wagons. (Archives CEA).

The beverage and spirits industry: A factory known as the Crown Brewery of Alexandria was constructed in 1897 in al-Ibrahimīyah. (Foda 2019; As-Sirūgī 2010) In 1884, the Greek Christos Bolanachi established the Bolanachi & Sons distillery by processing Egyptian sugar cane and cereals to make cognac, rum, and whiskey. Bolanachi constructed its distillery near the water reservoir of Alexandria. In 1920, groups of U-shaped extensions was carried out and the factory reached its peak of expansion to cover an area of about 22000 m2. Bolanachi experienced a decline in his fortune once the government charged the sale of spirits in 1921, and the evolvement of other wineries.

In 1918, Andreas Zottos constructed a small cognac distillery using sugarcane and in 1934, he founded a bigger one close to the large British Mustafa camp. (PashaHuri 1935) (T. Mirza, et al 1954) The Zottos winery was a three-storey edifice rectangular in shape. The underground area was used for packing and storage. The underground looked out on a shaded area enclosing both assembled materials to be manufactured and packed containers prepared for exportation. The raised ground floor was encircled by a shady, wooden terrace and was the place where the distillery procedure occurred. The first floor contained the administrative rooms. In 1949, Zottos also established a minor brewery in the vicinity of El-Siyūf district. (Huri, 1935)

Fig.5.39. This image shows the Zottos brewery in Cleopatra in the 1930s. (Archives CEA).

Cigarette production: As smoking became a sign of modernization throughout the latter part of the nineteenth century, a factory for cigarette production was built in 1890 in Muḥarram Bey. (I.B. Tauris, 2006; Saul 1997) Cigarette papers were supplied by the "Laghoudakis Paper Mill" which was a pioneering paper industrial factory. This factory included a private residential villa, two paper plants, one press, and numerous storage edifices. The factory manufactured about twenty tons of all types of paper, daily, including: papers for packing, cartons, boxes, typographic cards, notebooks and even recycled papers. (Politis 1930) The factory premises expanded to cover an area of 25 thousand m2 by 1930 and an area of more than 60 thousand m² by 1959. (Beinin and Lockman 1998)

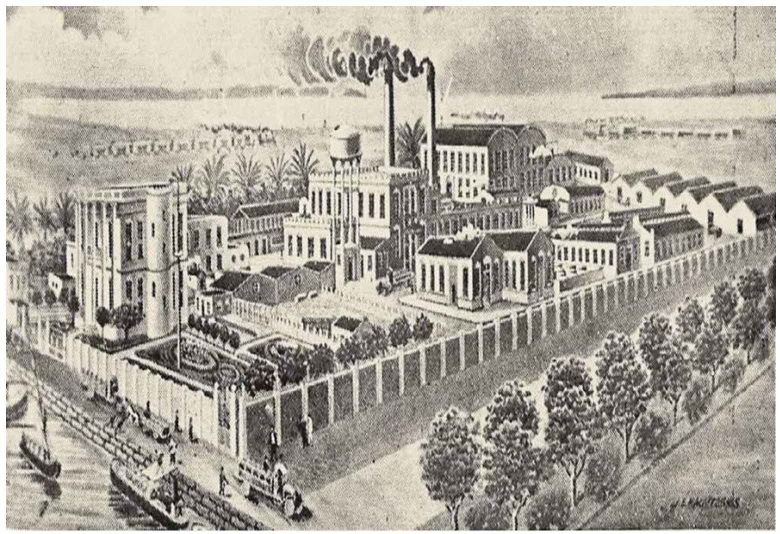


Fig.5.40. Paper- making facility of Mr. K. I. Lagoudakis & Co. (Archives CEA).

Plastic industry: The first plant to carry out the plastic industry in Egypt was "The Egyptian Plastic & Electrical Industries Corporation (EPEIC)" founded in Victoria area in 1945. It was constructed on an area of 20000 m2. The EPEIC site have a U-shaped modernist architectural style. Its southern main gate is looking on to a small triangular courtyard and is marked by its symmetrical sloping edges.

The entrance is also accentuated with a two-levelled protrusion, while the remaining of the cubature is marked by one-level building with ribbons of horizontally placed windows. The interior of the industrial site consisted of two preliminary versions of buildings that are different in the dimensions of their curvature. The company's nine edifices are identical, in shape, low height, architectural style and their enfolding with vertical small openings, to the enclosed U-shaped edifice. The repeated constancy of the site's style indicated its industrial reliability. (Bodenstein 2010) The company manufacture different products were: electrical supplies, housewares, haberdashery, batteries…In contrast to the destroyed Bolanachi and Zotos distilleries, the EPEIC is still maintained in a good condition and still functioning till now.

The Egyptian Copper Works plant: It was established in Alexandria in 1935 to support the evolution of the Egyptian industrial activities. The company was composed of 5 sectors all concerned with iron and metallic manufacturing including rolling, extrusion, pressing, repair components, and steel production. Its mass-production ranged from producing small households devices to spare parts, cars' appliances and all types of machines.

Cars and motors industry: By the mid-20th century, Alexandria contained exhibition, marketplaces and small industrial stores for the Italian Fiate Oriente in Al-Ḥaḍarah, the American General Motors Corporation in al-Qabbary and the American Ford Enterprise. The Ford Motor Corporation was founded in Egypt in 1932 as an exhibition marketplace and workshops for only car fixing up and repainting in El-Azarītah district over an area of 2 thousand $m^{2.}$ Ford expanded its operations in 1943 by opening its inaugural automobile assembly plant in Egypt. This facility together with the administrative office were constructed on the north-eastern end of Smouha, by the railroad line on an area of 31 thousand m^2. This car service edifice was considered as the largest center in the Middle East by that time as it was a huge, rectangular, two-storey structure of 14 thousand m^2. It accommodated spacious exhibition rooms, offices, marketplaces, and workshops. (Zoides (b), 1935) The Ford Motor Corporation edifices are continuing to stand up to this day but they have been reused as a private school.

Building materials industry: As a result of increasing in number of migrant workers to Alexandria, there was a need for increasing low rent residential units mainly in Karmūz district then in Mina El- Bassal, and El'Atarīn areas. Consequently, six factories, producing building materials, were established in Alexandria. These factories were: three brick, two cement, and one marble factories. Most of them were dispersed throughout the length of the northern canal bank over an area ranging from 300 m2 to 15000 m2 with the brick factory found in Mīna El-Baṣṣal district. Only the cement factory was established within the city framework. (Polits 1930)

5.6. Possible causes behind deterioration of industrial legacy of Alexandria

Regrettably, the diverse and distinctive industrial legacy of Alexandria is currently encountering numerous challenges including neglect, obsolescence, lacks proper documentation and even demolition. Without an action plan, there is a high risk that it may deteriorate and disappear in the near future. This can be attributed to different factors:

a- As machines got old, in addition to the absence of coal as source of energy for many of them, numerous factories were closed. (St. John, 1834)

b- Demographic pressures, the unavailability of land for city expansion and the valuable land of factories in urban areas compelled factory owners, particularly those located within the city, to sell their land to investors.

c- In an effort to revitalize the manufacturing industry, the Egyptian government leased off a number of firms to entrepreneurs as part of a privatized program that took place in the 1990s. However, after privatization, the Coca-Cola Drinking Factory in Wabour El Maya and the Pepsi Corporation in the Mostafa Kamel neighborhood were both turned into towering housing complexes after their respective plants were razed.

d- The Environmental Protection Act of 1994, which made it illegal to locate workplaces, or industrial plant or facilities within a certain radius of a residential neighborhood.

e- The evolving methods of manufacturing, transportation, and management of commodities, along with the transition from heavy industries to the expanding service sector, rendered a significant portion of Alexandria's industrial structures outdated.

f- Insufficient local population understanding of the importance of manufacturing legacy as an integral component of Alexandria's urban heritage.

g- Insufficient funding for the preservation and repair of industrial heritage.

Fig.5.41. Industrial edifices in the Smouha neighborhood, previously situated on the outskirts of the city, are now encircled by residential condominium complexes. (Author)

Fig.5.42. Deserted industrial buildings along the Mahmoudiyah Canal in Moharrem Bey were poised for redevelopment into housing units. (Elaborated by Author)

Fig.5.43.The declining situation of Alexandria's manufacturing legacy (Author & ANPIEMED)

As it was previously mentioned, such heritage includes various structures as warehouses, factories, mills, businesses, lighthouses, bridges, railways….. These buildings exemplify a distinctive architectural style and showcase advancements in engineering, material used and construction methods. Additionally, they hold significance in the context of social history. As a result of lowering demand on these industrial structures an abandoned and hazardous environment was created, which fostered the emergence and proliferation of unhealthy communities. Moreover, this undeveloped urban region is in close proximity to the city's major business sector. Consequently, these neglected industrial structures are susceptible to being demolished and replaced with new residential complexes, resulting in the loss and eradication of the ancient values and legacy of the region.

Heritage conservation is a relatively recent topic in Egypt. As an element of The Alexandria Strategic Agenda for 2005, the initial registry of safeguarding of non-monumental historical buildings was established in 1982.The list comprised approximately 126 buildings deemed worthy of preservation. Only a limited number of industrial and commercial structures were listed. Regrettably, the list lacked legal rules to safeguard these structures. Consequently, numerous buildings, both industrial and non-industrial, were demolished. Especially that the master plan also proposed the evacuation of industrial activities from Alexandria and the relocation of all factories to the western part of the city. Additionally, the plan called for the transformation of the city's industrial area into residential housing. (Alexandria Comprehensive Master Plan Project 1983)

It was not until around 2005-2006 that the Alexandria government identified the historical importance and social benefit, of numerous heritage structures, roads, and regions within the city including the industrial heritage. Consequently, these buildings and areas were added to the "National Registered Heritage Buildings' List of Alexandria". The Mina El-Bassal district was nominated as a legacy governed by regulations 6040 "Warehouse". (Alexandria governorate, Bibliotheca Alexandrina, 2007) Also, the "Cotton Bourse" was recorded in the list of Alexandria legacy buildings registry of 2007 under the coding number 535 as "Distinguished Building" (Government, 2014).The table below provides a summary of industrial heritage buildings in Alexandria, which has been drawn from the Alexandria Governorate legacy registry, 2007. The locations listed in the table are specifically those that have been officially recognized as heritage buildings.

Table 6.1. Cataloged industrial historical structures in Alexandria. (Adapted from Alexandria Heritage Catalogue of 2007)

Document number	Designation of the facility
2131	Egypt Sabbagh Al Bayda Leisure Cottage
2132	Egypt Sabbagh Al Bayda storehouses edifice
2133	Basily timber and masjid
1870	Zgheib Makbas / Marco- Interior Design
2019	Lighthouse montazah
2134	Sabahi Administration Structure
4002	Multi Pharma Pharmaceutics & Chemicals
2008	Sumed Arabic Conduit pipes Association
1952	Haj Taher Sibahi
1951	Haj Taher Sibahi
1904	The Arabic Transportation Firm
2103	Ramle Fort-Carpet Industry
1420	Railroad Operations
224	Egyptian naval transportation
603	Timber Enterprise of Al Bili (Manoli mansion)
124	Don Bosco vocational institution
505	The Residential of laborers in Kom Shuqafa railway
1255	Kobry El Tarikh
1706	Headquarters of Stani Farmhouse Enterprise
1711	Armory Corporate Structures
535	Mina El-Bassal Cotton Stock Exchange

However, there are numerous other sites that have historical significance like the Mandara wind plant and El Nabih underground reservoir and which are registered as archaeological sites. Others, like the smokestack and edifices of Alexandria Water Corporation, storehouses, lighthouses and the hangar of the imperial train of the late King Farouk which is located adjacent to Montazah Castle were not even recorded for protection (Aref, Y., 2013).

Chimneys served as a means of ventilation for the ovens in manufacturing facilities. These structures are characterized by their slender and tapering shape and are constructed using red bricks. These structures exemplify engineering superiority as they were attaining remarkable heights and enduring wind forces. The most eminent chimneys are those of the “Water Company” and those of the establishments in the Mina Al Bassal district.

Fig.5.44. Constructed in 1886, the Alexandria Water The organization's smokestack and building are a beautiful addition to the cityscape of Alexandria. (Alex Med)

Fig.5.45.The chimney's design exemplifies the artistry of masonry, incorporating metal bars to enhance its resilience against wind forces. (Bibliotheca Alexandrina)

Another distinctive edifice is the noble garage situated adjacent to the Montazah castle. Following his getting back from Cairo, the King Farouk's regale Train was parked in the garage. Keeping with the palace's design, the parking lot is located outside the palace's boundaries and was built by employing reddish façade brickwork and stucco. The garage is currently vacant and experiencing a state of decay. Furthermore, it has not been documented or designated in accordance with legislation no. 144/2006, which is directed toward the preservation of historical buildings.

Fig.5.46. The Cairo rail terminus was created by Antonio Lasciac. (The Alexandria and Mediterranean Research Center)

Fig.5.47.The parking lot of the Imperial Train of the late King Farouk, which is located beyond Montazah Castle. The structure is currently in a state of disrepair and is uninhabited. (Author)

Moreover, Alexandria possesses a substantial amount of industrial heritage, which presents tremendous potential for reutilization. Through their reusing and reintegration into the city's wider urban framework, such buildings will safeguard their rich cultural legacy, boost the overall standard of life, strengthen the natural environment, and act as an essential resource to the local community, leading to its good health while preserving their historic value. As an example: the Ford Motor Company factory and its administrative buildings in Alexandria, which were originally constructed in 1948 as an automobile assemblage facility. Later on, the plant underwent closure and subsequently, the edifices were re-purposed as a college in 1995. The structure's new function was well-suited to its spacious layout and high roofs.

(Author)

Fig.5.48. Riyada International School is an adaptive repurposing of the previous Ford facility, which was constructed in 1948.

(Archives CEA).

Chapter 6
The Study of Selected Historic Manufacturing Structures of Mina El-Bassal

6.1. Description of Mina El-Bassal zone and its buildings

The El-Mahmoudiyah Canal was essential in rejuvenating Alexandria, which had entered a period of decline prior to the rule of Mohammed Aly. The significant city's expansion occurred following the finishing of the El-Mahmoudiyah Canal in 1820. This canal, which was initiated to connect the Nile Delta with the Mediterranean coastline, significantly contributed to the development of the city. Therefore, the El-Mahmoudiyah helped Alexandria reclaim its former status as a trade hub in Egypt being the principal pathway linking Alexandria to other Egyptian governorates. Additionally, it enabled the creation of novel metropolitan regions, such as Mina Al-Basal in Alexandria's West zone.

Mina El-Bassal translates to "onion harbor" because of its historical importance in exporting onions abroad. (Badr, 2004) Although Mohammed Aly renovated several storage facilities for grain crops that were most probably situated near the marina and the El-Mahmoudiyah waterway. However, the urban evolution of this area commenced during the reign of Abbas I. He allocated Mina El-Bassal land to the city’s residents, constructing warehouses to facilitate the storage of goods for export. The streets were later on paved with a durable stone brought from Italy under the reign of Khedive Ismail (Mobarak 2008). This region has been populated from 1850, on either banks of the El-Mahmoudiyah Channel, in close proximity to its delta, and surrounding the Qabbary station. Subsequently, the area was incorporated with the Qabbary Masjyd and Shrine zones, and during the nineteenth century, it became linked with El-Mansheyia and El-Gomrok regions. The transportation network has facilitated the effective relocation of migrants from rural regions and Upper Egypt to Alexandria, as they settled forever beside their jobs in seafaring and cargo transport businesses.

Mina Al-Basal is situated at the mouth of the Mahmoudiyah Canal, adjacent to the Western Harbor gate at Alexandria Port. It was strategically established as a commerce hub for Egyptian exports to European nations. (Abd El-hakim, 2007; Khalil, 2009)

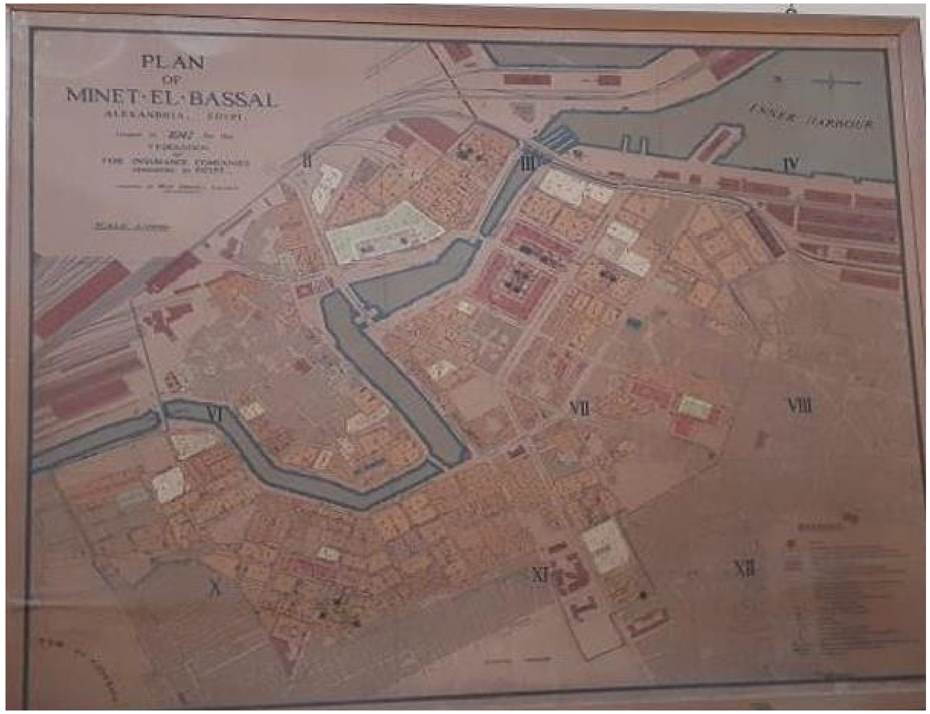


Fig.6.1. Mapping of Mina El-Bassal presses (from Misr organization for cotton pressing)

Fig.6.2. A unique depiction of the Mina El-Bassal zone with cotton harvesting at the onset of the previous decade. (Misr organization for cotton pressing)

Fig.6.3. Mina El-Bassal (marked in yellow) located in the seaside of Alexandria. (Google map)

Fig 6.4. Mina El-Bassal region (marked in red). (Google map)

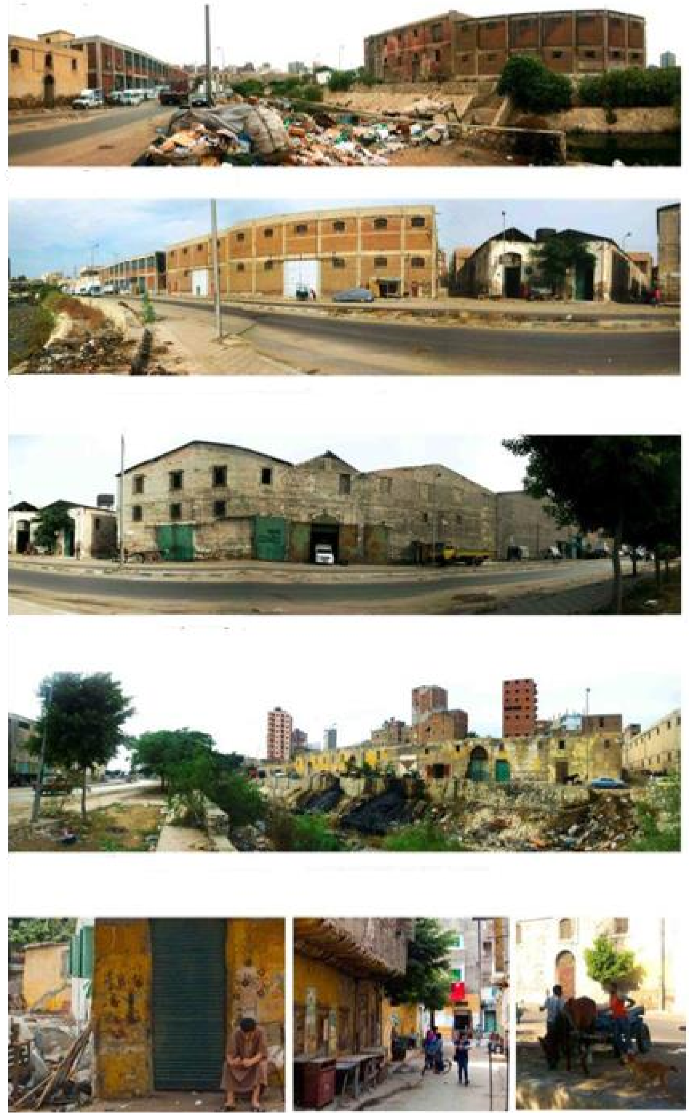


Fig. 6.5. Photographic survey of Mina El-Bassal (Author & ANPIEMED)

The urban configuration of Mina Al-Basal is determined through the canal that splits the region into two different sections displaying differing urban form. The eastern bank was characterized by a cluster of enormous manufacturing plants and other industrial edifices, while the western bank comprised small-scale residential buildings that were originally occupied by factory workers. The district has always been sustained by a meticulously planned transport infrastructure, catering to both the needs of individuals and the movement of commodities. In 1850, a cargo railway was constructed in Alexandria to cater to the needs of the western port, spanning from Qabbary station to Kafr El-Dawar (Nasr ElDin A. 2006). The establishment of the railway industry in Egypt in 1851, under the reign of Abbas Pasha I, primarily aimed to streamline and expedite trade transportation between Britain and its colonies in the distant East, particularly India, through an inland railroad. The rail route extended at a right angle to the Nile, connecting Alexandria and Suez, so establishing an additional trade route. Robert Stephenson, a British civil engineer, supervised the project. The inaugural standard gauge and train terminal in Egypt was initially established in Alexandria. (Nunes C. & Silva, 2016) This station was situated on the south edge of the storehouses that predominantly clustered on the south side of the water channel in the El-Qabbary neighborhood.

The establishment of the railroad and the growth of the cotton commerce elevated the economic significance of Mina El-Bassal. In the years 1821-1824, Mohammed Aly directly forwarded numerous cotton cargoes from Alexandria harbor to the United Kingdom. (El-Bahtimy 1952; Badr 2004) The growing demand for cotton in Europe, particularly during the American Civil War, resulted in substantial surge in cotton exports reaching a peak by the year 1910. (Abass, 2011).

Cotton must undergo pressing to facilitate its shipment and exportation. So, Mohammed Aly purchased pressing machines from England (Bek klot 2001). Moreover, additional presses were utilized by English spinning factories owned by foreign merchants in Alexandria. (El-Bahtimy 1952) For instance, the cotton press established by Monsieur "Tod" adjacent to the wind-driven wheel of El-Mahmoudiyah, in the vicinity of El-Qabbary railroad. The press was relocated to Mina El-Bassal and El-Asakil in 1852. (El-Saidy 2019)

The closeness of Alexandria harbor to the Mina El-Bassal district was the main reason contributing to the clustering of the cotton press section in this district. This closeness enabled the effective processing of Egyptian cotton for shipping. (Abd El-hakim 2008). So, the "Alexandria Cotton Pressing Company" was established by Ioannis Choremis in 1875. In 1889, Zervoudachis established "Société General de Pressage et de Depots" with the purpose of collaborating the aforementioned company with British capitalists, who ultimately gained control over the company. In 1897, Emmanuel Benaki established the "Société Anonyme de Presses Libres Egyptienne", a cotton pressing enterprise, with the involvement of several Greek individuals (Glavanis, 1989). "Alexandria Presses" company was established in 1925, most of its founders were foreigners. The enterprise was responsible for the compressing and cleansing of cotton, as well as all other operations associated with this industry (El-Dessouky 1975).

Many of these structures were rendered unusable following the 1952 coup in Egypt, as the newly established national authority prioritized the local production of cotton, which was primarily conducted in the Delta, adjacent to farmlands. Later on, the market liberalization resulted even in neglecting the cotton cultivation (Mansel, 2010). National banks acquired a portion of these manufacturing factories, particularly those that belonged to the Egyptian cotton processing enterprise. However, buildings and machinery became almost completely redundant due to the reduction of cotton cultivation. The discontinuity of cotton business, which had once maintained vast populations sustained large communities of people, resulted in unemployment that emerged as a significant issue in the local area.

In the Mina El-Bassal zone, certain cotton pressing facilities continue to exist from the era of the Mohammed Aly dynasty. These include the Makbas EL Taraekh and Makbas El- Nile, both of which are located near the shores of El-Mahmoudiyah channel. The two presses still have remnants of the original company name, written in French (Société General de Pressage et de Depots), above their entrances. Additionally, there is the Masr press, that experts believe also to date to the late 1889, the same period as the two previous presses, as it shares similarities in architectural style and planning with them.

Makbas El Taraekh: On Al-Huwais Road stands Makbas El Taraekh, a structure that was authorized for the Egyptian Corporation for cotton processing in 1954. It has a rectangular area measuring 43920 m^2. The area is filled by a building complex with halls, which are either rectangular or square in design.

Fig.6. 6. Entrance of El Tareekh press (Author & ANPIEMED)

Fig. 6.7. Architecture of El Tareekh press facade. (Author & ANPIEMED)

Fig.6.8. Present condition within the cotton warehouse of Makbas El Tarekk (Author & ANPIEMED)

Makbas El-Nile: Situated on Ancient Bridge Avenue, the 46,800 square meter Makbas El-Nile area received authorization in 1935. It has a U-shape, with one arm housing a rectangular structure that is bounded by an uncovered corridor. A closed metallic tunnel connects this structure with the construction around it.

Fig.6.9. Façade and Entrance of Nile press (Author & ANPIEMED)

Fig.6.10. Nile press (Author & ANPIEMED)

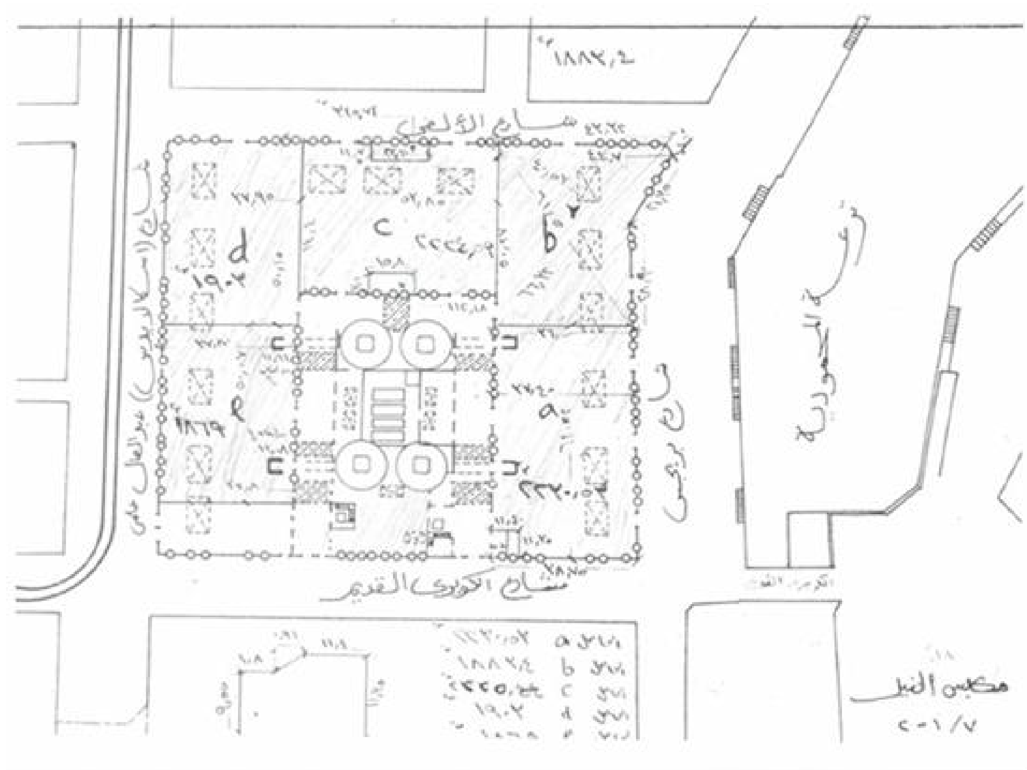


Fig.6.11. A plan for the ground level of Nile press. (Egyptian company for cotton pressing)

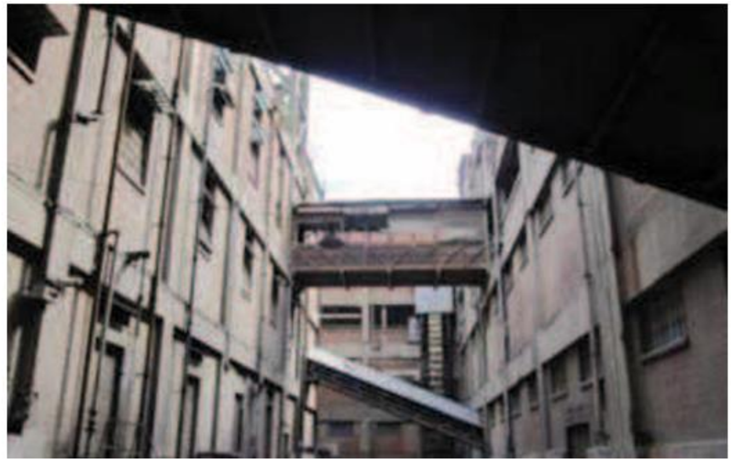


Fig.6.12. Current situation inside courtyard of Makbas El Nile (Author & ANPIEMED)

Every press comprises a ground story and 2 higher stories constructed in concrete framework. Each also contains 4 heaters and a single smokestack. In both chambers of Makbas El- Nile, there were four cotton compressing devices. In contrast, EL Tareekh had only three devices, as the fourth was leased. The devices were located in two hallways: a big hall in the shape of a rectangle in Makbas El- Nile and a tiny squared hall in the Makbas ELTareekh. The two presses' frontages' are composed of red bricks and are split into vertical portions by square windows that are positioned either horizontally or longitudinally.

Makbas Masr: received authorization in 1936 and is located in the ancient Bridge Avenue. It is rectangular in shape with an area of 22780 square meters. A shielded metalwork tunnel connects it to Makbas El- Nile. On its northwestern side, there are two parallel halls that are separated by an elongated space. The right hall is rectangular in form and held one compressing device, whereas the left squared hall possessed 2 compressing engines. Aside from its red brick elevation and chimney, this structure is notable for its iron water storage tanks and gats, which have longitudinal steel railings for transporting cotton. It is characterized by straightforward and utilitarian style. Interior places were distinguished by iron doors that were engineered with distinctive methods to isolate them in the event of a fire.

Fig.6.13. The bridge linking between the Nile and Masr presses. (Author & ANPIEMED)

Fig.6.14. The bridge linking between the Nile and Masr presses. (Author & ANPIEMED)

Fig.6.15. Gate of Masr press. (Author & ANPIEMED)

Fig.6.16. Plan of the ground level of Masr press. (Misr Organization for Cotton Compressing)

Egypt established its inaugural marketplace to trade cotton and cereals in 1861. It was named “Société Anonyme de la Bourse” and was initially established in the residence of previous General Consul Tossiza, which overlooked Mohammed Aly mansion. In 1882, the Tossitsas residence was obliterated by British bombardment. (Awad, 1996) A new Bourse was constructed in 1899, under the rule of Abbas Pasha II, at Mohammed Aly mansion and occupying the site of the former Tossitsas residence. (See H. 2004)

<u>Mina El-Bassal cotton bourse:</u> This marketplace was constructed by Petrufuscany, a designer from Italy, in accordance with the contemporary Italian Renaissance design, often known as neoclassical architecture. (Badr 2004).

Fig.6.17. The cotton bourse's frontage in Mina El-Bassal area (Author & ANPIEMED)

Fig.6.18. Rear area of the Mina El-Bassal cotton exchange. (Author & ANPIEMED)

Foreigners were in charge of it while Mohamed Ahmed Farghaly Pasha was the inaugural Egyptian to assume charge of the Mina El-Bassal cotton exchange. The bourse continued to operate until the revolution of July 23, 1952, when the stock exchange ceased. Currently, it is vacant (Hamdi Abd El-Basset 2004). It consists of a gate that provides access to a rectangular uncovered courtyard oriented towards the bourse's edifice which is a two-story rectangle. Every level includes rooms featuring doors that lead to a sheltered hallway, which faces the uncovered courtyard through a series of openings. An ascending ladder and a spiral staircase connected the two levels. The cotton exchange is also noticeable from the surrounding roads because of its three facades, each one is divided into vertical segments by shoulders. Every segment contains windows and entrances.

Warehouse Bank Misr

Fig.6.19. Bank of Egypt storehouse situated in front of the canal

Fig.6.20. Its side elevation (Records of CEAlex)

Mina El-Bassal district also contains Bank Misr warehouse. It was formerly a storehouse for storing cotton. It is currently under the ownership of Bank of Egypt. It is now vacant due to decaying roofs.

Makbas 45 building, the oldest among the group, featuring a stunning front (arcaded façades) that distinguishes it from everything else around it. It is now deserted due to the unsoundness of the remnants. The wooden ceiling of the building was demolished over time. Till now, the exact date of construction and the uses of the building are not clear. But the design of this two- story edifice, techniques of building and ornament indicate that it can be dated to the 1860s or 1870s. Most probably this edifice is the last vestige of shops "magazines," and this might justify its peculiar arcaded style of building. Behind these arches, on both floors, there are rooms with doors that open on to the posterior parts of the building, which is beyond reach nowadays. (Nassar D. M. &Sharaf Eldin S.2013)

Fig.6.21. Makbas 45 (Archives CEAlex)

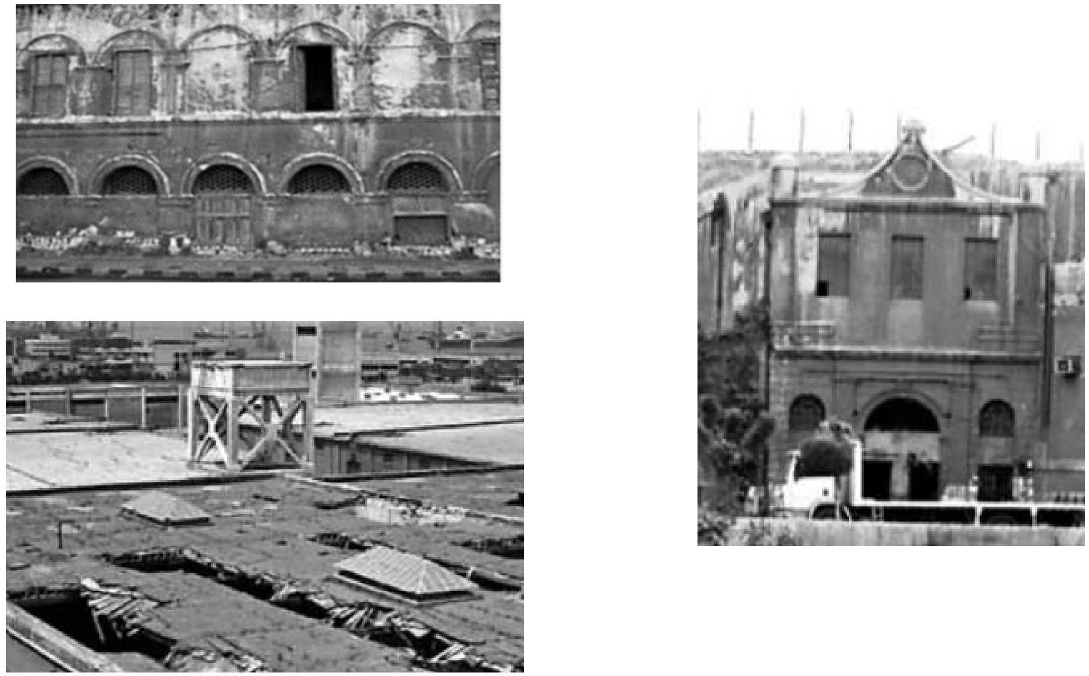


Fig.6.22. Lateral elevation and rooftop of Makbas 45, with the rest of the outstanding frontage overlooking the canal on the right (Records CEAlex)

"Mina-El-Bassal" branch of the Bank of Alexandria: This is a recently upgraded edifice designed in an eclectic design, formerly, it was a manufacturing pressing plant and storage for cotton.

Fig.6.23. Bank of Alexandria, Mina El Bassal branch (Archives CEAlex)

6.2. Territorial analysis

- The district and its buildings have historical and social significance. They used to have a profound economic role in Egypt and may contribute in the preservation of the cultural legacy of the Alexandrian people. Moreover, this district has the potentiality to be a fundamental part of the daily lives of Alexandrians. The district comprises few schools and a renowned market called "Souk El-Gomaa"(Friday market) for selling used goods. This market is usually held in this district on Friday and used to attract tourists before the Egyptian revolution on January 25, 2011. But, nowadays, the area is occupied by street vendors throughout the week, posing a challenge to local workers.

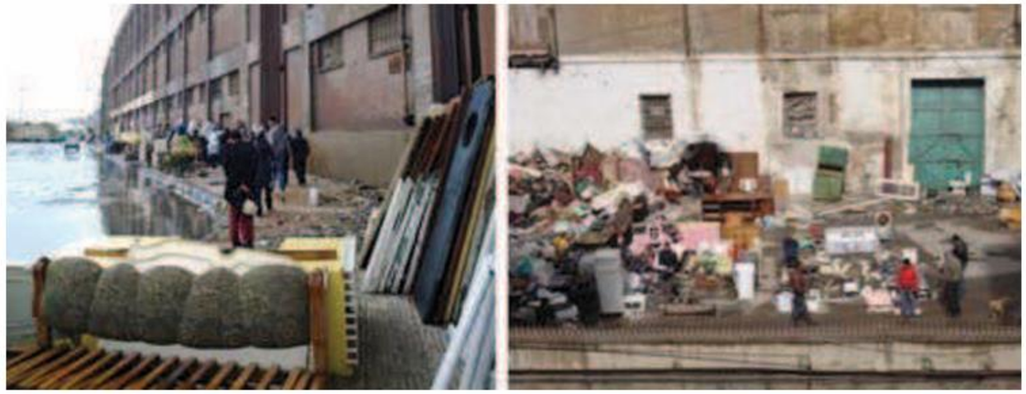


Fig.6.24. Nile press edifice and cotton bourse throughout the Friday Marketplace, (Author & ANPIEMED)

- The three presses were under the control of the Egyptian company for Cotton Pressing, then later on became governed by the General Business Sector Companies. Due to the cessation of operations in these presses, the company was sometimes leasing some sections of these facilities for several commercial and storage objectives to earn revenue during the period from 2005-2007. Moreover, the cotton bourse is currently housing offices for six cotton trade businesses and the Central Administration for Cotton Negotiation Professionals. Therefore, providing the potential for their subsequent repurposing


محافظة الإسكندرية - الأمانة الفنية للحفاظ على التراث الحضاري للإسكندرية (لجنة 142 لعام 2009)
استمارة بيانات مباني الحفاظ
مشروع المباني والمنشآت التراثية لمحافظة الإسكندرية يونيو 2007

كود المبنى 535
اسم المبنى بورصة مينا البصل
مستوى المبنى مستوى المدينة
الحى غرب
سبب قيد العقار بمجلد التراث المبنى ذو طراز معماري متميز. ز ويه ٣ حقبة تاريخية
عنوان المبنى 21 عبد العال حلمى (الأسكاريدس سابقا)
قـرارات وتوصيات لجنة التظلمات رفض التظلم
رفض التظلم المقدم من ابراهيم رمزي عبد المجيد - وكيل مالك العقار. مع التوصية لمحافظة الإسكندرية بترميم المبنى معماريا وإزالة التعديات على المبنى.
اسم المالك الحالي شركة بورصة مينا البصل
اسم المالك الأصلي شركة بورصة مينا البصل
خريطة المبنى
صورة المبنى

Fig.6.25. Preservation framework for the Mina El-Bassal cotton exchange building (NOUH)

- These buildings hold significant technical and scientific significance in the domains of manufacturing, architecture and building. As they possess significant aesthetic appeal as a result of their superior architecture, design, or planning.

- The industrial buildings of Mina El-Bassal are uniquely situated along the western harbor and close to the city center, making them an ideal candidate for adaptive reuse. Additionally, the district is linked to prominent landmarks and locations in the main city via a well-developed network of major streets and an efficient transportation system.

- However, Mina El-Bassal is considered one of the most impoverished districts in Alexandria with a population size of 316,612.0

individuals. This is primarily due to the presence of extensive slum areas that lack proper infrastructure and the growth of informal settlements as Kafr Ashry's residential area which is an illegal vertical expansion. Buildings are erected in compact places due to the limited area available to the population of Mina El-Bassal. The residents of Kafr Ashry, who were once employed in the canal and warehouse industries, are now facing unemployment. The canal's operations involving cargo handling and storage, fishing, and agriculture have significantly declined and in some cases, completely ceased. (Ghali, et. al, 2013). Furthermore, the neighborhood suffers from a dearth of security measures, leading to elevated crime rates and the proliferation of delinquents and drug addicts.

- The district could be a source of environmental contamination. The shutdown of harbor gateway 22 interrupted water circulation, so obstructing shipping and aquatic life from accessing the Mahmoudiyah Canal. Consequently, the canal became disconnected, and residents started throwing their waste into it. (Ghali, et. al, 2013) In addition, following the 2011 revolution, petroleum corporations began disposing of their chemical waste in the canal. So, with ending of the marine life, activities such as cultivation, finishing, and transportation were much decreased. The amount of agricultural land in Mina El-Bassal has experienced a substantial reduction, leaving only 3 fedans available for agricultural use (Allam, 2010).

- The sole governmental interventions in Mina El-Bassal encompass mainly the expansion of the district's streets. A development plan was undertaken on the Mahmoudiyah Canal, in July 2001, aiming to purifying canal water and removal of waste deposits for a distance of 3.5km. Additionally, there is a strategy to fully restore the canal's borders.

In order to achieve sustainable development, countries must integrate and align their economic, social, and environmental plans. The repurposing of abandoned and dilapidated industrial structures, is an advantageous approach to urban development, particularly when towns are confronted with the challenge of ongoing expansion. It contributes also to a decline in the crime rate and other forms of antisocial behavior within a given locality. (Peerapun, 2012)

The most successful projects involving the adaptive reuse of industrial heritage are those that effectively preserve and honor the historical significance of the structure, while also including a modern element that adds value for future generations. This allows the city to maintain and showcase its past to both local residents and visitors. (Chohan & WaiKi, 2005). The inherent nature of industrial buildings makes them well-suited for repurposing into different uses, accommodating various spatial arrangements and encompassing a range of functions, including industrial, commercial, recreational, cultural, administrative, and tourism.

Chapter 7

A proposal for adaptive reuse of some of Mina El-Bassal Buildings: Makbas El Nile and Makbas Masr

7.1. Historical background and development of Mina El-Bassal area

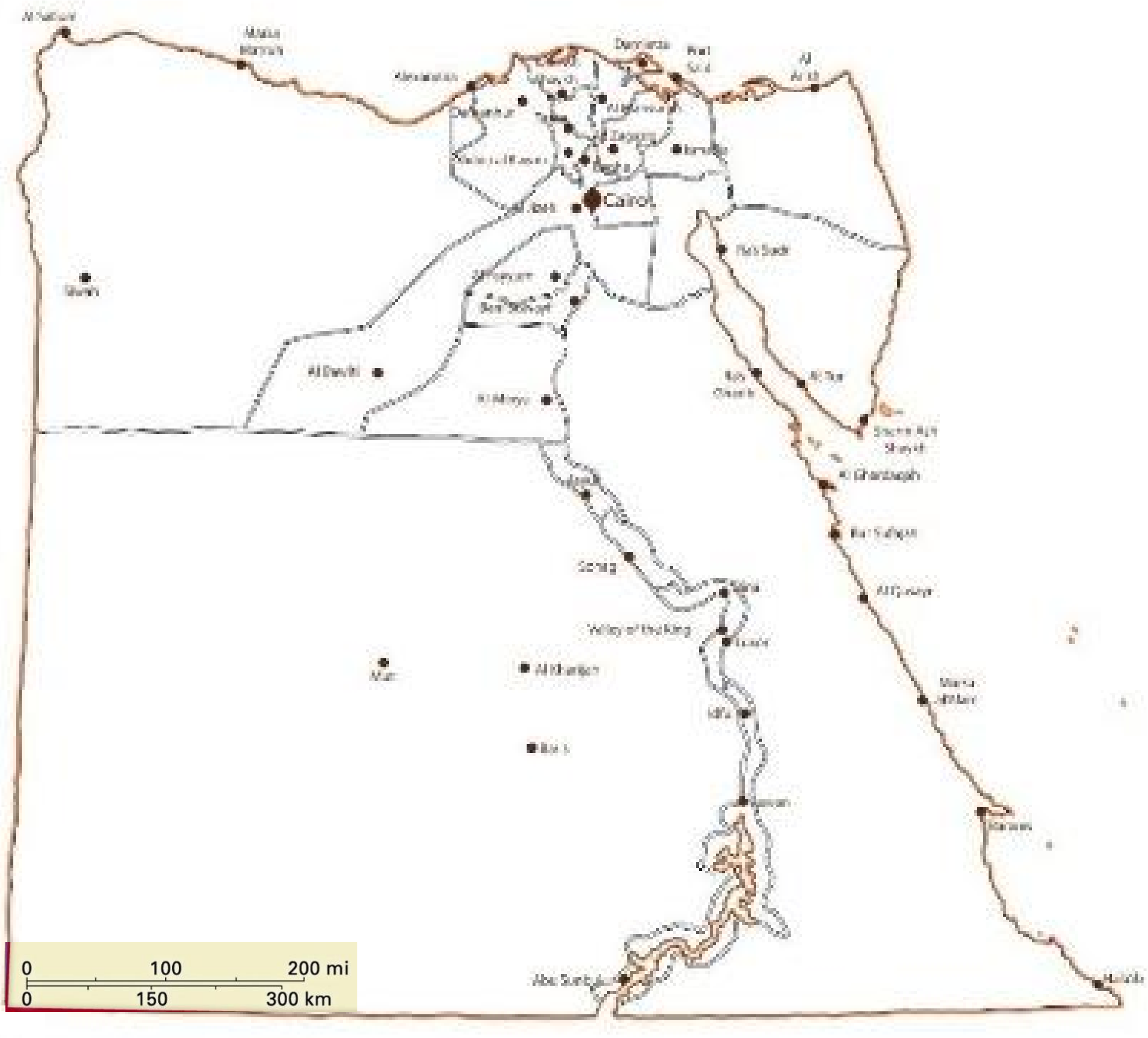


Fig.7.1. Map of Egypt (Elaborated author)

Established by Alexander the Great in 331 BC, Alexandria demonstrates meticulous urban design and ancient wisdom in the selection of commercialhubs. Located on the Mediterranean coast of Egypt, Alexandria has historically served as a vital link between the East and West, functioning as an essential gateway for trade among Europe, Africa, and Asia. Its evolution was influenced by its geographical and cultural position, placing it as a crucial center in both ancient and modern global trade networks.

The city's unique geographical position on the north-central coast of Egypt has provided significant advantages as a center for maritime trade. The harbor of Alexandria, once home to the illustrious Pharos lighthouse, one of the 7 astonishing global antiquity, has historically been one of the most vibrant and efficient ports in the Mediterranean, proficient in handling diverse maritime activities, including shipping, logistics, and extensive commercial operations. The modern Port of Alexandria remains a key maritime conduit for Egyptian imports and exports, facilitating a significant portion of the country's foreign trade.

The city's infrastructure is engineered to enhance trade and commerce, with facilities that streamline customs processes and augment cargo handlingefficiency. The infrastructure, along with its proximity to major international shipping routes, positions Alexandria as a crucial center in global logistics and distribution networks.

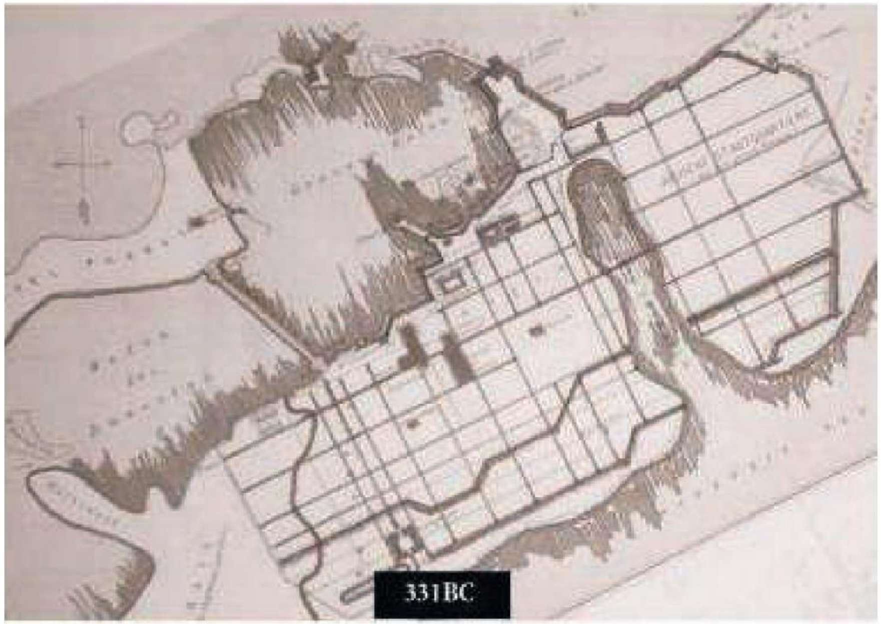


Fig.7.2. There was abay inside the city & there was a fence surrounding it, street network was in grid iron

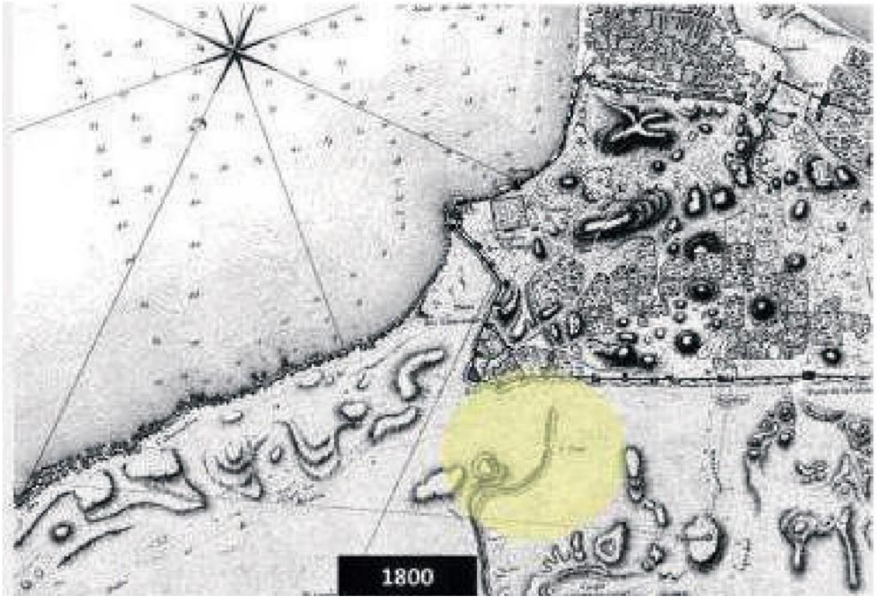


Fig.7.3. The beginning of the channel at the era of Mohammed Aly before using it

Fig.7.4. The Ottoman fence around the city lor the channel some of the warehouses appeared around it

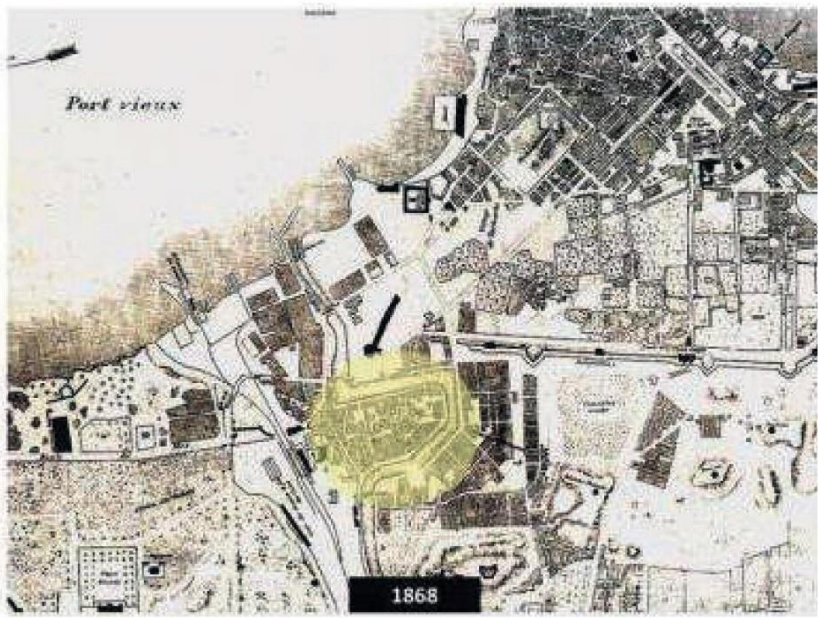


Fig.7.5. Then by the beginning of the Twentieth century, the municipality just removed the Arab walls completely and then by a new street that reaches directly to the Cotton exchange

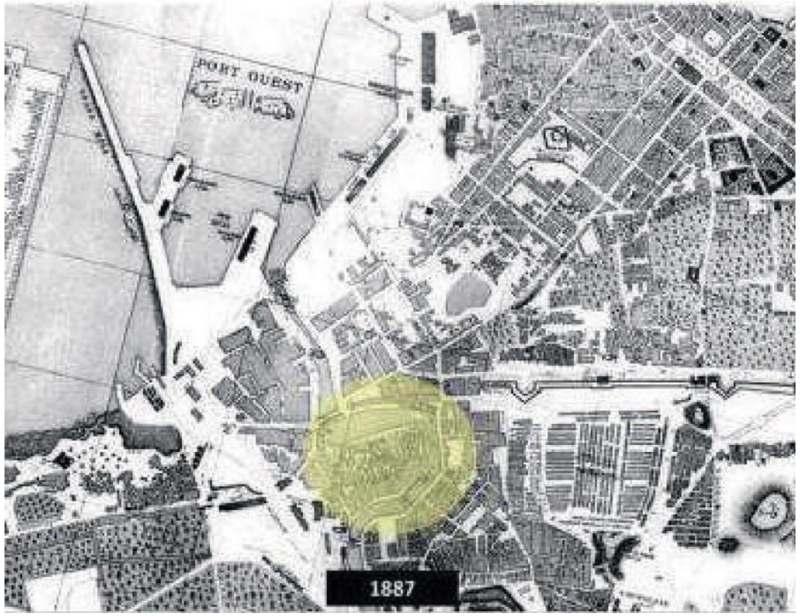


Fig.7.6. Cotton buildings still exist & urbanization begin to increase

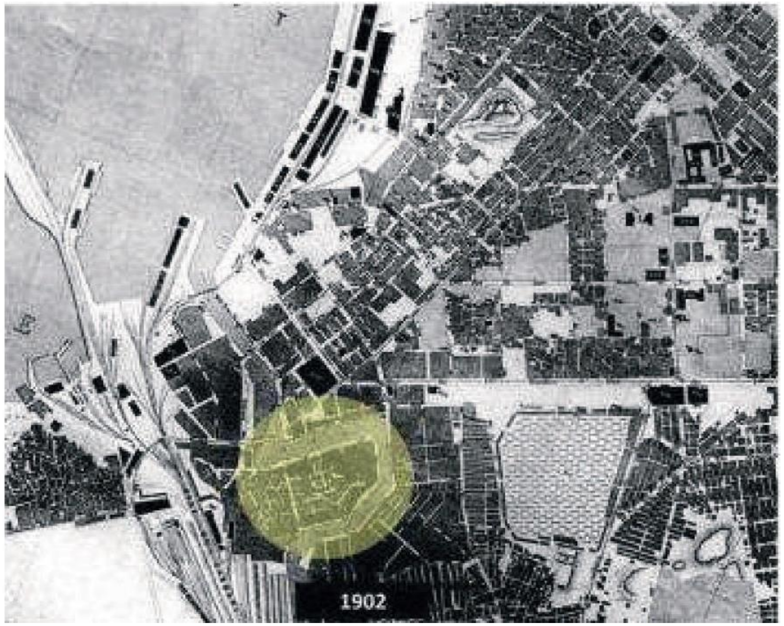


Fig.7.7. Development rate escalated but there was still a part of the Arab wall

7.1 Sociodemographic and environmental data ofAlexandria (Mina El-Bassal).

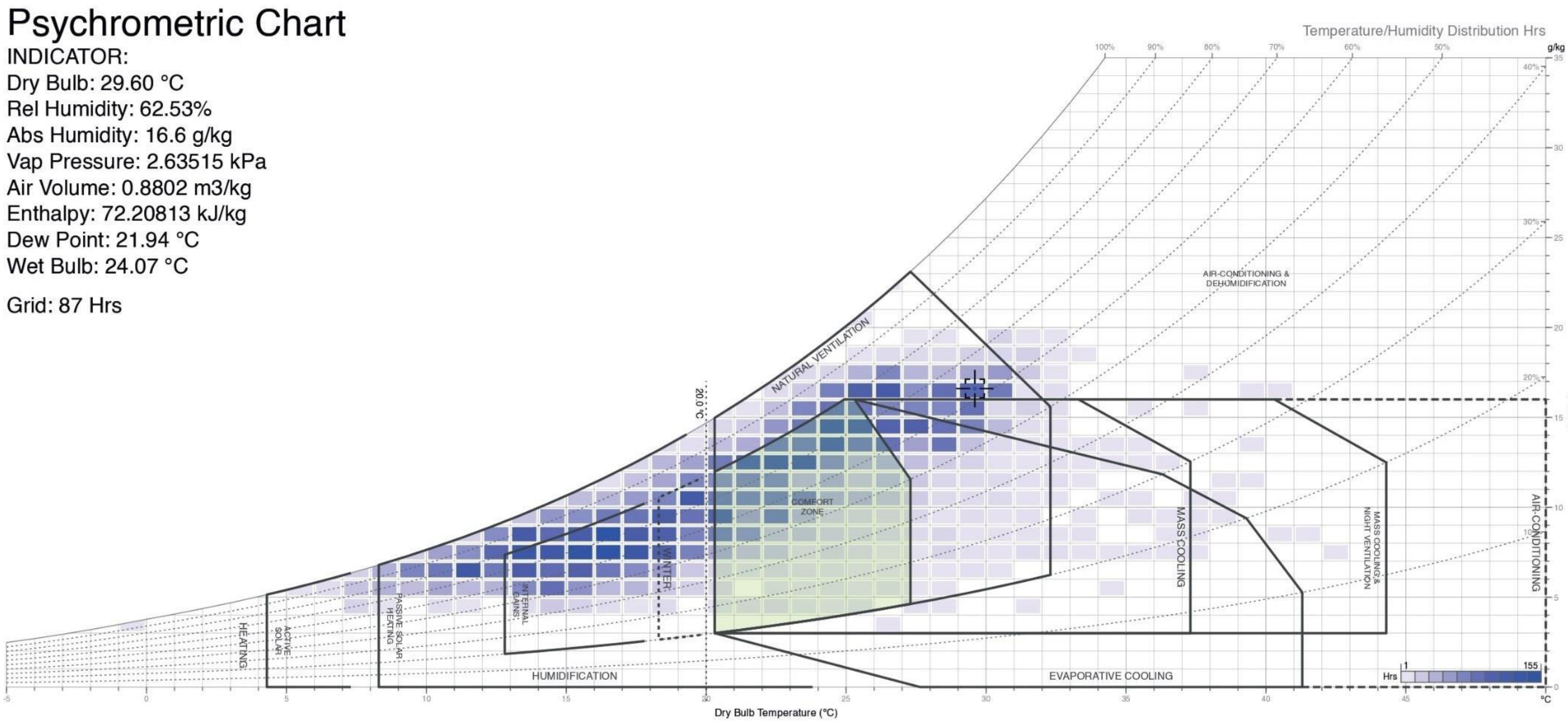


Fig.7.8. Psychrometric chart (Elaborated by author)

Psychrometric Chart for Alexandria's Climatic Analysis

The thermodynamic parameters illustrated include the dew point, a crucial indicator for forecasting atmospheric moisture saturation and condensation concerns, recorded at 21.94 °C. The wet bulb temperature, a crucial metric for thermal comfort and cooling methods, is reported at24.07 °C.

The chart also discusses "Passive and Active Solar Heating," highlighting the times and circumstances in which solar gain can be efficiently employed to heat interiors during temperate months. Zones for "Evaporative Cooling" are designated to signify humidity conditions optimal for this economical cooling technique. Moreover, "Mass Cooling & Night Ventilation" are emphasized as efficient strategies during colder evenings,leveraging the building's thermal mass to absorb heat throughout daytime and emit it at midnight, thereby improving comfort without incurring additional energy costs.

Strategies for "Air Conditioning and Dehumidification" are crucial for ensuring indoor comfort during peak summer months, whereas "Humidification" is important for times when indoor air may become overly dry, especially in heated spaces during colder seasons.

This psychrometric chart is essential for comprehending and enhancing the design and functionality of HVAC systems in Alexandria, providing optimal energy efficiency and comfort while preserving superior indoor air quality. The analysis utilizes Alexandria's distinctive combination ofMediterranean and desert climatic effects, rendering it an essential resource for climate-responsive architectural and technical solutions.

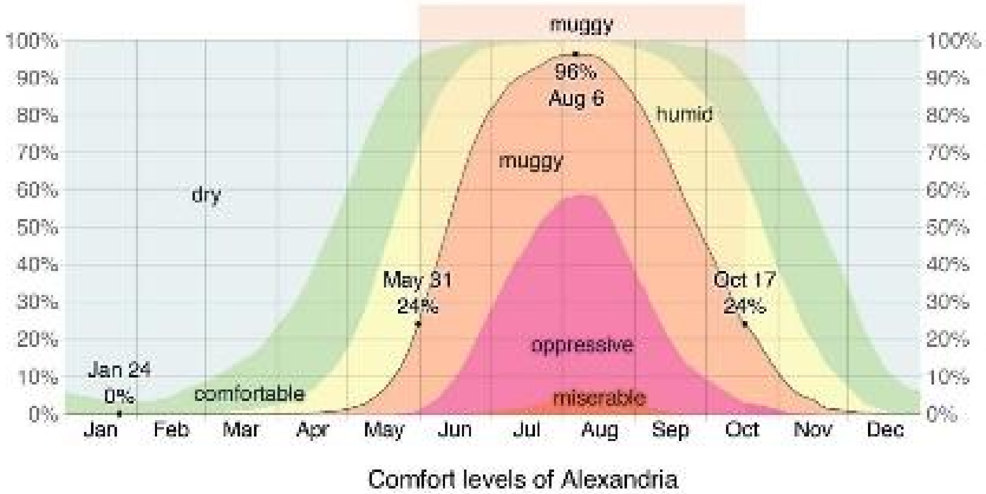
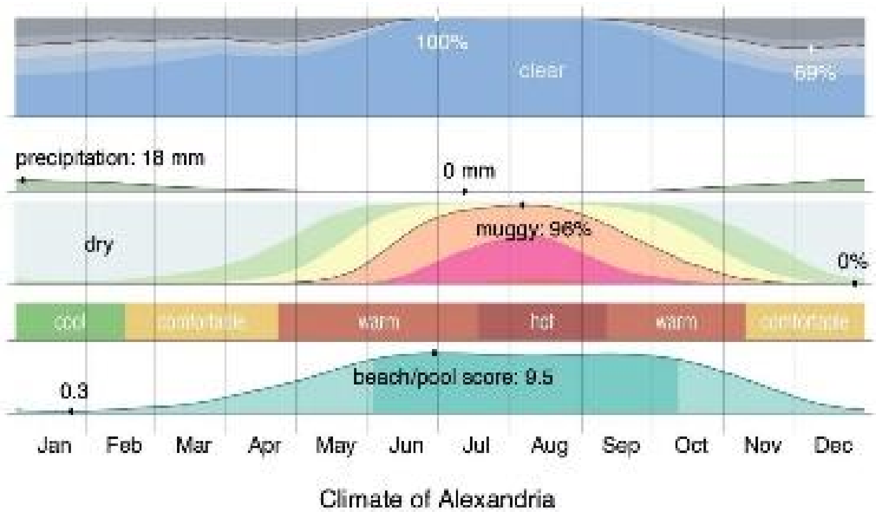


Fig.7.9. Comfort levels of Alexandria (Elaborated)

Fig.7.10. Climate of Alexandria (Elaborated by author)



This graphic meticulously delineates the comfort zones in Alexandria city, influenced by factors such as temperature, humidity, and ventilation. The chart is calibrated with a temperature scale ranging from -5°C to 45°C on the x-axis and relative humidity from 0% to 100% on the y-axis, offering a detailed representation of climatic conditions.

At the core of the diagram is the definition of the "comfort zone," representing the temperature and humidity range in which the average individual feels comfortable without artificial heating or cooling. The measurements presented in the diagram, including a dry bulb temperature of29.60°C and a relative humidity of 62.53%, delineate the peculiar climatic conditions of Alexandria. The figure includes advanced metrics such asabsolute humidity, vapor pressure, and enthalpy, which are crucial for comprehending the thermodynamic state of the air.

Supplementary environmental control options are delineated, encompassing natural ventilation, passive and active solar heating, evaporative cooling, mass cooling, and nocturnal ventilation. Each strategy is labeled in the diagram to denote its effect on the internal climate of buildings, thereby proposing realistic methods for sustainable building design in Alexandria.

The graphic delineates also certain specific dates featuring significant temperatures:

- February 4 and March 17 have moderate temperatures of 18°C and 20°C, respectively, indicative of early spring conditions.
- June 7 and October 10: temperatures of 28°C, exemplifying standard mild weather favorable for outdoor activities andtourists.
- August 9: Represents the peak of summer, with temperatures approaching 30°C, indicating possible strain on energy systems from heightenedair-conditioning usage.
- December 10: A cooler 20°C, signifying moderate winter conditions typical of Mediterranean areas.

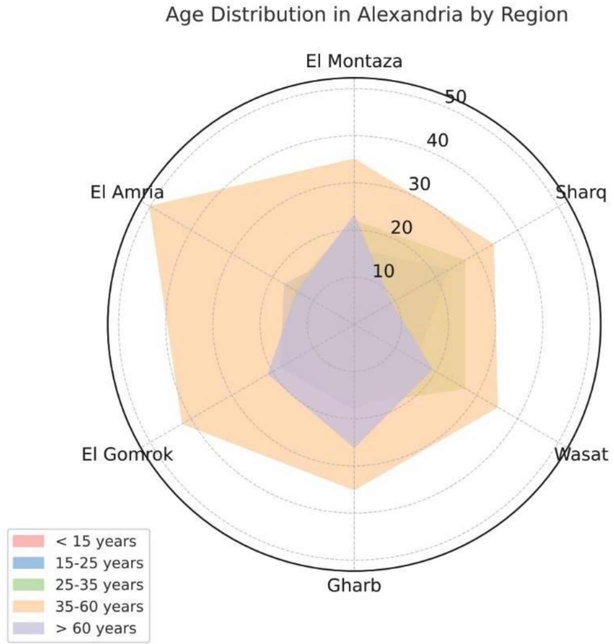


Fig.7.11. Age Distribution in Alexandria byRegion (Elaborated by author)

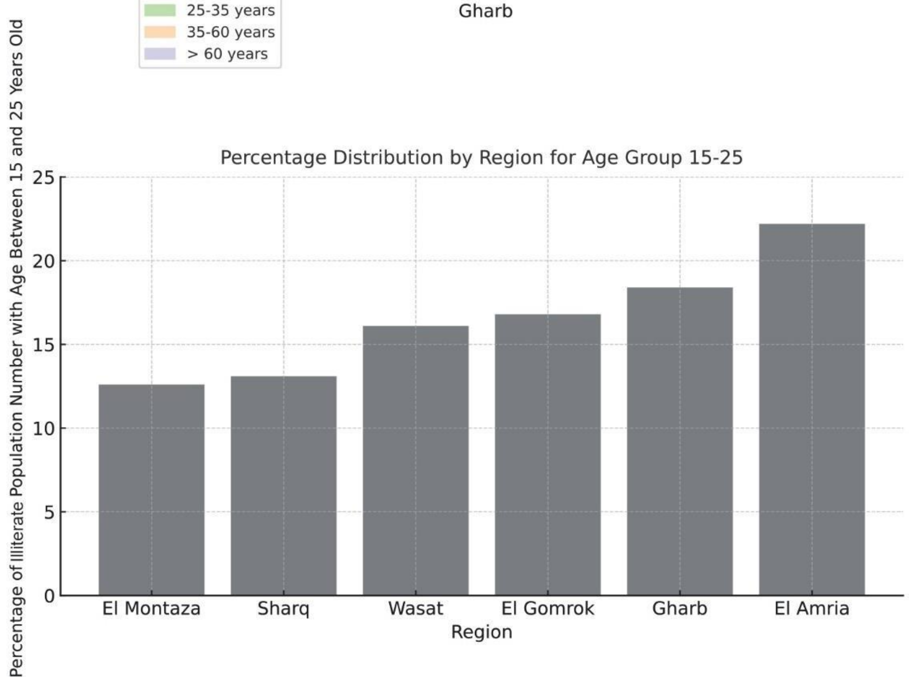


Fig.7.12. Percentage Distribution by Regionfor Age Group 15-25 (Elaborated by author)

The radar chart illustrates the age distribution of individuals in different areas of Alexandria. Each axis denotes a district, while the various hues signify distinct age groupings. Diverse districts exhibit distinct age demographics, impacting educational demand, employment categories, and healthcare services. The West District of Alexandria, illustrated by the Gharb sector in the radial map, exhibits a varied age distribution, notablyfeaturing a significant proportion of adults in their prime working years (35-60 years). The data indicates a vibrant and economically engaged district with diverse age-related requirements, encompassing educational institutions, youth initiatives, employment prospects, and healthcare services.

The bar chart illustrates the distribution of individuals aged 15 to 25 years throughout several districts in Alexandria. The Al Amria district exhibited the highest percentage of inhabitants in this age range, approximately 22%, followed by the West district, Gharb, at almost 18%.

This age distribution offers critical insights for urban planners to customize services, infrastructure, and programs to effectively address the distinct needs of each demographic group, thereby ensuring a balanced and inclusive strategy for urban development and community support inthe West District of Alexandria.

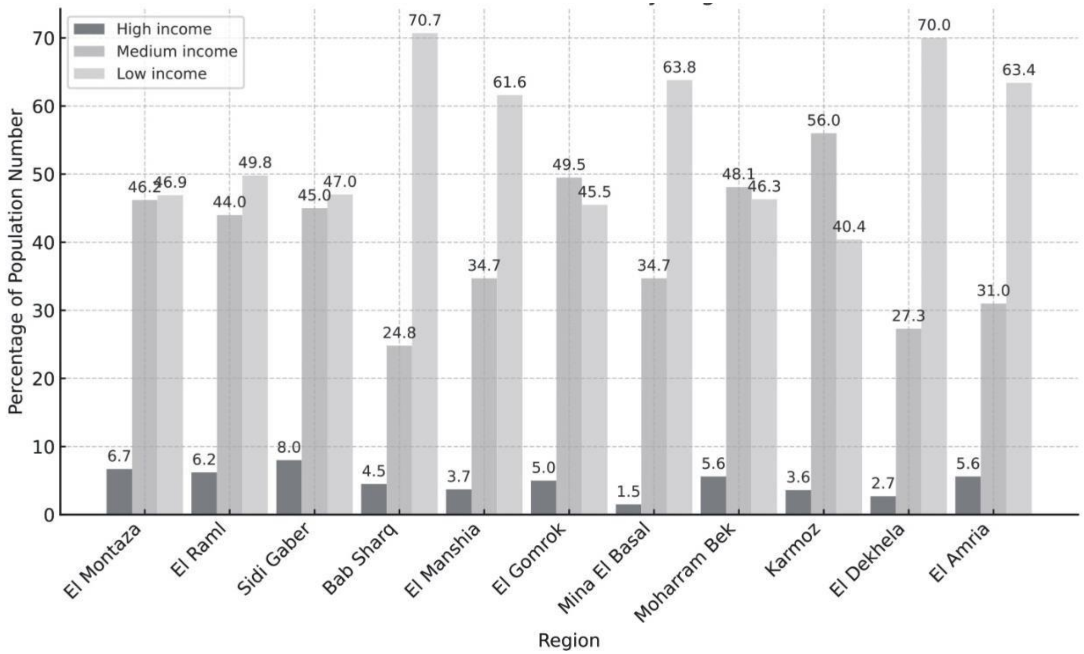


Fig.7.13. Income Distribution by Region (Elaborated by author)

This graph delineates the income distribution among different regions of Alexandria Governorate, classified into high, medium, and low-income categories.

- The majority of residents residing in various districts of Alexandria had either low- or moderate-income levels. Approximately 64% of residents in the Mina El-Bassal region are classified as low-income, while around 35% are categorized as medium-income.
- Among high-income persons, the Sidi Gaber district has the largest percentage at 8.0%, followed by El Montaza and El-Raml districts at 6.7% and 6.2%,respectively. Conversely, the Mina El-Bassal district exhibited the lowest proportion (1.5%) of individuals with high income.

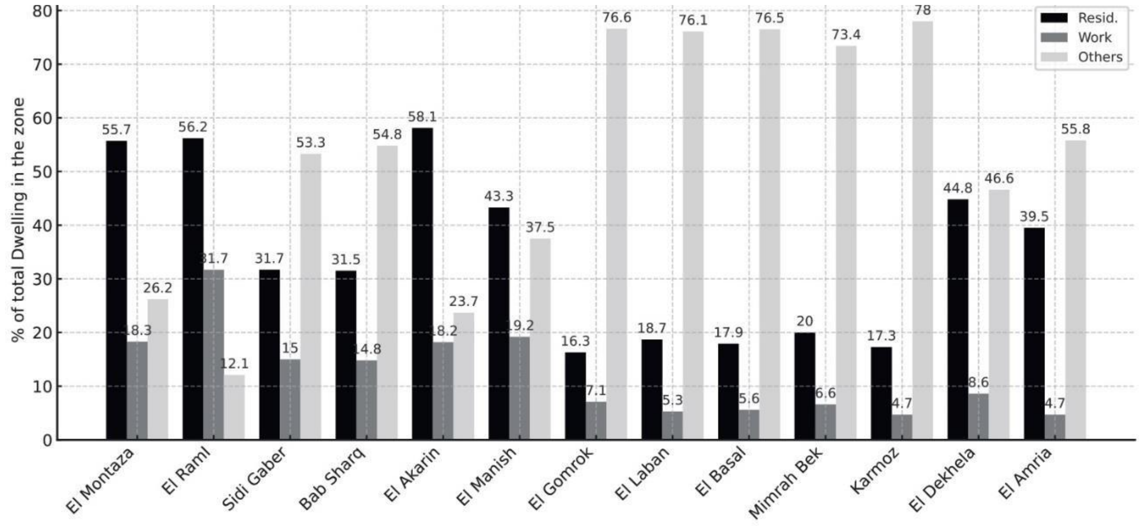


Fig.7.14. Distribution of Dwellings by Zone and Purpose (Black & White)(Elaborated by author)

This graph illustrates the distribution of homes by primary use throughout several zones, classified into residential, commercial, and other categories. Types ofUsage:

- Intensive residential utilization indicates heavily populated areas, necessitating strong local services and residential facilities.
- Work dwellings: Predominant in commercial or industrial areas, emphasizing centers of economic activity.
- The equilibrium between residential and commercial usage might signify the nature of each district—whether they are predominantly residential, mixed-use, orcommercial / industrial centers. Districts with a greater share of 'work' classification influence traffic patterns, public transportation requirements, and urban planning agendas.
- The "Other" category encompasses a range of non-traditional or multifunctional applications of the space, including recreational facilities, mixed-use buildings that integrate residential and commercial functions with retail shops on the ground floor and apartments above, educational institutions, healthcare services, andreligious facilities. These applications illustrate the multifunctional characteristics of urban living environments and the capacity of structures to accommodate diverse community requirements beyond mere habitation or employment.
- Concerning Mina El-Bassal, approximately 77% of the properties serve multi-use purposes, 17% are residential units, and 5.6% are designated as work homes.

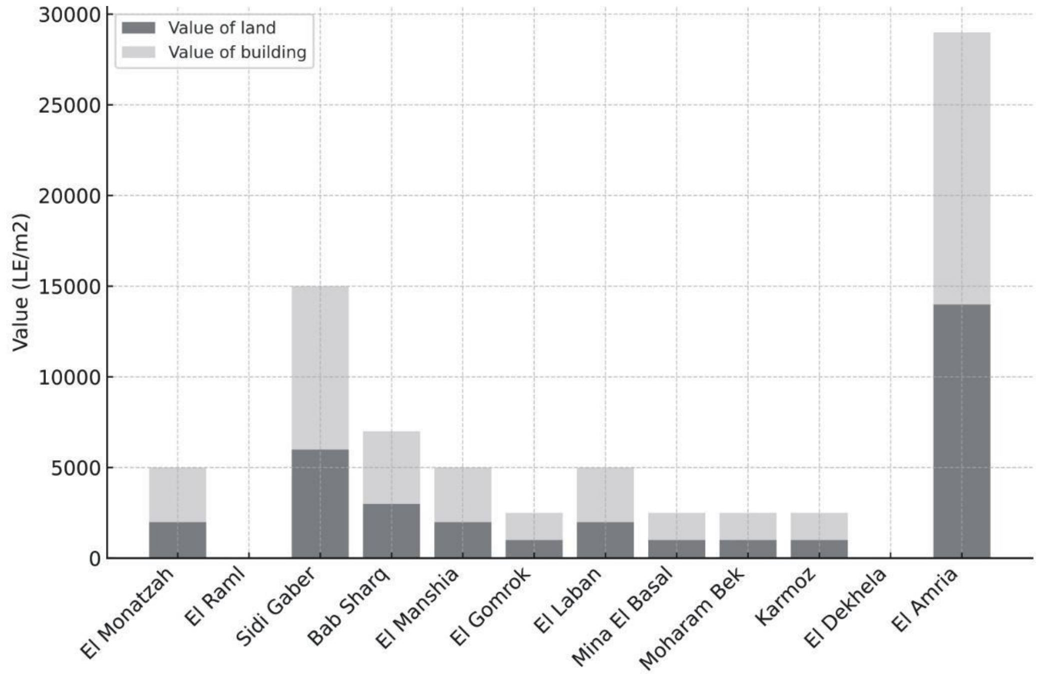


Fig.7.15. Value of land and building by city districts (Elaborated by author)

This bar graph illustrates the economic valuation of land and structures across several districts of Alexandria. This data is essential for comprehending the dynamics of the real estate market and the investment climate in each district.

The land value of Mina El-Bassal is modest relative to other districts, such as Sidi Gaber and El-Amria, which have the greatest landvalues, and El-Gomrok district, which has the lowest land value. The moderate value indicates a balanced demand for real estate, potentially influenced by factors such as location, accessibility, and industrial significance, while also suggesting growth potential, particularly if it attracts new investments or urban development initiatives that leverage its industrial legacy. The property values in Mina El-Bassal are comparatively low, indicating that the current edifices may be aged or require refurbishment. The diminished building value may suggest a necessity for substantial expenditure in rehabilitation.

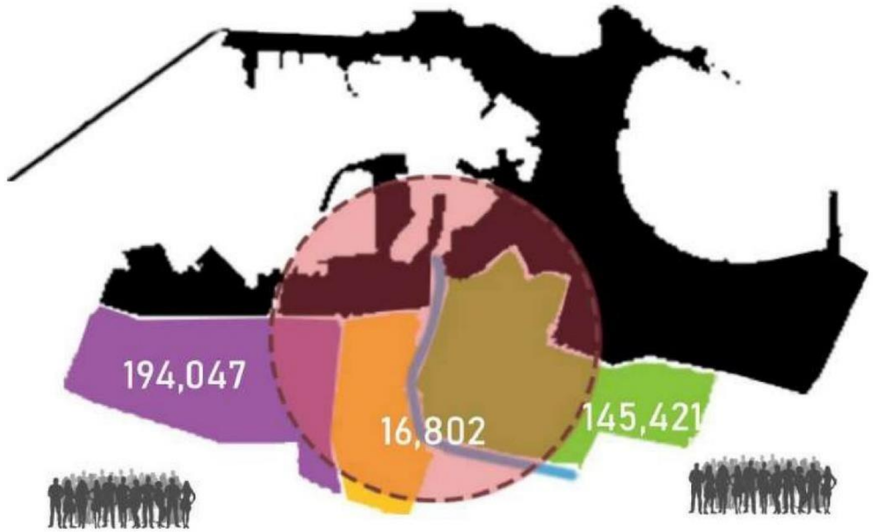


Fig.7.16. population density by districts (Elaborated by author)

An extensive examination of the demographic attributes and allocation of social services in Alexandria reveals that 36% of the local populace is illiterate, primarily among ladies and men over the age of 50. Moreover, 62% of the population are classified as low-income according to local criteria, whilst merely 4% are categorized within the elite economic class. Service distribution reveals that individual access to educational, recreational, and health facilities is restricted to 9% of the population. The eastern and central regions of Alexandria comprise a substantial percentage of these services, varying from 30% to 40%.

This distribution highlights the social and economic inequalities present in the city. The comprehensive population analysis in specific regions such as EL Wardian, Kafr Ashry, Karmouz, and Gheet el Enab, along with their respective population statistics,enhances the comprehension of the demographic configuration, offering a vital insight into the city's social framework.

This analysis is essential for comprehending the socio-economic issues and disparities in service distribution in Alexandria, being a fundamental component of the socio- economic discourse in my thesis.

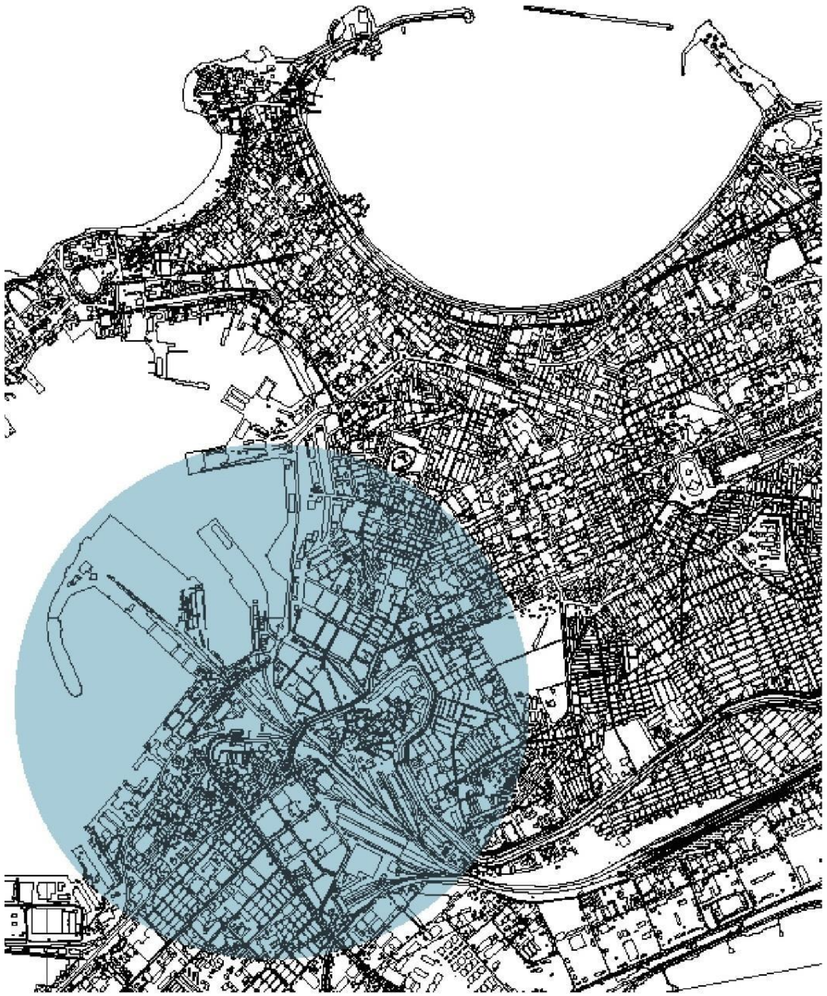


Fig.7.17. Geographical and Urban Layout of Alexandria West District and the studied area (Elaborated by author)

The present circumstances in the West District and Mina El-Bassal in Alexandria illustrate a multifaceted interplay of industrial heritage alongside residential and commercial expansion. Geographical and Urban Configuration:

- The West District is located in a strategically significant area of Alexandria, bordered by key roads that enhance both intra- and inter-city connection. The proximity to essential transport networks, including highways and potentially the Mahmoudiyah Canal, augments its accessibility and economic significance.
- The Mina El-Bassal district, located in the West District, is distinguished by its historical and industrial importance, particularly with the cotton trade.Mina El-Bassal has historically served as a center for industrial activity, particularly in cotton processing, impacting its urban infrastructure and architectural styles.
- The region features substantial warehouse structures, presses, and previous industrial facilities, many of which showcase the architectural stylescharacteristic of early 20th-century industrial design.
- The map probably outlines residential neighborhoods that have emerged around these industrial facilities, intermingled with business zones that servethe daily requirements of the local populace and the workforce.
- The district layout features a comprehensive road network that facilitates both local and regional travel. Principal thoroughfares enhance effective transportation and logistics activities, essential for the enterprises situated in this area. Access to public transportation, such as buses and trams, is likelyprovided, improving inhabitants' mobility and augmenting the area's connectivity within Alexandria.

7.1. Description of Mina El-Bassal area (SWOT analysis)

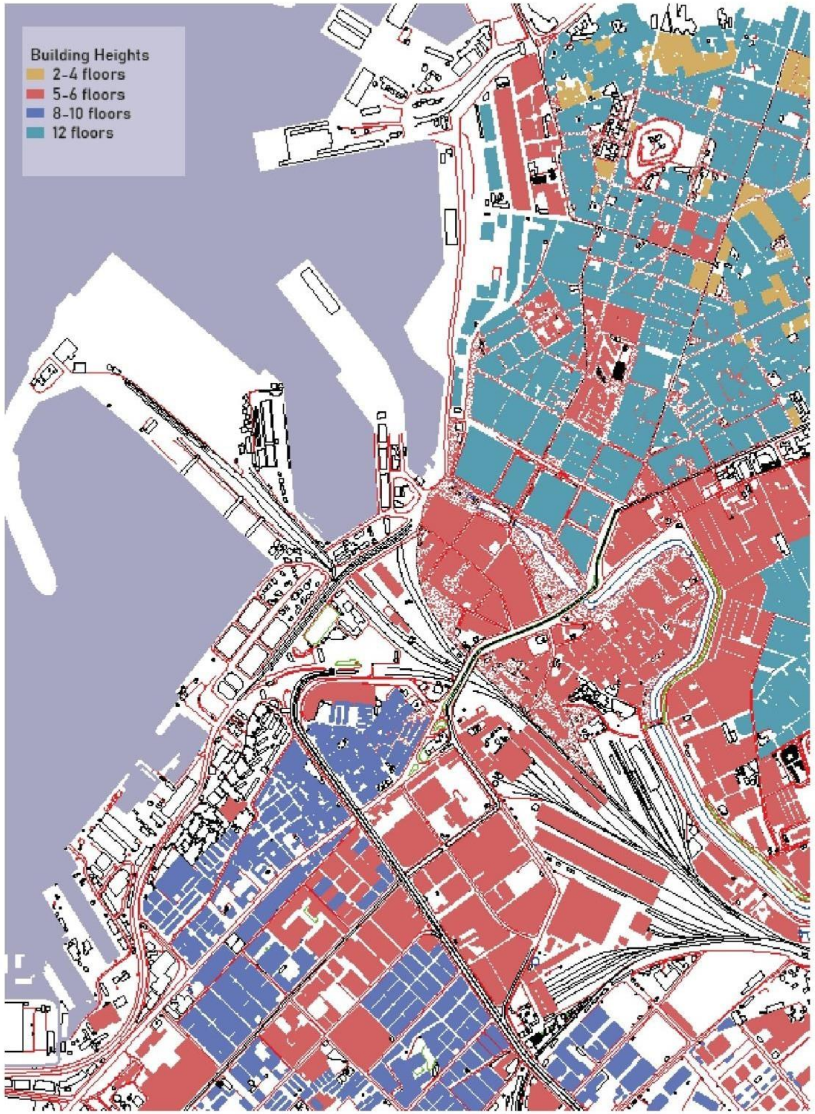


Fig.7.18. Building heights within the WestDistrict of Alexandria, Mina El-Bassal area(Elaborated by author)

The map is illustrating the heights of buildings in the West District of Alexandria, particularly in the Mina El-Bassal region.

- Two to four stories Structures are ubiquitous in regions. They probably preserve antiquated architectural styles, potentially relics of the original residential constructions that accommodated industrial laborers. These low-rise structures may now house small enterprises, artisan workshops, orresidential units that cater to local communities.
- Buildings with 5-6 floors represent a significant portion of the area's architectural landscape. They signify an era of heightened urban development,perhaps during mid-20th century expansions characterized by a transition to denser residential and mixed-use structures.
- Buildings with 8-10 floors are less common, indicating areas of increased density. The existence of 8-10 story structures designed to alleviate the excess population from Alexandria's most crowded regions. These structures are probably situated along primary thoroughfares or in proximity tocommercial centers.
- 12 Floors: These structures constitute the minimal percentage. They signify modern urban development initiatives focused on optimizing land usageefficiency.
- This distribution provides an overview of the architectural diversity and urban planning initiatives in the West District, emphasizing the equilibriumbetween maintaining the historical integrity of older districts and addressing contemporary urban requirements through targeted high-rise projects.

Fig.7.19. Land Morphology (Elaborated by author)

The examination of solid and void spaces elucidates the allocation of constructed regions in relation to open areas. This equilibrium is essential for facilitating sustainable urban development, averting congestion, and preserving adequate public open areas. Urban planners can leverage this information to make informed judgments regarding land use, ensuring that development does not excessively intrude into naturalor recreational areas.

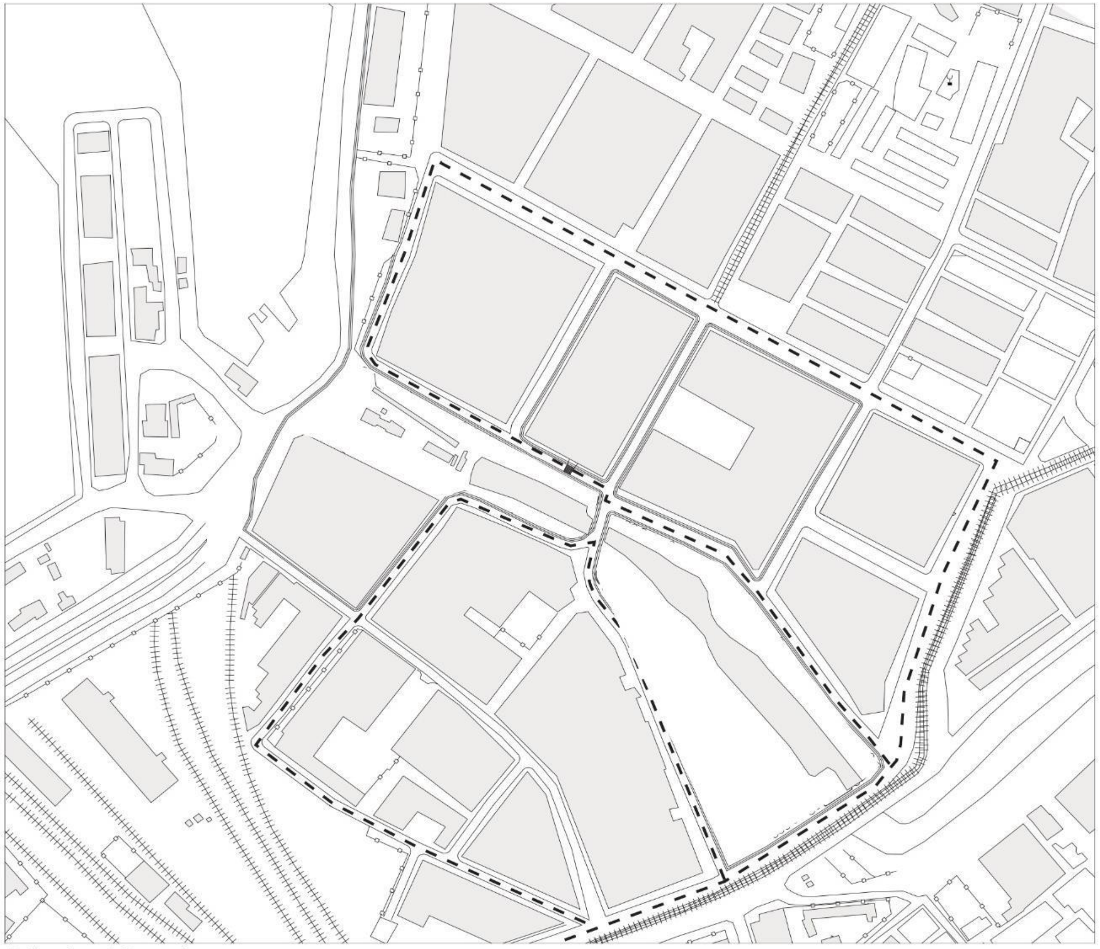


Fig.7.20. Principal Roads (Elaborated by author)

The main Roads diagram delineates the arterial routes that enable traffic flow and link major regions inside the city. These highways are essential for economic operations, facilitating the efficient transportation of products and services. Nonetheless, they may also exacerbate congestion and environmental pollutants if inadequately managed.

Fig.7. 21. Railway (Elaborated by author)

The railway network offers a vital alternative to vehicle transportation, potentially alleviating traffic congestion and environmental pollution. It links several areas of the city and provides a dependable means of transportation for daily commuters. The amalgamation of railway systems with alternative transport modalities, such as buses and taxis, can augment the overall efficacy of the urban transport network and render public transportation more attractive to inhabitants.

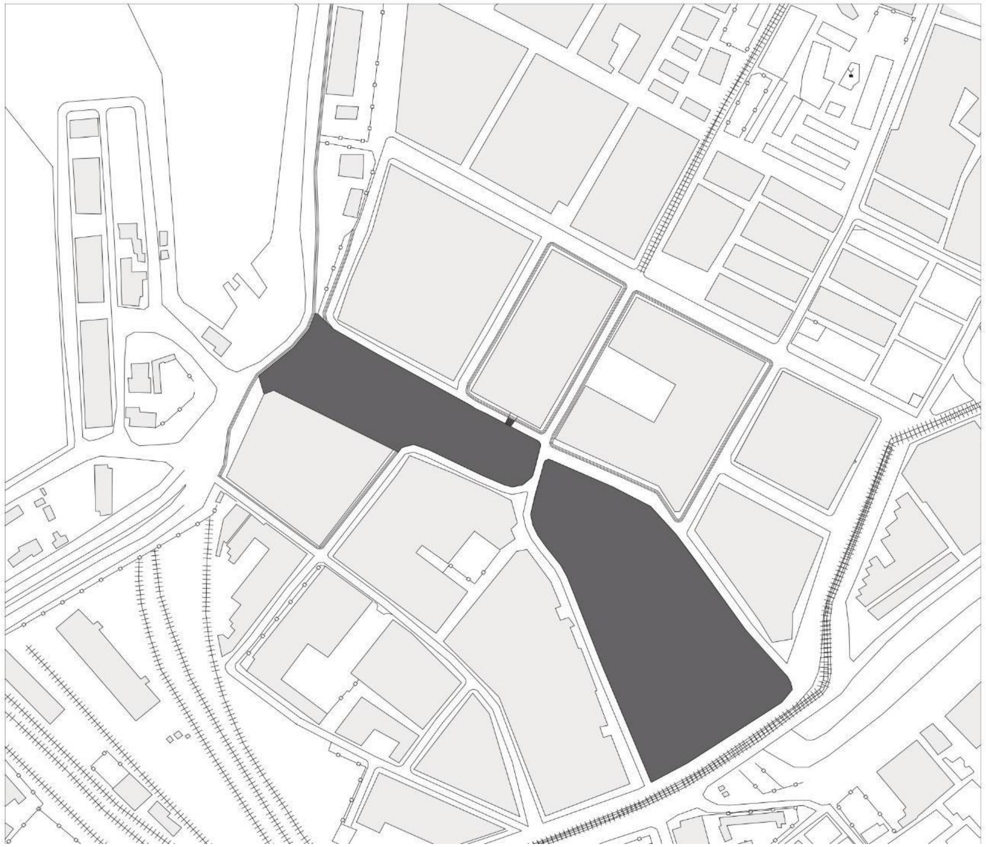


Fig.7.22. Parks (Elaborated by author)

The park areas of Mina El-Bassal function as essential green lungs for the city, offering recreational spaces for inhabitants and aiding in the reduction of urban heat island effects. The existence of these green spaces is crucial for fostering environmental sustainability and improvingthe visual appeal of the urban landscape. Their planned positioning can also affect social interactions and encourage better lifestyles among the urban populace.

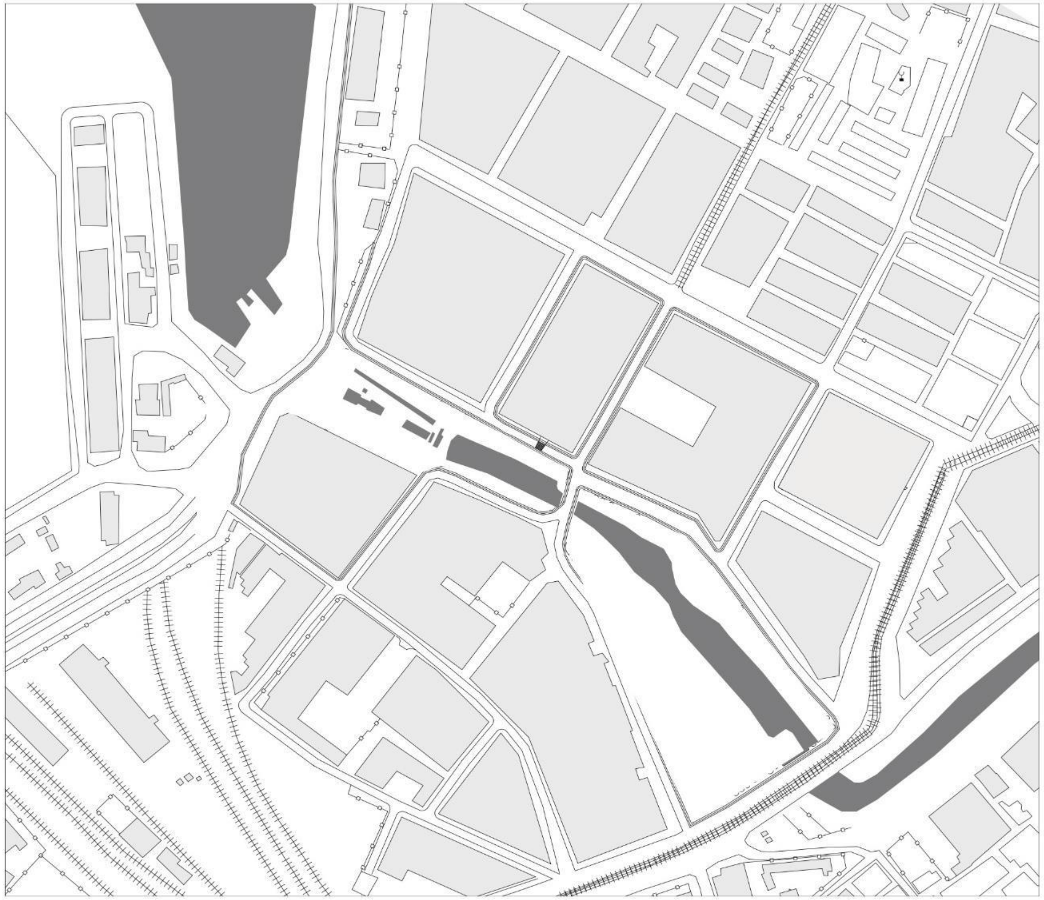
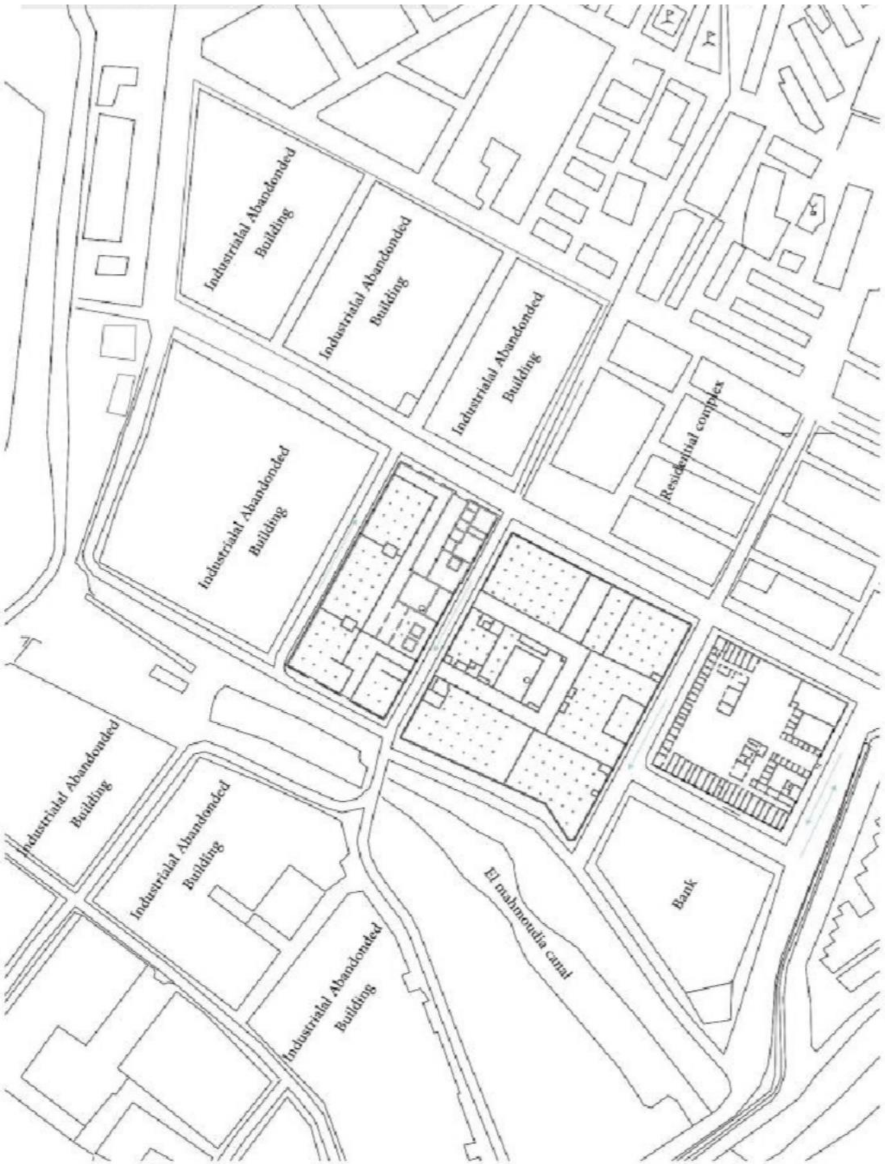


Fig.7.23. Water surfaces: Sea and canal (Elaborated by author)

The proximity to aquatic bodies like as sea and canals substantially affects the urban dynamics of Mina El-Bassal. Thesewater resources are essential for the city's environment and climate, as well as for economic activities like tourism and fishing. Nonetheless, regulating the effects of urbanization on these water bodies is crucial to avert contamination and preserve their biological equilibrium**.**

Fig7.24. Present Circumstances in the Mina El-Bassal Region (Elaborated by author)



Present Circumstances in the Mina El-Bassal Region

- Vacant Structures: Numerous industrial edifices in Mina El-Bassal are derelict and exhibit varied degrees of deterioration. These structures,comprising factories and warehouses, were once integral to the local economy but now contribute to urban deterioration.

- Makbas Masr and Makbas El-Nile: These edifices are notably important owing to their historical significance and architectural characteristics. They are substantial, structurally sound, however now unused, mirroring the overarching pattern of industrial decline in the region. Both edificesare designed for endurance, incorporating robust walls, expansive open areas, and elevated ceilings to facilitate industrial machinery and operations. Their design reflects early 20th-century industrial architecture. Notwithstanding their structural durability, both edifices exhibit indications of disrepair. Problems like shattered windows, decaying facades, and unkempt surroundings are prevalent, indicating an urgent necessity for preservation and adaptive reuse efforts.

- The derelict condition of these structures presents safety hazards, such as structural instability and the likelihood of illicit activity. This not onlyimpacts the local vicinity but also diminishes the general attractiveness and security of the neighborhood.

- Parcels of land surrounding Makbas Masr and Makbas El-Nile are either vacant or have devolved into rubbish disposal sites, exacerbatingenvironmental degradation and creating an unsightly visual impact.

- The present condition of Mina El-Bassal, characterized by a combination of functional and derelict industrial locations poses a multifacetedproblem while simultaneously offering a considerable possibility for urban revitalization.

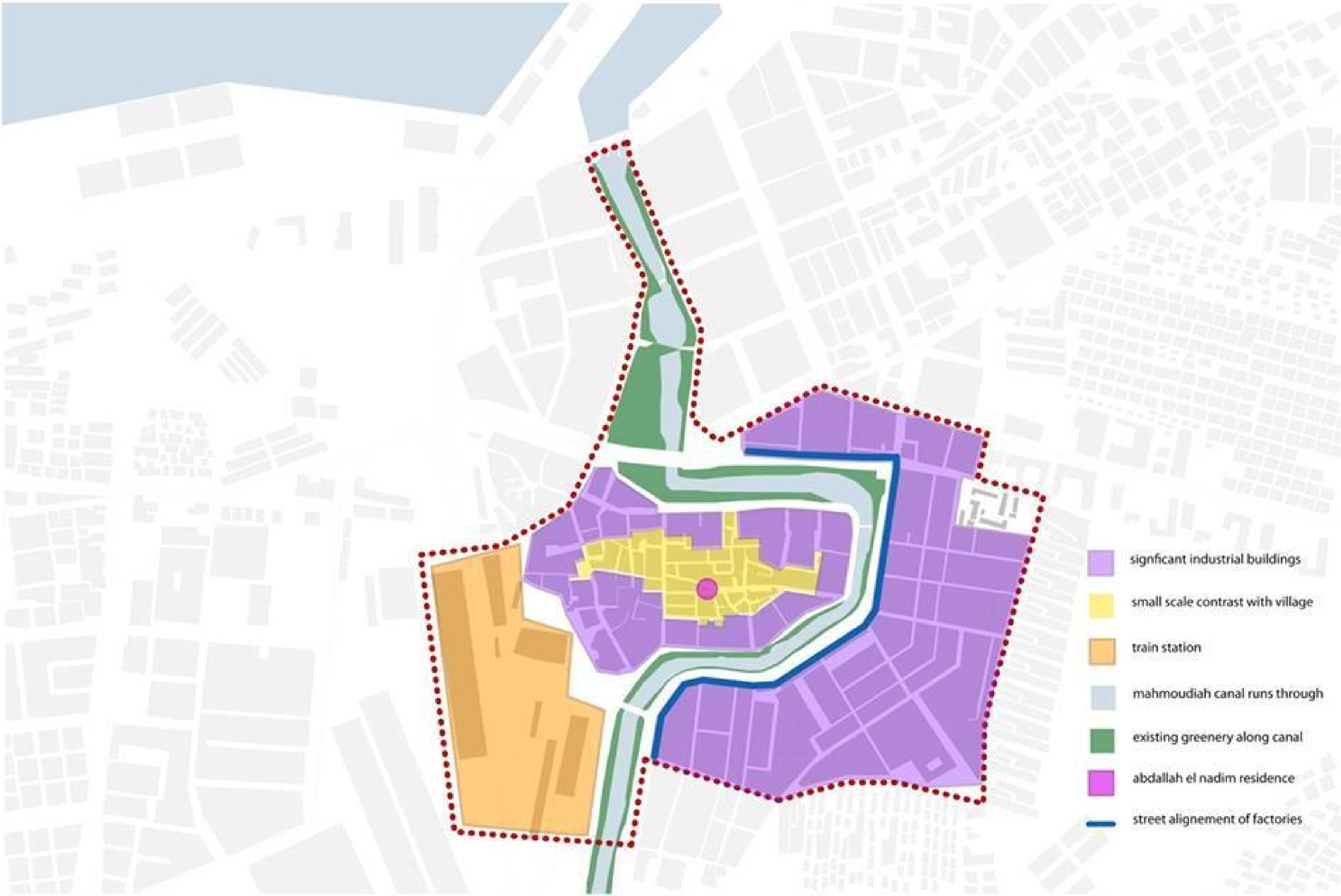


Fig.7.25. Strengths within Mina El-Bassal area (Elaborated by author)

Strengths within Mina El-Bassal area:

- This area is designated as having a concentration of substantial industrial structures that may be suitable for adaptive reuse. They provide a solidbasis for economic rejuvenation via industry-centric innovations or by converting them into creative centers that can draw tourism and stimulate local business endeavors.

- A small-scale village area is located adjacent to the industrial zone. This contrast highlights the varied urban fabric of Mina El-Bassal.

- The rail station functions as a vital hub in the local transportation, enabling convenient access to many regions of Alexandria and beyond.

- The Mahmoudiyah Canal is an essential waterway across the region, historically significant for transportation and water management. Thepresence of greenery along the canal augments its aesthetic and ecological value.

- The Abdullah El-Nadeem Residence certainly signifies a historically or culturally important edifice, potentially linked to a prominent individualor event in the region's history. Conserving and incorporating these historical sites into the wider urban environment can enhance the cultural fabric of Mina El-Bassal.

- The arrangement of industries along streets indicates a strategic industrial configuration, perhaps intended to enhance logistics and manufacturing efficiency. This configuration may alleviate road congestion and enhance accessibility.

- Numerous edifices on the east bank of the channel are well maintained.

- A diversity of building footprints, sizes, heights, styles and structures.

- Presence of many crafting skills.

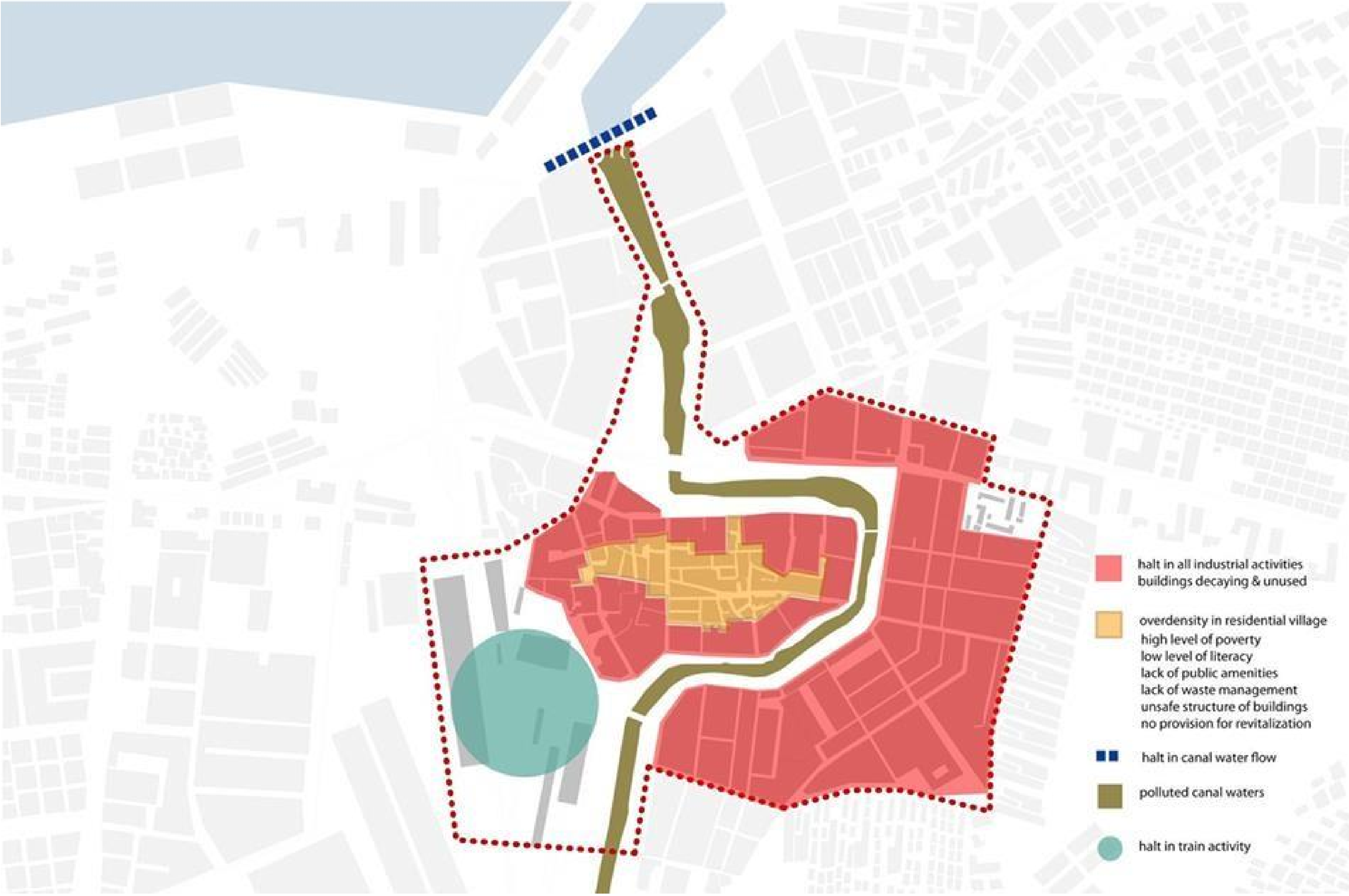


Fig.7.26. Weaknesses within Mina El-Bassal area (Elaborated by author)

Weaknesses within Mina El-Bassal area:

- A substantial cessation of industrial activities, resulting in numerous structures deteriorating and being unutilized. This halt in productivity leads to economic stagnation and the physical decline of infrastructure. Furthermore, there was no provision for the regeneration or adaptive reuse of these industrial sites.
- Elevated poverty levels, overpopulation and High level of illiteracy might intensify socio-economic difficulties, resulting in resource strain and substandard living conditions, with the informal residential settlement (as in Kafr Ashry's residential area).
- The deficiency of public amenities and services, including parks, educational institutions, and healthcare facilities, impairs the
- quality of life. Furthermore, inadequate waste management systems lead to unclean conditions and environmental deterioration.
- Contaminated canal water poses a considerable environmental issue. Pollution adversely influences water quality, communityhealth, and the local ecosystem. Stagnation of water flow may result in heightened pollutant concentration.
- The suspension of rail operations affects the connection of Mina El-Bassal, restricting access to economic opportunities anddiminishing the efficiency of commodities transportation.
- Increase in drug dealers in surroundings.

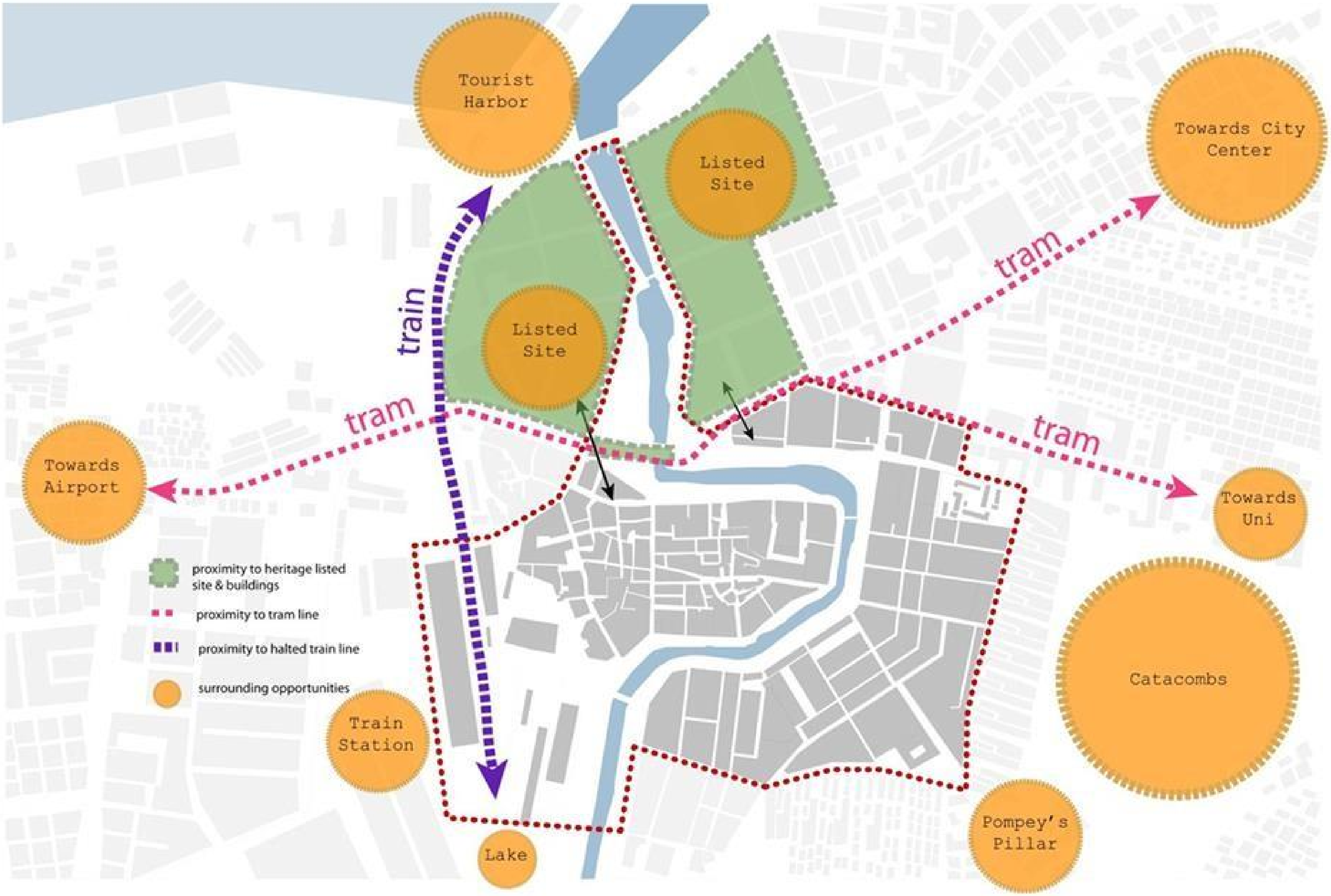


Fig.7.27. Opportunities surrounding Mina El-Bassal (Elaborated by author)

The map delineates the several prospects in the vicinity of Mina El-Bassal.

- Tram routes link Mina El-Bassal with other key locations in Alexandria, such as the city center, university, and airport. This network enablesconvenient access for both residents and visitors.
- Train connections are essential transit linkages that connect Mina El-Bassal to wider regional and national destinations. The train stations
- proximity to the Mina El-Bassal area is a strategic benefit.
- The area's closeness to prominent tourist attractions including Pompey’s Pillar and the Catacombs, as well as heritage-listed buildings of culturaland historical significance, attracts visitors, potentially benefiting local businesses and cultural institutions.
- The area's proximity to a lake and potential water bodies, as indicated on the map, enhances its environmental value, providing aesthetic appealand possibly serving as centers for leisure and recreational activities, thereby improving residents' quality of life and attracting tourists.
- The tourist harbor has the potential to function as a vital economic center, enhancing local enterprises and hospitality services. This facilityfacilitates marine transit and augments the recreational attractiveness of the region.

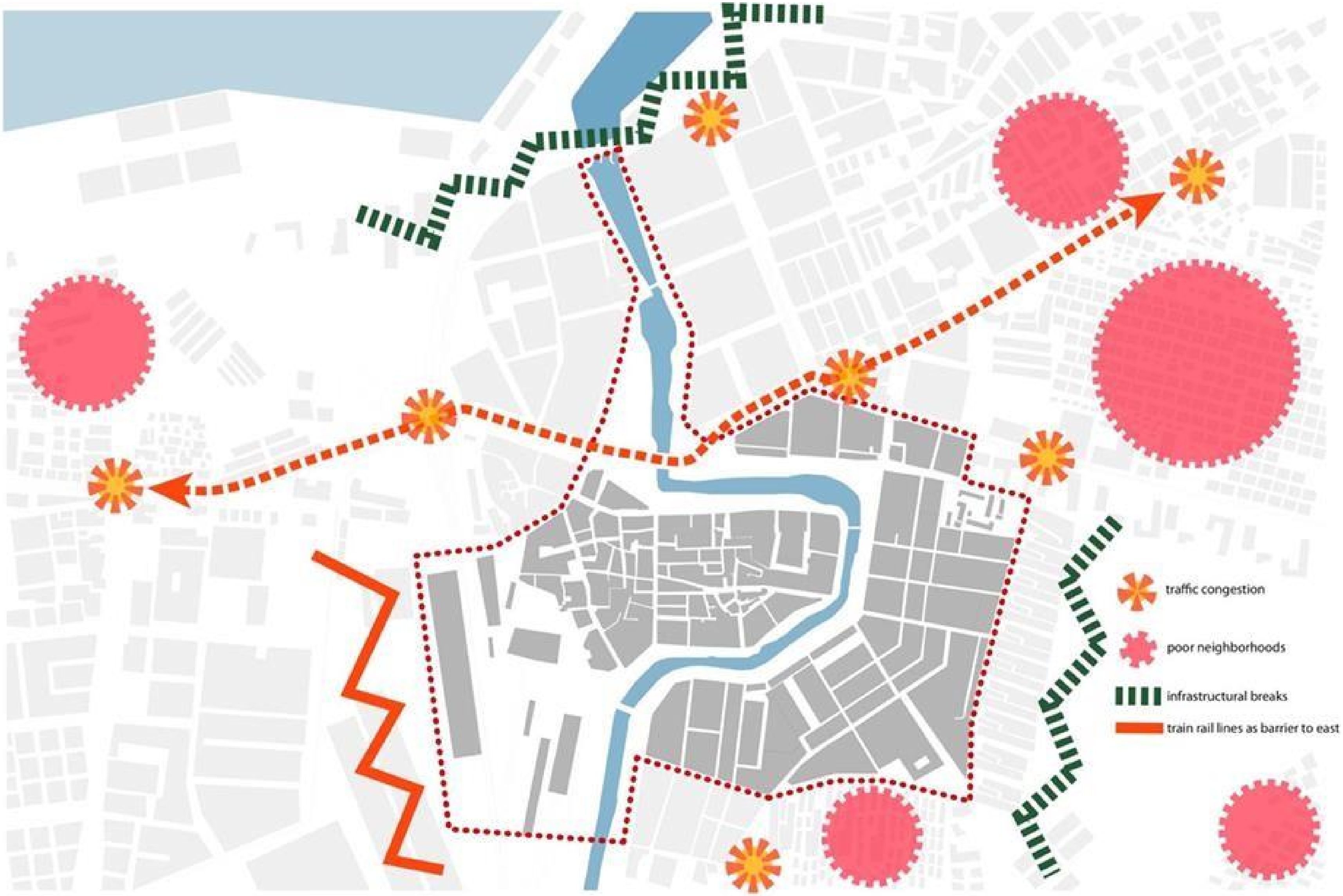


Fig.7.28. Threats surrounding Mina El-Bassal (Elaborated by author)

This map illustrates the diverse urban difficulties or risks confronting the Mina El-Bassal region.

- Notable traffic congestion was observed around Mina El-Bassal, perhaps due to insufficient road infrastructure, elevated vehicle density, orineffective traffic management. Congestion can significantly diminish quality of life by escalating pollutants, impairing transportation, and adversely influencing local economic activity.

- The map also illustrates the existence of multiple areas with diminished socio-economic conditions, characterized by substandard housing,restricted access to critical services, and inferior overall urban quality.

- Regions characterized by deficiencies in infrastructure, where urban services and utilities are either absent or substantially impaired. Thismay encompass malfunctioning sewage systems, insufficient water supplies, or defective road networks.

- Railway lines establish obstacles that might markedly disrupt the urban landscape, limiting connectivity between the Mina El-Bassal areaand various sections of the city, so generating isolated enclaves. Such obstacles can obstruct emergency services.

- The thorough examination of Mina El-Bassal's urban planning components highlights the need of cohesive planning and administration. Plans must prioritize sustainable development approaches that honor and integrate the natural and constructed ecosystems, thereby fosteringeconomic vibrancy, environmental sustainability, and enhanced quality of life for all people.

7.2. Analysis of the actual situation of Makbas Masr and Makbas El- Nile

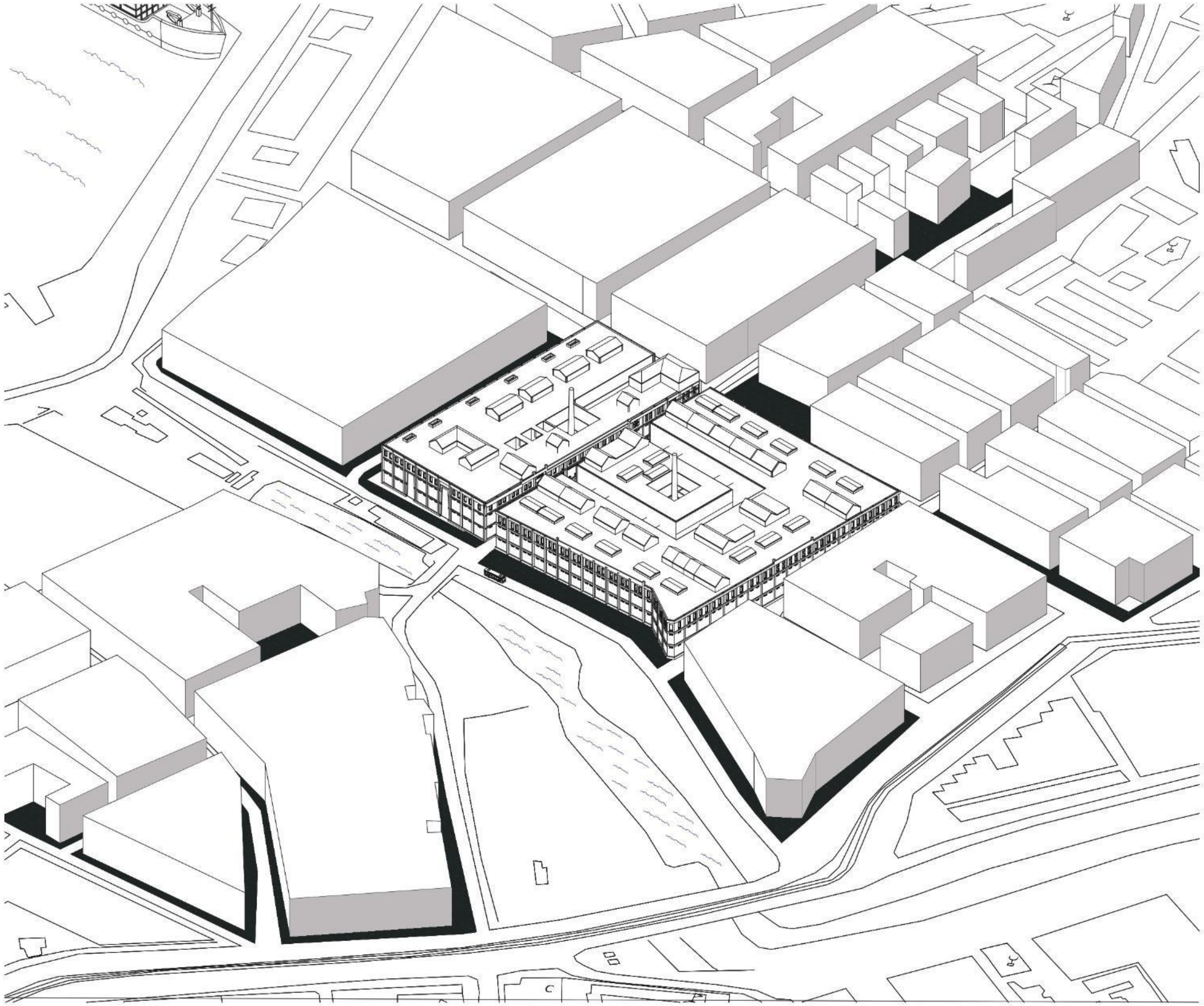


Fig.7.29. Contextual and Urban analysis for Makbas Masr and Makbas EL-Nile.
(Elaborated by author)

Contextual and Urban Analysis for Makbas El Nile and Makbas Masr:

- The historical significance of Mina El-Bassal as a crucial cotton trading and pressing center has influenced its architectural and urban design. Industrial structures such as Makbas El Nile and Makbas Masr exemplifies this history.

- Their substantial and resilient designs, exemplify the quintessential industrial architectural styles of the beginning of the twentieth century and reflect the industrial activities that need considerable space and logistical resources. Their design incorporates big windows for natural illumination,elevated ceilings for airflow, and ample floor space to support heavy gear.

- The axonometric figure illustrates that these structures are situated adjacent to essential urban infrastructure, such as road networks, trams,trains, ports, and waterways, which were vital for the logistical requirements of their initial industrial purpose.

- The edifices are encircled by diminutive constructions and open areas. Their magnitude and architecture distinguish them as landmarks inthis environment, presenting a distinctive potential to convert them into focal points of an enhanced metropolitan area.

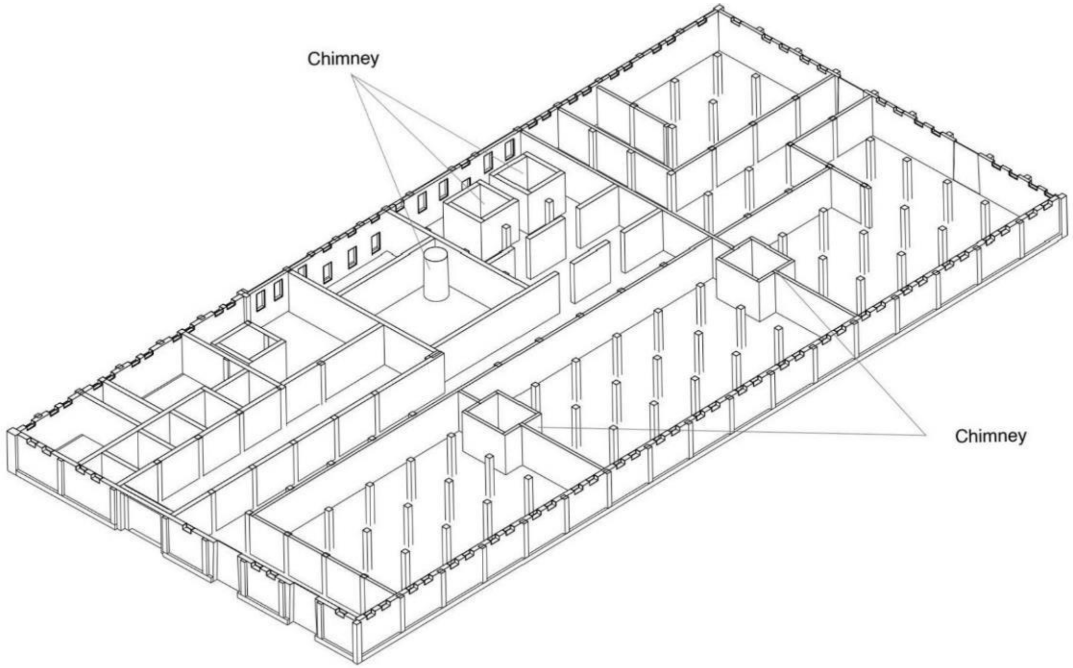


Fig.7.30. Ground floor of Makbas Masr (Elaborated by author)

The axonometric diagram of the ground floor of Makbas Masr: offers a detailed representation of its architectural configuration and functional design, highlighting the incorporation of the chimney structure. It is rectangular in shape. This floor constitutes the basis for the buildings operational and public interaction areas, while the chimney is vital to both environmental regulation and the building's aesthetic charm.

- Entryway & Reception Area: The primary entry opens into an expansive lobby, intended to facilitate a considerable influx of individuals. This spaceestablishes the building's first atmosphere and facilitates efficient movement to other areas of the ground level.
- The ground floor chimney is an essential element of the natural airflow system within the structure. It is engineered to utilize the stack effect, where in warmer air ascends and escapes via the chimney, thus inducing cooler air to enter the building through lower vents or windows. This natural ventilation aids in sustaining suitable indoor temperatures and air quality without excessive dependence on mechanical systems.
- The chimney functions as a visual focal point, enhancing the aesthetic aspect of Makbas Masr architecturally. It may symbolically symbolize conventionalaspects of Egyptian architecture, which frequently combines utilitarian design with cultural importance. The chimney provides structural support for the vertical integration of analogous components on the upper levels, enabling harmonious functionality throughout the structure.
- The structural configuration comprises a set of regularly spaced columns on the bottom level, creating a grid that upholds the building's structural integrity.The quantity and arrangement of these columns are crucial for assessing the floor's ability to support open areas and substantial weights. Columns are frequently fabricated from resilient materials such as stone or reinforced concrete.

-The ground floor walls are thicker than those on upper levels, offering structural support and stability. The materials employed, such as stone, brick, or concrete, not only bear the building's weight but also contribute to thermal insulation. This thickness insulate against the noise of the machinery and maintaina stable internal environment crucial for cotton processing, which is sensitive to temperature and humidity variations. They display antiquated fittings or remnants where machinery was formerly affixed.

- The partitions are less thick than the external walls and may possess diminished structural significance, although they are crucial for the functional zoningwithin the building.
- On the bottom floor, it is essential to mix natural light with security and seclusion. So windows' dimensions and positioning are frequently engineered to maximize illumination while reducing direct sunlight exposure, which is essential in hot climates such as those of Alexandria.

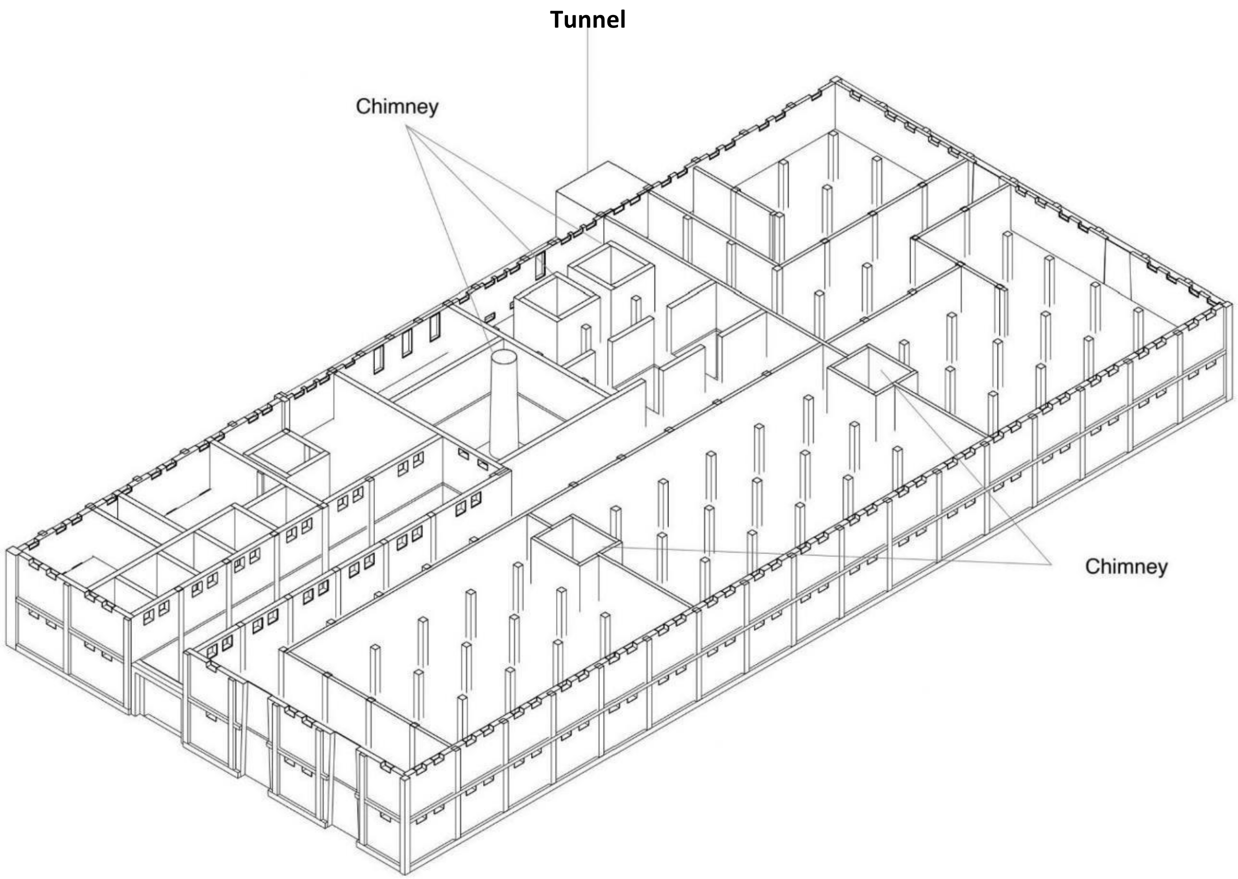


Fig.7.31. First floor of Makbas Masr (Elaborated by author)

The axonometric diagram of the first floor of Makbas Masr:

It offers a clear representation of the building's structural and functional dynamics, especially through the incorporation of several chimneys and a tunnel. This floor, mostly intended for operations and may be public or exhibition areas, is engineered to optimize air circulation and energy management inside the structure.

- The chimneys, strategically located on the first floor, are essential for the building's natural ventilation and passive cooling systems, ensuring a comfortable indoor climate and a healthy working environment by eliminating airborne contaminants such as cotton dust, which is vital in textile mills.Their dimensions and quantity would reflect the magnitude of operations.
- The existence of a tunnel on the first level suggests a conduit or channel perhaps utilized for utilities or as a component of an advanced air circulationsystem. The tunnel enables convenient access and movement, potentially supporting maintenance activities or functioning as a channel for diverse building functions. It functioned as a logistical conduit for the secure and fast transit of cotton and supplies across various sections of the building or toneighboring structures or transport facilities. This component guarantees that the building's infrastructure stays discreet and systematically arranged.
- Columns are uniformly placed to establish a rhythmic architectural pattern that satisfies both aesthetic and practical criteria of the floor, optimizingopen space for machines and the circulation of raw cotton and finished products. Their quantity and arrangement are essential for sustaining the building's weight. In comparison to the ground floor, minor differences in spacing or design are observed to meet distinct load requirements.
- A greater number of partitions than the ground floor, indicating an increase in operational areas.
- Windows on lower floors are taller or wider than those on upper floors. They additionally improve cross-ventilation.

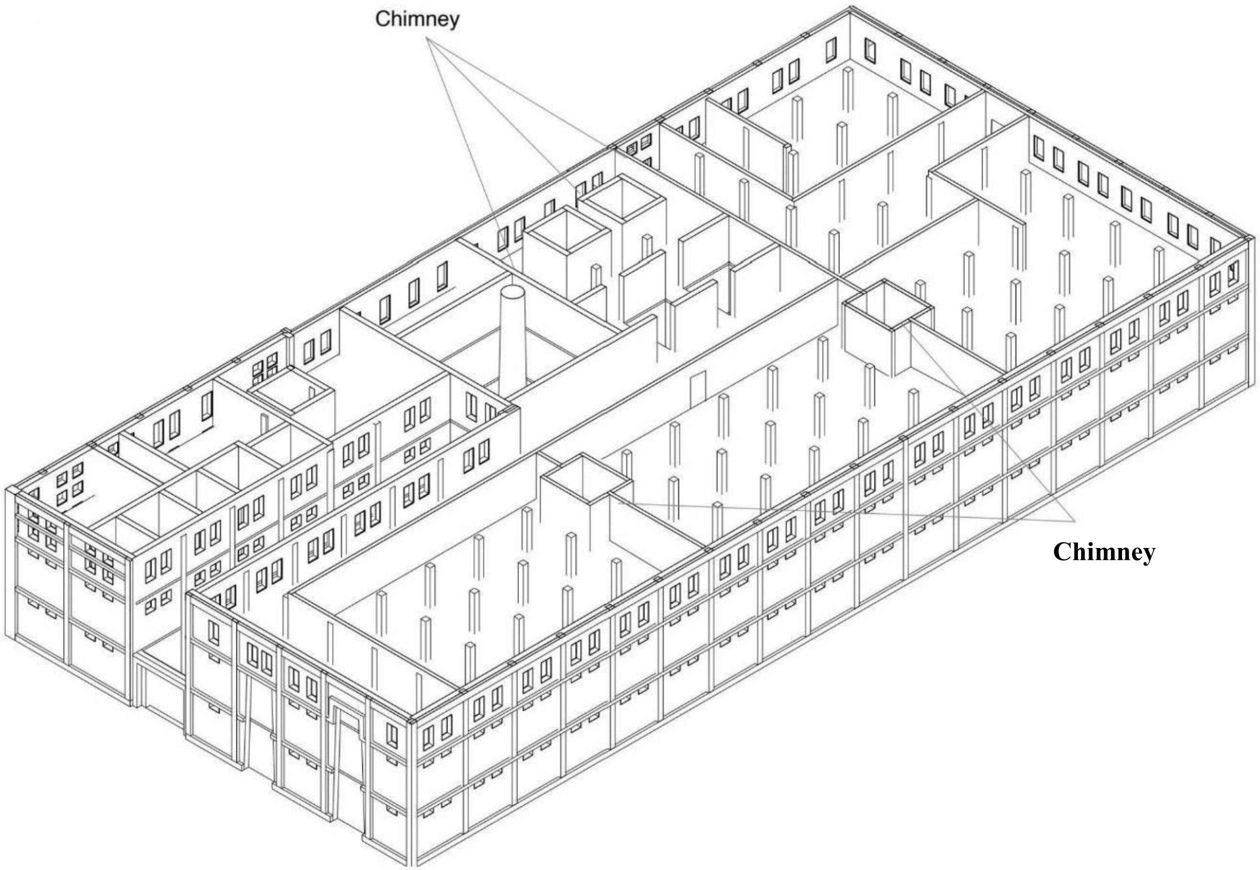


Fig.7.32. Second floor of Makbas Masr (Elaborated by author)

Analysis of the Axonometric Diagram of the Second Floor of Makbas Masr:

.

- The chimneys are significant elements on this floor. The existence of several chimneys signifies a strong design aimed at providing idealenvironmental comfort for the various activities conducted on this floor. Their positioning is strategically coordinated with the most demanding work areas on the floor.
- The spacing between columns is strategically designed to enhance the manufacturing process, providing adequate space for machinery operation and personnel mobility.
- The second floor presumably contains versatile spaces. It offers an area that is both attainable and practical.

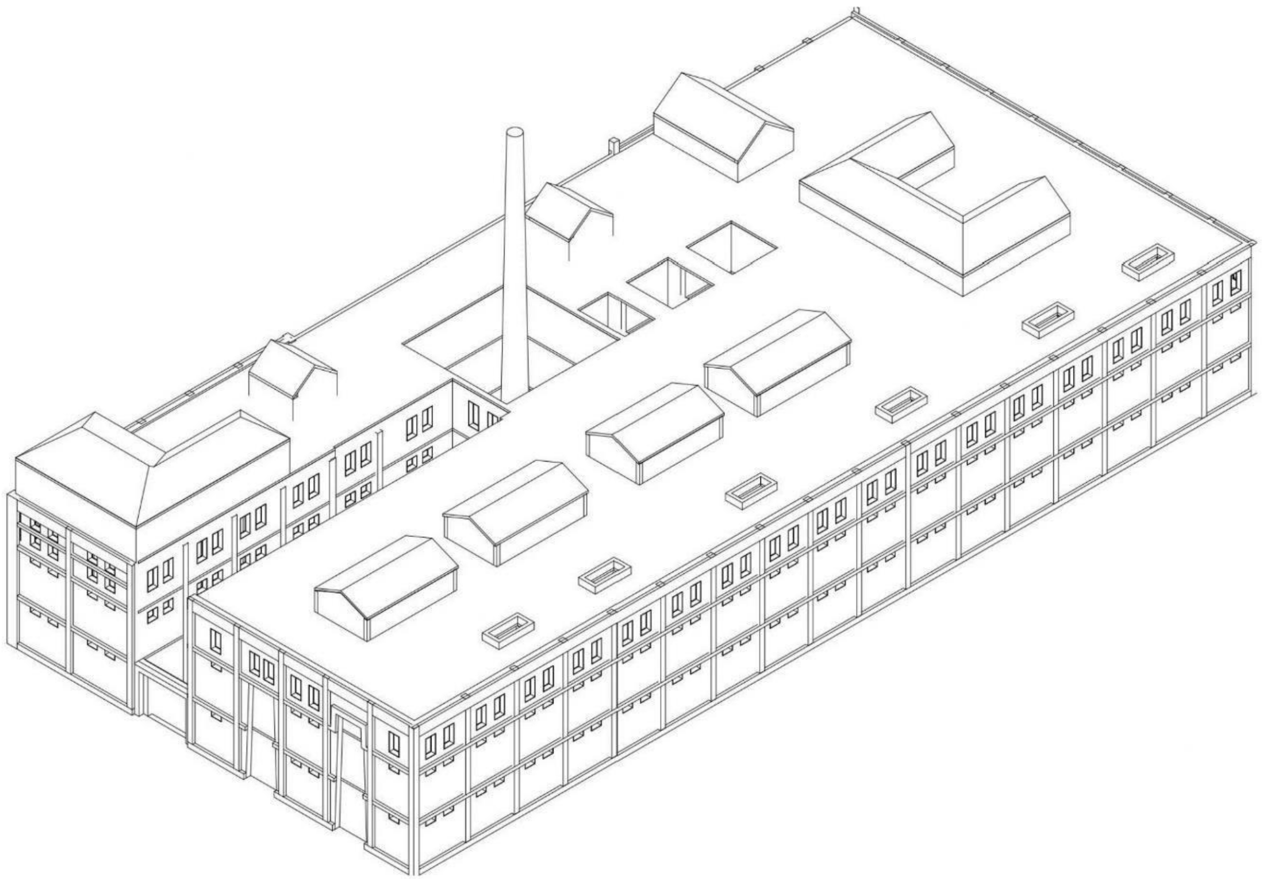


Fig.7.33. Makbas Masr Roof (Elaborated by author)

The Makbas Masr roof serves as more than just a protective barrier. The roof design may have been optimized to enhance the building's internal volume, facilitating the effective accommodation of huge machinery and equipment for cotton pressing. Elevated ceilings are characteristic of industrial structures from that period, designed to accommodate substantial machinery and enhance air circulation. It is intended to amplify natural light, reducing dependence on artificial lighting, which is both expensive and less efficient. Augmented natural illumination would enhance visibility and safety, essential in an environment characterized by heavy machinery and active labor.

- The roof presumably offered critical structural support for hoists and pulleys, which were crucial for transporting enormous bales of cotton and heavy machinery over the factory floor.
- During the cotton pressing process, the work environment may become excessively heated and laden with cotton dust and other pollutants. The chimneys were essential for venting contaminants from the worksite, ensuring air quality and fostering a safer working environment for the laborers. This natural ventilation system is essential for minimizing the building's carbon footprint.

-The processing of cotton creates a significant quantity of heat. Chimneys facilitate the regulation of a building's internal temperature by permitting the evacuation of hot air, so ensuring a more stable and controllable working environment.

Fig.7.34. Makbas Masr North Elevation, scale 1:800. (Elaborated by author)

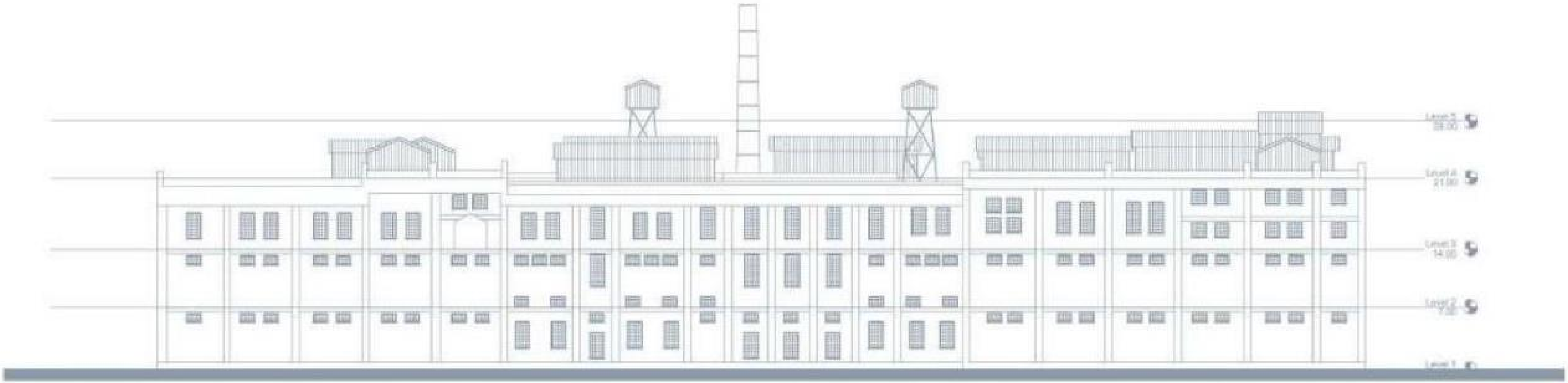


Fig.7.35. Makbas Masr South Elevation, scale 1:800. (Elaborated by author)

Fig.7.36. 3D section of Makbas EL-Nile (Elaborated by author)

The 3D section of Makbas El Nile:

- It offers an in-depth examination of the building's internal structure and material composition, showcasing its industrial past and practical design. The architecture of the building is engineered to accommodate substantial industrial activities while ensuring sufficient space and illumination foroperations.
- This section features expansive hall areas, typical of industrial structures such as cotton presses. These areas presumably enabled the installation of substantialmachinery and the efficient movement of materials and goods.
- Multiple visible levels interconnected by stairs indicate effective vertical travel, essential for industrial processes that may span various floors.
- The building features a sequence of regularly spaced columns, indicative of a design capable of supporting substantial loads. The columns seem sturdy, made ofreinforced concrete or steel, materials recognized for their strength and longevity in industrial architecture.
- Horizontal beams interlink the columns, enhancing the structural integrity of the edifice and bearing the weights of the roof and upper floors. These beams areessential for uniformly distributing weight and loads throughout the structure, hence ensuring the building's stability.
- The walls consist of concrete blocks or prefabricated panels, offering substantial thermal mass and resilience to industrial conditions, while also serving as a robustand fire-resistant material appropriate for industrial applications.
- The façade features large windows, indicating the incorporation of glass to provide natural illumination, hence decreasing power consumption during daylight and enhancing the work environment.

- The roof ranges from flat to mildly sloped, a design typical in industrial structures to enable straightforward maintenance and equipment installation.

- The roof include elements like skylights or windows to augment natural illumination within the structure. Ventilation units or exhaust systems are prevalent forregulating air quality and temperature in industrial environments.

- The elevated ceilings depicted in the section view enhance ventilation and illumination.

- The section proposes many entry points, which are crucial for safety and operational efficacy.

- Although the building is industrial, it incorporates aesthetic features, such the symmetrical placement of windows and the meticulous proportioning of variousarchitectural components, resulting in a visually harmonious structure.

- The internal partitions on each floor, as depicted in the section, indicate a combination of open-plan sections and delineated spaces. The open layout ischaracteristic of factory floors or workspaces necessitating substantial machinery or assembly lines.

- The apparent partitions appear to be non-load bearing, likely made from lightweight materials that facilitate plan flexibility and ease of reconfiguration in response to changing operational requirements.

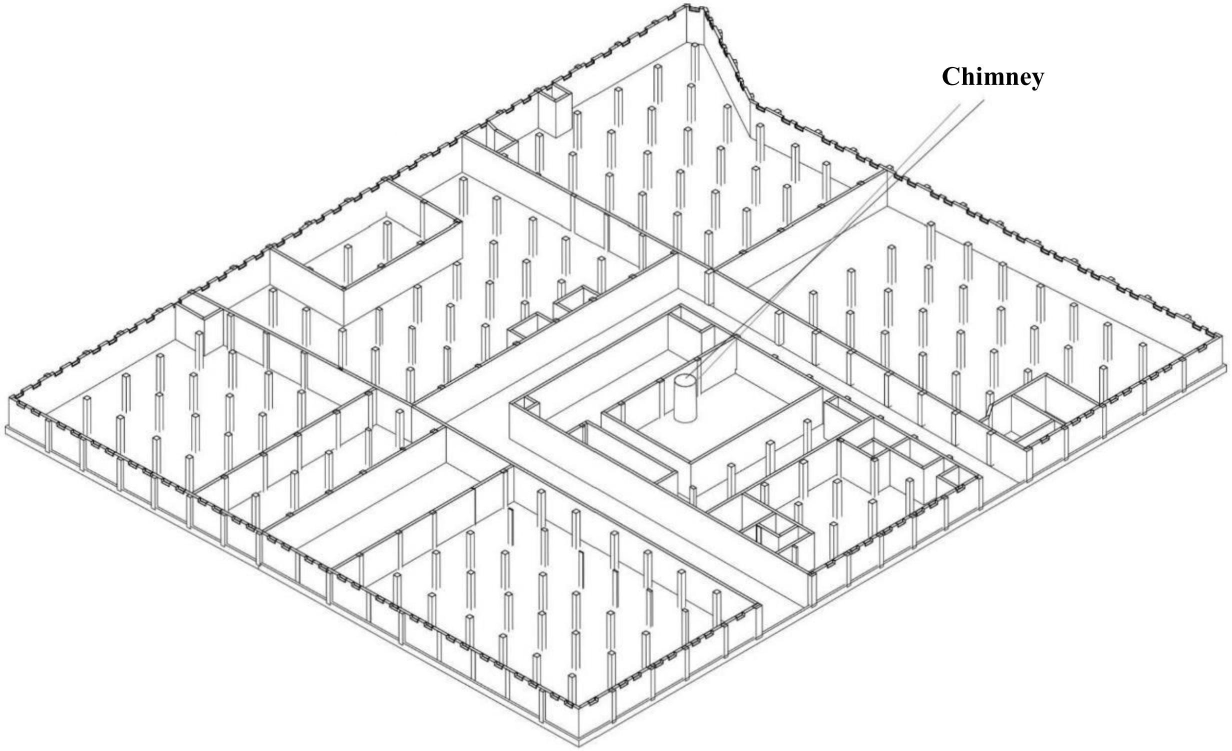
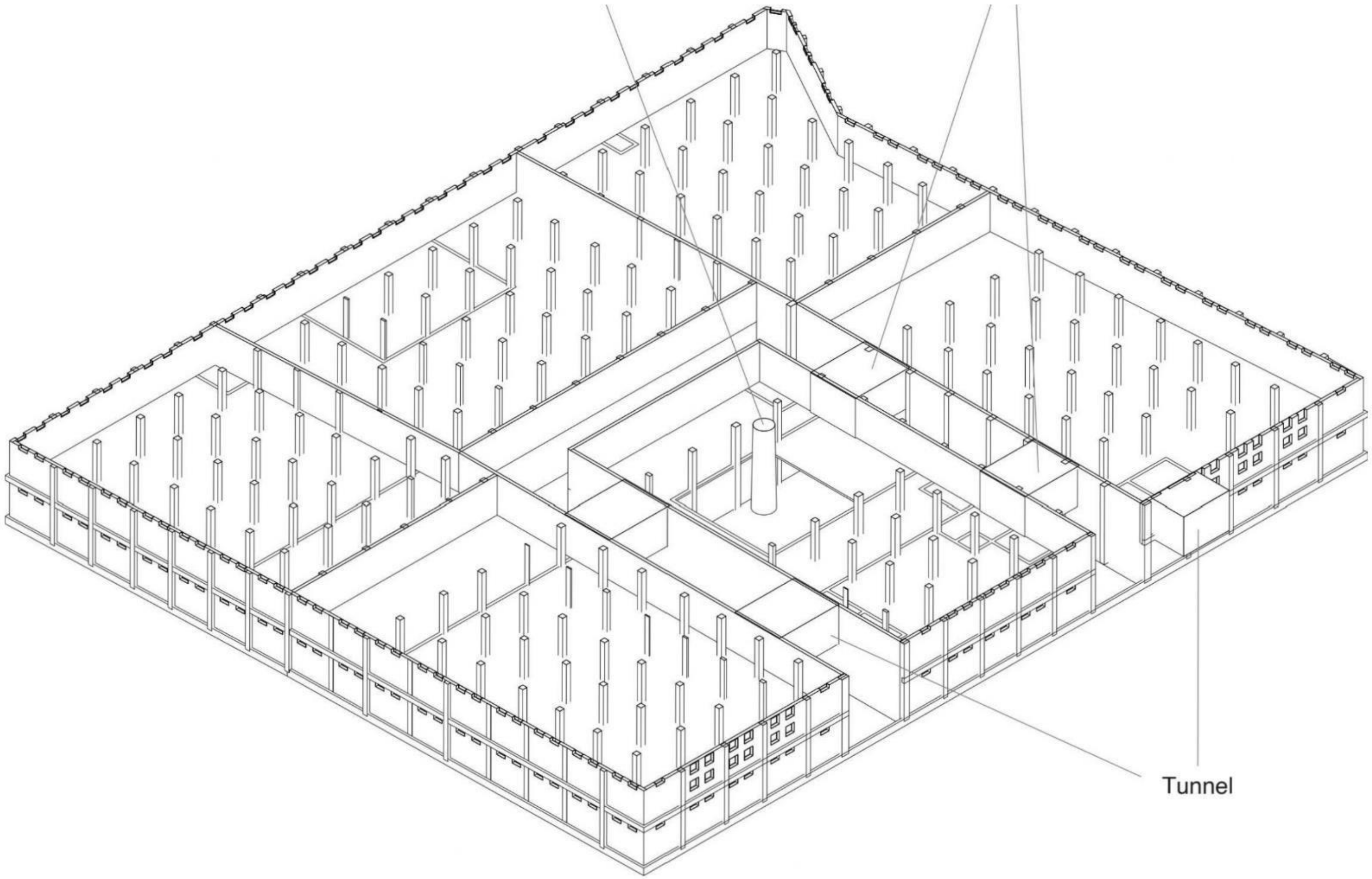


Fig.7.37. Ground Floor of Makbas EL-Nile (Elaborated by author)

Axonometric analysis of the ground level of Makbas El-Nile:

- It is U-shaped, containing a rectangle shaped unit encircled by uncovered aisle, joined to the surrounding structure by an enclosed steel passageway.
- The ground floor features sturdy, widely spaced columns essential for sustaining the industrial-scale gear traditionally employed in cotton pressing. These columns support an open layout, conducive to heavy machinery and effortless navigation.
- Robust outside walls ensure structural integrity and thermal mass, essential for sustaining stable internal temperatures in industrial environments.
- Expansive windows are deliberately positioned to optimize natural illumination, thereby diminishing dependence on artificiallighting and facilitating ventilation, essential for controlling the industrial by-products of cotton processing.
- Chimneys are essential for ventilation on the ground level, notably in cotton pressing activities to regulate heat and eliminateindustrial pollutants. They are considerable in size, indicating the necessity for ample air exchange.
- Tunnels primarily facilitate the transit of commodities and supplies to and from nearby buildings or transportation hubs, henceaiding the logistical needs of cotton press operations.

Fig.7.38. Makbas El- Nile first floor (Elaborated by author)



Axonometric examination of the first floor of Makbas El-Nile:

- Columnar and Structural Configuration are analogous to the bottom floor, however potentially exhibiting marginally lighter construction due to the diminished requirement for supporting heavy gear. The spacing may be modified to facilitate various activitiessuch as storage or light manufacturing.
- Interior partitions are more common on this floor, segmenting the room for different production phases or storage zones. These barriers are generally less substantial than the exterior walls.
- The expansive windows, with diverse shapes and dimensions to accommodate varying illumination requirements according to thefloor's use.
- Chimneys remain essential for ventilation, although their significance may diminish relative to the ground floor due to the lighter industrial activity on the first floor.
- Tunnels are also evident in the plan to facilitate the transportation of intermediate commodities between various processing steps or to the ground floor for shipping, highlighting their function in the building's internal logistics.

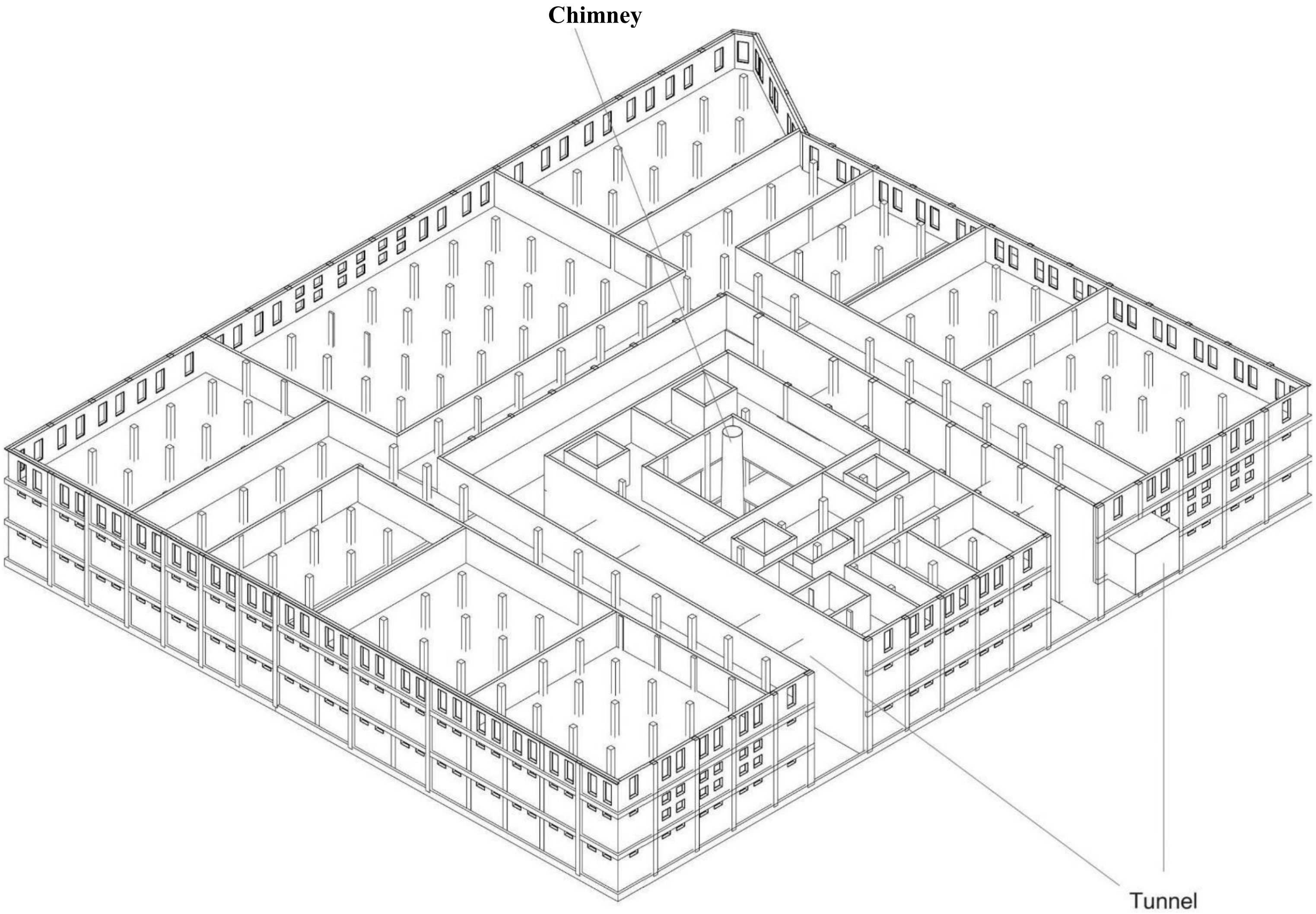


Fig.7.39. Makbas EL-Nile Second floor (Elaborated by author)

Axonometric assessment of the second floor of Makbas El-Nile:

- The second-floor columns are fewer and slenderer due to reduced structural load needs. This facilitates enhanced spatialflexibility.
- This floor contains numerous partitioned compartments, likely utilized historically for administrative purposes or as quality control zones in the cotton pressing process.
- Windows in this floor are crucial to creating a conducive working atmosphere, vital for activities necessitating meticulous focus, such as inspection and administrative responsibilities.
- The presence of tunnels at this level might facilitate the efficient transport of documents or smaller goods essential for the tasksconducted on this floor.

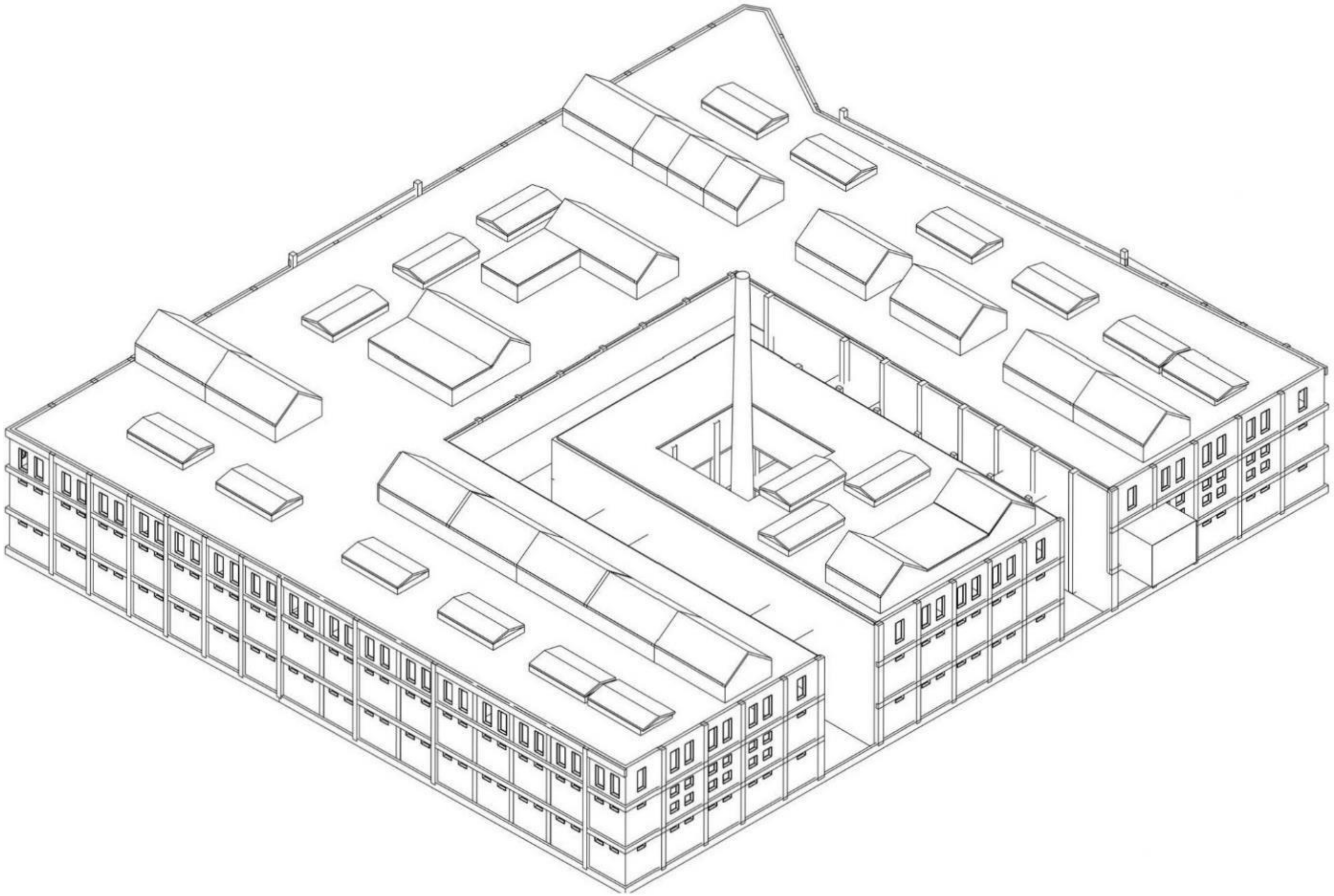


Fig.7.40. Makbas EL- Nile Roof (Elaborated by author)

Axonometric evaluation of the Makbas El-Nile roof:

- The roof presumably accommodates lightweight structures, such as water tanks….

- The expansion of chimneys to the roof is essential for the effective expulsion of air from all floors below. They may appear as significant elements, possibly topped or incorporated with contemporary systems to preserve their operability.

- Tunnels do not extend to the roof, but other components such as water tanks can benefit from the elevation for gravity-fed systems.

- The roof features a flat with slightly inclined surface areas, common in industrial edifices to promote water drainage and occasionally to accommodate light weight structures or apparatus. The structure is resilient, able to endure adverse weather conditions and offer a safe enclosure for the edifice.

- The arrangement and strength of columns are customized for each floor, accommodating the differing load-bearing demands from heavy equipment on the bottom floor to lighter applications on the upper levels. The exterior walls exhibit uniform thickness throughout all levels for structural integrity, however the inner partitions differ markedly, corresponding to the distinct functions of each floor. The window design varies in proportions and placements to accommodatethe specific requirements of each floor, balancing illumination with thermal comfort.

- Makbas Masr and Makbas El Nile are interconnected by tunnels, essential for the direct transportation of commodities between processing and storage facilities. This configuration facilitated an efficient cotton processing workflow and reduced external transportation requirements inside the district. Tunnels were essential, especially in Makbas El Nile, facilitating the transit of commodities to the coastline and other facilities, hence improving logistical efficiency.

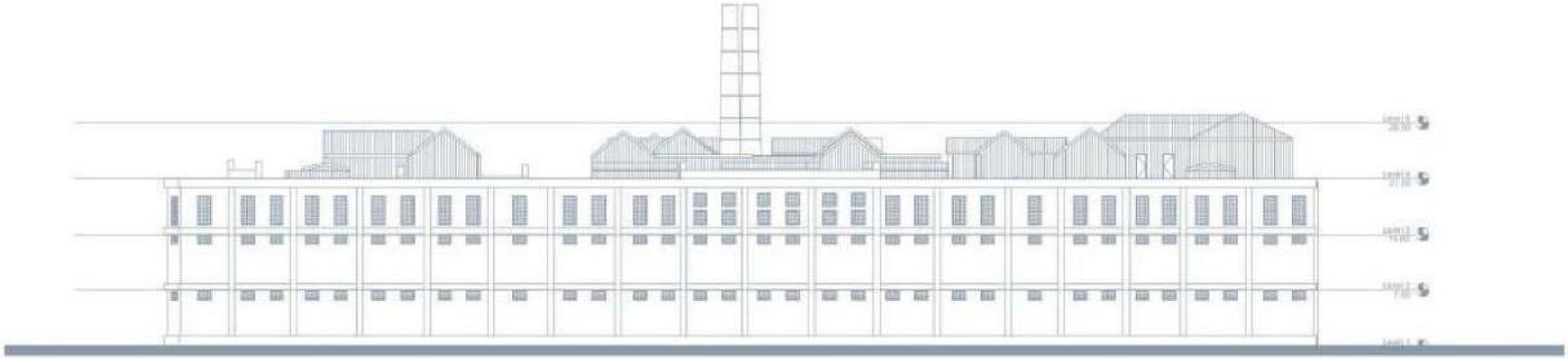


Fig.41. Makbas El-Nile South Elevation. Scale 1:800. (Elaborated by author)

Fig7.42. West Elevation. Scale 1:800. (Elaborated by author)

Fig7. 43. East Elevation. Scale 1:800. (Elaborated by author)

Table.7.1. Makbas Masr & Makbas El- Nile, Flex 4.0 Evaluation table of generally applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 12 Generally Applicable Flexibility Indicators					
Layer	**Sublayer**	**Flexibility Performance Indicators**	**Weighting**	**Assessment**	**Score**
1-Site		1-Expandable site/ location	**1**	4	4
2- Structure	Measurements	2- Surplus of building pace/ floor space	**4**	4	16
		3-Surplus of free floor height	**4**	4	16
	Access	4-Acess to building	**2**	3	6
	Construction	5-Positioning obstacles/ Columns in load	**3**	3	9
3- Skin	Facade	6-Façade windows to be opened	**1**	3	3
		7-Daylight facilities	**2**	3	6
4- Facilities	Measure/ Control	8-Customisability/ controllability facilities	**3**	3	9
	Dimensions	8-Surplus of facilities shafts and ducts	**4**	4	16
		10-Modularity of facilities	**2**	3	6
5- Space Plan	Functional	11-Distinction between support- infill	**4**	3	12
	Access	12-Horizontal access to building	**3**	3	9

Total: 112

Flexibility Score:

Flexibility Class: 3

Class:	Table Flexibility Scores	Score range
Class1:	Not flexible at all	12-48
Class2:	Hardly flexible	49-85
Class3:	Limited flexible	86-122
Class4:	Very flexible	123-159
Class5:	Excellent flexible	160-192

Table.7.2. Makbas Masr & Makbas El- Nile, Flex 4.0 Evaluation table of specifically applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
1- Site		1-Surplus of site space	**4**	4	16
		2- Multifunctional site/location	**3**	4	12
2- Structure	Measurements	3- Available floor space of building	**4**	4	16
		4- Size of floor buildings	**3**	4	12
		5- Measurement system/ modular coordination	**3**	3	9
		6- Horizontal zone division/ layout	**1**	4	4
		7- Presence of stairs/ elevators	**2**	3	6
		8- Extension/ reuse of stairs/ elevators	**1**	3	3
	Construction	9- Surplus of load bearing capacity	**2**	4	8
		10- Shape of columns	**1**	4	4
		11- Positioning of facilities zones and shafts	**3**	4	12
		12- Fire resistance main bearing construction	**3**	2	6
		13- Extendible building /units horizontal	**2**	3	6
		14- Extendible building/ units vertical	**4**	3	12
		15- Rejectable part of building/ unit horizontal	**2**	3	6
		16- Insulation between stories and units	**2**	2	4
3- Skin	Façade	17-Dismountable façade	**1**	3	3
		18- Location/shape daylight facilities	**2**	4	8
		19- Insulation of façade	**1**	3	3
4- Facilities	Measure/Control	20- Measure and control technique	**4**	3	12
	Dimensions	21- Surplus capacity of facilities	**4**	3	12
	Distribution	22- Distribution of facilities	**4**	4	16
		23- Location sources facilities (heating, cooling)	**3**	3	9
		24- Disconnection of facility components	**3**	4	12
		25- Accessibility of facility components	**3**	4	12
		26- Independence of user units	**1**	2	2

5- Space Plan	Functional	27-multifunctional building	**2**	4	8
	Technical	28- Disconnectible, removable, relocatable units	**1**	3	3
		29- Disconnectible, removable, relocatable walls	**4**	2	8
		30- Disconnectible connection detail inner walls	**4**	3	12
		31- Possibility of suspended ceilings	**2**	4	8
		32- Possibility of raised floors	**2**	4	8

Total Flexibility Score: 272

Flexibility Class: 3

Class	**Table Flexibility Scores**	**Score Range**
Class 1:	Not flexible at all	32- 128
Class 2:	Hardly flexible	129- 225
Class 3:	Limited flexible	226- 322
Class 4:	Very flexible	323- 419
Class 5:	Excellent flexible	420- 512

7.5 Comparable local proposals to conserve and repurpose Mina El-Bassal district.

Architecture School of Alexandria University suggested a plan to convert the structures housing the cotton mill and the cotton trade. This initiative was supported by the French Agency for Development (AFD) and was included in the urban scheme for Alexandria for 2032. In April 2013, a partnership contract was established between the Library of Alexandria and the French Development Agency, and through their collaboration with the Centre of Mediterranean Integration (CMI), they aimed to develop sustainable urban areas. The Mina El-Bassal Kafr Ashry project has been added to the roster of eligible urban projects for funding initiatives. The execution of this project is presently in progress, monitored by the North Military sector and the National Directorate of City development (Abdelhamid and Elfakharany, 2018).

Additional government projects suggested for the region included: the construction of a marina for tourist vessels, the establishment of a museum for underwater artifacts, the renovation of the historic lighthouse of Alexandria, and the creation of a water theme park (Ghali, et. al, 2013).

In 2019, the Egyptian Company for Cotton Pressing proposed a project to be executed by the Faculty of Engineering, Alexandria University, with the goal of enhancing the architectural features of the cotton press structures to safeguard them as heritage sites. The objective was to reach the maximum economic return possible, in accordance with the state's strategy to advance the El-Mahmoudiyah hub as an activity core of Alexandria City.

The repurposing of industrial legacy within the tourism sector has demonstrated considerable promise as a method for urban renewal and fostering sustainable economic development. Industrial heritage tourism serves as a strategy that fosters preservation while generating economic benefits by sustainably repurposing structures (Xie, 2015). Edward & Llurdés i Coit (1996) contend that industrial historical locations hold significant symbolism and can draw a considerable number of visitors. For instance, the Iron Bridge Gorge in the UK, recognized as the origin of the industrial revolutionary era, draws over five hundred forty five thousand visitors annually. Every year, three million tourists are drawn to Beijing's converted industrial structures. In Italy, a formerly significant flour mill recognized as one of the biggest European mill since 1895 was transformed into the Hilton Molino Stucky Venice hotel in 2007. The hotel offers 379 elegant guestrooms, including eighty eight luxury accommodations and forty five flats (Chen, Judd, and Hawken, 2016; MIHIĆ and MAKARUN 2017 a).

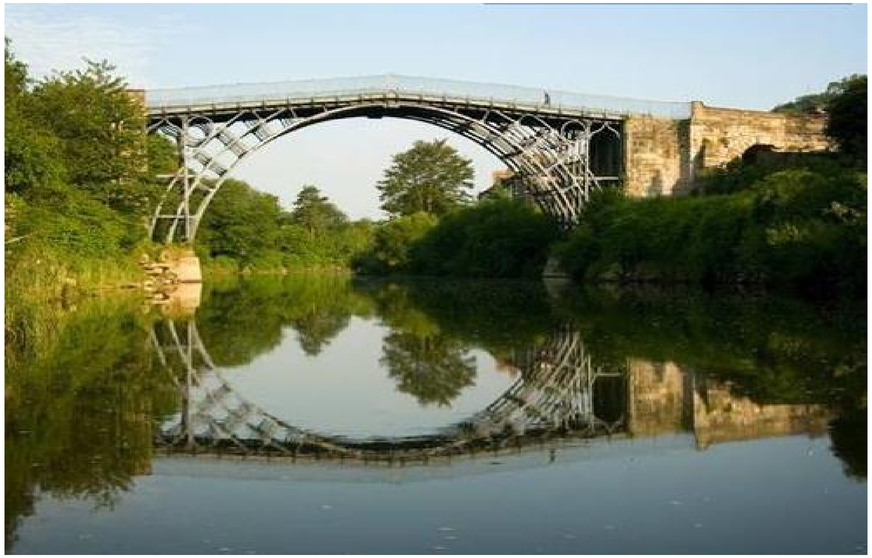


Fig.7.44. Iron Bridge Gorge. https://www.ironbridge.org.uk/about-us/the-iron-bridge/

Fig.7.45. Hilton Molino Stucky Venice.

https://www.gettyimages.com/detail/photo/hilton-molino-stucky-venice-italy-royalty-free-image/1180913138?adppopup=true

In this regard, Khalil & Elgohary proposed a concept for transforming the manufacturing facilities in the Mina El-Bassal area. They showed that there are chances to leverage the district's industrial heritage for the tourism sector, potentially aiding in the sustainable growth of tourism in Alexandria. The suggested plan for the repurposing of the industrial legacy in the Mina El-Bassal area aimed to draw more visitors to Alexandria and enable the local residents to acquire knowledge about and take pride in their industrial past. Their suggestion involves establishing a vibrant museum, where the outdoor space would serve as a showcase for functional equipment like mills and heating tools.

The first floor would be supplemented with interactive virtual reality screens and a hologram technology that showcase the historical aspects of cotton pressing and display the laborious process of pressing operations. Rooms previously used by women engaged in cotton pressing can be repurposed as exhibition halls for female artists and craftworkers. The roofs will serve as multifunctional spaces, housing cafés, restaurants, and gift shops. (Khalil N.I., Elgohary A.G.)

Nassar & Sharaf Eldin recommended reusing of the location buildings as leased residential units, hotels, and cafeteria to provide different career paths and ensure nighttime security. The ground floors adjacent to both sides of the canal, have the potential to be transformed into cafeterias and stores. Offices in buildings can be leased to maritime corporations, transportation and logistics agencies, tourism bureaus and other enterprises associated with the harbor. The remaining buildings can serve as art galleries and host exhibitions on their uppermost floors. The intermediate levels, specifically the 2nd and 3rd floors, have the potential to be transformed into residential spaces, such as studios and flats that can be made available for rental purposes. (Nassar and Sharaf Eldin, 2013)

The study carried out by Fouad S.S. et al, in 2021, aimed to convert Mina El-Bassal into a business and commercial area by the re-organization of Souq El-Gomaa, establishment of marketplaces, open green areas and entertainment facilities. The proposed vision for Mina El-Bassal included improving accessibility to public transport, upgrading the infrastructure, such as the sewage system, electricity, and water supply. It also involves developing the recycling waste industry.

Abi Ghanem M.W. (2014) studied the environmentally friendly rejuvenation of the Mina El-Bassal district in Alexandria, focusing on urban design. In order to achieve sustainable revitalization of an abandoned industrial zone. He revealed that it is essential to adopt a comprehensive approach that considers various dimensions and phases, as emphasized by Moudon in 1992. So, the researcher addressed five fundamental challenges related to city planning: identity, infrastructure, environmental concerns, civic space, and speculation. These topics, when collectively addressed, form a comprehensive and an extensive intervention approach (Saliba, R. 2010). Thus, achieving a harmonious equilibrium between improving the physical infrastructure, developing natural assets, implementing financial rewards, and guaranteeing social equality. Accordingly, the researcher proposed a design intervention to sustainably renovate Mina El-Bassal including:

- Preservation of the industrial uniqueness by urban designs that safeguard the morphological distinction between the manufacturing plants pattern and the gradually constructed hamlet whatever their upcoming reshape.
- Improvement of already present public areas and generating new ones serving several purposes on the boundaries of the hamlet.
- Reassemble the inside of industrial edifices into small household spaces to overcome housing deficit.
- Ecological revival of the Mahmoudiyah Canal by redeveloping its side edges creating a pedestrian promenade.

7.6. Comparable adaptive reuse projects of industrial heritage in some European Cities

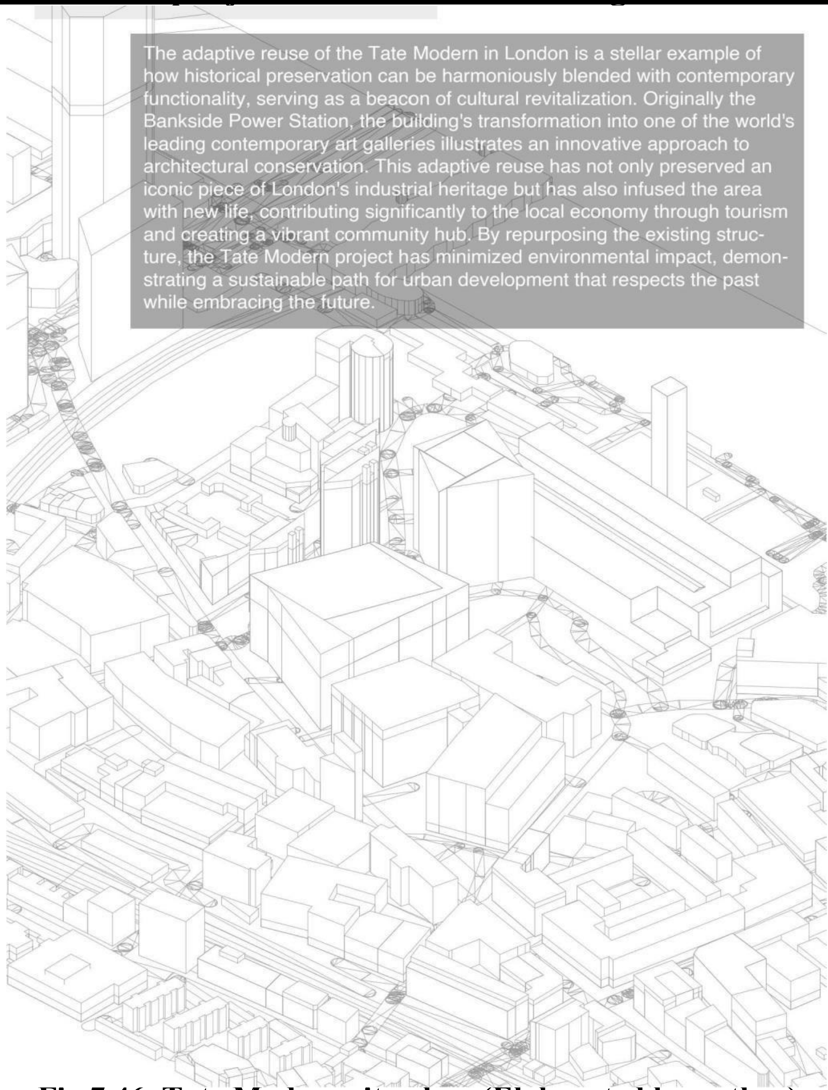


Fig.7.46. Tate Modern site plan. (Elaborated by author)

7.6.1. Tate Modern https://www.archdaily.com/429700/ad-classics- the-tate-modern-herzog-and-de-meuron

- It was situated in the repurposed Bankside energy plant from year 2000, a structure originally planned by Sir Giles Gilbert Scott and constructed over two distinct periods from 1947 to 1963. It was constructed precisely opposite St Paul's Cathedral across the river. The plant station ceased operationsby year 1981. The Tate Gallery declared, in 1994 that the plant will serve as the location for the novel Tate Modern. The changeover commenced in June 1995 with the elimination of the remaining redundant plant. The conversion was executed by the “Carillion firm” and finalized in January 2000. Certain components of the internal construction persist, including the turbine hall. The southern section of this edifice was home to an electric transformer that remained in its place and was owned by the French energy corporation (EDF). In 2006, EDF transferred the western portion of this asset to the museum.

- So, the Switch House, located in the southern portion of the structure, persisted under the ownership of the French power firm EDF Energy, meanwhile Tate acquired the boiler unit located in the north for the primary display rooms of Tate Modern.

- A significant portion from the initial intrinsic framework persisted, encompassing the expansive primary turbine space, that preserved the overhead traveling derrick.

- The layout, geotechnics, civil, frontage engineering, ecological and sustainability consultant services were provided by “Ramboll Company” between 2008
and 2016.

- The main conspicuous outside alteration was the two-mezzanine of glazed fiberglass addition on one edge of the rooftop.

- The two oil tanks were transformed into a live performance art venue inaugurated in July 2012. The third tank offers functional space.

- A ten-storey expansion to the museum, reaching a height of 65 meters (213 feet) from the surface of the earth, had been constructed over the oil reservoirs and inaugurated on 17 June 2016. Initially conceived to be a transparent tiered pyramidal tower, the design was modified into a slanted façade constructed of masonry framework, aligning with the genuine plant structure. The western portion of the Switch House was dismantled to accommodate the new lofty edifice in addition to the reconstruction, aroundit, of vast gallery areas and approach points.

- The Switch House comprises eleven levels, designated from 0 to 10. Level 0 comprises the Tanks, areas repurposed from the original fuel oil tanks
of the power station, whereas all subsequent levels are situated within the tower extension building erected above them.
- The connecting spaces and adjacent chambers within the tanks, previously utilized by the power station, were renovated for the gallery's usage. Tanks
were utilized to exhibit installation and video art. They have also served as a location for live music performances. Alongside the exhibition area, there exists a substantial performance venue, the Clore Education Centre, the Clore Information Room, and McAulay Studios, that function as amenities for schools and colleges touring.
- An Amphitheatre and a lecture room are located on the first storey.
- Floors two through level four encompass exhibition zones. Every level is divided into a substantial eastern and western flank, with a minimum of
eleven chambers in every flank. The area separating these two flanks is utilized for minor exhibits. The newly constructed galleries on the fourth floor
use natural overhead lighting.
- Bridges were erected between the primary structure, the main steam unit, and the new edifice on the ground and the fourth level. The bridge
constructed through the turbine hall on the fourth level offers an elevated accessibility pathway.
- The Turbine Hall is an expansive area extending the entire lengthwise of the structure, situated amidst the Boiler unit and the Switch House.

- It formerly contained the energy generators of the antiquated power platform and stands six floors in height, reflecting the complete elevation of the initial power station structure. The western terminus features a gradual descent starting from the entryway, granting accessibility for the two parties

at stage zero. The other extremity on the east offers a substantial area suitable for displaying unusually big artworks, owing to its remarkable height.

- These extensions offer 22,492 m² (242,100 ft^2) of total interior space including show and exposition areas, concert venues, educational institution, workplaces, small grocery stores, food and retail services, as well as a garage plus a newly developed outdoor community area.

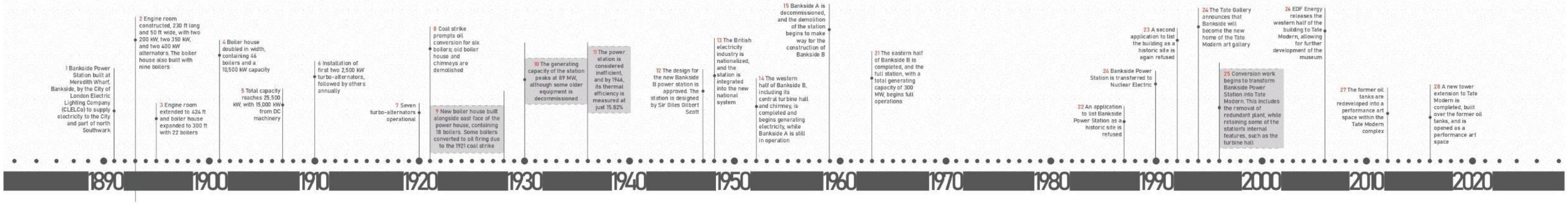


Fig.7.47. Time line of Tate Modern (Elaborated by author)

Fig.7.48. Tate Modern's smokestack and its Swiss Light, at the apex, was conceived by Michael Craig-Martin in collaboration with designers Herzog & de Meuron. It was funded by the Swiss authorities. It was demolished in May 2008.

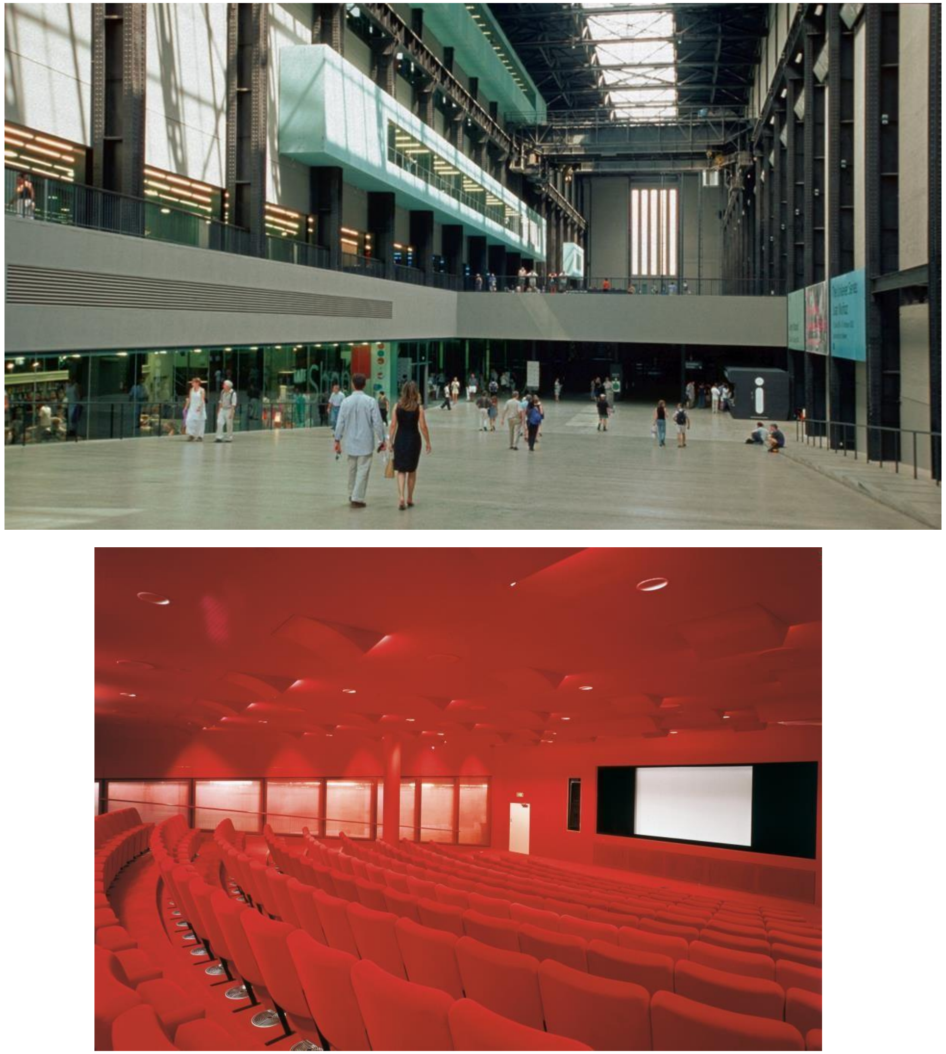
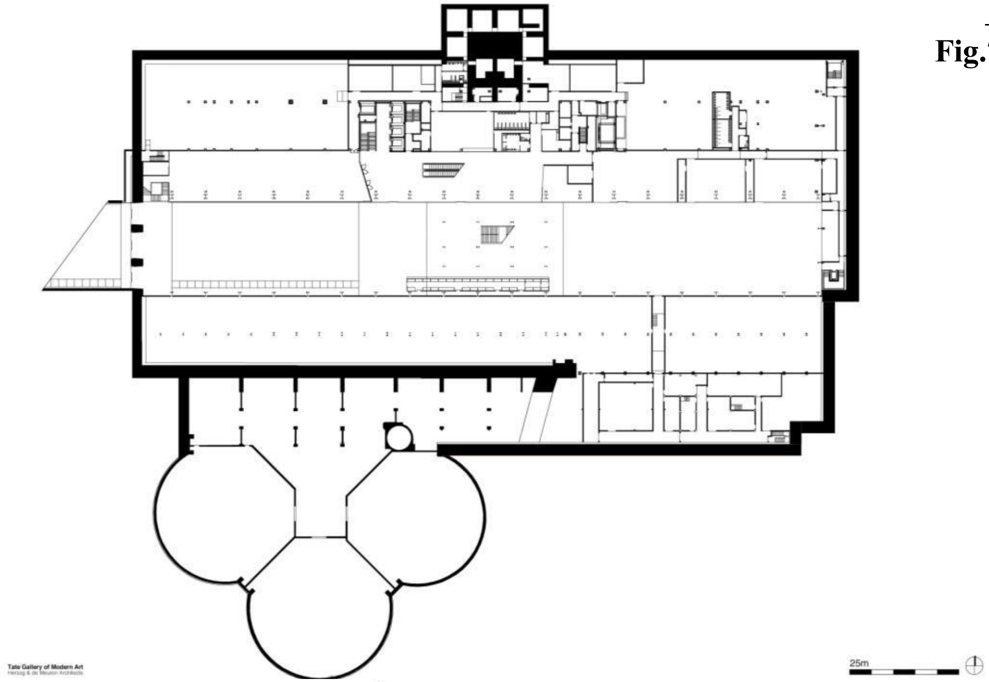


Fig.7.49. Tate Modern Turbine Hall and Theatre

Fig.7.50. The exterior of the Switch House and internal works

Fig.7. 51. The Tate Modern - Ground level plan. (Herzog & de Meuron)



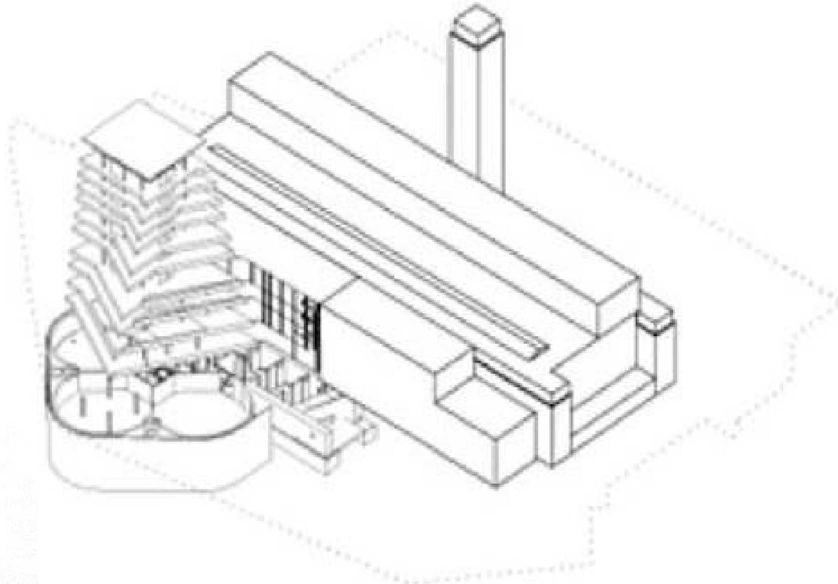


Fig.7.52.The plan illustrates the huge underground oil reservoir that constitute the basis of the novel museum edifice. (Herzog & de Meuron)

Fig.7.53. Plan of the steam engine unit, generator space, with the fuel storage vessels. (Herzog & de Meuron)

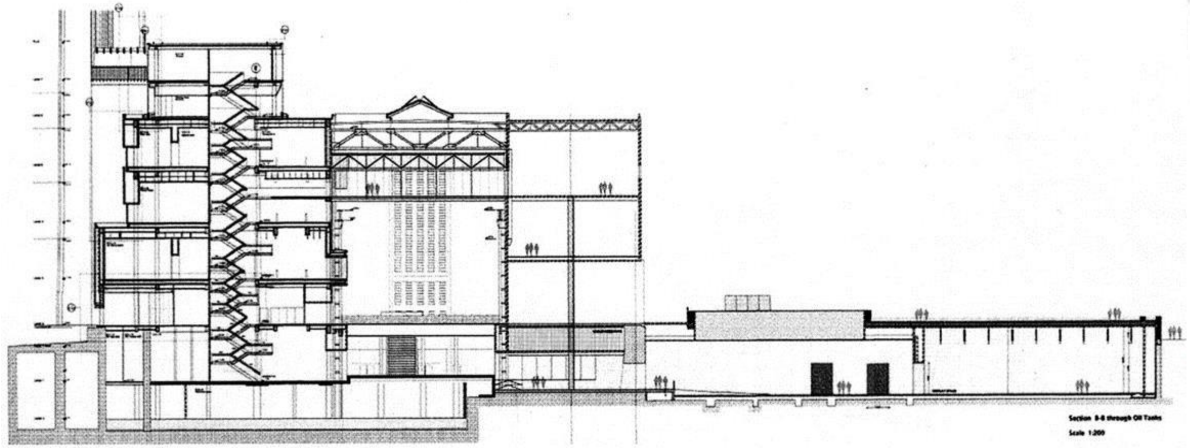


Table.7.3. New Tate Modern, Flex 4.0 Evaluation table of generally applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 12 Generally Applicable Flexibility Indicators					
Layer	**Sublayer**	**Flexibility Performance Indicators**	**Weighting**	**Assessment**	**Score**
1-Site		1-Expandable site/ location	**1**	1	1
2- Structure	Measurements	2- Surplus of building pace/ floor space	**4**	3	12
		3-Surplus of free floor height	**4**	4	16
	Access	4-Acess to building	**2**	4	8
	Construction	5-Positioning obstacles/ Columns in load	**3**	4	12
3- Skin	Façade	6-Façade windows to be opened	**1**	3	3
		7-Daylight facilities	**2**	4	8
4- Facilities	Measure/ Control	8-Customisability/ controllability facilities	**3**	3	9
	Dimensions	8-Surplus of facilities shafts and ducts	**4**	2	8
		10-Modularityu of facilities	**2**	1	2
5- Space Plan	Functional	11-Distinction between support- infill	**4**	4	16
	Access	12-Horizontal access to building	**3**	4	12

Total Flexibility Score: 107

Flexibility Class 3

Class:	Table Flexibility Scores	Score range
Class1:	Not flexible at all	12-48
Class2:	Hardly flexible	49-85
Class3:	Limited flexible	86-122
Class4:	Very flexible	123-159
Class5:	Excellent flexible	160-192

Table.7.4. New Tate Modern, Flex 4.0 Evaluation table of specifically applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
1- Site		1-Surplus of site space	**4**	1	4
		2- Multifunctional site/location	**3**	4	12
2- Structure	Measurements	3- Available floor space of building	**4**	2	8
		4- Size of floor buildings	**3**	4	12
		5- Measurement system/ modular coordination	**3**	3	9
		6- Horizontal zone division/ layout	**1**	4	4
		7- Presence of stairs/ elevators	**2**	4	8
		8- Extension/ reuse of stairs/ elevators	**1**	4	4
	Construction	9- Surplus of load bearing capacity	**2**	4	8
		10- Shape of columns	**1**	4	4
		11- Positioning of facilities zones and shafts	**3**	4	12
		12- Fire resistance main bearing construction	**3**	3	9
		13- Extendible building /units horizontal	**2**	3	6
		14- Extendible building/ units vertical	**4**	3	12
		15- Rejectable part of building/ unit horizontal	**2**	1	2
		16- Insulation between stories and units	**2**	3	6
3- Skin	Façade	17-Dismountable façade	**1**	4	4
		18- Location/shape daylight facilities	**2**	3	6
		19- Insulation of façade	**1**	2	2
4- Facilities	Measure/Control	20- Measure and control technique	**4**	4	16
	Dimensions	21- Surplus capacity of facilities	**4**	2	8
	Distribution	22- Distribution of facilities	**4**	2	8
		23- Location sources facilities (heating, cooling)	**3**	4	12
		24- Disconnection of facility components	**3**	3	9
		25- Accessibility of facility components	**3**	2	6
		26- Independence of user units	**1**	4	4
5- Space Plan	Functional	27-multifunctional building	**2**	4	8
	Technical	28- Disconnectable, removable, relocatable units	**1**	3	3
		29- Disconnectable, removable, relocatable walls	**4**	4	16

		30- Disconnactible connection detail inner walls	**4**	3	12
		31- Possibility of suspended ceilings	**2**	4	8
		32- Possibility of raised floors	**2**	4	8

Total Flexibility Score: 250

Flexibility Class: 3

Class	**Table Flexibility Scores**	**Score Range**
Class 1:	Not flexible at all	32- 128
Class 2:	Hardly flexible	129- 225
Class 3:	Limited flexible	226- 322
Class 4:	Very flexible	323- 419
Class 5:	Excellent flexible	420- 512

Fig.7.54. Battersea Power Station Site Plan. (Elaborated by author)

7.6.2. Battersea Power Station

It is a retired coal-powered station positioned on the southern side of the River Thames. It was constructed by the London Power Company (LPC) according to the plans of Leonard Pearce. The structure emerged from the partnership of notable British designers J. Theo Halliday and Sir Giles Gilbert Scott. Battersea Power Facility and its towering chimneys constituted an emblematic feature of the London skyline since it was built. The station stands as one of the biggest brick edifices worldwide and stands for its distinctive Art Deco internal design and decoration. The edifice consists of a pair of power plants that were constructed in two phases within one structure. Battersea A Power Plant was constructed during the period from 1929 to 1935, whilst Battersea B Power Plant, located to the east, was finished from 1937 to 1941, at which point construction stopped because of the deteriorating consequences of the second global war. The structure was finalized in 1955. "Battersea B" was constructed based on a layout substantially similar to "Battersea A", resulting in the distinctive four- smokestack configuration. When finished, it was able to produce four hundred megawatts (MW) of electrical power. The chosen location encompassed a fifteen acres (sixty one thousands m^2) parcel that previously contained reservoirs for the now-obsolete plant A. The location was selected because to its nearness to the River Thames for cooler water and coal transit. The creation of B Station boosted the plant's generation output to five hundreds and nine MW.

The station was constructed in the brick-cathedral manner, a prevalent architecture form for power plants during that time, and was called a "temple of power." The control center at Station A was equipped with various Art Deco pieces designed by architect Halliday. The turbine hall was embellished with stunning granite from Italy, and smooth wood flooring along with forged ironworks stairs were installed throughout. Because of inadequate financing following World War II, B Station's interior did not receive the same upgrades, and the fixtures were made from stainless steel instead.

Both interconnected stations feature an elongated boiler house with a smokestack at each end, along with a neighboring turbine hall. This leads to a unique primary structure made up of a steel framework featuring brick cladding. The total dimensions of the building are one hundred and sixty meters (five hundred and twenty feet) by one hundred and seventy meters (five hundred and sixty feet), while the rooftop of the boiler edifice rises above fifty meters (one hundred and sixty feet) in height. The two pairs of smokestacks are constructed of concrete, each towering one hundred and three meters (three hundred and thirty-eight feet) in elevation, featuring a base diameter of eight and half meters (twenty-eight feet) that narrows to six and half meters m (twenty one and half feet) at its summit. The station featured landing stage for charcoal unpacking, a coal processing and holding location, monitoring units, and administrative offices. Station A had nine boilers while Station B had six.

Battersea A was deactivated in 1975. In 1980, the entire facility was designated as a heritage site and awarded Grade II listed status; "Battersea B" ceased operations 3 ys subsequently in 1983. In 2007, the designation was elevated to Grade II*. The structure sat vacant and neglected until 2014, during which it deteriorated significantly. The premises were developed in 2012, by managers Ernst & Young in collaboration with Malaysia's S P Setia and Sime Darby, incorporating houses, bars, restaurants, office spaces, retail outlets, and amusement venues. Proposals received authorization, and rebuilding began a few years subsequently. The plans encompassed the interior and external restoration of the art deco edifice, the restoration of the smokestacks, and the refurbishing of the ancient docks and pier that will function as a modern river cab station. The current building has been stabilized and maintained, and new structures have been introduced to establish workplaces within the steam engine unit in addition to residential units above the switch houses.

Moreover, significant digging had occurred within and beyond the structure, resulting in the construction of a new basement beneath turbine hall A for the energy center development. The section of the power plant in the south features a subterranean level designated for a vast parking facility, along with an underground service road. Substantial steel beams had been outwardly reinforced both the north and south sides between the rinsing buildings as the roofing had been removed. Novel reinforcing structures were installed on the inner sides of these walls. On the southern aspect, this comprises a sophisticated arrangement of bowstring trusses, featuring compression beams affixed to the wall and tension forces supported by a number of rods.

- Integrating offices and a substantial event area into the expansive, vacant boiler house necessitated the construction of an entirely new framework.
- Four additional cores were constructed at the center to enhance consistency and a downward flow for individuals and services, featuring C-like masonry blocks within the 4 rinsing edifices to reinforce the structural integrity of the northern and southern peripheries of the office flooring plates.
- The iconic chimneys were severely cracked and the reinforcing significantly deteriorated, prompting Historic England and Wandsworth Council to concur that they might be dismantled and reconstructed, contingent upon the employment of same techniques as the originals. The south-western chimney was dismantled and reconstructed prior to the commencement of construction on the remaining three.

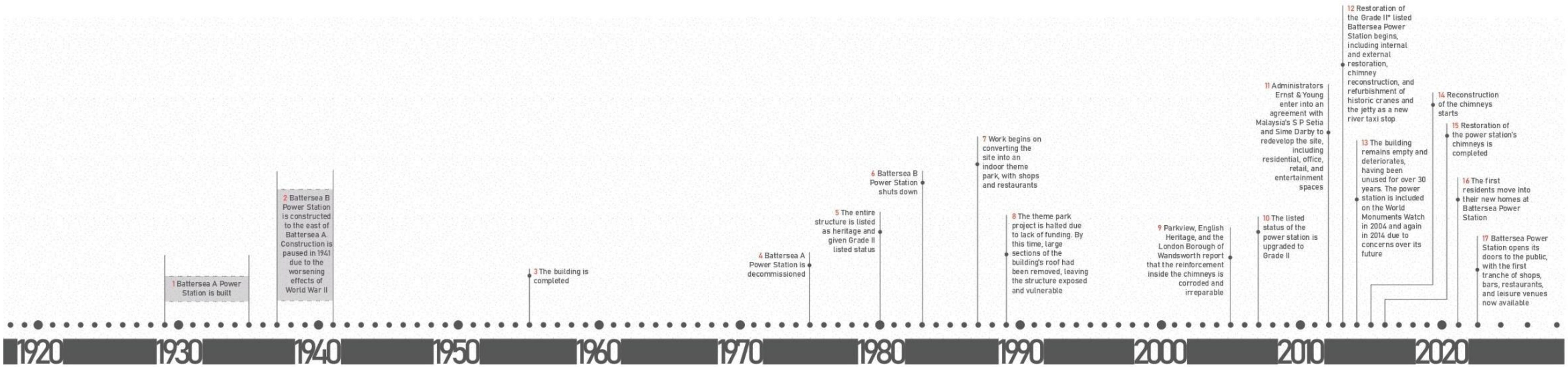


Fig.7.55. Time line of Battersea Power Station (Elaborated by author)

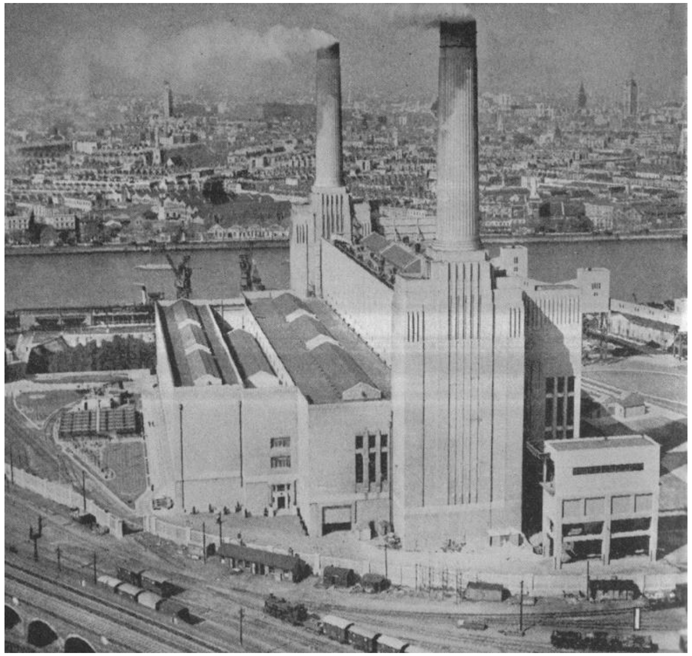


Fig.7.56. Battersea power station was built in two phases. This the first phase operational in 1934.

Fig.7.57. Battersea power station 2003

Fig.7.58. Station turbine hall 2006

Fig.7.59. Battersea power station's chimney being removed 2016

Battersea Power Station (1934-2016) https://wilkinsoneyre.com/projects/battersea-power-station

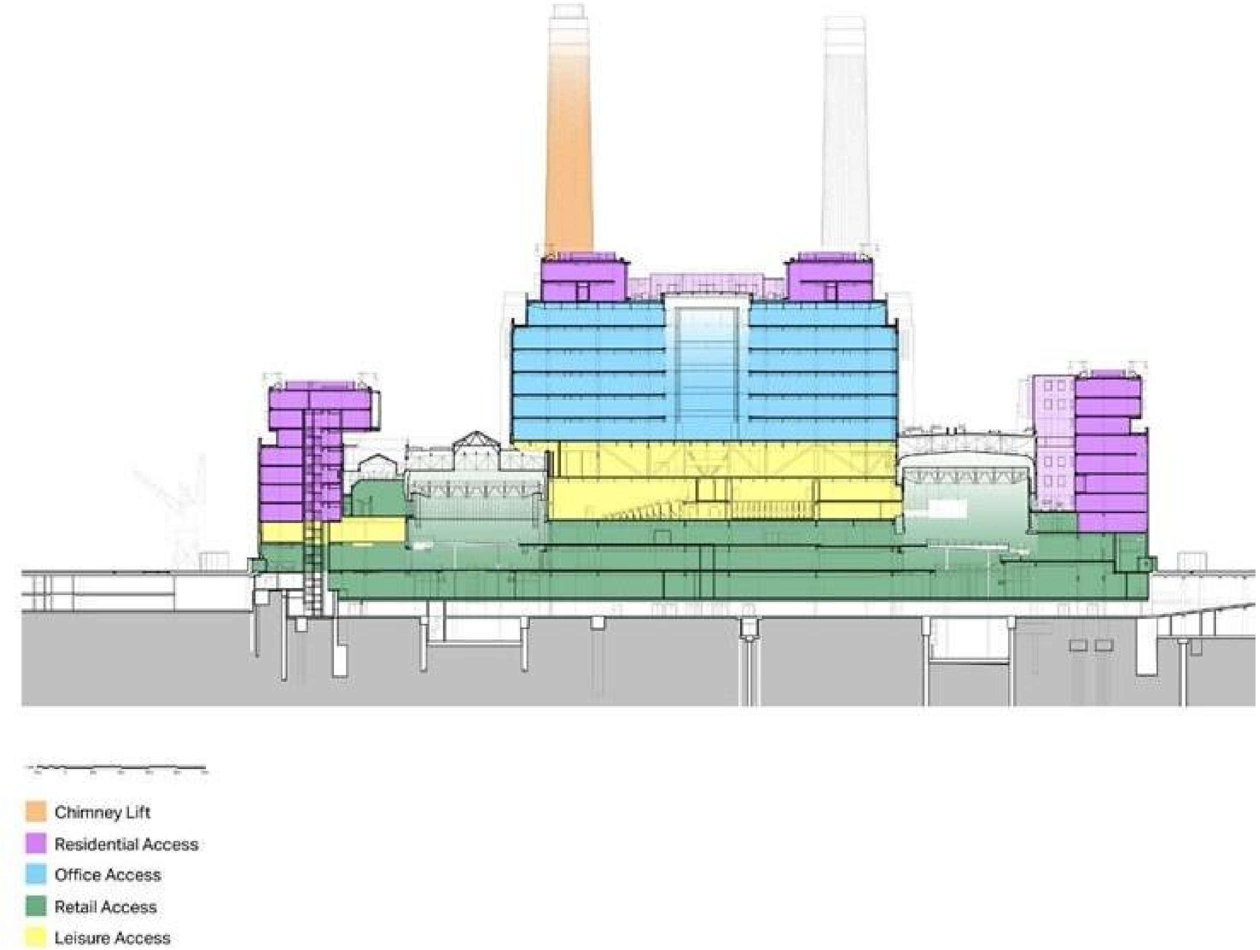


Fig.7.60. Battersea Power Station Plan.
https://www.archdaily.com/990615/battersea-power- station-wilkinsoneyre/6349b490e2ed0f653e86b0dd-battersea-power-station-wilkinsoneyre-

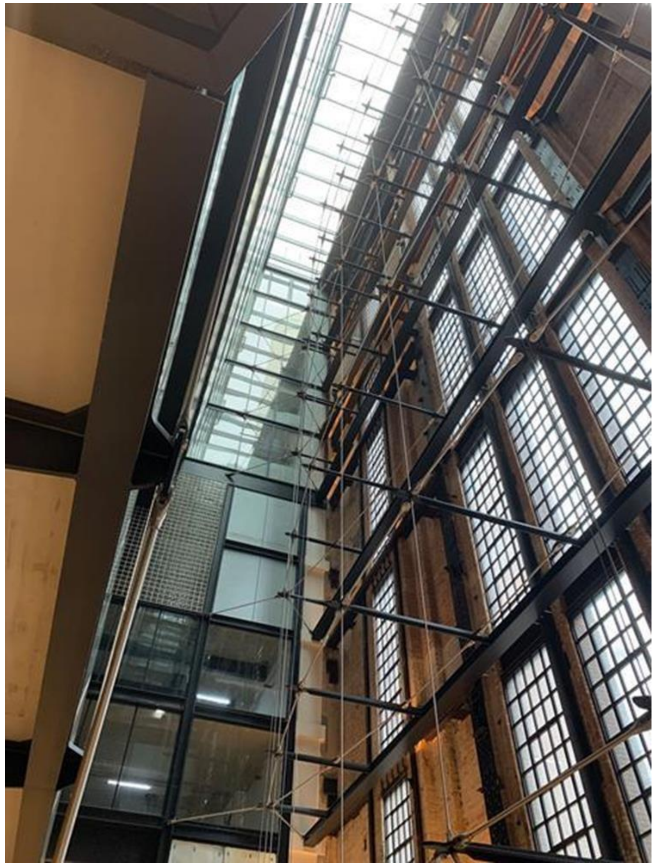


Fig.7.61. A sophisticated and lighter bowstring truss design made up of compressing columns and tension rods has been used in place of the sturdy temporary structural steel framework that held up the southern wall. (Source: John Sturrock)

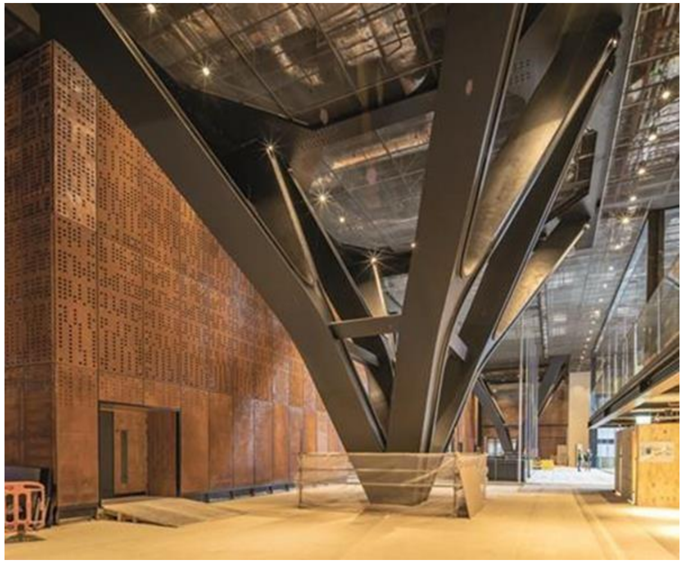


Fig.7. 62. Two substantial structural trees support the new office levels within the boiler house. The components were delivered to the site in thirteen segments and subsequently welded together.

Fig.7.63. Switch houses on both east and west ends of the structure were transformed into residential units which are small in size. They preserve the identical black-coated welded steel and visible masonry characteristics of the remainder of the structure. The two-story glass additions above the switch houses provide inhabitants with access to private rooftop gardens. This Private roof gardens have been established above the turbine halls for the sole benefit of inhabitants residing in the repurposed switch houses and two-storey rooftop additions.

Table.7.5. Battersea Power Station, Flex 4.0 Evaluation table of generally applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated author)

Assessment from 12 Generally Applicable Flexibility Indicators					
Layer	**Sublayer**	**Flexibility Performance Indicators**	**Weighting**	**Assessment**	**Score**
1-Site		1-Expandable site/ location	**1**	3	3
2- Structure	Measurements	2- Surplus of building pace/ floor space	**4**	4	16
		3-Surplus of free floor height	**4**	3	12
	Access	4-Acess to building	**2**	4	8
	Construction	5-Positioning obstacles/ Columns in load	**3**	3	9
3- Skin	Facade	6-Façade windows to be opened	**1**	3	3
		7-Daylight facilities	**2**	3	6
4- Facilities	Measure/ Control	8-Customisability/ controllability facilities	**3**	3	9
	Dimensions	8-Surplus of facilities shafts and ducts	**4**	4	16
		10-Modularityu of facilities	**2**	3	6
5- Space Plan	Functional	11-Distinction between support- infill	**4**	3	12
	Access	12-Horizontal access to building	**3**	3	9

Total Flexibility Score: 109

Flexibility Class: 3

Class:	**Table Flexibility Scores**	**Score range**
Class1:	Not flexible at all	12-48
Class2:	Hardly flexible	49-85
Class3:	Limited flexible	86-122
Class4:	Very flexible	123-159
Class5:	Excellent flexible	160-192

Table.7.6. Battersea Power Station, Flex 4.0 Evaluation table of specifically applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
1- Site		1-Surplus of site space	**4**	3	12
		2- Multifunctional site/location	**3**	3	9
2- Structure	Measurements	3- Available floor space of building	**4**	4	16
		4- Size of floor buildings	**3**	3	9
		5- Measurement system/ modular coordination	**3**	3	9
		6- Horizontal zone division/ layout	**1**	3	3
		7- Presence of stairs/ elevators	**2**	4	8
		8- Extension/ reuse of stairs/ elevators	**1**	3	3
	Construction	9- Surplus of load bearing capacity	**2**	3	6
		10- Shape of columns	**1**	3	3
		11- Positioning of facilities zones and shafts	**3**	4	12
		12- Fire resistance main bearing construction	**3**	3	9
		13- Extendible building /units horizontal	**2**	3	6
		14- Extendible building/ units vertical	**4**	3	12
		15- Rejectable part of building/ unit horizontal	**2**	3	6
		16- Insulation between stories and units	**2**	2	4
3- Skin	Façade	17-Dismountable façade	**1**	3	3
		18- Location/shape daylight facilities	**2**	4	8
		19- Insulation of façade	**1**	3	3
4- Facilities	Measure/Control	20- Measure and control technique	**4**	4	16
	Dimensions	21- Surplus capacity of facilities	**4**	3	12
	Distribution	22- Distribution of facilities	**4**	4	16
		23- Location sources facilities (heating, cooling)	**3**	3	9
		24- Disconnection of facility components	**3**	4	12
		25- Accessibility of facility components	**3**	4	12
		26- Independence of user units	**1**	2	2

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	Sub-Layer	Flexibility Performance Indicator	Weighting	Assessment	Score

5- Space Plan	Functional	27-multifunctional building	**2**	4	8
	Technical	28- Disconnectible, removable, relocatable units	**1**	3	3
		29- Disconnectible, removable, relocatable walls	**4**	2	8
		30- Disconnectible connection detail inner walls	**4**	3	12
		31- Possibility of suspended ceilings	**2**	4	8
		32- Possibility of raised floors	**2**	4	8

Total Flexibility Score: 276

Flexibility Class: 3

Class	Table Flexibility Scores	Score Range
Class 1:	Not flexible at all	32- 128
Class 2:	Hardly flexible	129- 225
Class 3:	Limited flexible	226- 322
Class 4:	Very flexible	323- 419
Class 5:	Excellent flexible	420- 512

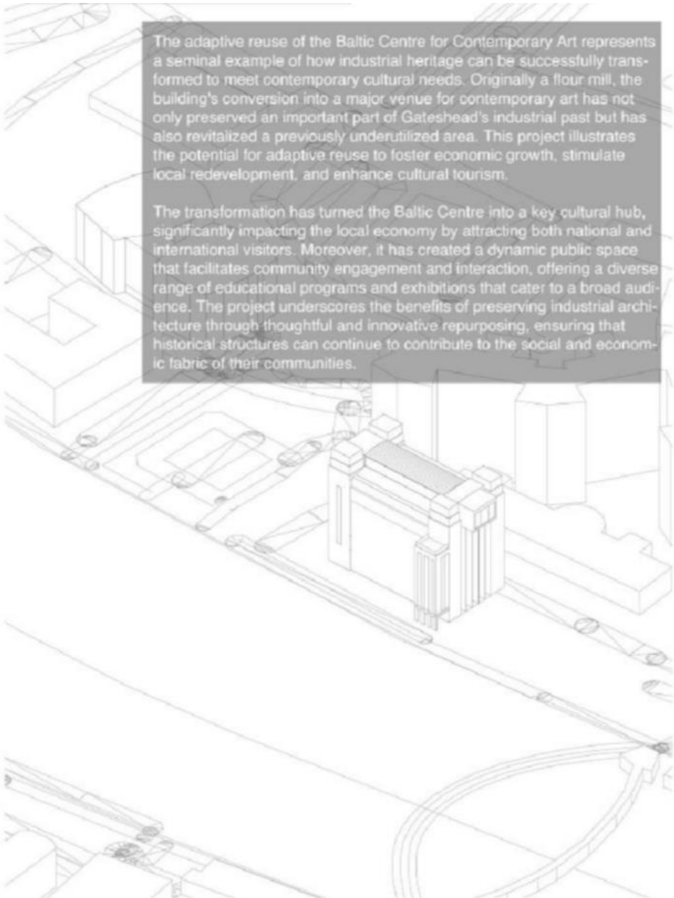


Fig.7.64. Baltic Hub for Modern Art (Elaborated by author)

7.6.3 Baltic Centre

- It is a contemporary art center situated in the southern bank of the River Tyne in Gateshead, Tyne and Wear, England. It features a constantly evolving array of shows, activities and learning programs without a perpetual exposition. Baltic commenced operations in July 2002 within a repurposed flour mill that started to function in 1950 and stopped functioning in 1984. The construction plans of Baltic were conceived by DominicWilliams of Ellis Williams Designers. The structure includes exhibition areas, a visitor center, a rooftop dining establishment, and outdoor observation decks that provide vistas of the River Tyne.
- Baltic Grain Plant was constructed by Joseph Rank of Rank Hovis, while it was designed by the Hull-based architects Gelder and Kitchen. The initial foundations were established by the end of 1930s. Despite the building halting during the World War II, the plant wasfinalized and commenced operations by the year 1950. The structure consisted of 2 masonry façades-oriented east-west, situated within afoundation of concrete silos. The facility has the capacity to keep twenty-two thousand tons of cereals. The building's plan included a larger silo for the storage and cleaning of wheat. It was outfitted with the most advanced and effective machinery of the era. In 1957, the property was expanded with the incorporation of 'Blue Cross Mill', which manufactured animal feed. The attached warehouse (now demolished) had a 5,000 metric tons of storage space and the ability to transport 240 metric tons of cereals every hour.
- This structure stands at a height of 42 meters (about 138 feet). The width is 24 meters (about 79 feet) and the length is 52 meters (170 feet).
- In 1976, a fire compelled the closure of both mills, however the silos continued to hold onto some of the "European Economic Community" wheat till 1984.
- In 1994, the advisory board of Gateshead solicited the "Institution of Royal Architects of Great Britain" to conduct a contest for the re-adaptive planning of the Baltic Flour Mills aiming to establish a hub for innovative artistic endeavors on local and global scales.

- This plan entailed excavating the antiquated grain silos beneath the preserved façade of the Flour Mill and incorporating new levels by erecting multiple levels to accommodate galleries and performing venues. It has about 3,000m² of artistic space, featuring five galleries, artists' studios, a cinema/lecture area, media laboratories, education workshops, a library and archive dedicated to the study of contemporary art. This is enhanced by a retail establishment and other food and beverage venues, including an impressive rooftop restaurant.
- His design preserved much of the building's original character, featuring its formidable brick façade and concrete fins. The design plan entailed the removal of the existing interior structure by opening of the eastern and western walls. About 1,000-ton of iron framework was necessary to sustain the residual structure.
- Additional 4 fundamental levels were integrated into the edifice, upheld by a series of columns. Intermediate levels constructed from steel framework and slender masonry were also incorporated. They were planned to be removed to facilitate the adaptation of the edifice and generate flexible areas for artistic purposes. So, comprising a total of 13 distinct levels.
- A glass-roofed restaurant with panoramic vistas of Gateshead, Newcastle, and the surrounding areas. The restaurant occupies the building's apex, constructed to provide natural light to illuminate the upper gallery level.
- Exterior glass elevators provide panoramas of Newcastle, Gateshead, and the River Tyne.

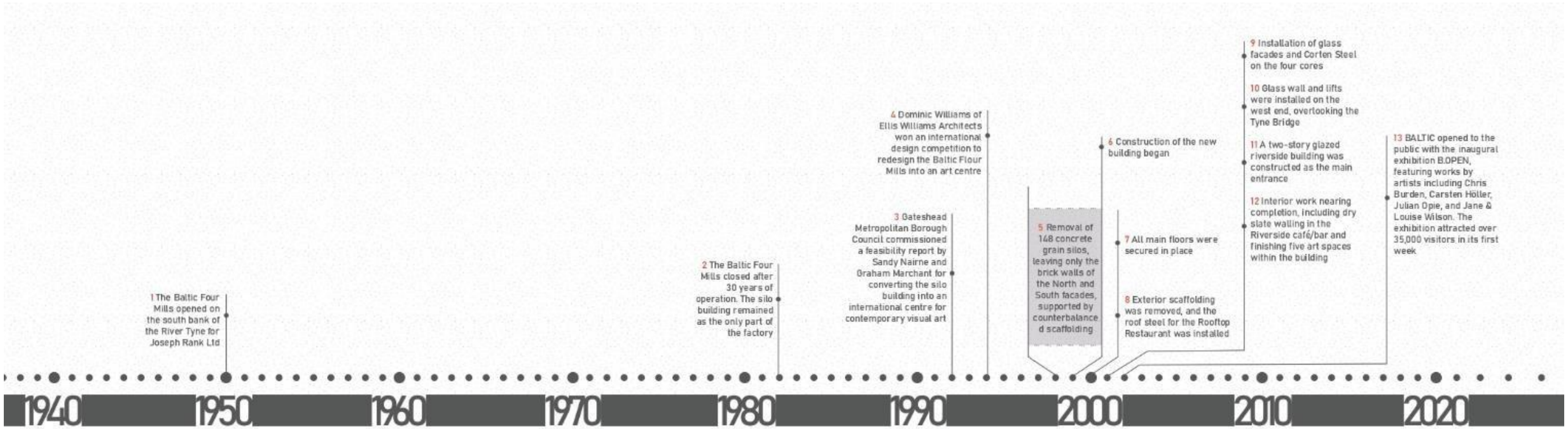


Fig.7.65. Time line of Baltic Centre for Contemporary Art (Elaborated by author)

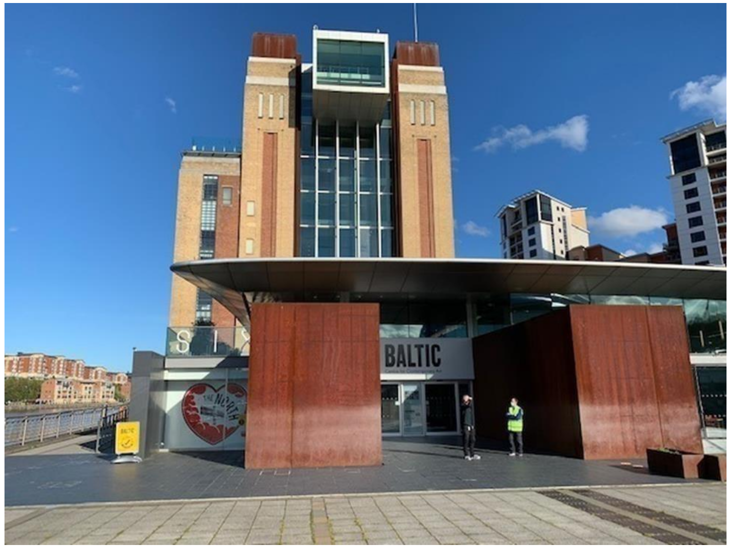


Fig.7.66. The Baltic Mill https://www.arkitektuel.com /ba ltik-modern-sanat-merkezi/

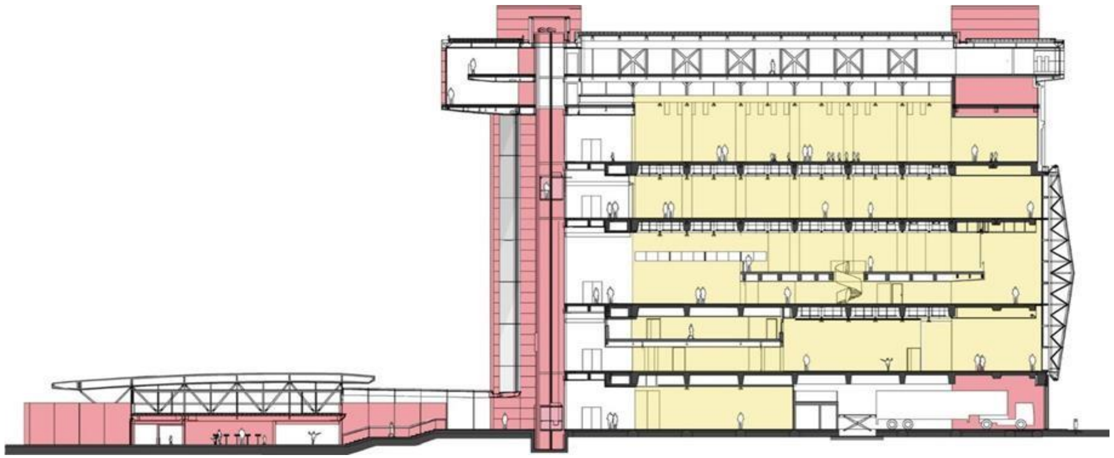


Fig.7.67. Baltic Hub for Modern Art, Gateshead - Ellis Williams Architects

Table.7.7. Baltic Art Centre, flex 4.0 Evaluation table of generally applicable indicators according to default weighting and flex 4.0 class table flexibility scores

Assessment from 12 Generally Applicable Flexibility Indicators					
Layer	**Sublayer**	**Flexibility Performance Indicators**	**Weighting**	**Assessment**	**Score**
1-Site		1-Expandable site/ location	**1**	1	1
2- Structure	Measurements	2- Surplus of building pace/ floor space	**4**	3	12
		3-Surplus of free floor height	**4**	4	16
	Access	4-Acess to building	**2**	3	6
	Construction	5-Positioning obstacles/ Columns in load	**3**	3	9
3- Skin	Façade	6-Façade windows to be opened	**1**	1	1
		7-Daylight facilities	**2**	4	8
4- Facilities	Measure/ Control	8-Customisability/ controllability facilities	**3**	2	6
	Dimensions	8-Surplus of facilities shafts and ducts	**4**	2	8
		10-Modularityu of facilities	**2**	2	4
5- Space Plan	Functional	11-Distinction between support- infill	**4**	2	8
	Access	12-Horizontal access to building	**3**	4	12

Total Flexibility Score: 91

Flexibility Class: 3

Class:	Table Flexibility Scores	Score range
Class1:	Not flexible at all	12-48
Class2:	Hardly flexible	49-85
Class3:	Limited flexible	86-122
Class4:	Very flexible	123-159
Class5:	Excellent flexible	160-192

Table.7.8. Baltic Art Centre, flex 4.0 Evaluation table of specifically applicable indicators according to default weighting and flex 4.0 class table flexibility scores

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
1- Site		1-Surplus of site space	**4**	1	4
		2- Multifunctional site/location	**3**	1	3
2- Structure	Measurements	3- Available floor space of building	**4**	2	8
		4- Size of floor buildings	**3**	4	12
		5- Measurement system/ modular coordination	**3**	2	6
		6- Horizontal zone division/ layout	**1**	3	3
		7- Presence of stairs/ elevators	**2**	4	8
		8- Extension/ reuse of stairs/ elevators	**1**	3	3
	Construction	9- Surplus of load bearing capacity	**2**	4	8
		10- Shape of columns	**1**	4	4
		11- Positioning of facilities zones and shafts	**3**	4	12
		12- Fire resistance main bearing construction	**3**	4	12
		13- Extendible building /units horizontal	**2**	3	6
		14- Extendible building/ units vertical	**4**	2	8
		15- Rejectable part of building/ unit horizontal	**2**	1	2
		16- Insulation between stories and units	**2**	4	8
3- Skin	Façade	17-Dismountable façade	**1**	2	2
		18- Location/shape daylight facilities	**2**	3	6
		19- Insulation of façade	**1**	2	2
4- Facilities	Measure/Control	20- Measure and control technique	**4**	4	16
	Dimensions	21- Surplus capacity of facilities	**4**	2	8
	Distribution	22- Distribution of facilities	**4**	2	8
		23- Location sources facilities (heating, cooling)	**3**	4	12
		24- Disconnection of facility components	**3**	3	9
		25- Accessibility of facility components	**3**	3	9
		26- Independence of user unit	**1**	4	4

5- Space Plan	Functional	27-multifunctional building	**2**	4	8
	Technical	28- Disconnectible, removable, relocatable units	**1**	2	2
		29- Disconnectible, removable, relocatable walls	**4**	4	16
		30- Disconnectible connection detail inner walls	**4**	4	16
		31- Possibility of suspended ceilings	**2**	4	8
		32- Possibility of raised floors	**2**	4	8

Total Flexibility Score: 241

Flexibility Class: 3

Class	**Table Flexibility Scores**	**Score Range**
Class 1:	Not flexible at all	32- 128
Class 2:	Hardly flexible	129- 225
Class 3:	Limited flexible	226- 322
Class 4:	Very flexible	323- 419
Class 5:	Excellent flexible	420- 512

Barcelona is a Mediterranean city that has seen post-industrial transformation. One of the most prominent and innovative city planning is the Barcelona Plan. The city is internationally recognized for being easily attainable, for its extensive public spaces, and pedestrian-friendly atmosphere. Olympic Games in 1992, were the principal catalyst for the city's modern transformation. The urban designers employed the games as a stimulus for urban rehabilitation and regeneration by establishing around two hundred public spaces including recreational areas, marketplaces, and educational institutions. Barcelona has undergone a substantial metamorphosis, evolving from an area plagued by urban deterioration in both its central and outskirts regions into a model of successful population density management and enhanced quality of life in a relatively compact urban environment. The Poblenou district of Barcelona was formerly an industrial area. The affluent industrial background of Poblenou is evident in the multitude of structures and artifacts designated as heritage sites. A number of statutes were enacted to protect and maintain this group of edifices. Moreover, several of these structures were effectively adapted. The Caixa Forum in Barcelona demonstrates the adaptability of an industrial structure that was repurposed into a hub for culture through the addition of an extension over the original structure. The Cai GiliVell an inaugural wheat mills in Poblenou, has been re-adapted into residential structures. The recurring and symbolic design enabled its conversion into fifty six loft units. The total space encompasses 5,396 square meters.

7.6.4. Caixa Forum Barcelona (https://www.barcelona.de/en/barcelona-museum-caixa-forum.html)

- It is a cultural institution located in Barcelona, Catalonia, Spain. Situated in the Montjuïc district within a former Modernist textile mill designedby Josep Puig i Cadafalch. Following the building's renovation, the art center commenced operations in 2002 and has since hosted temporary art exhibitions and cultural activities. It is held by the non-profit banking institution "la Caixa".

The structure was initially planned to be used as a textile mill by Casimir Casaramona i Puigcercós and constructed by the renowned Catalan contemporary engineer Josep Puig i Cadafalch. The Caixa Forum was completed by 1911 and earned the municipal Council's award for the finest manufacturing facility in that aforementioned year. The historic building complex, merging the intricate design characteristic of the Modernism movement with that of a textile manufacturing facility, was promptly acknowledged as a masterpiece. The plant ceased operations in 1919 but resumed as a warehouse for the “1929 Barcelona International Exposition”.

In 1940, the structure served as a police station for the Spanish Armed Police Corps until its acquisition by the "la Caixa" banking foundation in 1963. Since its designation as a cultural historic site in 1976, it has been acknowledged as a significant example of contemporary Catalan architectural constructions.

It was inaugurated as a cultural center in February 2002. The building underwent restoration before its inauguration, and a new entrance, designed by Japanese architect Arata Isozaki, was constructed, involving the fire of 100,000 bricks to replicate the original materials.

- The center encompasses over three acres of exhibition space, a media library, an auditorium, classrooms, a café, offices, and workshops, distributed across three levels interspersed with open-air courtyards. It has also a cinema/auditorium and a café-restaurant.
- Visitors descend via escalator to the subterranean lobby, embellished with a Sol LeWitt painting, before ascending to the exhibition areas on theground floor, situated within the crenelated brickwork. The institution is totally accessible to individuals with physical disabilities.
- The outdoor area, situated beneath the ground level, consists solely of some marble wall structures and an expansive buoyant sidewalk made of the similar components. A compact area, defined by brick sidewalls and referred to as the Secret Garden, is designed for outdoor displays. Furthermore, this limestone construction extends into the inside of the projects, creating a spacious vestibule that encompasses all essential functions of the entrance space.

Fig.7.68. Entrance of the Caixa Forum, designed by architect Arata Isozaki

Fig.7.69. Caixa Forum in a former textile factory from the time of Modernism

Fig.7.70. Caixa Forum in a restored textile mill
https://www.archdaily.com/912598/centro-cultural-caixa-forum-barcelona-arata-isozaki

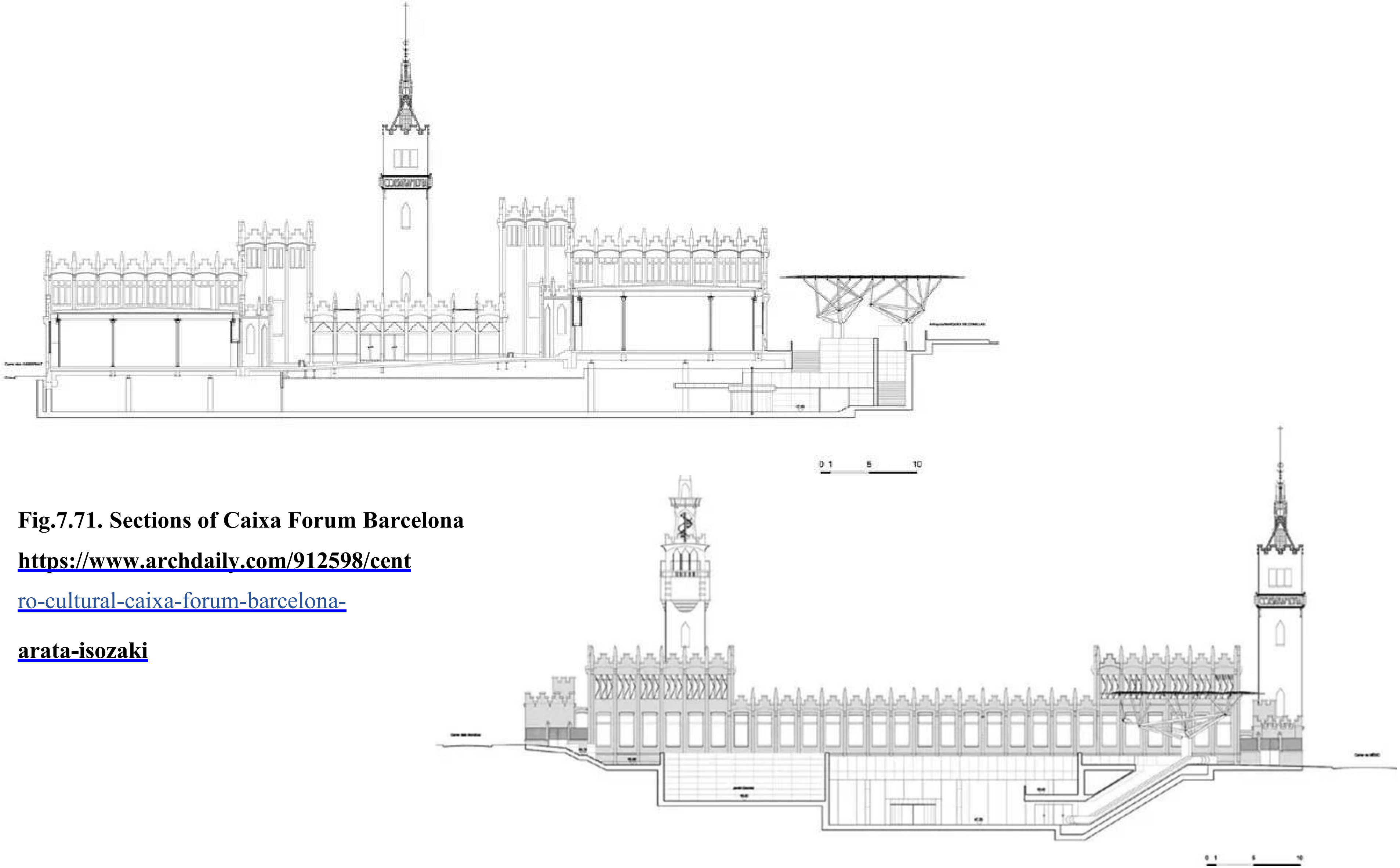


Fig.7.71. Sections of Caixa Forum Barcelona

https://www.archdaily.com/912598/cent
ro-cultural-caixa-forum-barcelona-

arata-isozaki

Fig.7.72. The use of this steel manufacturing method in this metallic framework echoes contemporary Catalonia style.
https://www.archdaily.com/912598/centro-cultural-caixa-forum-barcelona-arata-isozaki

Table.7.9. Caixa Forum Barcelona, Flex 4.0 Evaluation table of generally applicable indicators according to default weighting and

flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 12 Generally Applicable Flexibility Indicators					105
Layer	**Sublayer**	**Flexibility Performance Indicators**	**Weighting**	**Assessment**	**Score**
1-Site		1-Expandable site/ location	**1**	3	3
2- Structure	Measurements	2- Surplus of building pace/ floor space	**4**	3	12
		3-Surplus of free floor height	**4**	4	16
	Access	4-Acess to building	**2**	3	6
	Construction	5-Positioning obstacles/ Columns in load	**3**	3	9
3- Skin	Façade	6-Façade windows to be opened	**1**	3	3
		7-Daylight facilities	**2**	4	8
4- Facilities	Measure/ Control	8-Customisability/ controllability facilities	**3**	3	9
	Dimensions	8-Surplus of facilities shafts and ducts	**4**	3	12
		10-Modularityu of facilities	**2**	3	6
5- Space Plan	Functional	11-Distinction between support- infill	**4**	3	12
	Access	12-Horizontal access to building	**3**	3	9

Total Flexibility Score:

Flexibility Class: 3

Class:	Table Flexibility Scores	Score range
Class1:	Not flexible at all	12-48
Class2:	Hardly flexible	49-85
Class3:	Limited flexible	86-122
Class4:	Very flexible	123-159
Class5:	Excellent flexible	160-192

Table.7.10. Caixa Forum Barcelona, Flex 4.0 Evaluation table of specifically applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
1- Site		1-Surplus of site space	**4**	3	12
		2- Multifunctional site/location	**3**	4	12
2- Structure	Measurements	3- Available floor space of building	**4**	3	12
		4- Size of floor buildings	**3**	3	9
		5- Measurement system/ modular coordination	**3**	2	6
		6- Horizontal zone division/ layout	**1**	4	4
		7- Presence of stairs/ elevators	**2**	3	6
		8- Extension/ reuse of stairs/ elevators	**1**	3	3
	Construction	9- Surplus of load bearing capacity	**2**	4	8
		10- Shape of columns	**1**	3	3
		11- Positioning of facilities zones and shafts	**3**	3	9
		12- Fire resistance main bearing construction	**3**	3	9
		13- Extendible building /units horizontal	**2**	3	6
		14- Extendible building/ units vertical	**4**	3	12
		15- Rejectable part of building/ unit horizontal	**2**	3	6
		16- Insulation between stories and units	**2**	2	4
3- Skin	Façade	17-Dismountable façade	**1**	3	3
		18- Location/shape daylight facilities	**2**	4	8
		19- Insulation of façade	**1**	3	3
4- Facilities	Measure/Control	20- Measure and control technique	**4**	3	12
	Dimensions	21- Surplus capacity of facilities	**4**	3	12
	Distribution	22- Distribution of facilities	**4**	4	16
		23- Location sources facilities (heating, cooling)	**3**	3	9
		24- Disconnection of facility components	**3**	4	12
		25- Accessibility of facility components	**3**	4	12
		26- Independence of user units	**1**	2	2

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
5- Space Plan	Functional	27-multifunctional building	**2**	4	8
	Technical	28- Disconnectible, removable, relocatable units	**1**	3	3
		29- Disconnectible, removable, relocatable walls	**4**	2	8
		30- Disconnectible connection detail inner walls	**4**	3	12
		31- Possibility of suspended ceilings	**2**	4	8
		32- Possibility of raised floors	**2**	4	8

Total Flexibility Score: 272

Flexibility Class: 3

Class	**Table Flexibility Scores**	**Score Range**
Class 1:	Not flexible at all	32- 128
Class 2:	Hardly flexible	129- 225
Class 3:	Limited flexible	226- 322
Class 4:	Very flexible	323- 419
Class 5:	Excellent flexible	420- 512

7.6.5. The Cai GiliVell:

The first wheat plant in Poblenou which has been converted into dwellings.

The recurring and iconic layout facilitated its conversion into 56 apartments.

Its overall space was 5,396 square meters.

Fig.7.73. The Cai GiliVell, Cap a un Poblenou amb un 22@ més productiu, més inclusiu i més sostenible (al title ara posa Impulsem el 22@) (barcelona.cat)

Table.7.11. Cai Gili Vell, flex 4.0 Evaluation table of generally applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 12 Generally Applicable Flexibility Indicators					
Layer	**Sublayer**	**Flexibility Performance Indicators**	**Weighting**	**Assessment**	**Score**
1-Site		1-Expandable site/ location	**1**	2	2
2- Structure	Measurements	2- Surplus of building pace/ floor space	**4**	3	12
		3-Surplus of free floor height	**4**	3	12
	Access	4-Acess to building	**2**	3	6
	Construction	5-Positioning obstacles/ Columns in load	**3**	3	9
3- Skin	Façade	6-Façade windows to be opened	**1**	3	3
		7-Daylight facilities	**2**	3	6
4- Facilities	Measure/ Control	8-Customisability/ controllability facilities	**3**	3	9
	Dimensions	8-Surplus of facilities shafts and ducts	**4**	3	12
		10-Modularity of facilities	**2**	3	6
5- Space Plan	Functional	11-Distinction between support- infill	**4**	3	12
	Access	12-Horizontal access to building	**3**	3	9

Total Flexibility Score: 98

Flexibility Class: 3

Class:	Table Flexibility Scores	Score range
Class1:	Not flexible at all	12-48
Class2:	Hardly flexible	49-85
Class3:	Limited flexible	86-122
Class4:	Very flexible	123-159
Class5:	Excellent flexible	160-192

Table.7.12. Cai Gili Vell, Flex 4.0 Evaluation table of specifically applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
1- Site		1-Surplus of site space	**4**	2	8
		2- Multifunctional site/location	**3**	3	9
2- Structure	Measurements	3- Available floor space of building	**4**	3	12
		4- Size of floor buildings	**3**	2	6
		5- Measurement system/ modular coordination	**3**	3	9
		6- Horizontal zone division/ layout	**1**	3	3
		7- Presence of stairs/ elevators	**2**	3	6
		8- Extension/ reuse of stairs/ elevators	**1**	2	2
	Construction	9- Surplus of load bearing capacity	**2**	3	6
		10- Shape of columns	**1**	3	3
		11- Positioning of facilities zones and shafts	**3**	3	9
		12- Fire resistance main bearing construction	**3**	3	9
		13- Extendible building /units horizontal	**2**	2	4
		14- Extendible building/ units vertical	**4**	3	12
		15- Rejectable part of building/ unit horizontal	**2**	3	6
		16- Insulation between stories and units	**2**	2	4
3- Skin	Façade	17-Dismountable façade	**1**	3	3
		18- Location/shape daylight facilities	**2**	3	6
		19- Insulation of façade	**1**	3	3
4- Facilities	Measure/Control	20- Measure and control technique	**4**	3	12
	Dimensions	21- Surplus capacity of facilities	**4**	3	12
	Distribution	22- Distribution of facilities	**4**	3	12
		23- Location sources facilities (heating, cooling)	**3**	3	9
		24- Disconnection of facility components	**3**	3	9
		25- Accessibility of facility components	**3**	3	9
		26- Independence of user units	**1**	2	2
Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
5- Space Plan	Functional	27-multifunctional building	**2**	3	6

	Technical	28- Disconnectible, removable, relocatable units	**1**	3	3
		29- Disconnectible, removable, relocatable walls	**4**	2	8
		30- Disconnectible connection detail inner walls	**4**	3	12
		31- Possibility of suspended ceilings	**2**	3	6
		32- Possibility of raised floors	**2**	3	6

Total Flexibility Score: 248

Flexibility Class: 3

Class	**Table Flexibility Scores**	**Score Range**
Class 1:	Not flexible at all	32- 128
Class 2:	Hardly flexible	129- 225
Class 3:	Limited flexible	226- 322
Class 4:	Very flexible	323- 419
Class 5:	Excellent flexible	420- 512

7.6.5. The Arenc Le Silo (https://www.cilac.com/silo-d-arenc-de-Marseille)

Marseille is the second most populous city in France and serves as a major trading harbor on the Mediterranean coastline. The economic framework of the city was primarily characterized by its crucial function as a port, serving as an essential connection between France and its Northern territories in Africa, namely Algeria, Morocco, and Tunisia. In the 19th century, the city had significant economic advancement and an increase in manufacturing endeavors. In 1960, most port activities were transferred to the newly constructed harbor located 50 kilometers to the north. The port region experienced industrial collapse and economic stagnation predominantly during the 1970s, leading to increased poverty and crime rates. During the period from 1980s to 1990s, the maritime neighborhood of Marseille was notorious as the most impoverished area in France, plagued by rampant gang violence, street crime, and drug trafficking.

Marseille, motivated by Barcelona's significant transformation, commenced a sustainable urban redevelopment project from 1995 to 2020. This program involved the redevelopment of the area between the harbor and city center, as well as the improvement of community services, infrastructure, housing, and recreational amenities. Les Docks and Le Silo demonstrate renovation within the framework of Marseille.

The Arenc Silo, constructed in 1927, served as a repository for grain exports. The silo, situated adjacent to the port of Marseille, is a significant architectural edifice. Its strategic location makes it prominently visible from many vantage points around the city, establishing it as an essential component of the city's distinctive skyline. Subsequent to the port's downfall, it remained unoccupied and forsaken for some years, hovering on the verge of demolition. In 2004, the structure was designated as a site of "20th-century Heritage."

The preservation of the Silo ultimately resulted in a substantial project conceived by Marseille architect Eric Castaldi, in collaboration with SOGIMA. The project, initiated in 2007 and spanning four years. The Silo's reinforced concrete structure was restored, fortified, and repurposed to accommodate office spaces, a rooftop restaurant, and additional parking facilities. A substantial theatre was created by excavating a considerable area, resulting in an impressive performing arts auditorium with a seating capacity over 2000. The outcome demonstrates that a structure of this magnitude, with significant renovation limitations, integrates seamlessly within the expansive Euroméditerrannée project. The significance of the Marseille model resides in the transformation of the city's formerly inactive waterfront into a vibrant cultural and commercial hub

Les Docks Silos Coopératifs rouages essentiels de la commercialisation des céréales (Photo Benhamou.)

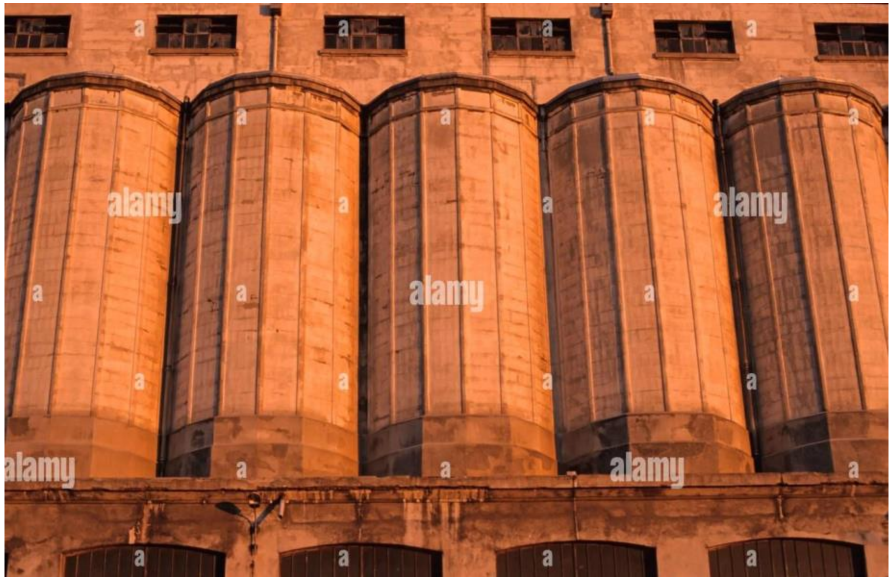
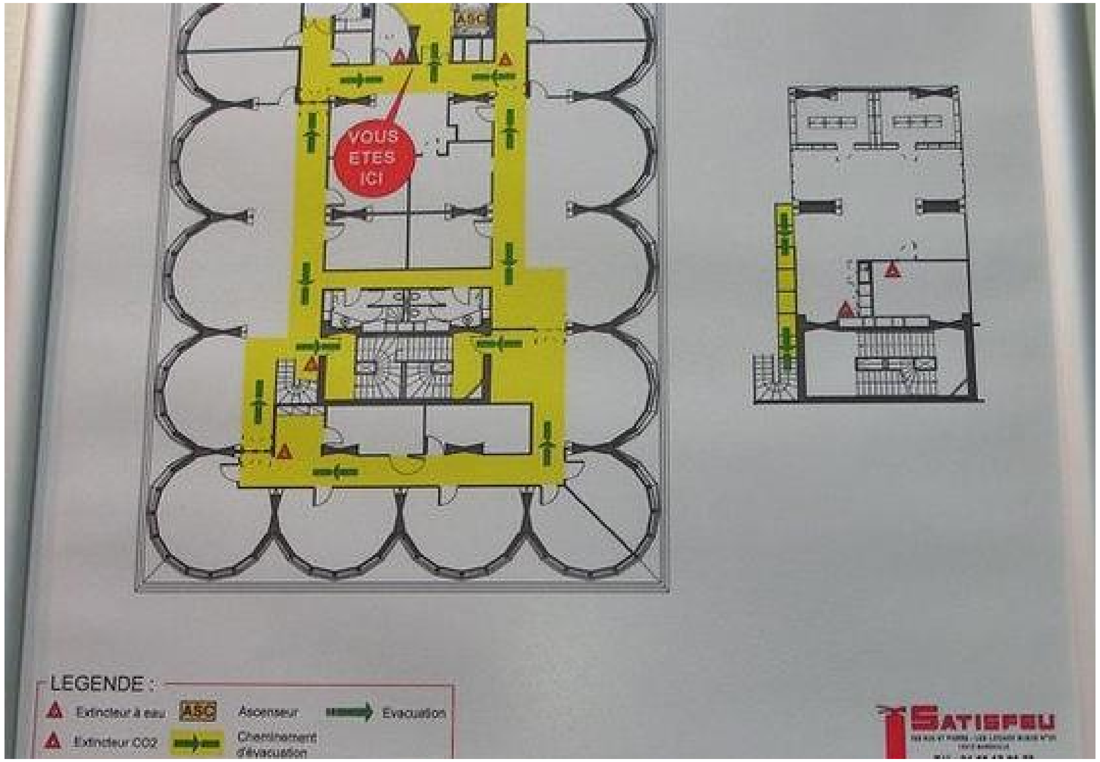


Fig.7.74. Vintage Photos and Images of Silo, Marseille.

Alamy https://www.alamy.com › stock-photo › silo-Marseille



barrels. But traces of theoriginal framework have been preserved. https://www.lemoniteur.fr/photo/visite-du- silo-complexe-culturel-et-tertiaire-a-marseille.921924/cloisons.8#galerie-anchor

Fig.7.75. Construction works, Le Silo, Autonomous Harbor of Marseille
Fig.7.76. The office Floors replaced the silo

Fig.7.77. Silo Images, http://inhabitat.com/abandoned-grain-silo converted-into-arenc-silo-opera-house-in-marseille/silo-opera-house-ct-architectures-1/

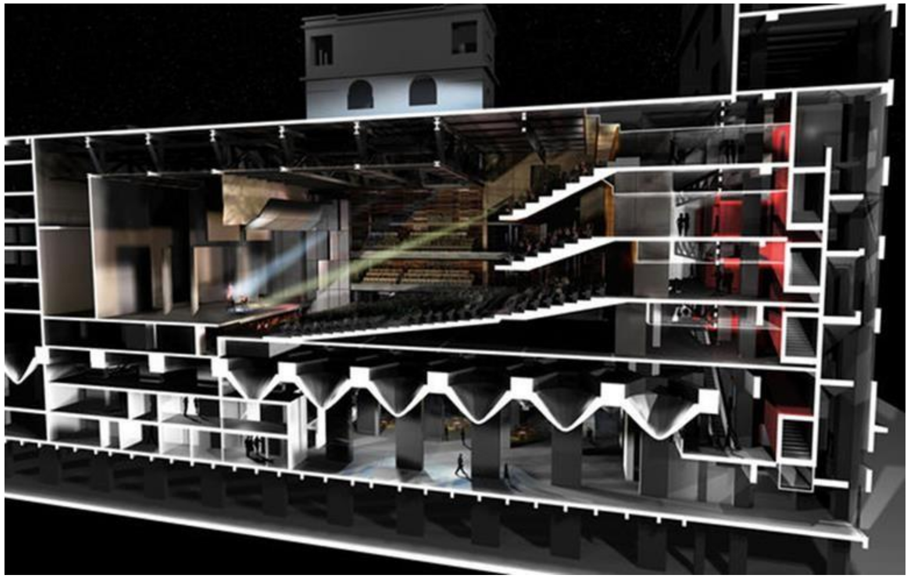


Fig.7.78. The performance hall, 17 meters high (50 x 25 m) is positioned above the 600 m2 foyer (also called the breast room),and three levels of service areas (dressing rooms, catering, offices, changing rooms, etc.). The north tower (50 meters) accommodates the vertical circulation.

Fig.7.79. The numbered inverted cones throughwhich the grains flowed are now highlightedby ambient lighting designed by Georges Berne. https://www.conventions- seminaires.fr/lieu/le-silo-marseille/

Fig.7. 80.The glass partitions are an extension ofthe original framework of the silos, of which visible traces of the vertical walls remain. https://www.lemoniteur.fr/photo/visite-du- silo-complexe-culturel-et-tertiaire-a-marseille.921924/cloisons.8#galerie-anchor

Table.7. 13. Le Silo de Marseilles, Flex 4.0 Evaluation table of generally applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 12 Generally Applicable Flexibility Indicators					
Layer	**Sublayer**	**Flexibility Performance Indicators**	**Weighting**	**Assessment**	**Score**
1-Site		1-Expandable site/ location	**1**	3	3
2- Structure	Measurements	2- Surplus of building pace/ floor space	**4**	3	12
		3-Surplus of free floor height	**4**	3	12
	Access	4-Acess to building	**2**	3	6
	Construction	5-Positioning obstacles/ Columns in load	**3**	3	9
3- Skin	Facade	6-Façade windows to be opened	**1**	3	3
		7-Daylight facilities	**2**	3	6
4- Facilities	Measure/ Control	8-Customisability/ controllability facilities	**3**	3	9
	Dimensions	8-Surplus of facilities shafts and ducts	**4**	3	12
		10-Modularityu of facilities	**2**	3	6
5- Space Plan	Functional	11-Distinction between support- infill	**4**	3	12
	Access	12-Horizontal access to building	**3**	3	9

Total Flexibility Score: 99

Flexibility Class: 3

Class:	Table Flexibility Scores	Score range
Class1:	Not flexible at all	12-48
Class2:	Hardly flexible	49-85
Class3:	Limited flexible	86-122
Class4:	Very flexible	123-159
Class5:	Excellent flexible	160-192

Table.7.14. Le Silo de Marseilles, Flex 4.0 Evaluation table of specifically applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
1- Site		1-Surplus of site space	**4**	3	12
		2- Multifunctional site/location	**3**	3	9
2- Structure	Measurements	3- Available floor space of building	**4**	3	12
		4- Size of floor buildings	**3**	3	9
		5- Measurement system/ modular coordination	**3**	2	6
		6- Horizontal zone division/ layout	**1**	3	3
		7- Presence of stairs/ elevators	**2**	3	6
		8- Extension/ reuse of stairs/ elevators	**1**	2	2
	Construction	9- Surplus of load bearing capacity	**2**	3	6
		10- Shape of columns	**1**	3	3
		11- Positioning of facilities zones and shafts	**3**	3	9
		12- Fire resistance main bearing construction	**3**	3	9
		13- Extendible building /units horizontal	**2**	3	6
		14- Extendible building/ units vertical	**4**	3	12
		15- Rejectable part of building/ unit horizontal	**2**	2	4
		16- Insulation between stories and units	**2**	2	4
3- Skin	Façade	17-Dismountable façade	**1**	3	3
		18- Location/shape daylight facilities	**2**	3	6
		19- Insulation of façade	**1**	3	3
4- Facilities	Measure/Control	20- Measure and control technique	**4**	3	12
	Dimensions	21- Surplus capacity of facilities	**4**	3	12
	Distribution	22- Distribution of facilities	**4**	3	12
		23- Location sources facilities (heating, cooling)	**3**	3	9
		24- Disconnection of facility components	**3**	3	9
		25- Accessibility of facility components	**3**	3	9

		26- Independence of user units	**1**	2	2
5- Space Plan	Functional	27-multifunctional building	**2**	3	6
	Technical	28- Disconnectible, removable, relocatable units	**1**	3	3
		29- Disconnectible, removable, relocatable walls	**4**	2	8
		30- Disconnectible connection detail inner walls	**4**	3	12
		31- Possibility of suspended ceilings	**2**	3	6
		32- Possibility of raised floors	**2**	3	6

Total Flexibility Score: 250

Flexibility Class: 3

Class	**Table Flexibility Scores**	**Score Range**
Class 1:	Not flexible at all	32- 128
Class 2:	Hardly flexible	129- 225
Class 3:	Limited flexible	226- 322
Class 4:	Very flexible	323- 419
Class 5:	Excellent flexible	420- 512

7.6.6. Les Docks of Marseilles https://www.atelierfemia.com/en/2015/06/marseille-docks/

Les Docks comprises a vast collection of marine infrastructures accommodating various businesses, while Le Silo serves as a concert venue that was formerly a grain storage facility.

- Les Docks de Marseille were Constructed under the supervision of designer Gustave Desplaces between 1858 and 1863.
- They comprised four storage spaces, every one including its own outdoor spaces, together with an administration structure known as "Hôtel de Direction."
- In 1955, Les Docks served as a warehouse depot for paper and grain, subsequently incorporating refrigeration spaces, and ultimately undergoing substantial conversion into offices.
- The structure measured 365 meters in length.
- It maintained operational until 1988, when manufacturing operations at Les Docks ceased and the buildings were vacated.
- During the year 1991. Architect Eric Castaldi spearheaded a renovation plan that converted the old storage facilities into office space. The renovation undertaken involved the preservation of masonry arched structures, the enlargement of windows, the replacement of a portion of the rooftop with glass to form plazas, and the incorporation of an inner central thoroughfare.
- In 2009, the Docks' ground- levels were renovated and it is now occupied by shops, bars and restaurants.

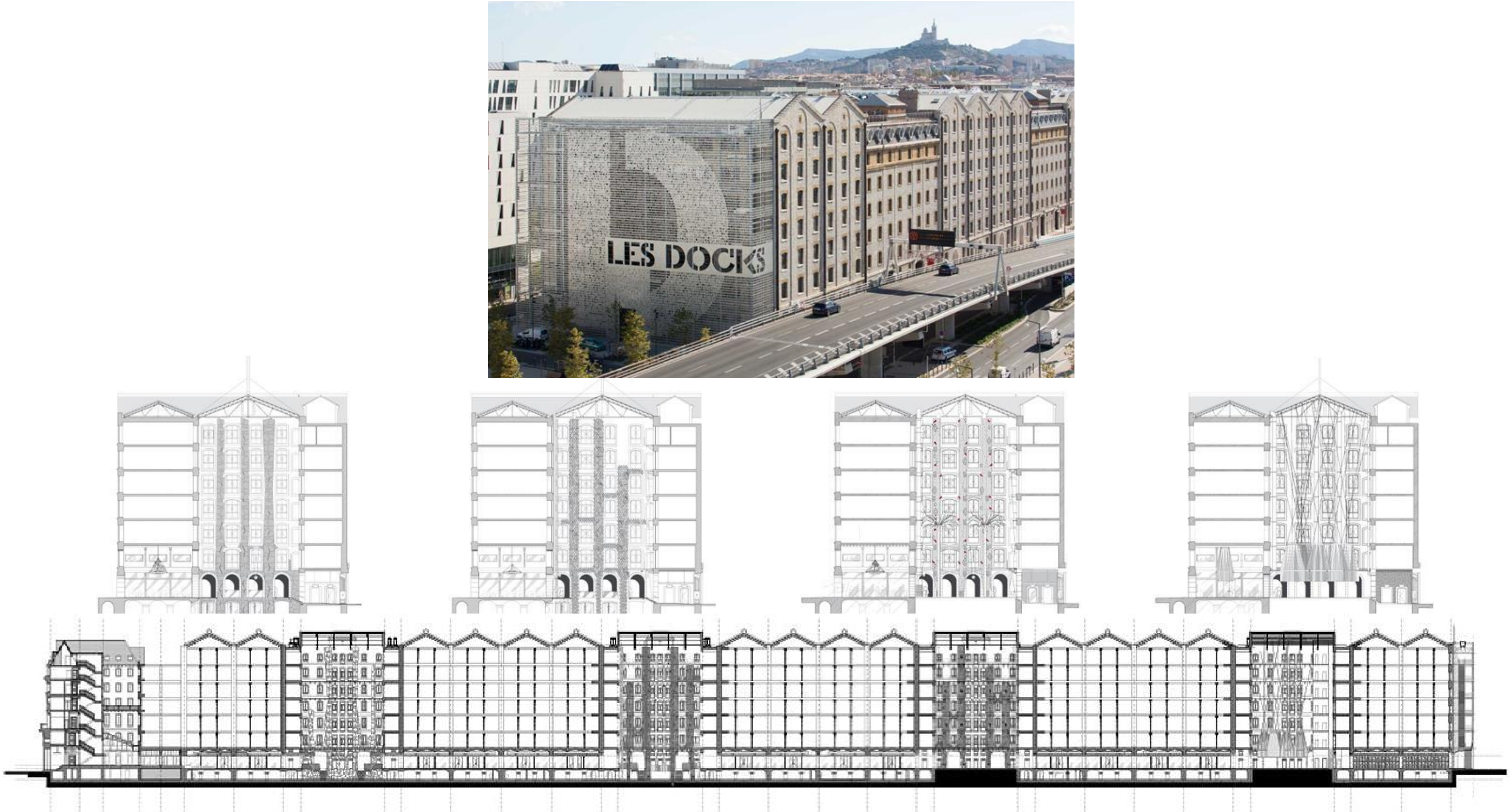


Fig.7.81. Les Docks of Marseilles. https://www.atelierfemia.com/en/2015/06/marseille-docks

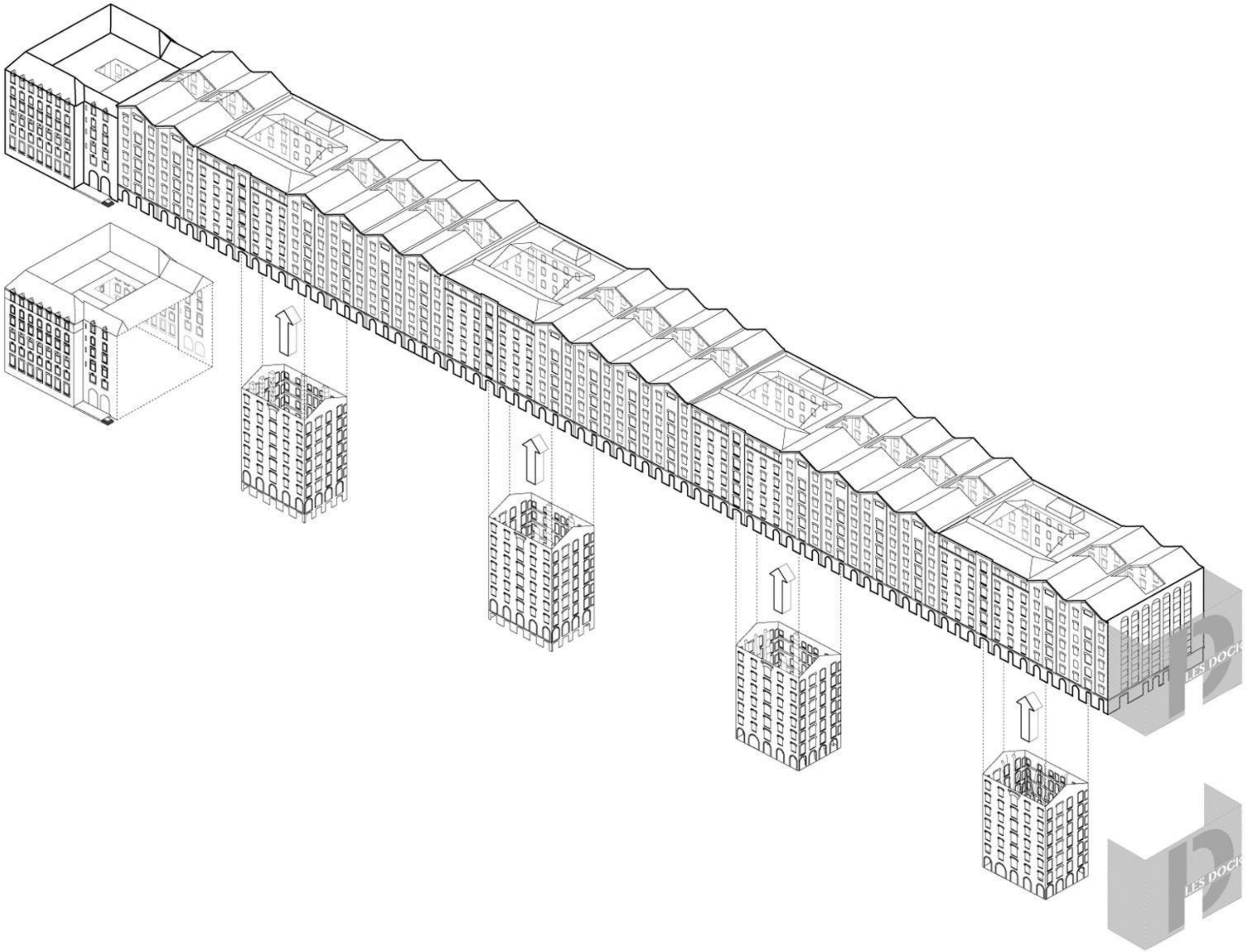


Fig.7.82. Les Docks of Marseilles.

https://www.atelierfemia.com/en/2015/06/marseille-docks/

Table.7.15. Les Docks of Marseilles, Flex 4.0 Evaluation table of generally applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 12 Generally Applicable Flexibility Indicators					
Layer	**Sublayer**	**Flexibility Performance Indicators**	**Weighting**	**Assessment**	**Score**
1-Site		1-Expandable site/ location	**1**	3	3
2- Structure	Measurements	2- Surplus of building pace/ floor space	**4**	3	12
		3-Surplus of free floor height	**4**	3	12
	Access	4-Acess to building	**2**	3	6
	Construction	5-Positioning obstacles/ Columns in load	**3**	3	9
3- Skin	Facade	6-Façade windows to be opened	**1**	3	3
		7-Daylight facilities	**2**	3	6
4- Facilities	Measure/ Control	8-Customisability/ controllability facilities	**3**	3	9
	Dimensions	8-Surplus of facilities shafts and ducts	**4**	3	12
		10-Modularityu of facilities	**2**	3	6
5- Space Plan	Functional	11-Distinction between support- infill	**4**	3	12
	Access	12-Horizontal access to building	**3**	3	9

Total Flexibility Score: 99

Flexibility Class: 3

Class:	Table Flexibility Scores	Score range
Class1:	Not flexible at all	12-48
Class2:	Hardly flexible	49-85
Class3:	Limited flexible	86-122
Class4:	Very flexible	123-159
Class5:	Excellent flexible	160-192

Table.7.16. Les Docks of Marseilles, Flex 4.0 Evaluation table of specifically applicable indicators according to default weighting and flex 4.0 class table flexibility scores. (Elaborated by author)

Assessment from 32 Specifically Applicable Flexibility Indicators					
Layer	**Sub-Layer**	**Flexibility Performance Indicator**	**Weighting**	**Assessment**	**Score**
1- Site		1-Surplus of site space	**4**	3	12
		2- Multifunctional site/location	**3**	3	9
2- Structure	Measurements	3- Available floor space of building	**4**	3	12
		4- Size of floor buildings	**3**	3	9
		5- Measurement system/ modular coordination	**3**	2	6
		6- Horizontal zone division/ layout	**1**	3	3
		7- Presence of stairs/ elevators	**2**	3	6
		8- Extension/ reuse of stairs/ elevators	**1**	2	2
	Construction	9- Surplus of load bearing capacity	**2**	3	6
		10- Shape of columns	**1**	3	3
		11- Positioning of facilities zones and shafts	**3**	3	9
		12- Fire resistance main bearing construction	**3**	3	9
		13- Extendible building /units horizontal	**2**	3	6
		14- Extendible building/ units vertical	**4**	3	12
		15- Rejectable part of building/ unit horizontal	**2**	2	4
		16- Insulation between stories and units	**2**	2	4
3- Skin	Façade	17-Dismountable façade	**1**	3	3
		18- Location/shape daylight facilities	**2**	3	6
		19- Insulation of façade	**1**	3	3
4- Facilities	Measure/Control	20- Measure and control technique	**4**	3	12
	Dimensions	21- Surplus capacity of facilities	**4**	3	12
	Distribution	22- Distribution of facilities	**4**	3	12
		23- Location sources facilities (heating, cooling)	**3**	3	9
		24- Disconnection of facility components	**3**	3	9
		25- Accessibility of facility components	**3**	3	9

		26- Independence of user units	**1**	2	2
5- Space Plan	Functional	27-multifunctional building	**2**	3	6
	Technical	28- Disconnectible, removable, relocatable units	**1**	3	3
		29- Disconnectible, removable, relocatable walls	**4**	2	8
		30- Disconnectible connection detail inner walls	**4**	3	12
		31- Possibility of suspended ceilings	**2**	3	6
		32- Possibility of raised floors	**2**	3	6

Total Flexibility Score: 250

Flexibility Class: 3

Class	**Table Flexibility Scores**	**Score Range**
Class 1:	Not flexible at all	32- 128
Class 2:	Hardly flexible	129- 225
Class 3:	Limited flexible	226- 322
Class 4:	Very flexible	323- 419
Class 5:	Excellent flexible	420- 512

7.6.7. The Ford Motor Company in Alexandria, 1945-1960

- Alfred and Edward Flower would emerge as the pioneers of contemporary motoring in Egypt. Upon their first establishment, they served as concessionaires for the burgeoning automotive powerhouse, Ford. Subsequently, they would emerge as the distributors of the leading brands in the industry. The Ford Motor Company supplied materials to Alexandria for the British war effort against the Italian forces in Libya, Eritrea, and Ethiopia.Ford opened a branch in Egypt in 1926.
- In 1935, Ford-Egypt reported profits surpassing those of all European Ford companies, with the exception of Dagenham. Sales increased significantly during the war, resulting in Ford-Egypt becoming the company's regional headquarters for the Middle East, the Balkans, and Northeast Africa by the early 1950s.
- The inaugural stone of the Ford Motor Company in Smouha, Alexandria was positioned on 20 September 1948 under the reign of King Farouq.
- In 1958, Ford declared its entry into the heavy and extra-heavy truck market. An assembly plant for trucks was created in Alexandria at that time.
- Approximately 80% of the components were produced internationally, whereas merely 20% were fabricated in Egypt. The majority of automotive engineers in Egypt received their training at Ford Belgium.
- The pivotal moment for Egypt's commercial sector, particularly its foreign element, occurred with the attack of Egypt by the United Kingdom, France and Israeli in November 1956, subsequent to which a series of Egyptianization directives were implemented. Due to the adverse environment for foreign enterprises, Ford considered dissolving its Egyptian operations but ultimately determined that the financial repercussions anticipated from the Egyptian government would be excessively harsh to facilitate this decision.
- The company ceased its operations in Egypt in 1960.
- On 27 October 1992, Mr. Mohamed Ragab acquired the Ford Factory and subsequently established Riada Language School in 1993

after renovating the premises

-The school facilities at that time included the Kindergarten department on the ground floor and the junior department together with administration on the first floor. The playgrounds are located on either side of theschool building.

- In 1996-1997, the second storey was constructed, currently housing the Middle and Senior schools as well as the IGCSE programs.

Educational infrastructure includes:

- Four well-equipped laboratories, a multimedia room, two Computer Laboratories, two libraries, eleven activity rooms designated for extracurricular pursuits, including art, music, videography, and ballet.
- The third floor was built later to construct a theatre designated for the performance of various creative activities.

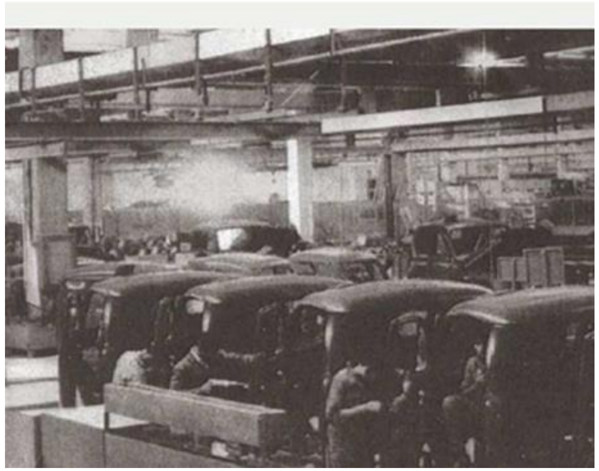


Fig.7.83. Adoptive restoration of the previous Ford Manufacturing facility constructed in International School (taken by author)

Fig.7.84. Ford Company in Smouha, Alexandria (Archives CEA).

7.7. Details of adaptive reuse project of the two historical edifices

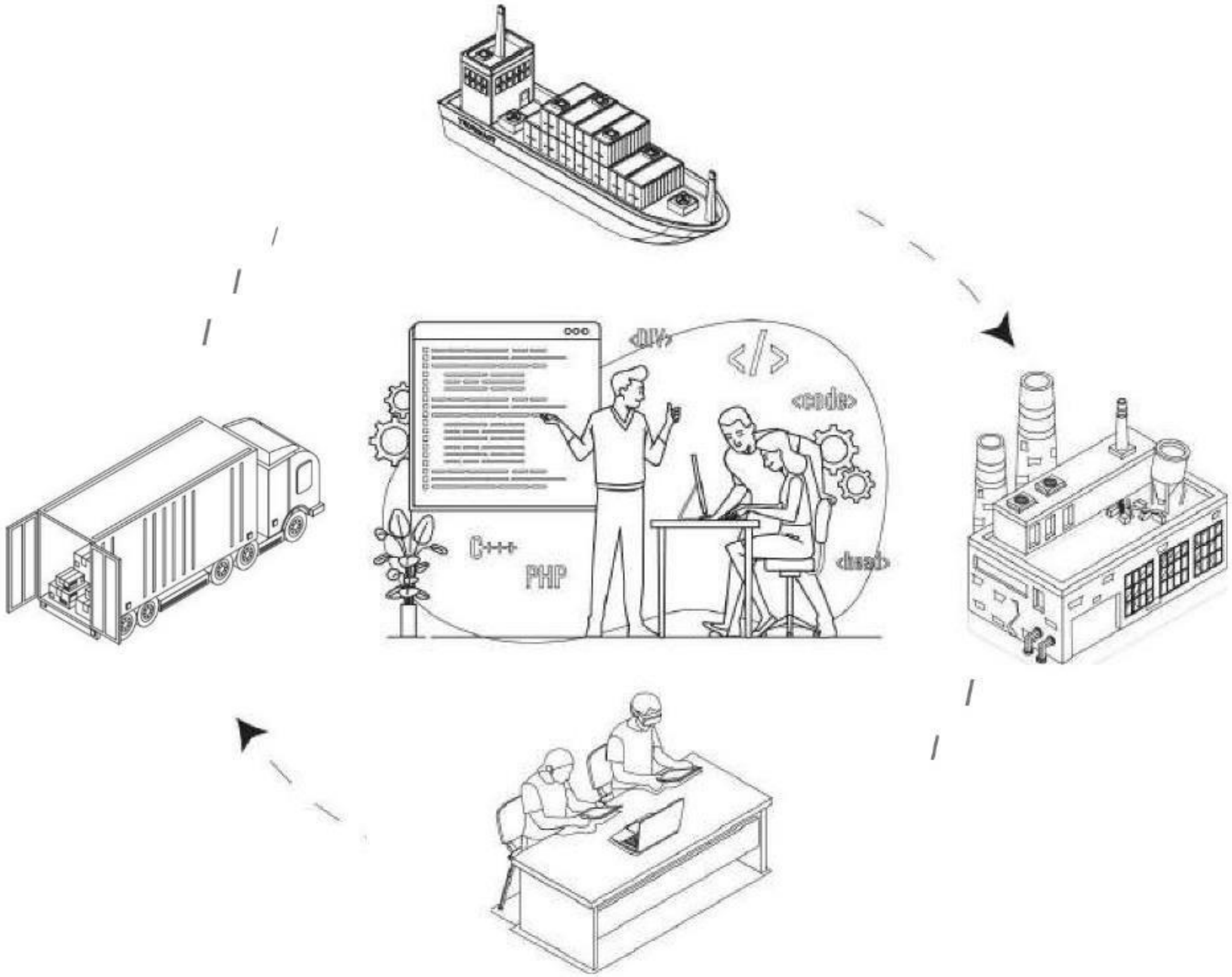


Fig.7.85. Concept analysis (Elaborated by author)

- The proposed project to convert abandoned cotton presses in Mina El-Bassal, Alexandria into a specialized educational facility for chip production is a commendable endeavor that aligns with the community's needs, as indicated by interviewing local leaders and stakeholders.The interviews revealed that over 80% of the local population in the studied area prioritized their need for jobs, while educational facilities, particularly vocational schools, ranked as the second most significant necessity
.
- This project, located in the port, leverages Alexandria's strategic position to enhance educational and economic prospects. Considering theelevated illiteracy rates and economic limitations encountered by several youths in the region, transforming this historical edifice into an educational facility could profoundly influence the local community.

- The project concentrates on chip fabrication, catering to worldwide technological demand while fulfilling local requirements for vocational and technical training that can result in immediate employment prospects. Furthermore, it is intricately connected to Alexandria'shistorical role as an international economic hub on the Mediterranean Sea and the Mahmoudiyah Canal.

- Despite being abandoned, the two selected presses are in acceptable condition for reuse (flexibility class: 3), with significant aesthetic value due to their high-quality architecture, design, or planning. Furthermore, the two presses are in proximity and linked by a sheltered bridge.

- The selection of location and topic of study is particularly judicious, given the expanding tech industry and the critical significance of technology education in the contemporary economy. This effort not only conserves a historical landmark but also repurposes it to provide young individuals with a feasible alternative to conventional university education, which may be financially inaccessible for many. This project represents a significant advancement for community enhancement and sustainable economic development in Alexandria.

- The ideas of my project were inspired from the previous projects that renovated notable industrial architectural heritage in various nations to conserve their structures and rejuvenate their environments. The renovation involved the demolition of certain sections, the addition of supporting structures, the installation of partitions, and the implementation of safer technologies. The project concept introduced an innovative approach distinct from prior local initiatives aimed at the restoration of the historical edifices in Mina El-Bassal area.

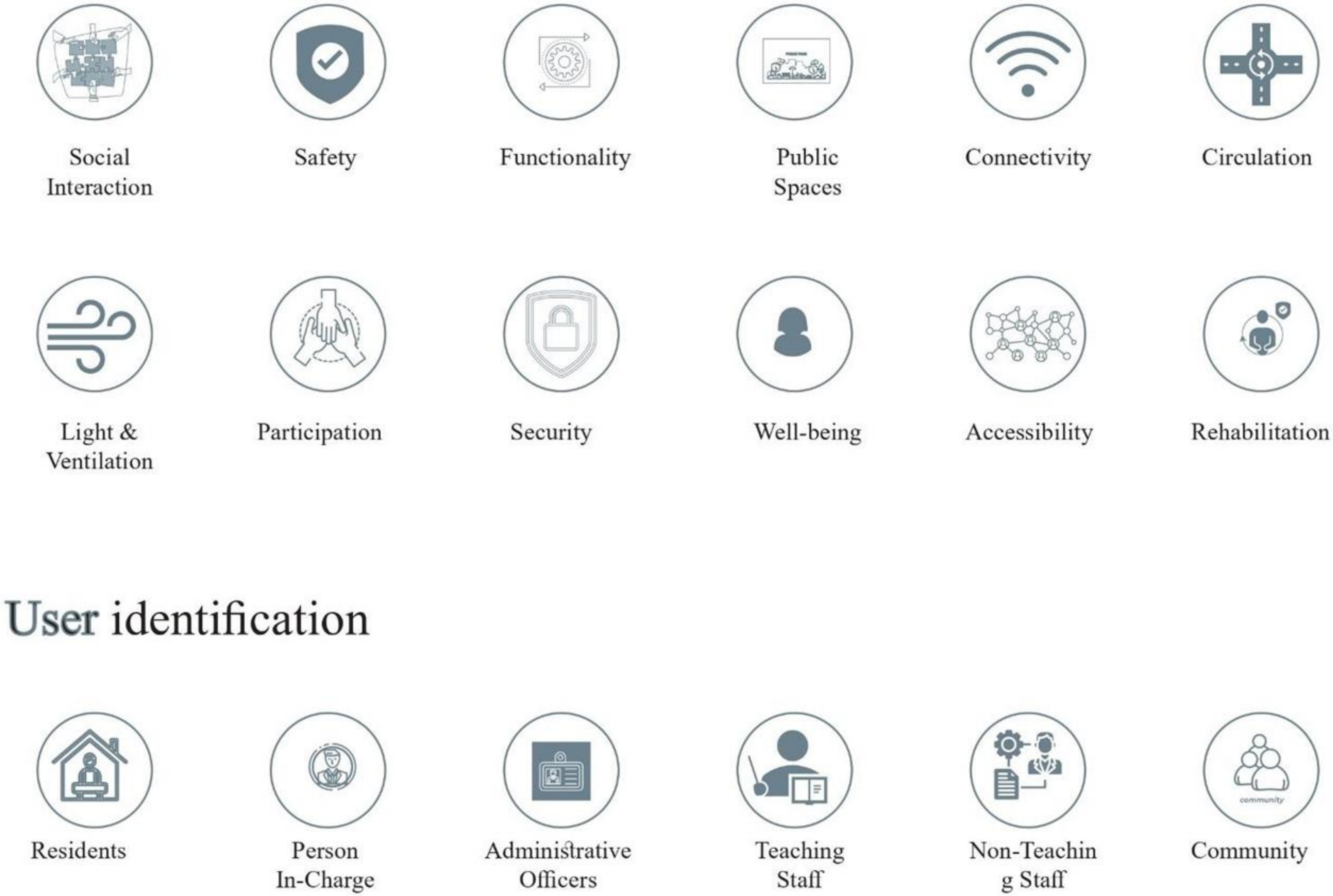


Fig.7.86. Keywords. (Elaborated by author)

Particular Keys and Their Utilization in the Project

These keys establish a framework for a comprehensive approach for the advancement of Mina El-Bassal, ensuring that the infrastructure and services address the varied demands of the population while promoting an environment favorable to learning and professional advancement inship production.

Stakeholder Identification: Ascertain and comprehend the requirements of all parties associated in the Mina El-Bassal project, including students,instructors, shipbuilders, community members, and prospective tourists.

Social Interaction: Create communal areas that promote engagement among local residents, students, and professionals in the shipbuilding sector.

Safety: Confirm that all educational and production facilities comply with the highest safety requirements. This encompasses surveillance systems and well illuminated pedestrian routes, emergency protocols, secure material management, and accident mitigation strategies.

Functionality: The reconstruction is meticulously designed to ensure that all spaces are versatile and adaptable for diverse educational and community activities.

Public Spaces: Develop multifunctional public places suitable for educational events, community gatherings, and recreational activities, as wellas market spaces, so improving the neighborhood's quality of life and transforming the waterfront into a dynamic public asset.

Connectivity: Establish effective communication inside the area surrounding the two presses to ensure seamless access to educational facilities,shipbuilding zones, and community centers. This encompasses pedestrian walkways and bridges spanning the canal.

Efficient circulation: is essential in the design, enabling seamless movement throughout educational and manufacturing areas to ensure a smooth flow of individuals and materials, hence boosting the usage of spaces.

Illumination & Airflow: Construct the edifices spaces that optimize natural illumination and guarantee superior ventilation.

Involvement: Involve community residents, educators, and industry professionals at every stage of the project, from design to implementation, to guarantee that the development aligns with their requirements, thereby cultivating a sense of ownership and pride.

Security: Establish extensive security protocols to safeguard the premises, apparatus, and personnel.

Well-being: Integrate design features that enhance physical, mental, and social well-being, including green areas and recreational amenities.

Accessibility: Guarantee that all facilities are accessible to individuals with disabilities, fostering their inclusivity in educational opportunities andcommunity engagements.

Rehabilitation: Modernize and repurpose existing industrial edifices in Mina El-Bassal for educational and shipbuilding applications, retaining historical features while enhancing them to satisfy contemporary functional requirements.

By implementing these strategies with precision, the Mina El-Bassal development plan can convert the region into a center for education, shipbuilding, and community involvement. The proposal revitalizes the historical industrial edifices of Makbas Masr and Makbas El-Nile whilesimultaneously transforming the adjacent canal area into a vibrant public space.

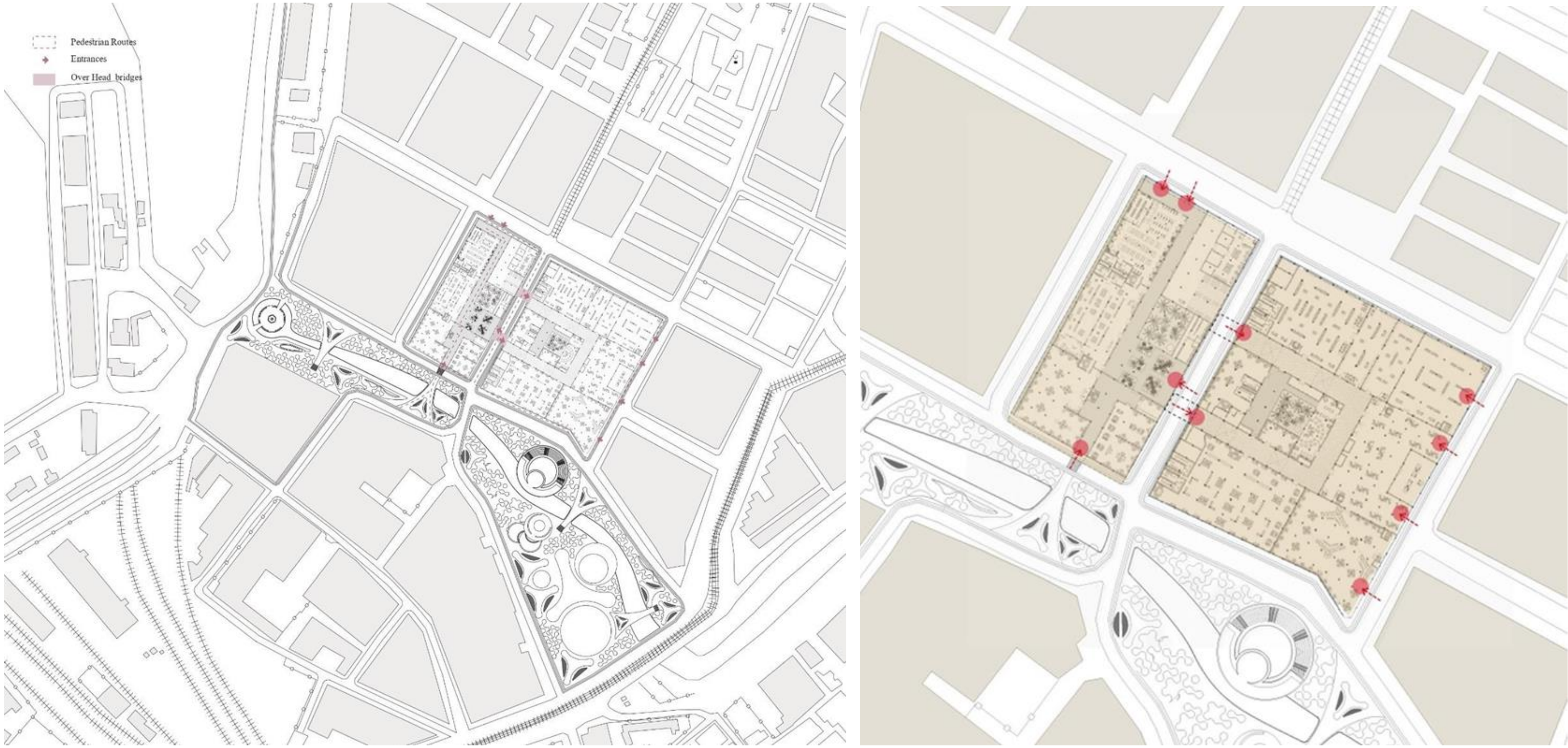


Fig.7.87. Comprehensive Mapping of Building Accessibility: Integrating Pedestrian Routes and Overhead Bridges in Urban Development (Elaborated by author)

Fig.7.88.

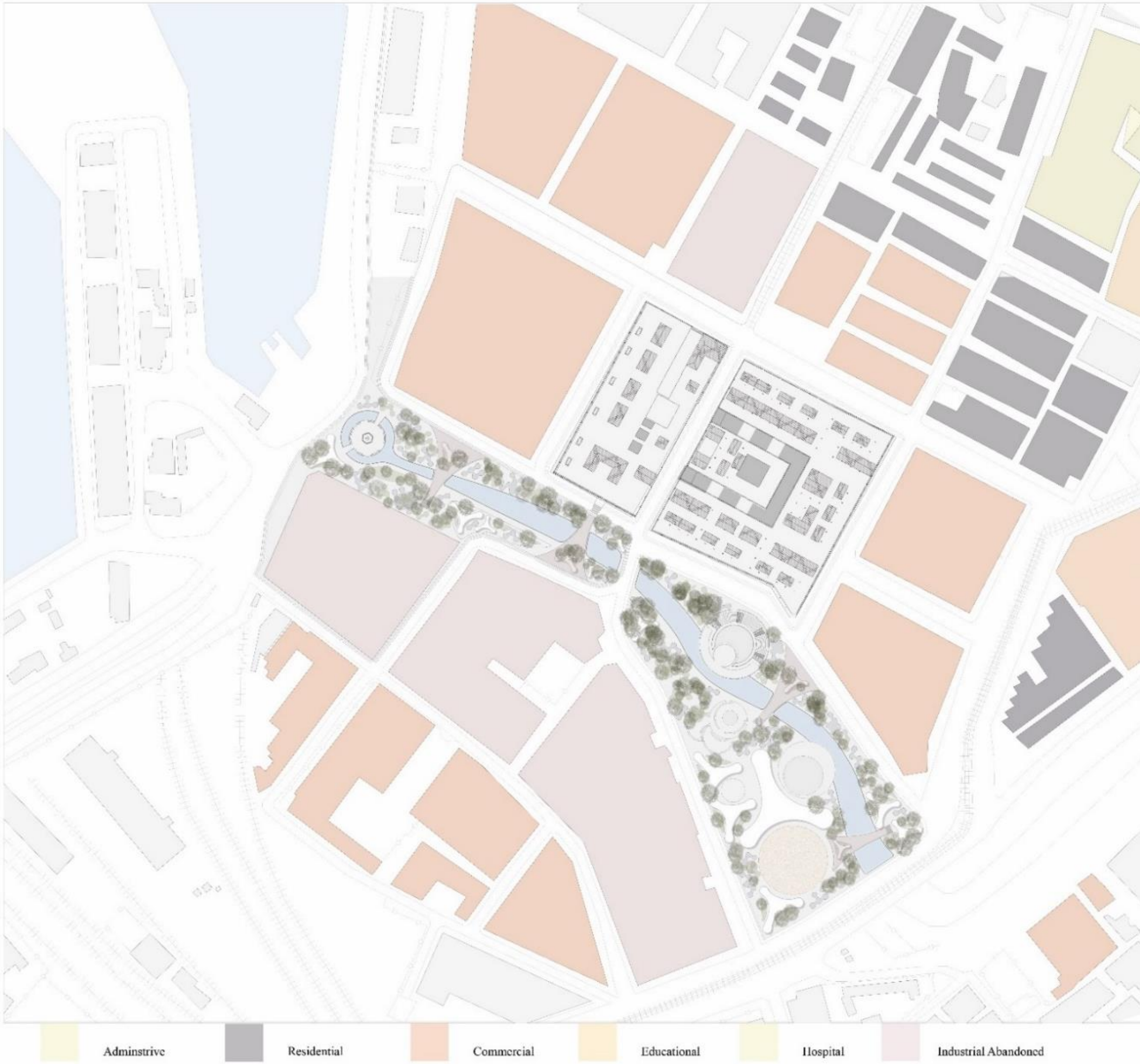

Adminstrive
Residential
Commercial
Educational
Hospital
Industrial Abandoned

Fig.7.89.

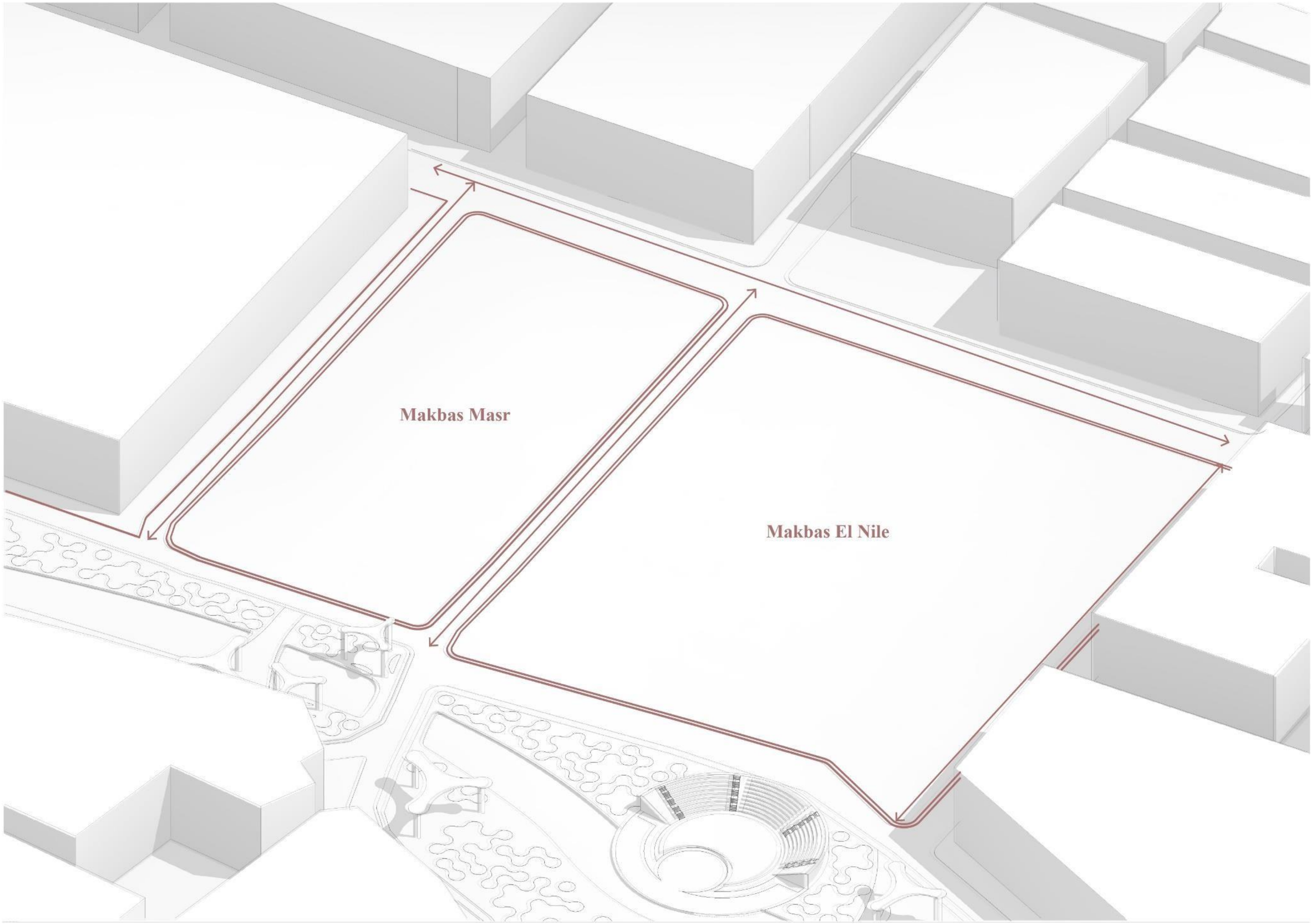


Fig.7.90. Architectural Strategy for Main Road Access and Its Relationship with SurroundingBuildings and its integration within the Urban Site Development. (Elaborated by author)

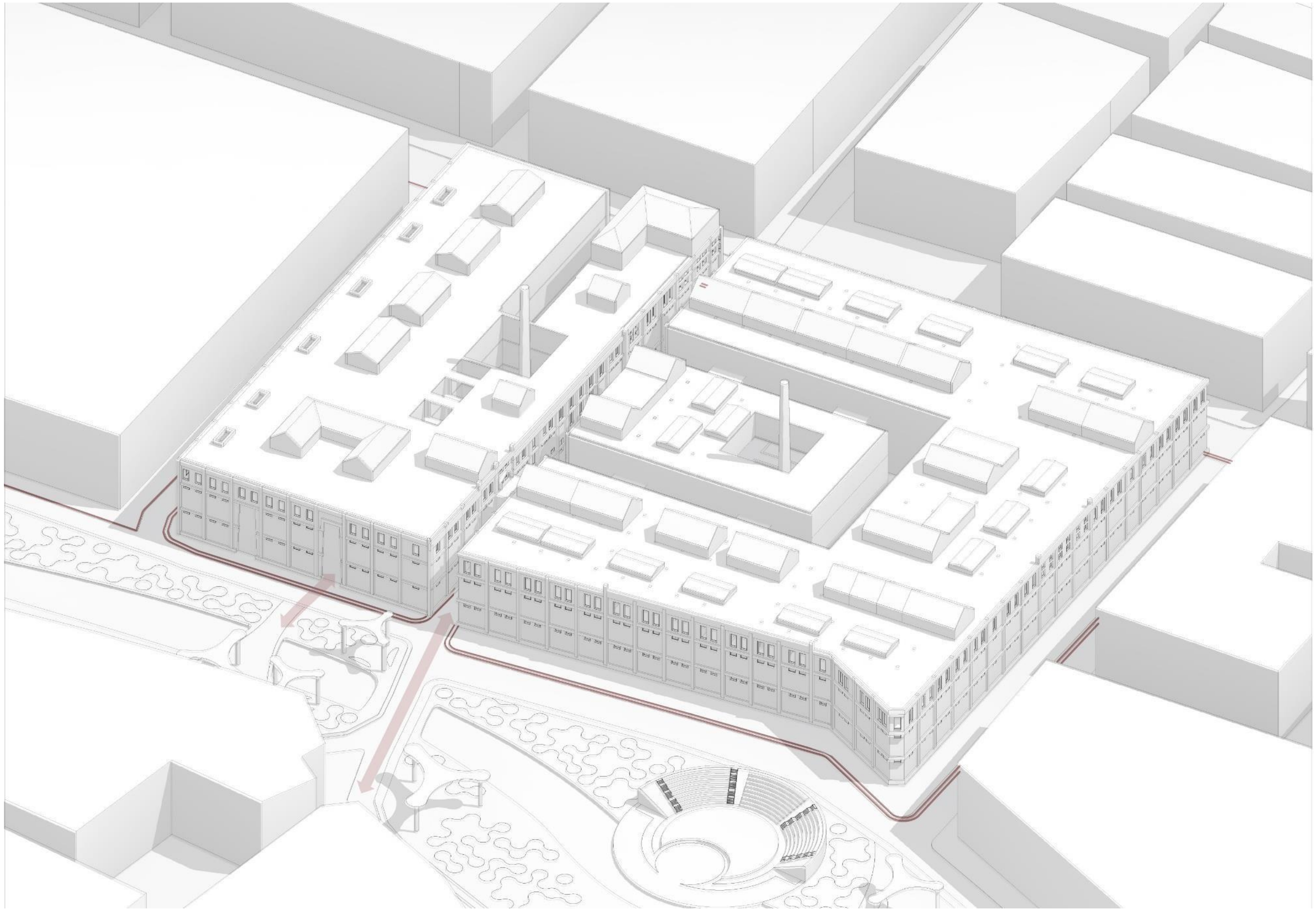
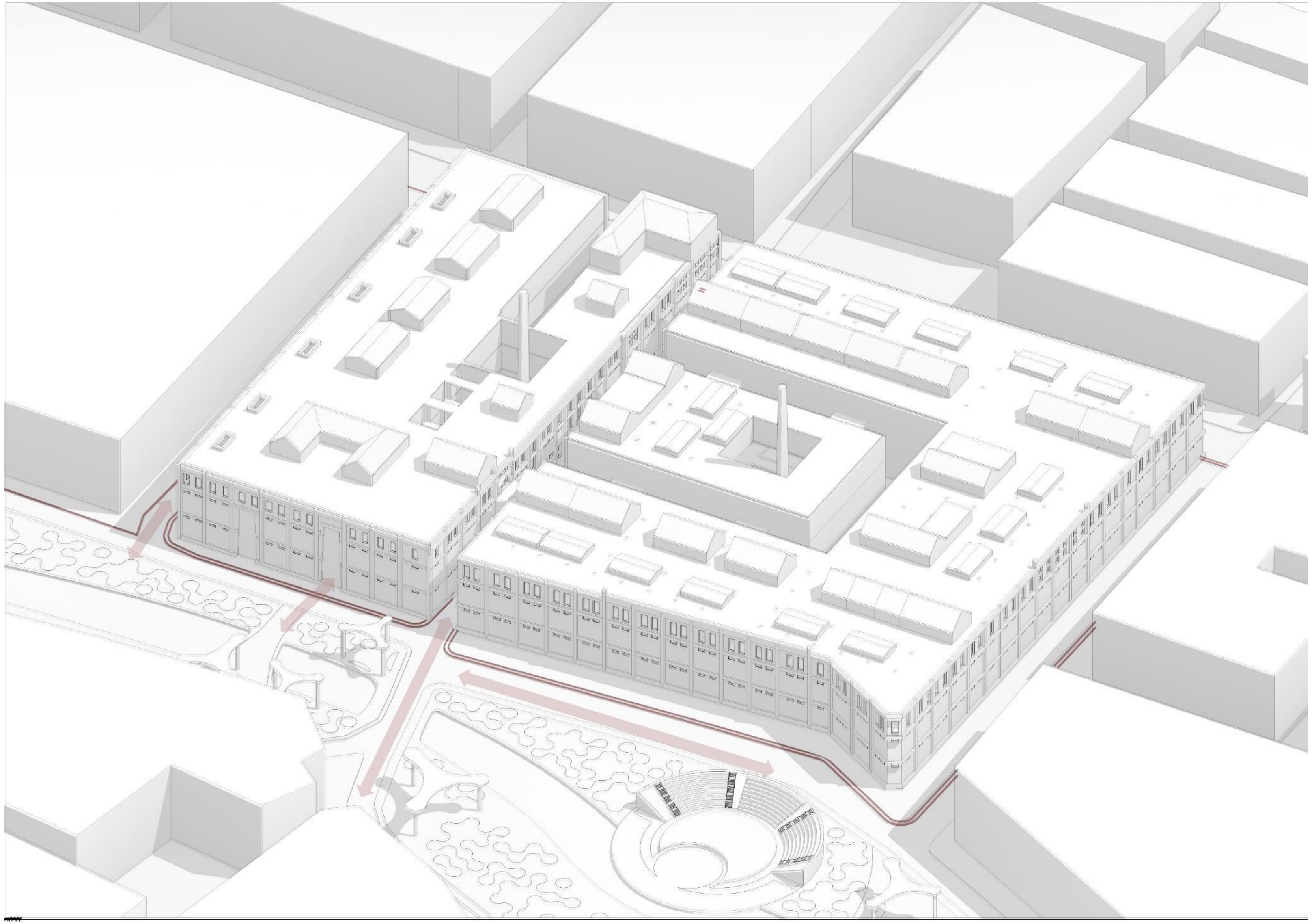


Fig.7.91. Three-Dimensional Analysis of the optimizing Pedestrian Connectivity in Urban Environments: Integratinga Bridge for Access to Provide a Road Closure for Pedestrian and Student Use (Elaborated by author)



F ig.7.92. The 3D Structural Urban plan of the Pedestrian Walkway during Market Day. (Elaborated by author)

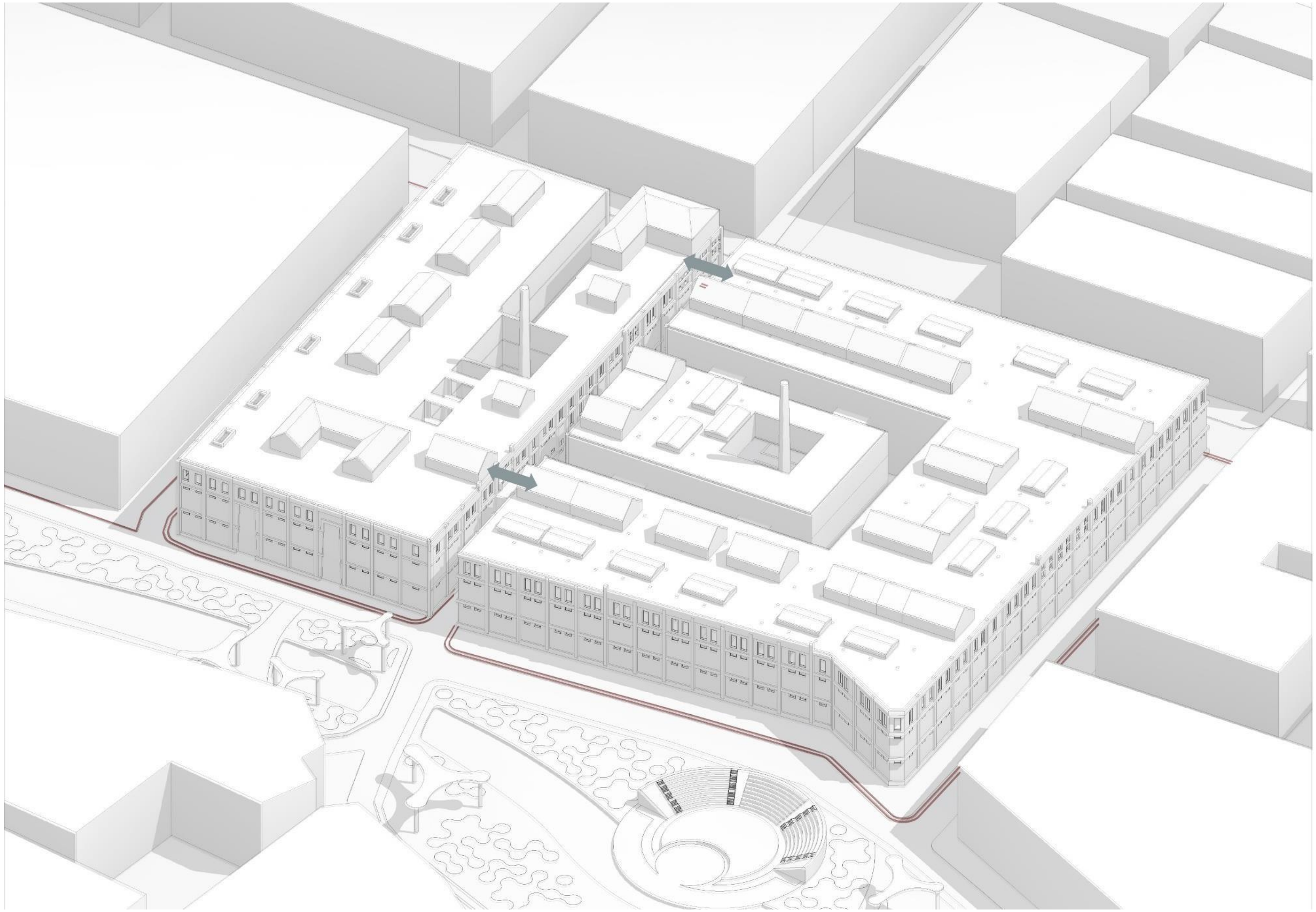
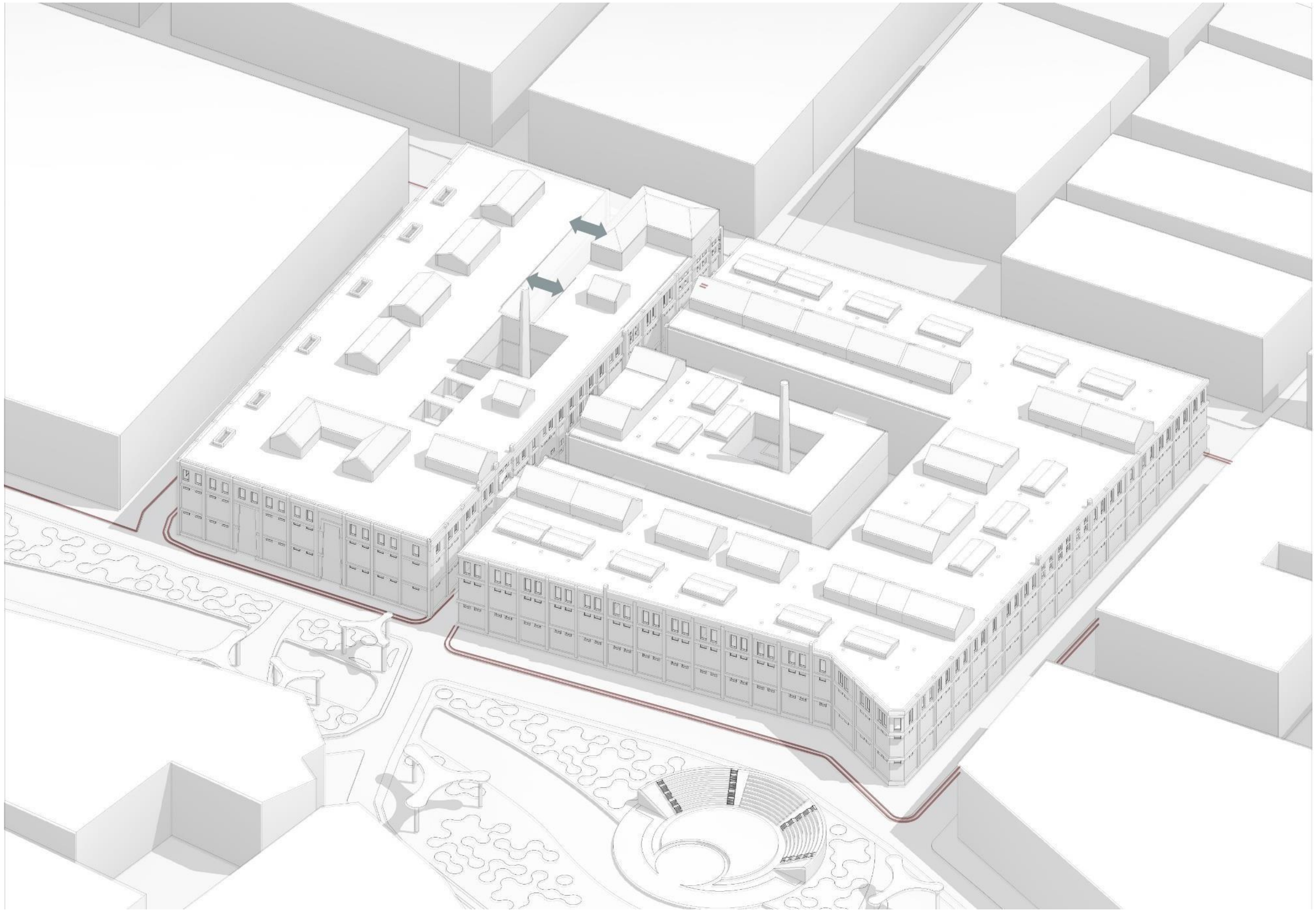


Fig.7.93. Buildings Connectivity and Spatial Integration in their Surrounding Urban Environment (Elaborated by author)

Fig.7.94. **Design and**



Implementation of a Pedestrian Bridge for Closure of Open Space to Enhance Building Connectivity in Urban Environments. (Elaborated by author)

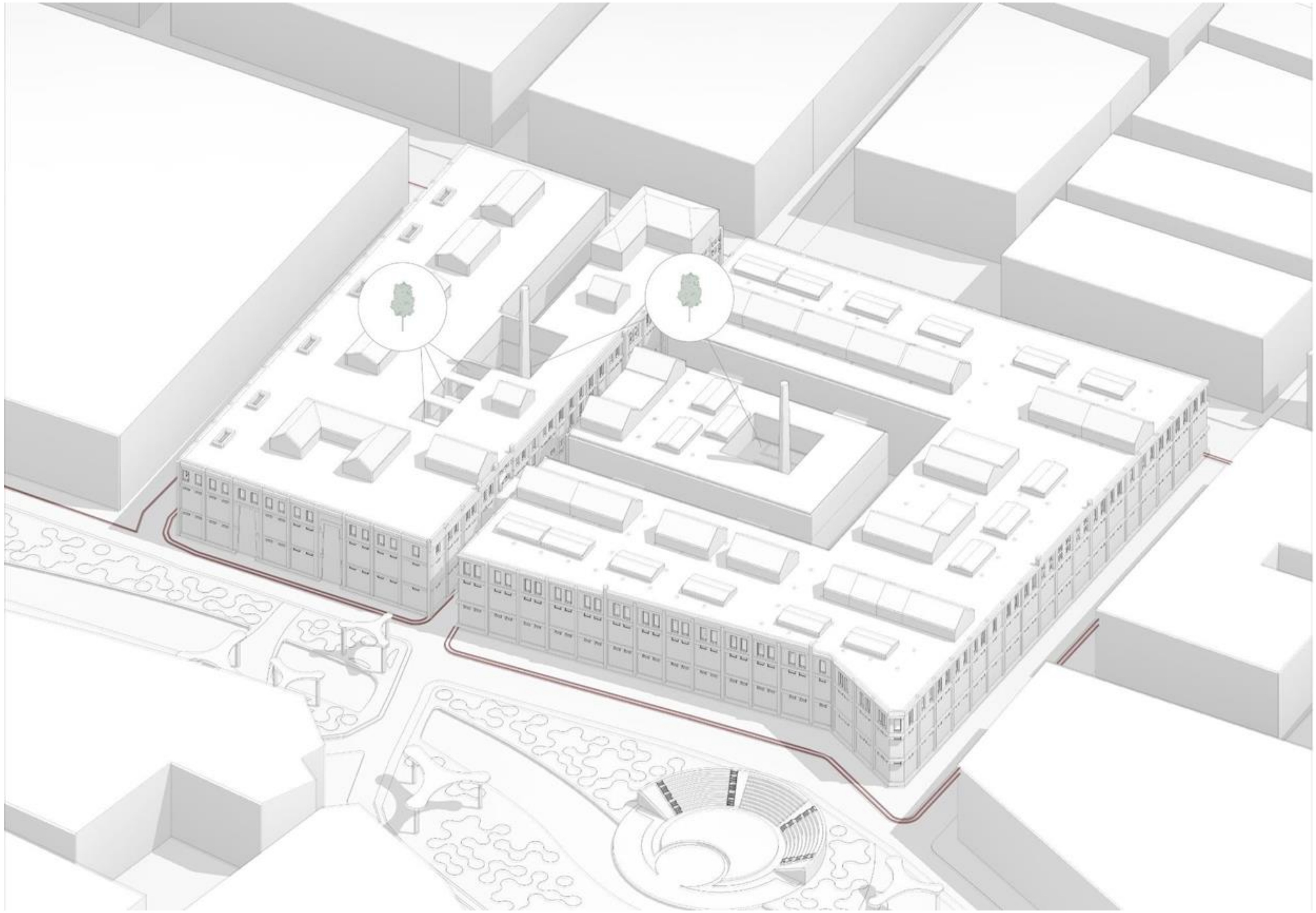


Fig.7.95. Integration of Open Green Spaces within Building Architectural Frameworks: Utilizing Chimney Areas for Enhanced Environmental Design. (Elaborated by author)

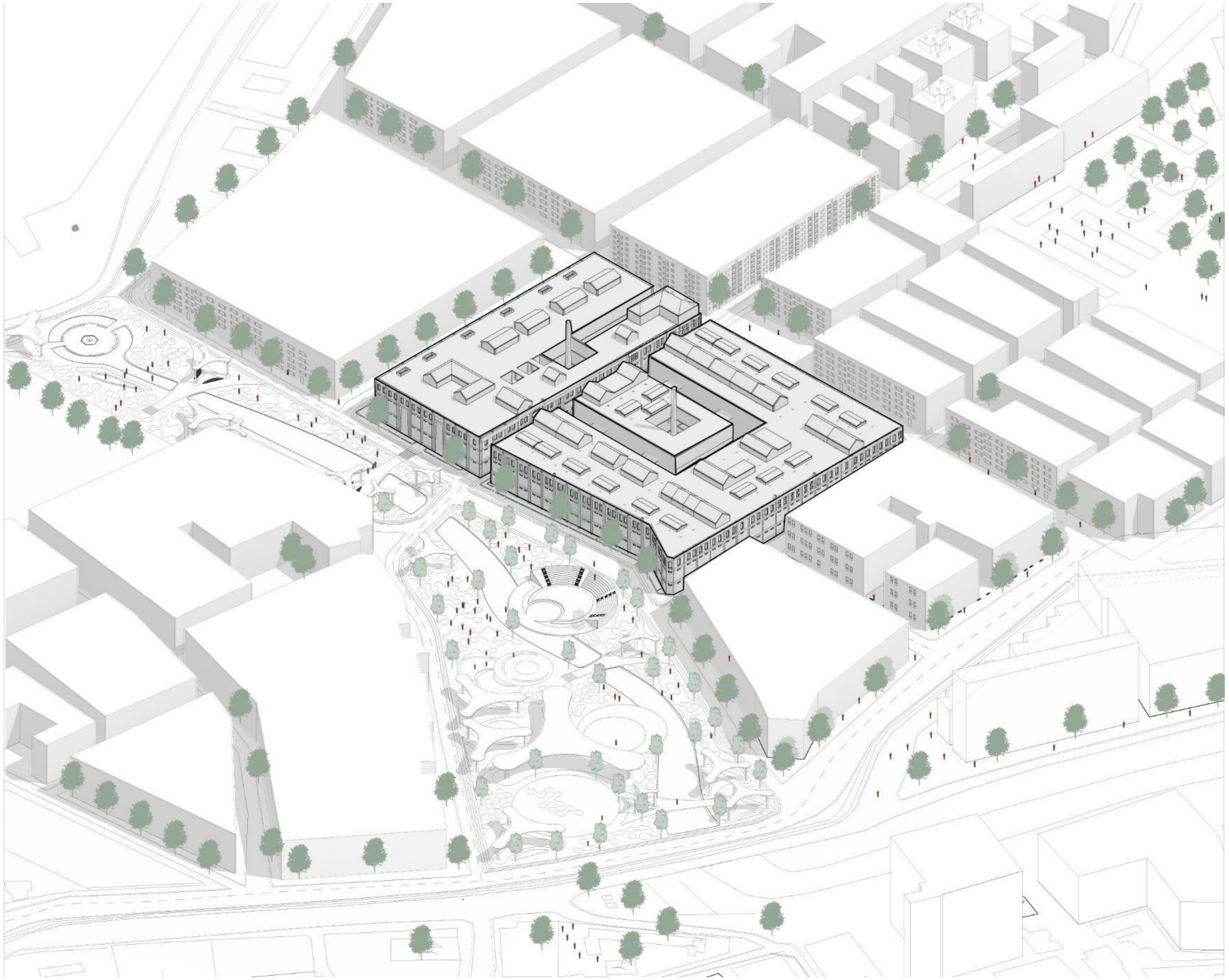
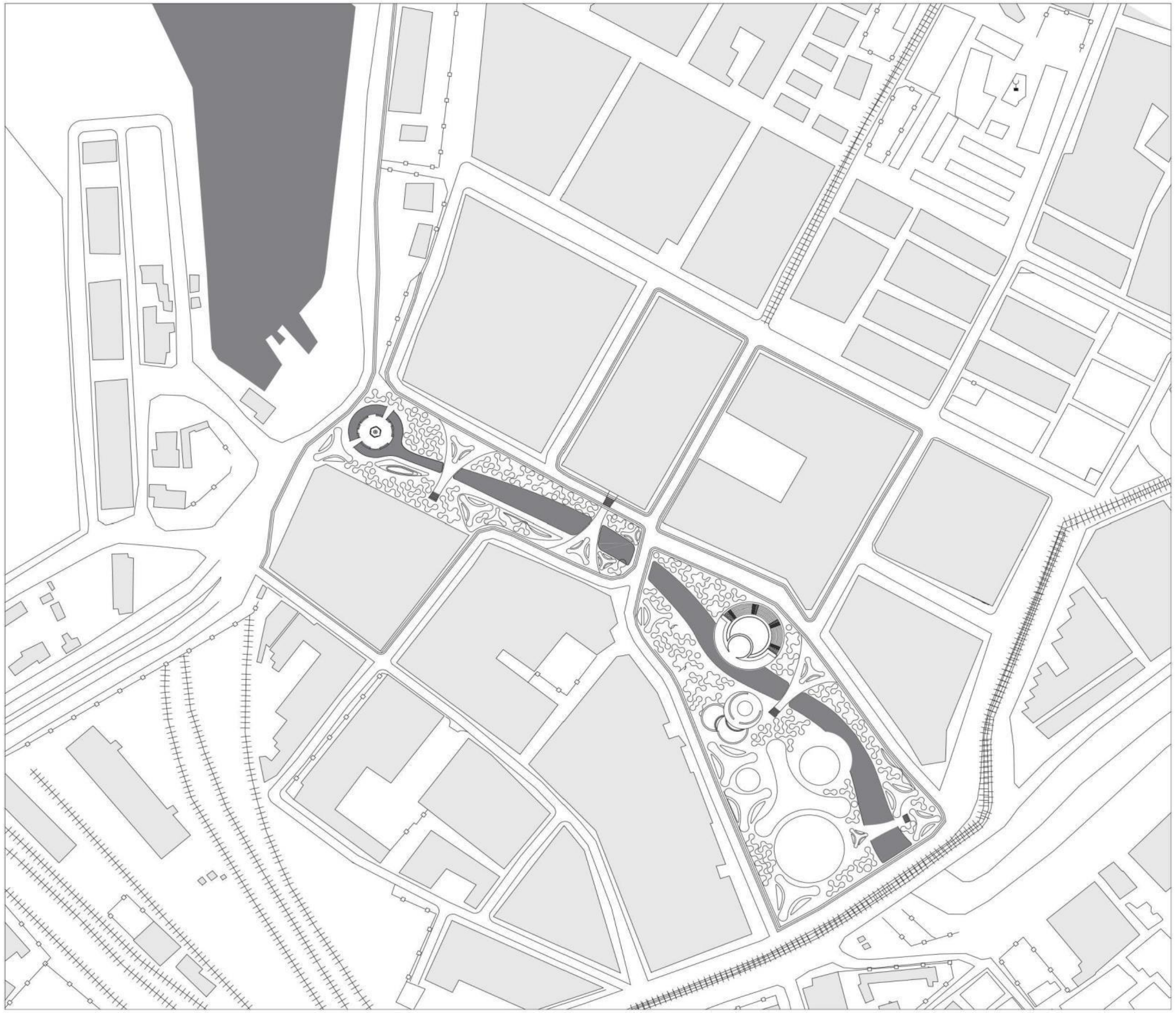


Fig.7. 96. Isometric Analysis of Proposed Urban Development: Integrating Accessibility and Pedestrian Connectivity (Elaborated by author)



F i g .7.97. New Site Design and Implementation. (Elaborated by the author)

Overview of the New Site Design

1. Integration of Bridges: The addition of bridges over the canal not only improves connectivity between different parts of the community but also facilitates easier access across previously separated areas. The bridges are designed to be visually appealing and in harmony with the surrounding environment, potentially acting as landmarks within the community, adding to the district's identity and aesthetic character.
2. Preservation of Existing Trees: ensures continuity in the landscape's natural heritage and provides essential greenery, which improves air quality and offers shaded areas.

3- Increasing in greenery areas serve as carbon sinks, helping mitigate urban heat island effects. Parks and green areas also provide community members with spaces for recreation and relaxation.

4. Shading Elements: The introduction of shading elements is crucial for climate control, making outdoor spaces more comfortable and usable throughout the year. They likely serve multiple functions, providing shelter for vendors during market days and adaptable spaces for community events and social gatherings.
5. Market and Event spaces: The areas are likely designed to be flexible, capable of hosting a variety of events and adapting to different community needs, from markets to public celebrations.

By preserving natural elements and incorporating new, multifunctional structures, the new site design developed a space that caters to the diverse needs of its residents and visitors, fostering a sense of belonging and community ownership.

Fig.7.98. New Site Design and Implementation + Functions (Elaborated by the author)

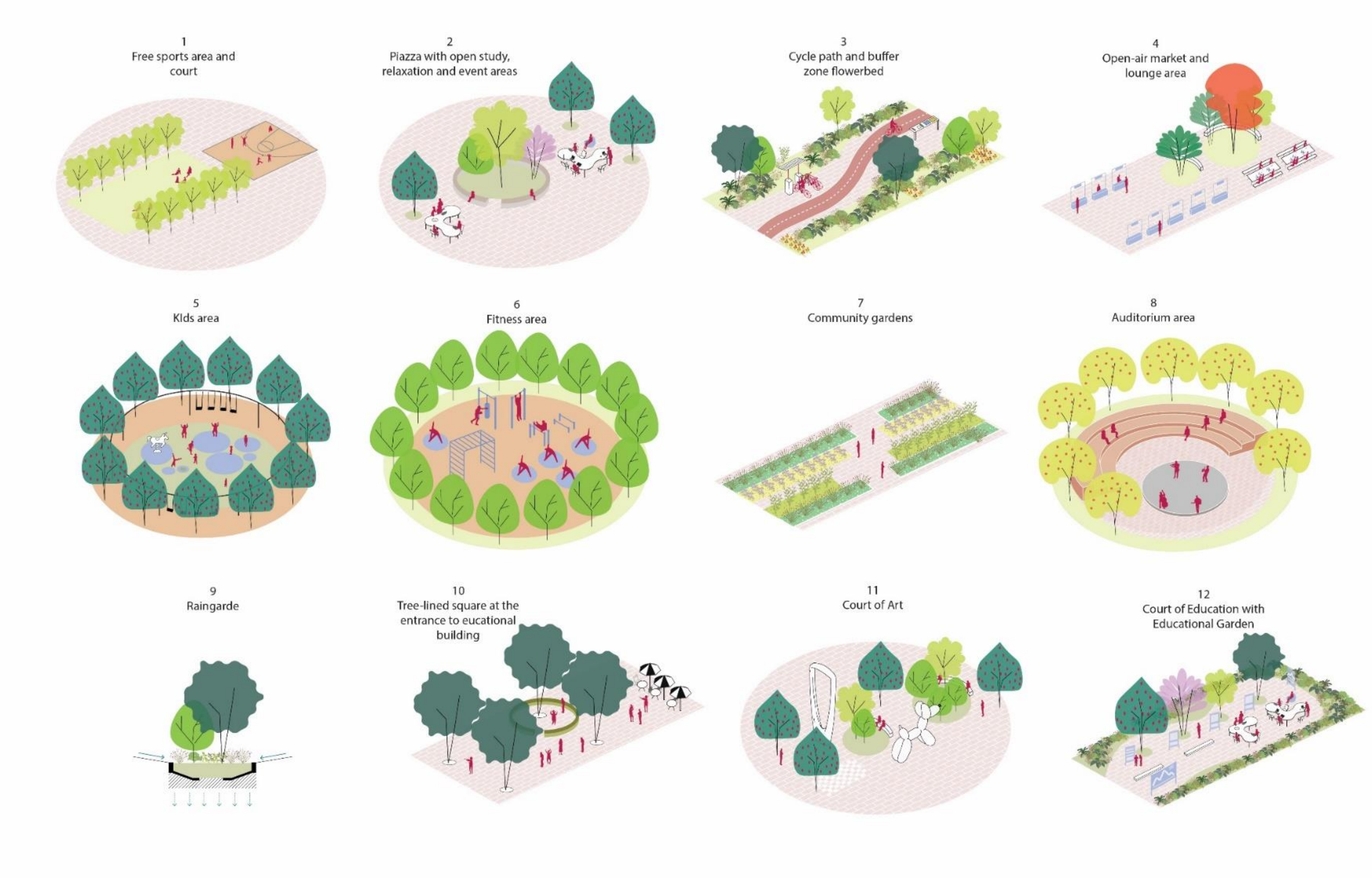


Fig.7.

99. New Site Design and Function Implementation. (Elaborated by the author)

Fig.7.100. New Site Design and Implementation (Elaborated by author)

Reconfigurations for Educational and Naval Construction Objectives

Demolished Walls (Yellow color);

The elimination of specific walls enables the formation of expansive, open-plan environments essential for educational facilities such as classrooms, workshops, and lecture halls, as well as for practical shipbuilding operations that necessitate ample space for equipment and mobility.

Expansive open areas facilitate improved accessibility for all individuals, including those with impairments, and augment safety by minimizing congestion and offering clearer evacuation pathways.

The elimination of some interior walls can provide greater natural light penetration and enhanced air circulation within the structure,fostering a more enjoyable and sustainable atmosphere.

New Structures (red color):

New structures will likely be incorporated to accommodate unique purposes necessitated by the new design, including additional mechanical rooms, offices, or specialized production zones. Laboratories for material testing, design studios, and technologically equippedclassrooms that facilitate specialized teaching programs in naval architecture and marine engineering.

New developments may include the incorporation of sophisticated infrastructure essential for shipbuilding operations, such as overhead cranes, expansive doors for transporting ship pieces.

Integrating new windows to optimize natural light and ventilation.

The incorporation of additional walls and curtains is essential for delineating specific sections within the expansive open spaces of structures. These could facilitate the establishment of distinct zones for various activities, like educational workshops, exhibition areas, or administrative offices, ensuring requisite separation and structure inside the facility.

Additional walls can mitigate noise and obstruct visual distractions, fostering conditions that are more favorable for learning and concentrated tasks.

Partitions assist in regulating pedestrian movement, directing visitors and personnel to specified locations while ensuringthe security of operational or sensitive zones.

The new walls may also integrate modern utilities like as electrical and data cables, HVAC systems, and plumbing, discreetly buried inside the structures to preserve aesthetic integrity while delivering essential services and which cannotbe attainable with the current situations.

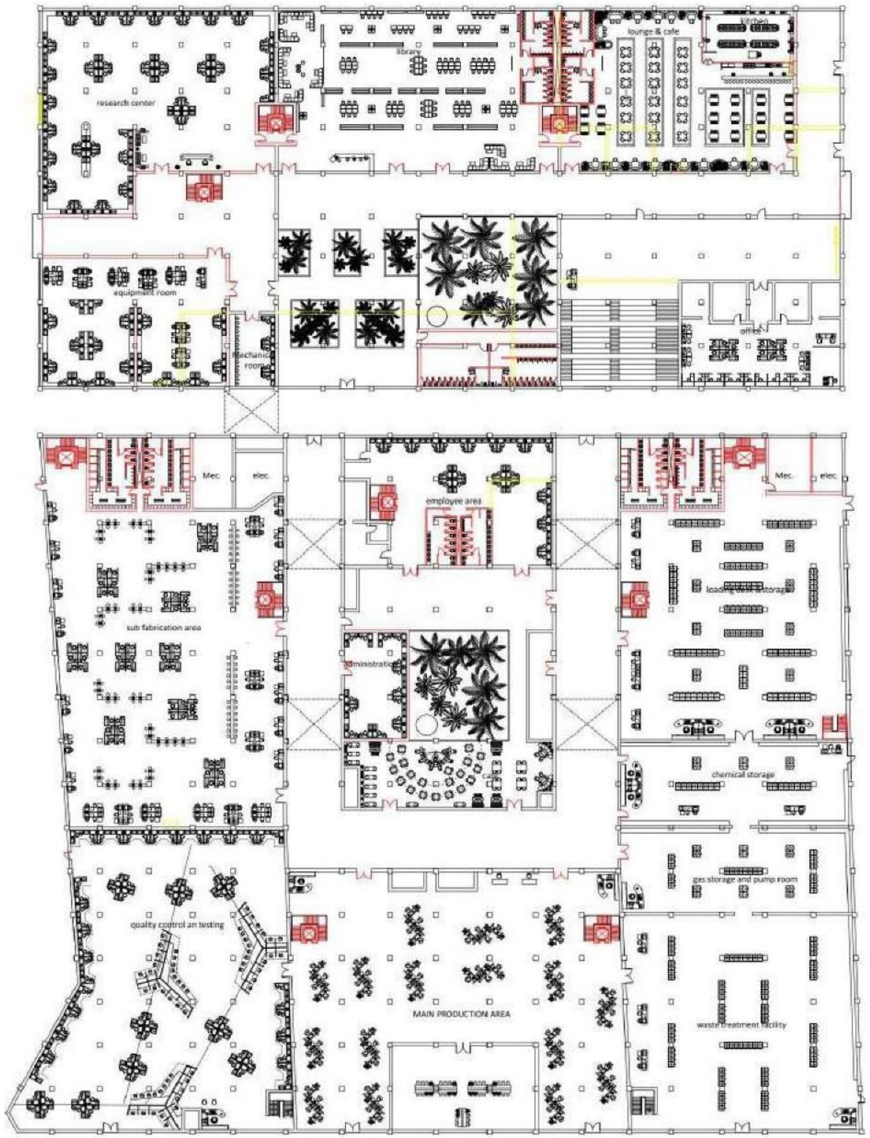
Certain additional partitions may be engineered to be movable or modular, facilitating the reconfiguration of spaces as requirements evolve over time.

-These new constructions are likely non-load-bearing. The selected materials for the new walls likely reconcile endurance with aesthetics, such glass, polished concrete, or wood, utilized not only for their utilitarian attributes but also to elevate the interior design.

The *redevelopment* initiatives for Makbas Masr and Makbas El-Nile exhibit a strategic methodology. The design of each floor is customized to meet its own functional needs, exhibiting a clear transition from publicly accessible areas on the ground floor to more specialized and regulated spaces on the upper floors. This guarantees that each level effectively facilitates its designated purpose, ranging from community participation and general education on the lower levels to specialized research and production operations on the upper floors.

Partitions gradually increased from the ground up, with the first floor featuring the fewest and the second floor the ost, corresponding to the seclusion and control required for technical and specialized operations on the upper levels.

Corridors and Passageways are positioned to enhance pedestrian traffic flow and accessibility, with a focus on safety and efficiency. The ground floor emphasizes wider, more open corridors to facilitate public and community engagements, whereas the upper floors include restricted access pathways appropriate for staff and students participating in specialized activitie

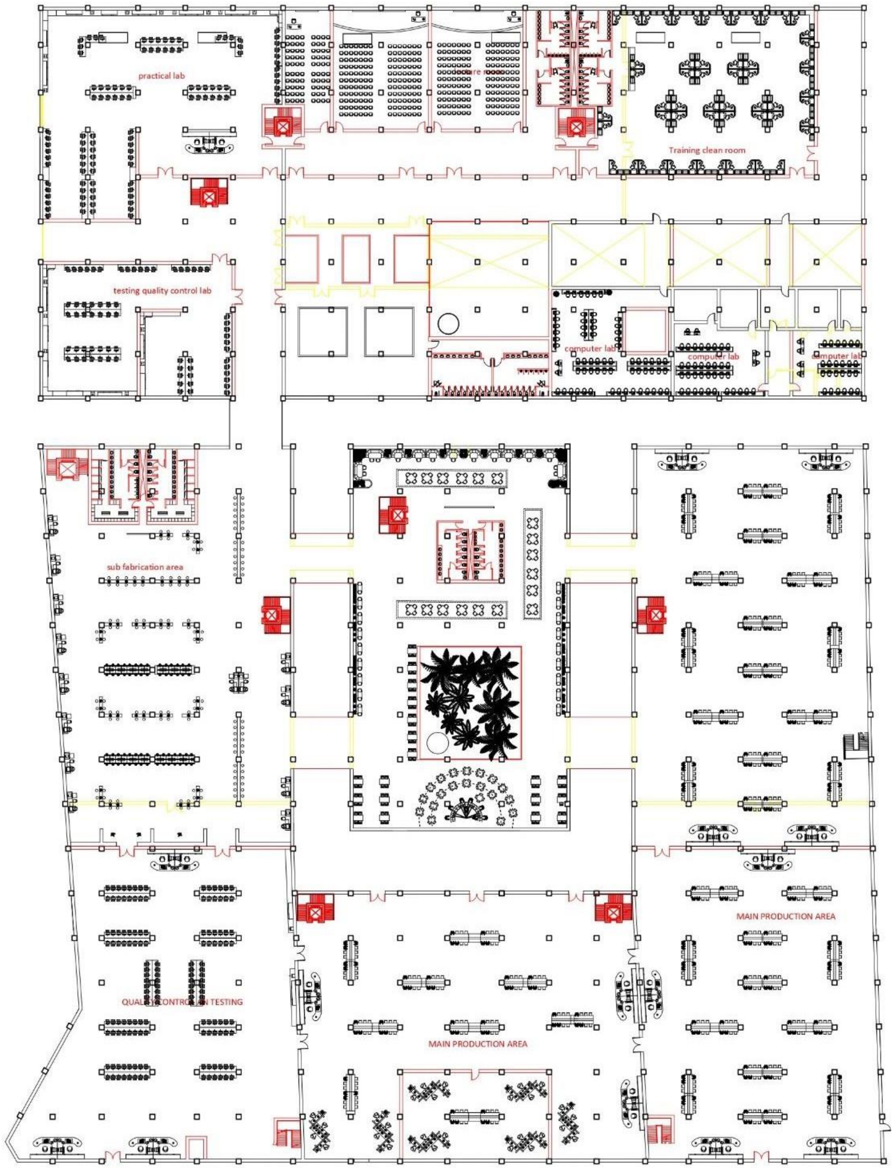


Demolished
New

Fig.7.101. Ground Floor of both Makbas Masr and Makbas El- Nile (Elaborated by author)

Details of the Ground Floor

- The bottom floor renovation of Makbas Masr and Makbas El-Nile by demolition of some structures and the meticulous addition of new ones designed to optimize the buildings for their revised functions, augmenting their utility and accessibility while safeguarding their architectural with practical shipbuilding zones, promoting a smooth transition from theoretical study to practical application.
- Entrances, corridors, and communal spaces are reconfigured to facilitate substantial foot circulation, guaranteeing seamless transitions between various zones while adhering to accessibility regulations.
- In publicly accessible spaces, such as exhibitions or community gatherings, flexible walls like curtains can be employed to modify the environment for various events without necessitating permanent structural alterations.
- The antiquated plans, owing to their industrial character, have restricted public access and lacked multi-use adaptability, prioritizing operational efficiencyfor industrial functions.
- The new designs exhibit a shift towards open and multifunctional spaces, which are more versatile for many applications, including educational institutions, public gatherings, and cultural activities, while also improving natural light and overall building circulation.
- The alteration of internal walls is conducted based on structural analysis to guarantee building stability while tolerating changing load distributions and usage patterns.
- Contemporary infrastructural enhancements such as upgraded HVAC systems, improved lighting, and augmented safety protocols, which are essential for public edifices will be carried out.
- The selection of materials for new constructions in these ancient buildings will reconcile aesthetic factors with utilitarian necessities, such as longevity,maintenance, and compatibility with existing structures.



Demolished
New

Fig.7.102. First Floor of both Makbas Masr and Makbas El- Nile (Elaborated by author)

The designs for the first levels of both Makbas Masr and Makbas El-Nile, illustrating their conversion for educational functions and ship-building activities.

Previous Strategy:

The initial configuration of the first floor featured numerous segmented sections including multiple smaller rooms and limited regions, characteristic ofindustrial use, potentially encompassing storage or delineated workspaces.

The revamped layout in the new strategy:

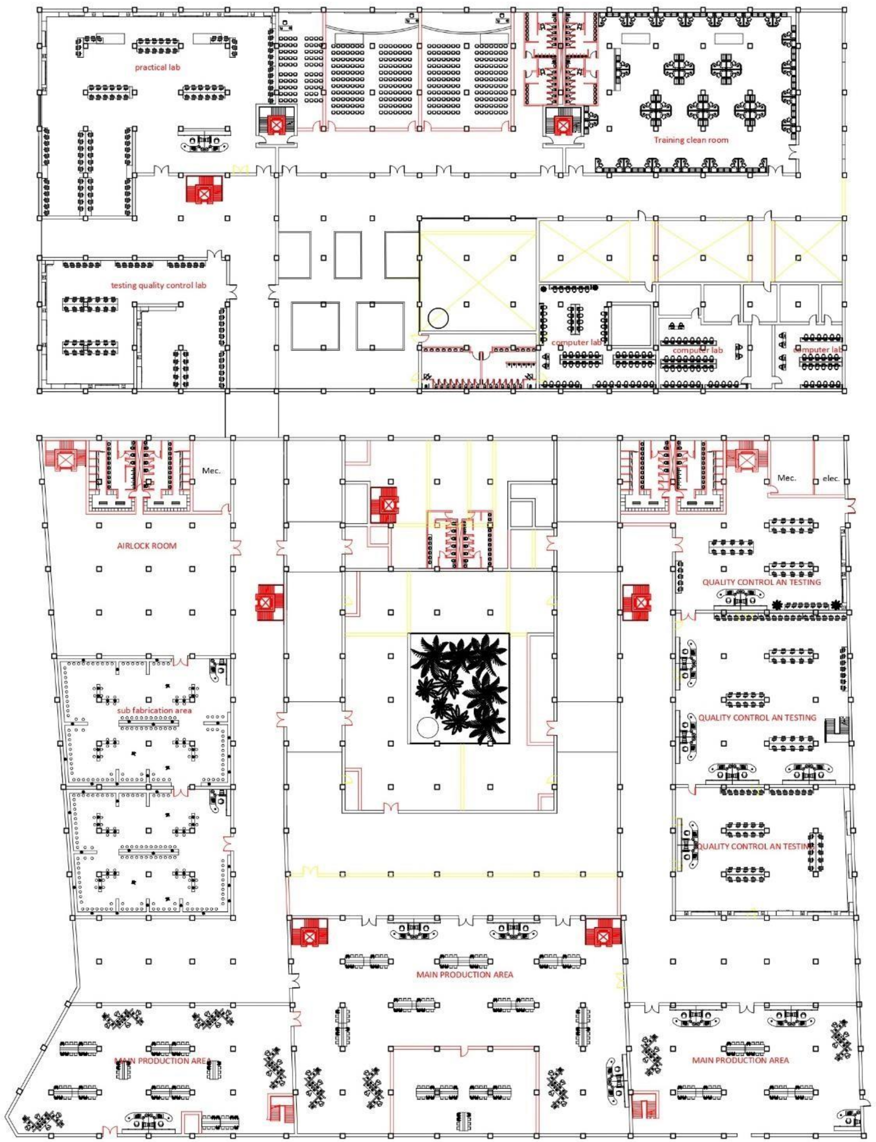
-It features a more open floor plan with reduced partitions, enabling larger, multifunctional areas. This modification benefits educational settings and shipbuilding workshops, where expansive, adaptable areas are essential for many activities includinglectures, collaborative projects, and practical training.

-Enhancements in accessibility are apparent through broader corridors and less impediments, facilitating improved circulation within the structure. This isessential in educational and commercial environments where mobility facilitates an improved user experience and adherence to safety regulations.

-The heightened focus on natural light and enhanced ventilation systems certainly influenced the positioning of new walls and the elimination of existingones. This emphasize environmental sustainability and occupant comfort, which are crucial in educational environments and learning outcomes.

-The new design presumably integrates more sustainable and eco-friendly materials. The utilization of glass for dividers, for instance, optimizes naturallight, hence diminishing energy consumption.

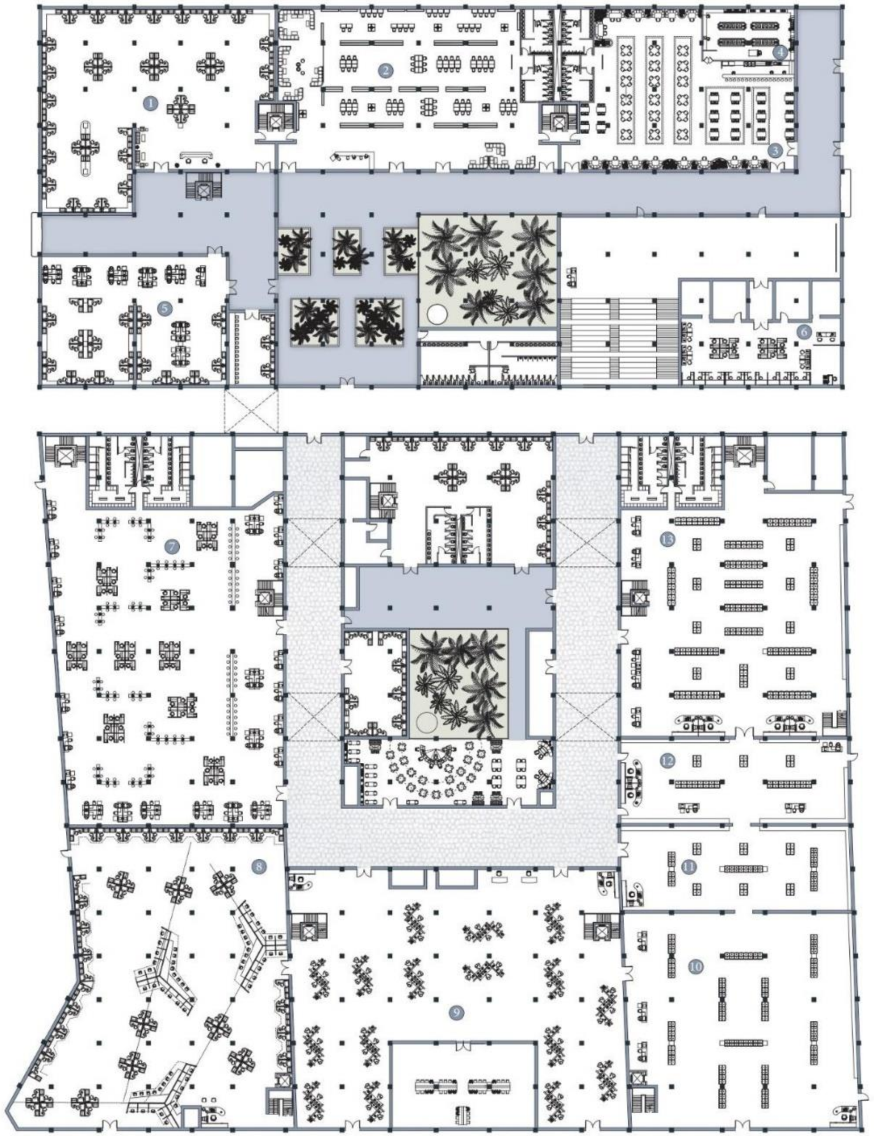
-The deliberate positioning of wall curtains and new barriers likely incorporates acoustic dampening materials and designs to mitigate noise interference,essential for sustaining focus and diminishing machine operating noise in educational environments.



Demolished
New

Fig.7.103. Second Floor of both Makbas Masr and Makbas El- Nile (Elaborated by author)

- Initially, these second floors contained multiple small enclosed spaces designated for particular industrial or storage use for specialist machinery or procedures.
- The new second-floors designs reveal substantial modifications, including removed walls and structures, as well as newly incorporated elements.
- Eliminating walls and other constructions certainly enhances the space, which is essential for contemporary educational facilities and expansive practical areas required in shipbuilding. Open spaces are more versatile for several applications, including expansive classrooms,practical laboratories, or workshops. Moreover they promote improved air circulation and natural illumination, thereby boosting environmental quality and decreasing energy usage.
- The redesign entails recalibrating load distributions and structural integrity to guarantee that new walls and open spaces can uphold the building's safety and functional specifications.
- Materials chosen for new projects must be resilient while also being adaptable to alterations and technological enhancements, including sound proofing in laboratories or fire-resistant materials in manufacturing zones.



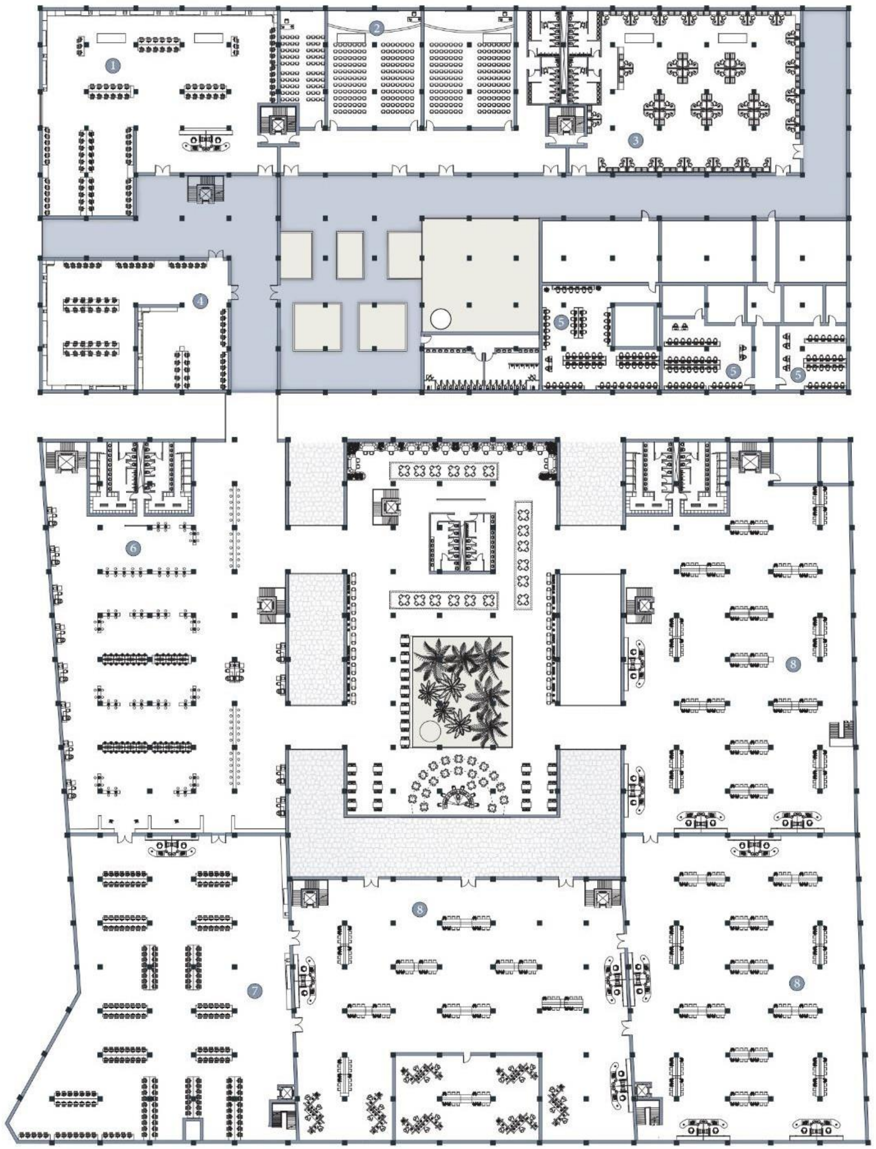
1. Research Center
2. Library
3. Lounge and café
4. Kitchen
5. Equipment room
6. Office
7. Sub-manufacturing area
8. QC inspection
9. Main production area
10. Waste treatment facility
11. Gas storage room and pump
12. Storage of chemicals
13. Loading and storage office

Fig.7.104. Ground floor, scale 1:800

The renovated plans for Makbas Masr and Makbas El-Nile encompass specialized rooms intended to facilitate the changing roles of these structures including:

- A research center for facilitating scholarly and empirical research endeavors, essential for the progression of knowledge in shipbuilding and other disciplines.
- A library: offering resources for education and inquiry. It is centrally located in an accessible area within the building to optimize utilization by all tenants,featuring tranquil, well-illuminated places that facilitate study.
- Lounge and Café: to provide an environment for leisure, fostering a sense of community and promoting mental wellness. It is typically situated with vistas oraccess to outside spaces, promoting utilization throughout the day.
- A kitchen delivering food services to students, workers, and guests.
- Equipment chamber which provides vital operational and maintenance equipment, ensuring the facility operates smoothly. It is positioned strategically to facilitate maintenance workers access without interfering with other operations.
- Office or administrative area which is crucial for the management and operational supervision of the facility.
- Sub-manufacturing zone that facilitates niche or specialized production methods, essential for shipbuilding, training and development. It is outfitted withspecialized machines and tools, engineered for adaptability to various applications.
- Quality Control Inspection area guarantees that all products adhere to established criteria prior to advancing to the subsequent phase of production or marketrelease. It is situated within or adjacent to production zones to optimize processes and reduce the displacement of incomplete products.
- Main Production Zone; the core of the ship production training facility, where significant assembly and building activities are executed. It is expansive,unobstructed area featuring elevated ceilings and durable flooring to support substantial equipment and materials.
- Waste Management Facility essential for environmental adherence and sustainability.

- Gas Storage Facility and Pump to ensure a secure storage for gases utilized in production operations. It is situated away from high-traffic zones to mitigate danger.
- Chemical Storage: the design rationale incorporates spill containment, adequate ventilation, and a strategic location to mitigate risks to adjacent regions.
- Loading and Storage Facility that manages the logistics of commodities entering and exiting the facility, it is adjacent to delivery and shipping zones.



1. Practical lab
2. Lecture room
3. Training clean room
4. Testing quality control lab
5. Computer lab
6. Sub fabrication area
7. Quality control and testing
8. Main production area

Fig.7.105. First floor, scale 1:800

Design of Specific Rooms in this floor level includes:

- Practical Laboratory to facilitate experiential learning, essential in educational environments for the practical application of theoretical concepts, and strategically located for convenient access from lecture halls and computer laboratories.

- Lecture Hall situated adjacent to practical and computer laboratories to provide seamless transitions from lectures to hands-on exercises.

- Training clean room to establish a regulated atmosphere for training in production processes necessary in shipbuilding and where cleanliness is important. It is located next to quality control and testing facilities to enable the prompt application and reinforcement of skills acquired in a regulated environment.

- Quality Control Laboratory Testing guarantees that materials and products conform to established standards. It is also essential in educational environments for instructing quality assurance methodologies. Its proximity to practical laboratories and production zones facilitates the seamless transfer of prototypes and products for testing, optimizing the workflow from production to quality assurance.

- Computer Laboratory to facilitates education related to software applications, simulations, and design, essentials to contemporary ship design and manufacturing.

- Sub-Fabrication Zone focused on limited-scale or component-specific manufacturing activities, facilitating intricate elements of ship building. It is close to primary production zone and quality control laboratories.

- Quality Assurance and Evaluation to assess materials and assembled components, essential for upholding superior standards in ship manufacturing. It is positioned to immediately receive materials from sub-fabrication and major production regions.

- Primary Production Zone for the fabrication of massive ship components or complete assemblies, necessitating considerable space and specialized machinery. It is the most expansive area, strategically positioned to facilitate convenient access from all specialist laboratories and workshops, enhancing the flow of materials and work-in-progress across the space.

- The synergistic design of each area enhances the others, with proximity that reduces unnecessary movement, optimizes production efficiency and creates environments that intimately link theoretical with practical domains, hence equipping students more effectively for real-world difficulties in ship production.

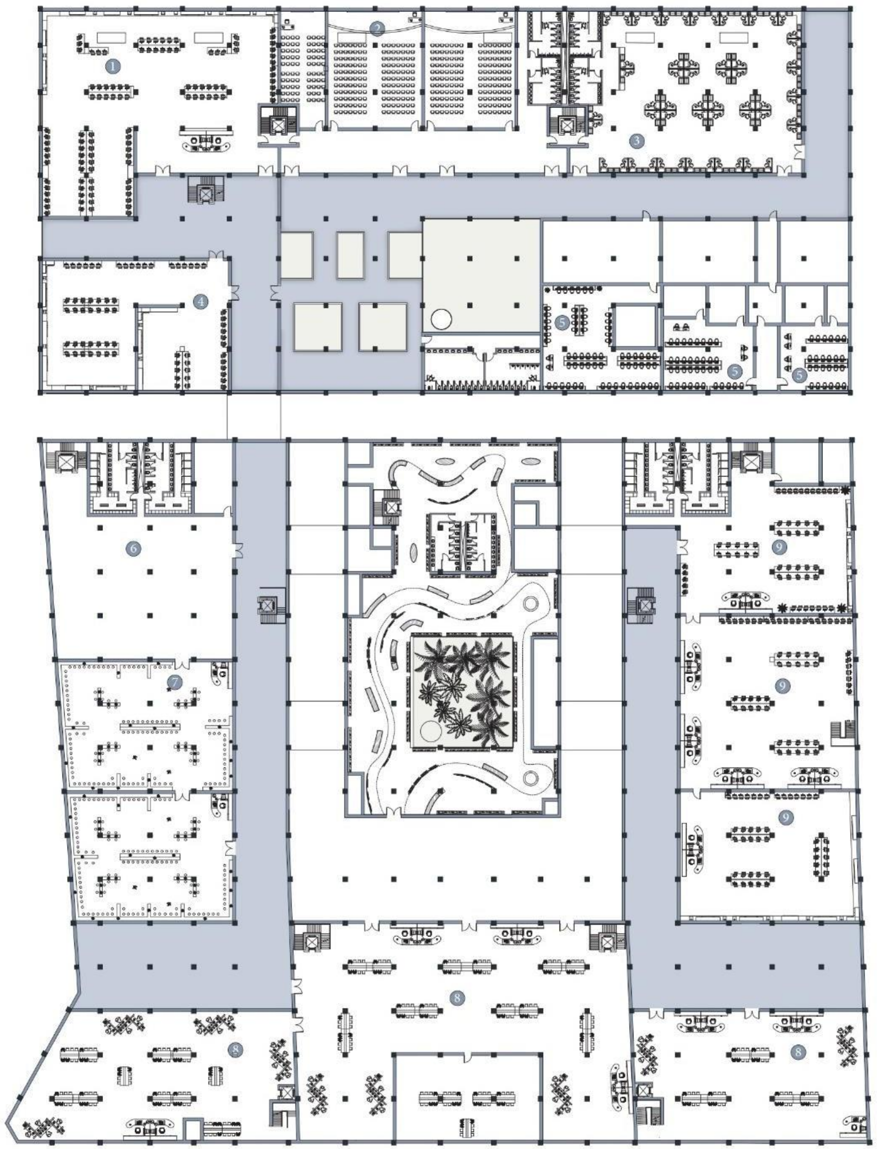
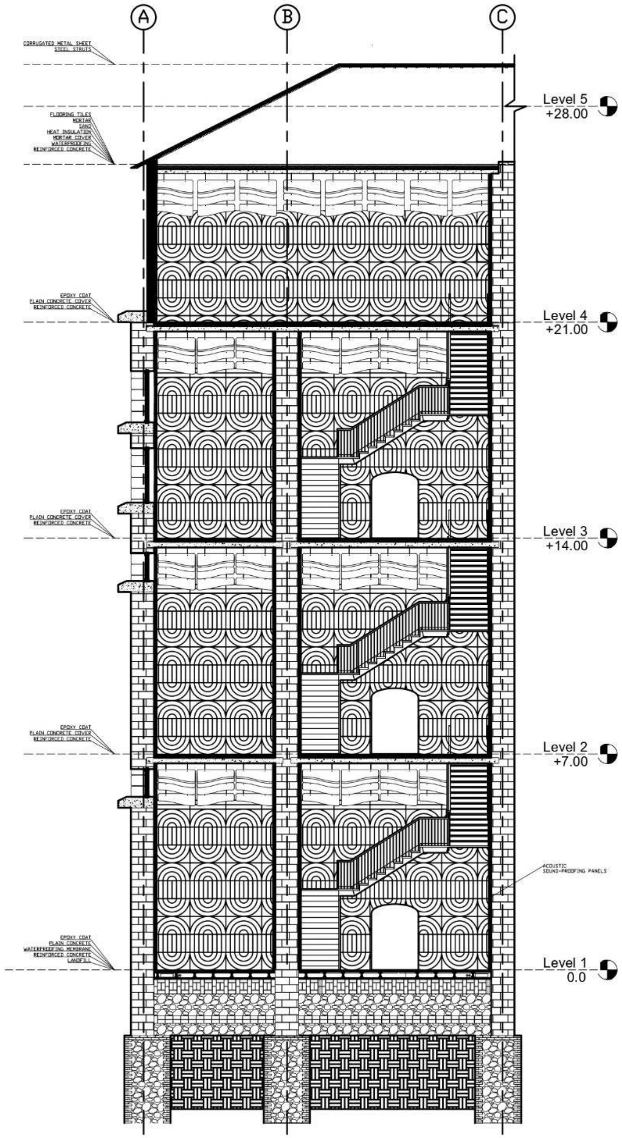


Fig.7.106. Second floor, scale 1:800

Room Description of this floor;

- Lab: to implement theoretical knowledge and augment practical competencies vital for shipbuilding and associated sectors.
- Lecture room: Utilized for delivering lectures and holding seminars, facilitating basic learning and the distribution of theoretical knowledge.
- Training clean room to allow training in a controlled environment to establish a regulated environment for specialized instruction, particularly infields necessitating sterile conditions, such as electronics or materials science.
- Quality Control Laboratory Testing to evaluate materials and assemblies to verify compliance with specified standards. Maintaining good quality in manufacturing outputs is essential and fundamental to the quality assurance learning process.
- Computing Laboratory offering resources for computer-aided design, simulation, and analysis. It facilitates advanced education in design andengineering essential for contemporary shipbuilding and integrating design with production.
- Airlock Chamber: It is crucial for sustaining regulated conditions in laboratories and manufacturing environment. Strategically positioned attransition zones to maintain environmental integrity between sensitive regions.
- Sub-Fabrication Zone: to enable seamless incorporation of components into extensive assemblies.
- Primary Production Zone: A spacious center area designed to facilitate diverse production processes and provide convenient access to ancillary zones.
- Quality Assurance and Evaluation: It guarantees that all procedures adhere to the established quality standards. It aids in instructing students on thesignificance of quality control in manufacturing operations.



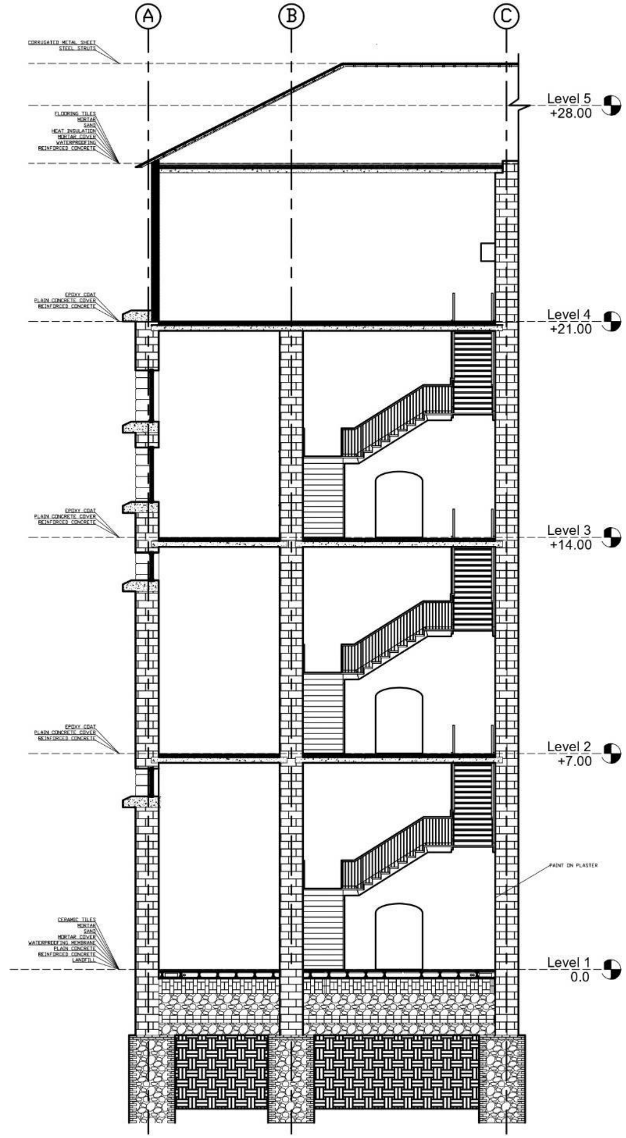


Fig.7. 107. The executive section of the adaptive reuse plan for Makbas Masr and Makbas El-Nile (Elaborated by author)

The executive section of the adaptive reuse strategy for Makbas Masr and Makbas El-Nile:

- It delineates the alterations and enhancements intended to facilitate the buildings' future roles in education and shipbuilding.

- The scientific significance of a comprehensive structural analysis is paramount for the safe adaptation of ancient industrial structures for new applications, especially when accommodating heavy machinery and dynamic stresses, as encountered in shipbuilding. This include evaluating load-bearing capacity, vibration tolerances, and the incorporation of new structural components.Incorporated Structures and Attributes:

* Solar Insulation: To regulate sun gain, to improve thermal comfort within buildings and to mitigate UV damage to interior materials and equipment, essential for sustaining an optimal learning and working environment.

* Epoxy Flooring Application: To provide a robust, resilient furnishing surface appropriate for both academic settings and intensive manufacturing zones. Epoxy-flooring presents numerous benefits:

• It Exhibits resistance to wear, rendering them suitable for high-traffic educational environments and industrial uses.

• It provides a smooth surface that facilitates cleaning, crucial for upholding hygiene and aesthetics in educational environments.

• Able to endure chemicals utilized in shipbuilding procedures.

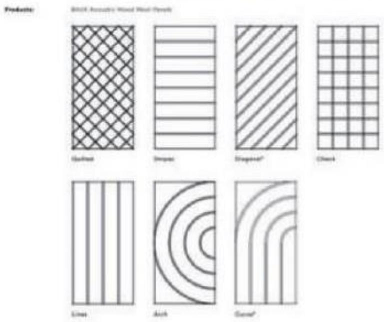
• It offers a slip-resistant surface essential for accident prevention in educational and industrial settings.

The new project strategy sustains protection of the historical and architectural integrity of the structures.

- The preservation of existing structures such as brick walls, original facades, and structural frameworks is crucial for maintaining cultural and architectural legacy.

- Integration of historical components with contemporary modifications was carried out to maintain functionality while preserving the building's integrity. The integration necessitates meticulous material selection and engineering methodologies to guarantee that new components harmonize with existing structures regarding load distribution, thermal expansion coefficients, and aesthetic coherence. This is essential in adaptive reuse projects where the old and new must coexistwithout compromising structural integrity.

2.3.2.1 Acoustic wall panels



Dimensions: **Panels**

Product:	Width: (mm & inch)	Height: (mm & inch)	Thickness: (mm & inch)	Pieces per m2 and sq.ft.
Quilted	1160 mm, 45.7"	580 mm, 22.84"	25 mm, 1.0"	1.49/m2, 0.14/sq.ft.
Stripes	1160 mm, 45.7"	580 mm, 22.84"	25 mm, 1.0"	1.49/m2, 0.14/sq.ft.
Diagonal	1160 mm, 45.7"	580 mm, 22.84"	25 mm, 1.0"	1.49/m2, 0.14/sq.ft.
Check	1160 mm, 45.7"	580 mm, 22.84"	25 mm, 1.0"	1.49/m2, 0.14/sq.ft.
Lines	1160 mm, 45.7"	580 mm, 22.84"	25 mm, 1.0"	1.49/m2, 0.14/sq.ft.
Arch	1160 mm, 45.7"	580 mm, 22.84"	25 mm, 1.0"	1.49/m2, 0.14/sq.ft.
Curve	1160 mm, 45.7"	580 mm, 22.84"	25 mm, 1.0"	1.49/m2, 0.14/sq.ft.

Physical appearance and performance

Physical appearance & performance:

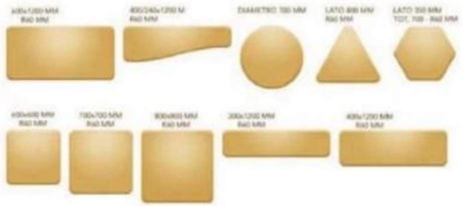
Appearance:	Interior/Exterior wall or ceiling panels	Steam coefficient permeability:	4-5x10-6m2/s
Colours:	Unpainted or painted	Air permeability:	~20 m3/m2hPa
Odour:	None	Light reflection:	Unpainted 43%, White painted 69% (lower for darker colours)
Solubility in water:	None		
Density:	~300kg/m3 (11kg/m2 = 2.25 lbs/ft2 (25mm)	Tensile strength:	0.007 MPa
Dust:	No measurable particle attraction	Compression strength:	0.4 MPa
		Flexural strength:	0.7 MPa
Emissions:	<1µg/m2 x h	Deformation:	4 mm (0.05 MPa pressure), 5mm (0.10 MPa pressure)
Asbestos release:	No content		
Recycled content:	None		
Harmful additives:	None	TVOC emission rate (µg/m2h):	14/33 (unpainted/painted)*
Red list chemicals:	None	VVOC emission rate (µg/m2h):	9?*
Product lifetime:	50 years	SVOC emission rate (µg/m2h):	<2*
Thermal resistance:	RD m2·K/W = 0,294 (25 mm) 0,588 (50 mm) and 0,823 (70 mm)	Formaldehyde (µg/m2h):	<1*
Thermal conductivity:	Average 0,085 W/m°C (25 mm thickness)		
Stability and reactivity:	Stability: Stable; Conditions to avoid: None known		

Source--- https://www.acousticlab.com/wp-content/uploads/2022/12/BAUX-MSDS_Wood-Wool.pdf

Fig.7.108. Walls and Ceilings: Insulation and waterproof measures were used for walls and roofs.

2.3.2.2 ceiling acoustic panel

600 x 600 mm; 700 x 700 mm; 800 x 800 mm; 300 x 1200 mm; 400 x 1200 mm; 600 x 1200 mm; 400/240 x 1200 mm; diametro 700 mm; esagono lato 350 mm; triangolo lato 800 mm.
Spessore 40 mm (tolleranza +/- 2 mm).



Technical Characteristics

Internal coatings

100% pure virgin wool fabric – 75% wool and 25% polyamide fabric – 100% polyester Trevira CS® fabric.
Abrasion resistance:> 50,000 Martindale cycles (± 20%)
Light resistance: EN ISO 105-B02-5
Friction resistance: EN ISO 105-X12 – Wet 4/5 – Sec 5
Flammability: 1 IM UNI 9175 – EN 1021-1: 2006 – EN 1021-2: 2006 – TB 117: 2013 – IMO
Treatments: hydro-oil repellent.

Internal sound-absorbing material

100% polyester fiber (PET), average density 45 kg / m3, Multidensity thermolysis treatment. Available in black, white and grey.

General characteristics: Resistant to chemical agents (acids, salts, hydrocarbons), fungi, bacteria and microorganisms, water-repellent, non-rotting, odorless. Not dangerous substance according to D.M. 02/12/93.
Flammability: UNI EN 13501-1: 2009 B-s2, d0 – It does not emit opaque or toxic fumes (ANFOR F1 16-101).
Sound absorption class "A" according to UNI EN ISO 354: 2003 (highly sound absorbing).

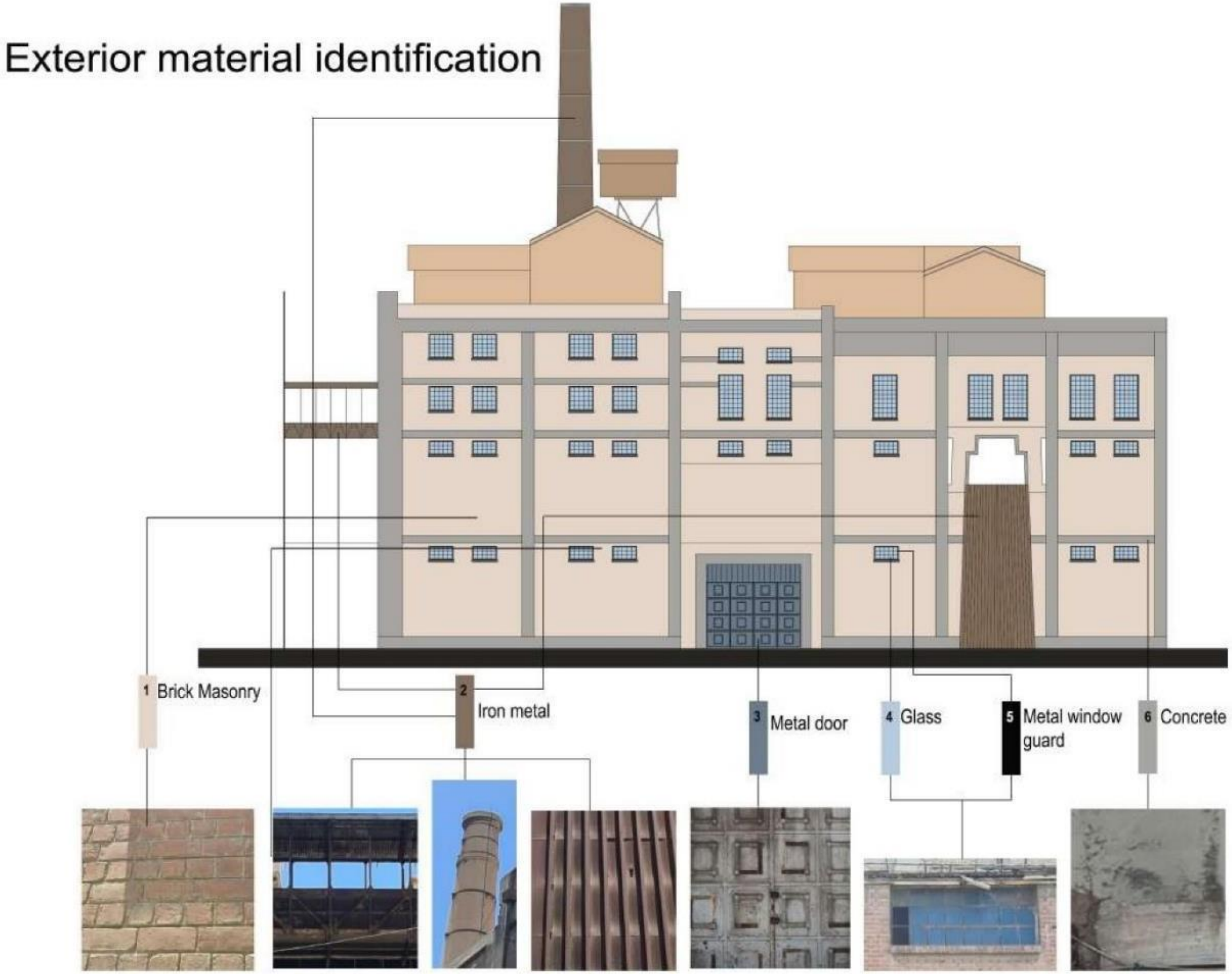


Fig.7.109. Material indication (Elaborated by author)

Fig.7.110. Exterior decay maps (Elaborated by author)

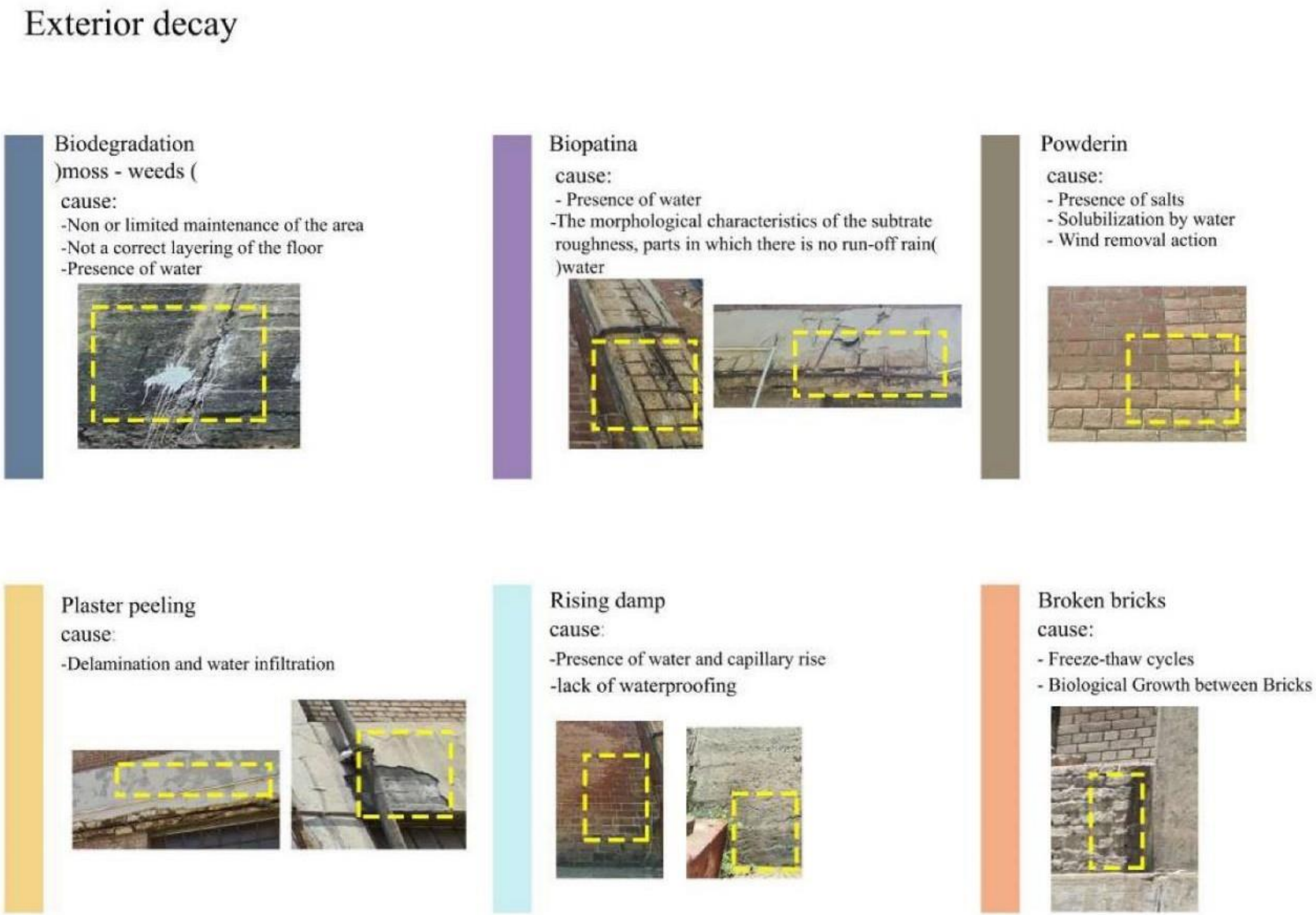


Fig.7.111. Types of decays elaborated by author

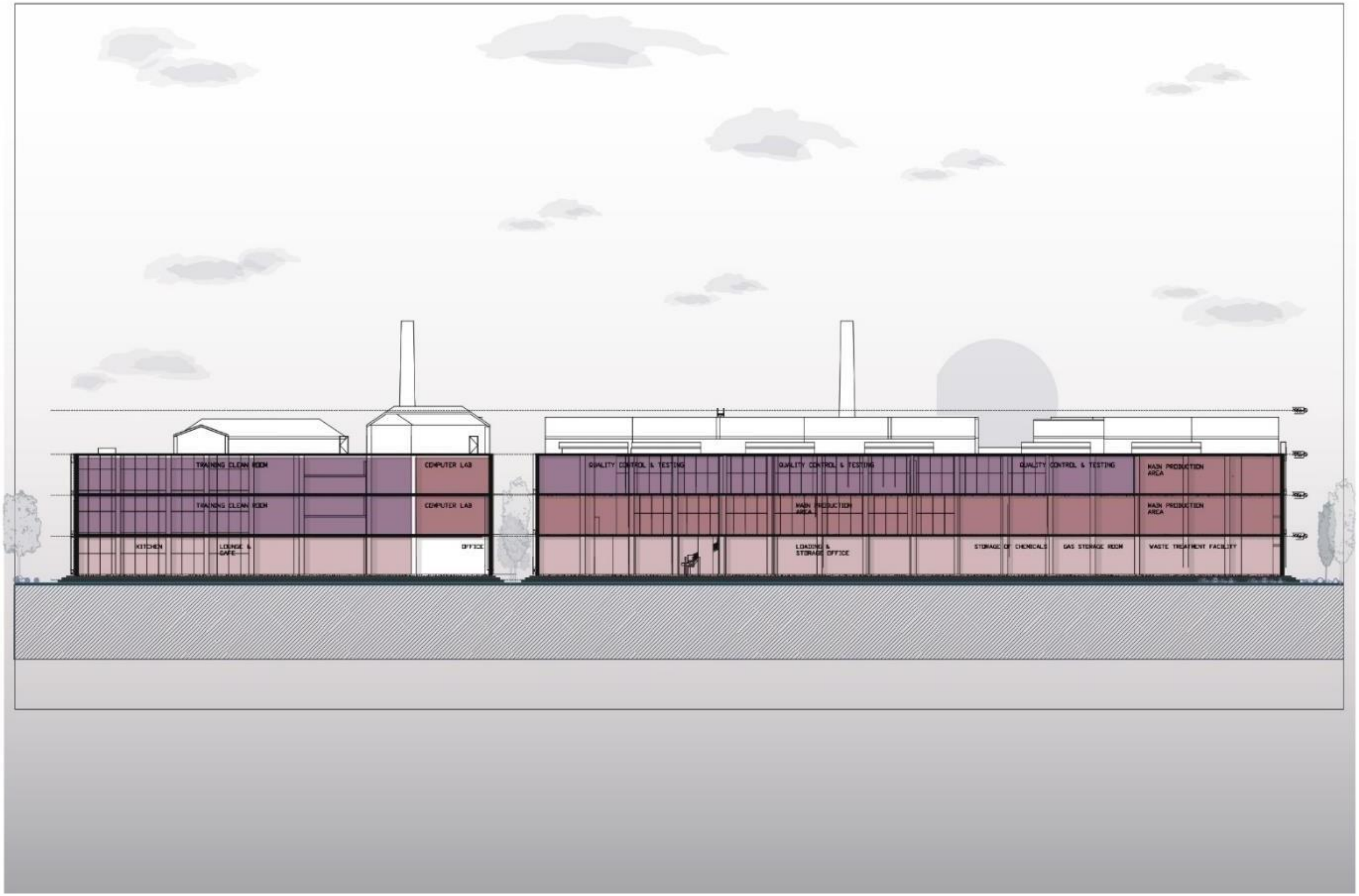


Fig.7.112. Showing building zoning and room function (Elaborated by author)

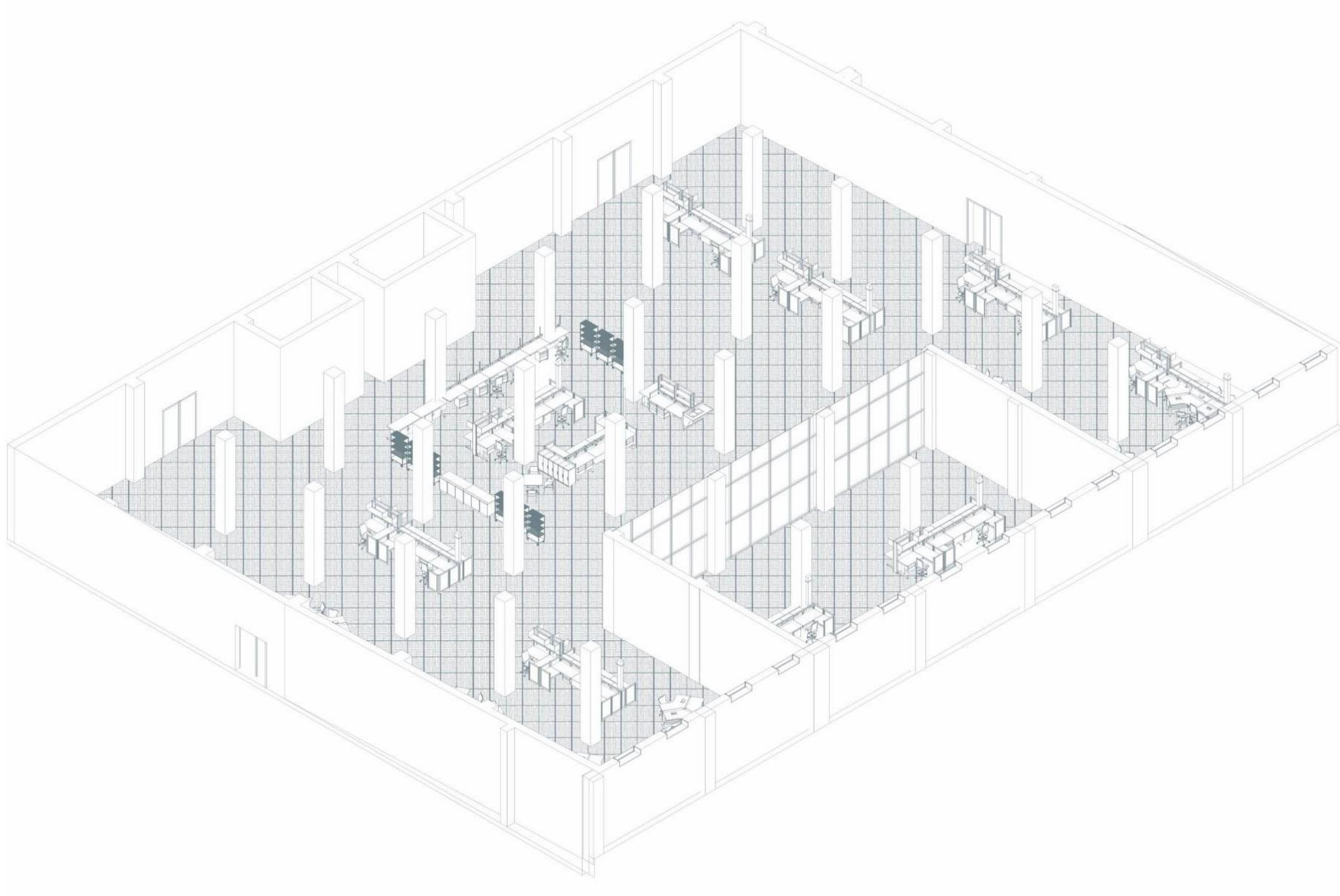


Fig.7.113. Main Production Room (Elaborated by author)

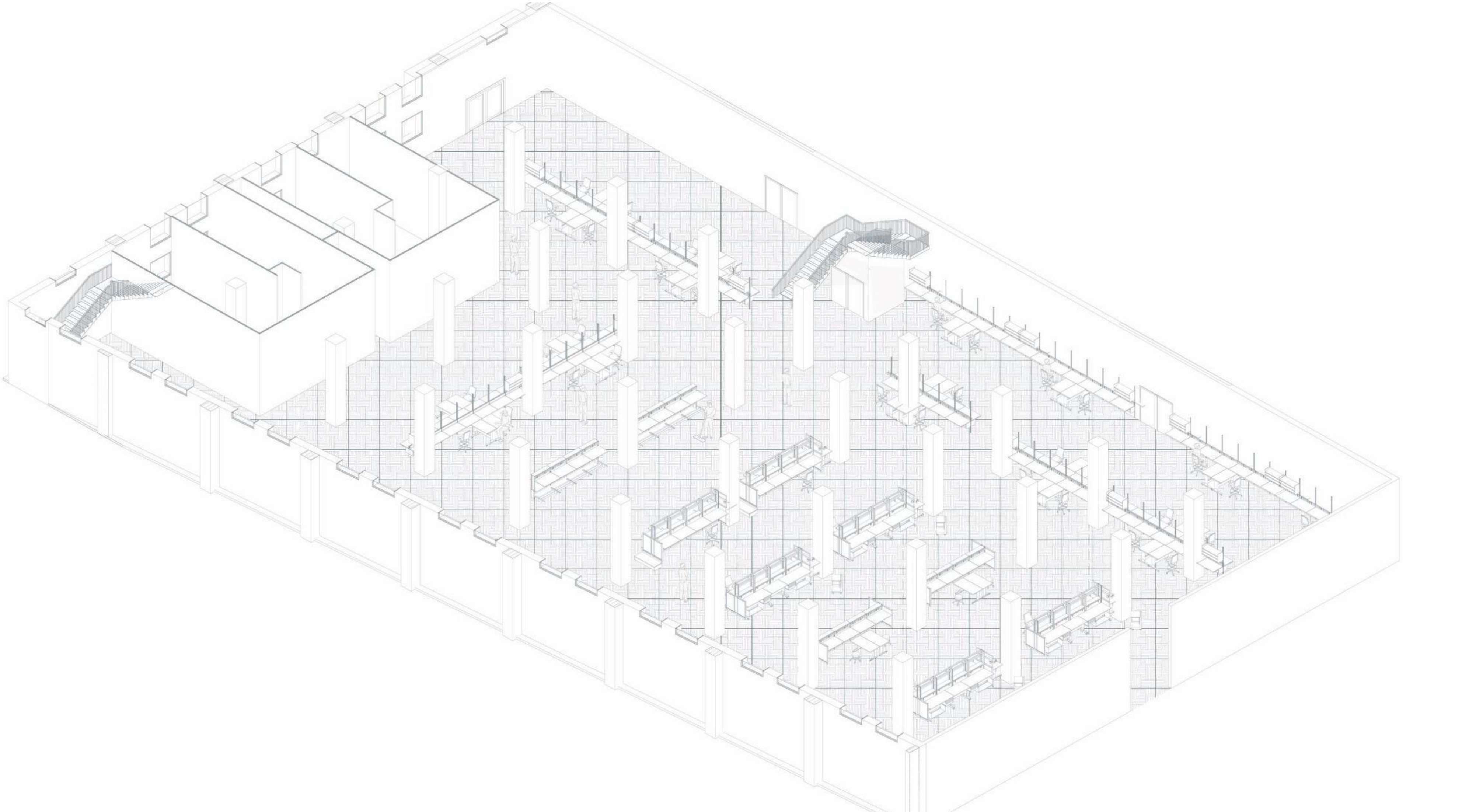


Fig.7.114. Sub-fabrication Room (Elaborated by author)

The primary production space:

- Its architectural plan delineates designated for ship manufacturing. The concept is designed to optimize the ship building process, prioritizing safety and efficiency.

- The production room is a spacious area designed for the assembly of significant ship pieces, It is separated into distinctly labeled sections, each assigned to various phases of ship construction: as frame assembly area, welding section, sections for the installation of internal components as plumbing and electrical systems in addition to zones for painting and final inspections, where vessels are readied for delivery.
- Overhead cranes are essential components in ship building operations. These robust cranes are utilized for transporting huge goods and massive ship parts. The layout indicates extensive coverage by these cranes.
- Safety is essential in ship building due to the intensive industrial operations involved. The proposal encompasses emergency exits that are readily accessible.
- **The Sub-fabrication Room** is intended for numerous essential preparatory phases of ship construction, prior to their transfer to the main assembly floor.
- The plan features designated sections for quality inspection and control, where components are evaluated against engineering standards before to advancing to the subsequent production stage.
- Specific locations are allocated for the storage of raw materials and the staging of finished components prior to their transfer to the primary assembly zones.

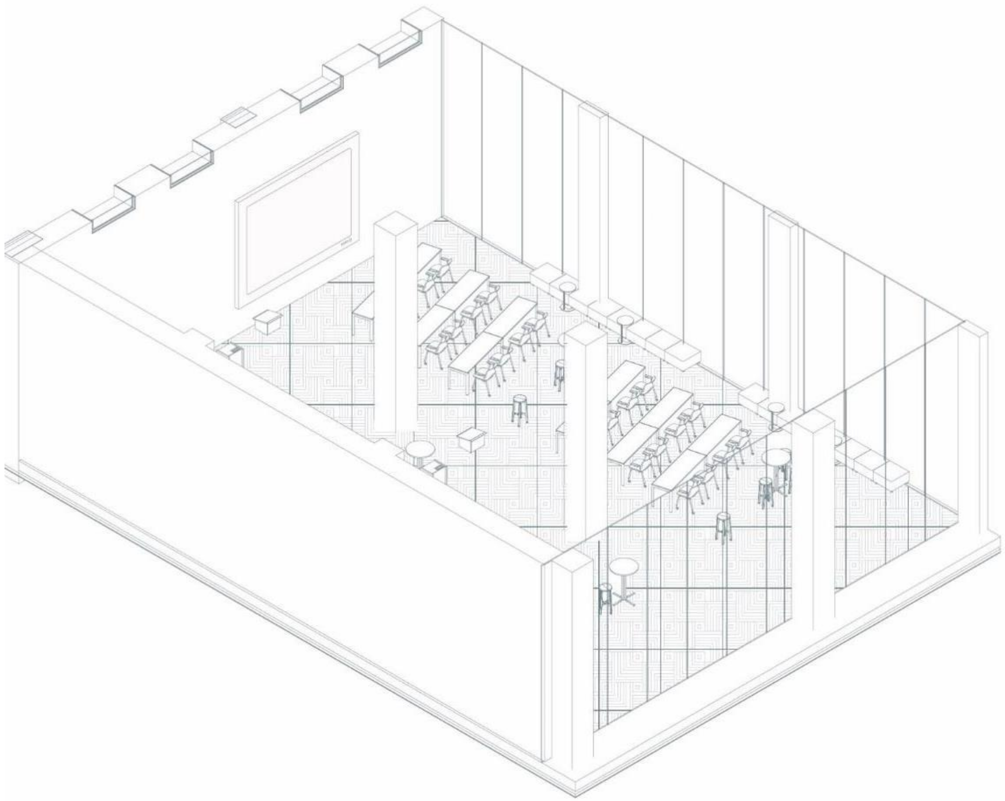


Fig.7.115. Classroom (Elaborated by author)

- **This classroom arrangement** is essential for the educational aspect that meets the technological requirements of the ship construction industry located within the same facility. The classroom incorporates a tiered seating arrangement, optimizing visibility and audibility for allstudents, so ensuring that instructional materials and lectures are readily perceivable from any position.
- At the front, there exists a clearly defined space presumably allocated for the instructor, furnished with what seems to be a podium or desk.
- The wide screen at the front indicates the utilization of digital presentations and real-time ship design software demonstrations.
- The design presumably incorporates integrated power supplies and data connectivity to facilitate the usage of laptops, projectors, and otherelectronic equipment vital for a technology-focused classroom.
- The space appears versatile and it is engineered to facilitate interactive and collaborative learning experiences, essential for courses thatencompass intricate problem-solving and design issues in ship production.
- The design incorporates expansive windows or potentially light fixtures that deliver ample illumination and Airflow, crucial for sustainingan attentive, comfortable and efficient learning atmosphere.

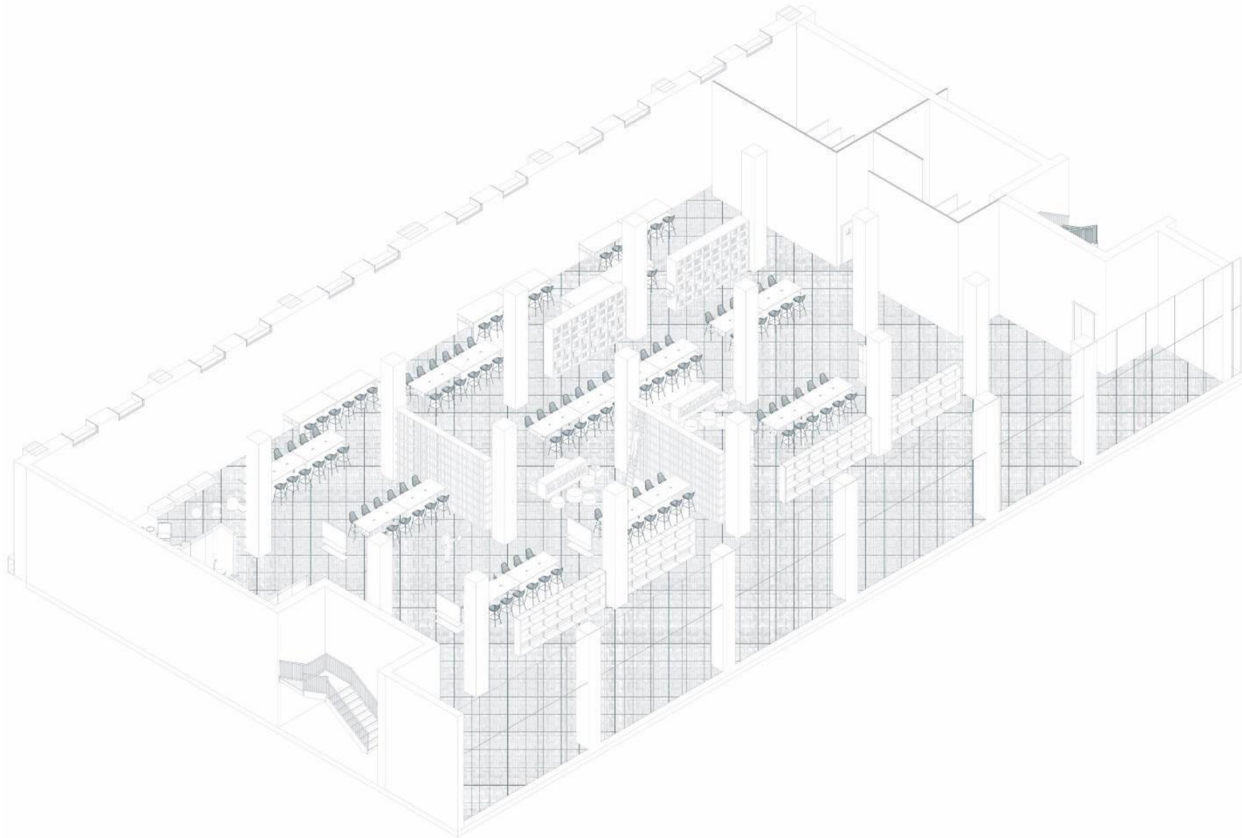


Fig.7.116. Library. (Elaborated by author)

This isometric illustration depicts the library's design.

- This library is a fundamental component of the educational institution. The library features many levels, optimizing space utilization and establishing separate zones for diverse activities. Each zone can be allocated to distinct categories ofresources or fields of study.

- The configuration has multiple individual study stations furnished with tables and chairs, providing a tranquil setting for reading and research.

- Extensive shelving units house a diverse array of materials that underpin the ship production curriculum.

- Specific locations are designated to promote group work and conversations.

- A central desk is present, functioning as a point of information and support for library patrons.

- The design incorporates staircases to guarantee universal access to the library. Proper illumination also provide a conducive learning atmosphere.

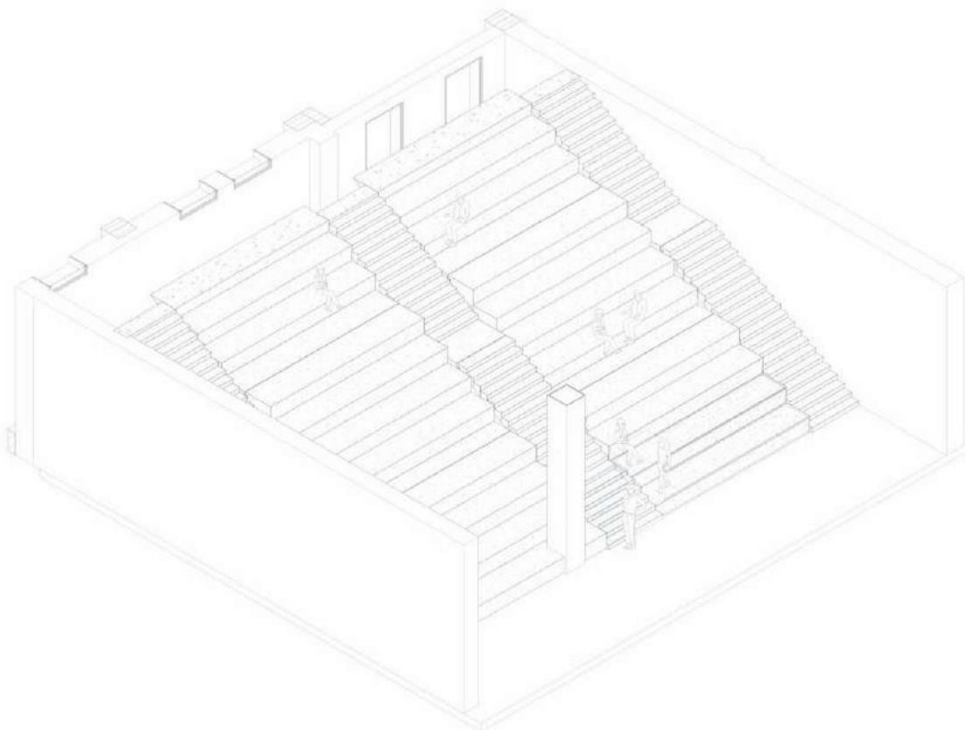


Fig.7.117. Exhibition and open conference room. (Elaborated by author)

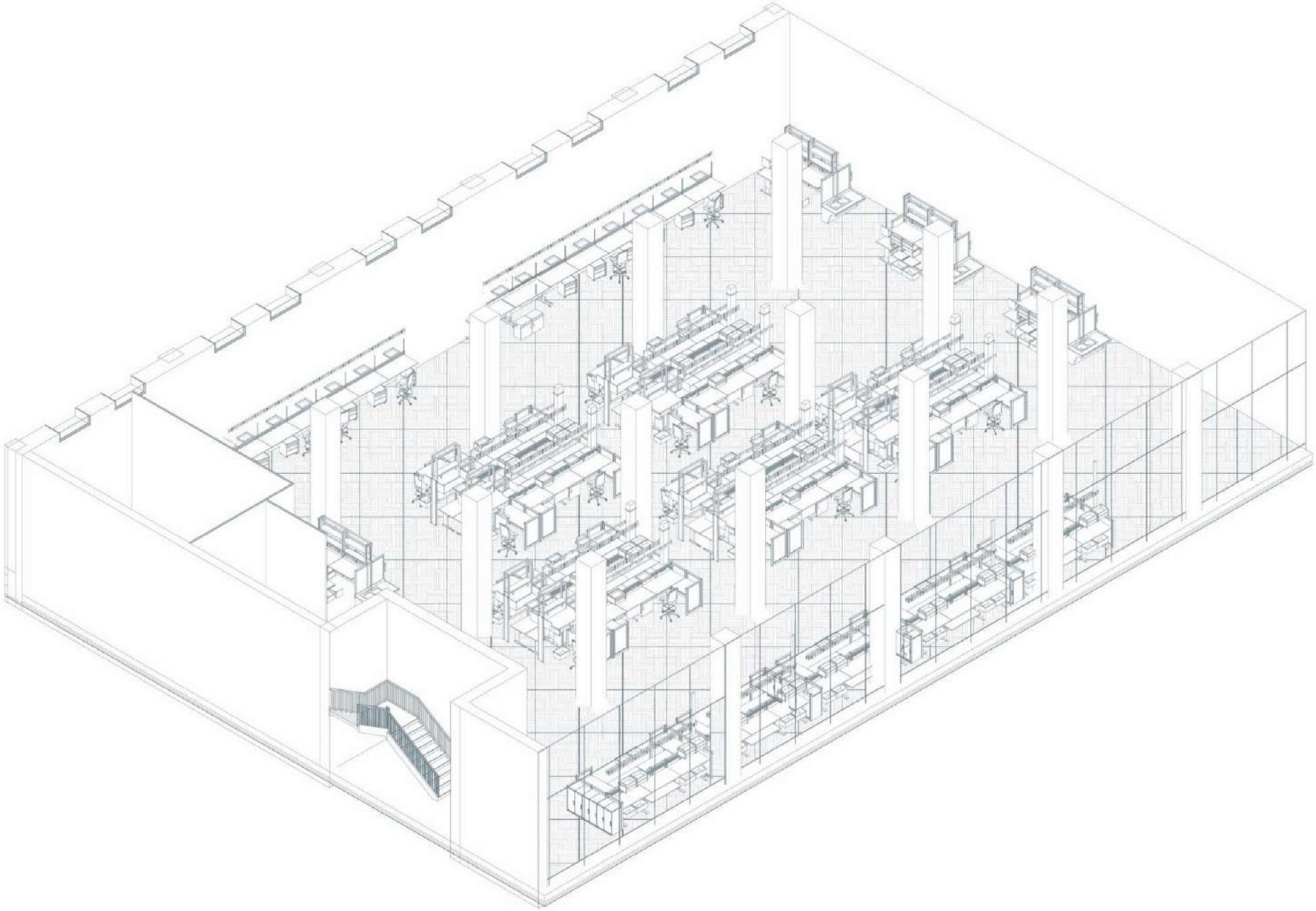


Fig.7. 118. The practice and testing lab. (Elaborated by author)

- **The isometric drawing depicts an exhibition and open conference area** that can accommodate various activities, including academic presentations, industry showcases, and collaborative conversations.

- Tiered Seating Area is optimal for visibility to guarantee that all participants possess an unobstructed perspective of the presentations or speakers.

- The design incorporates stair access, so allowing all people, including individuals with disabilities, to navigate and utilize the area effortlessly.
- The open space can be modified with temporary structures such as exhibition stands or demonstration models, especially advantageous for displaying ship models or technical prototypes. Its architecture can accommodate several configurations allowing for rapid adaptation based onthe event type, so rendering it a versatile asset to the institution

- **The practice and testing laboratory** contains multiple workstations organized in rows. These stations facilitate experiential learning and assessment, enabling students and professionals to participate in practical tasks pertinent to ship production methodologies. It aids students in comprehending the entire lifecycle of ship production, from conception to construction.
-Designated zones are allocated for the evaluation of materials and components, crucial for analyzing the durability, functioning, and safety of ship parts.
- The intervals between workstations provide sufficient space to promote user collaboration.
- Several prominent desks or stations are included in the design functioning as control or monitoring centers. Essential for coordinating experiments and practice sessions.
- The design incorporates unobstructed walkways for safety.

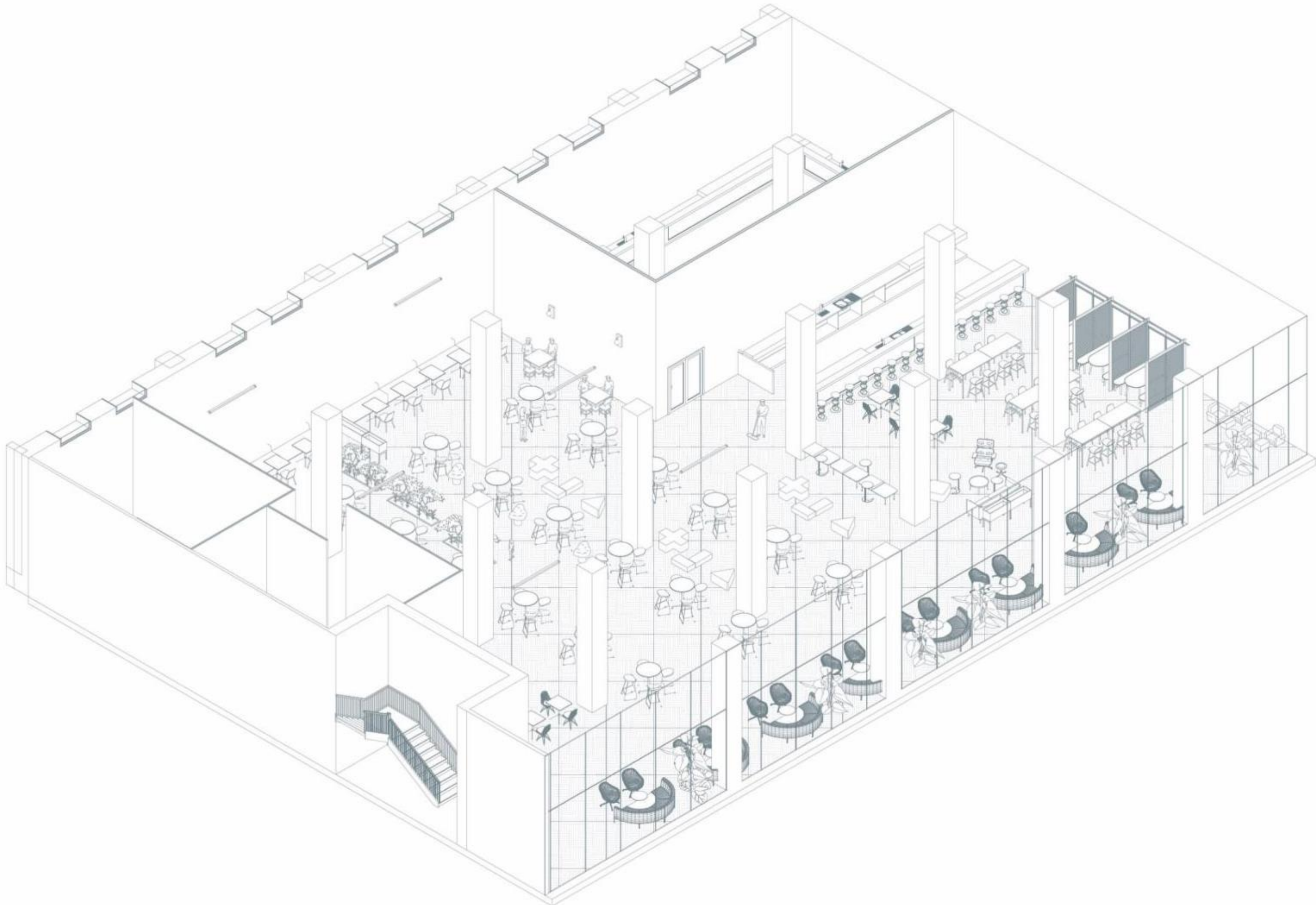


Fig.7.119. The lounge and cafe area. (Elaborated by author)

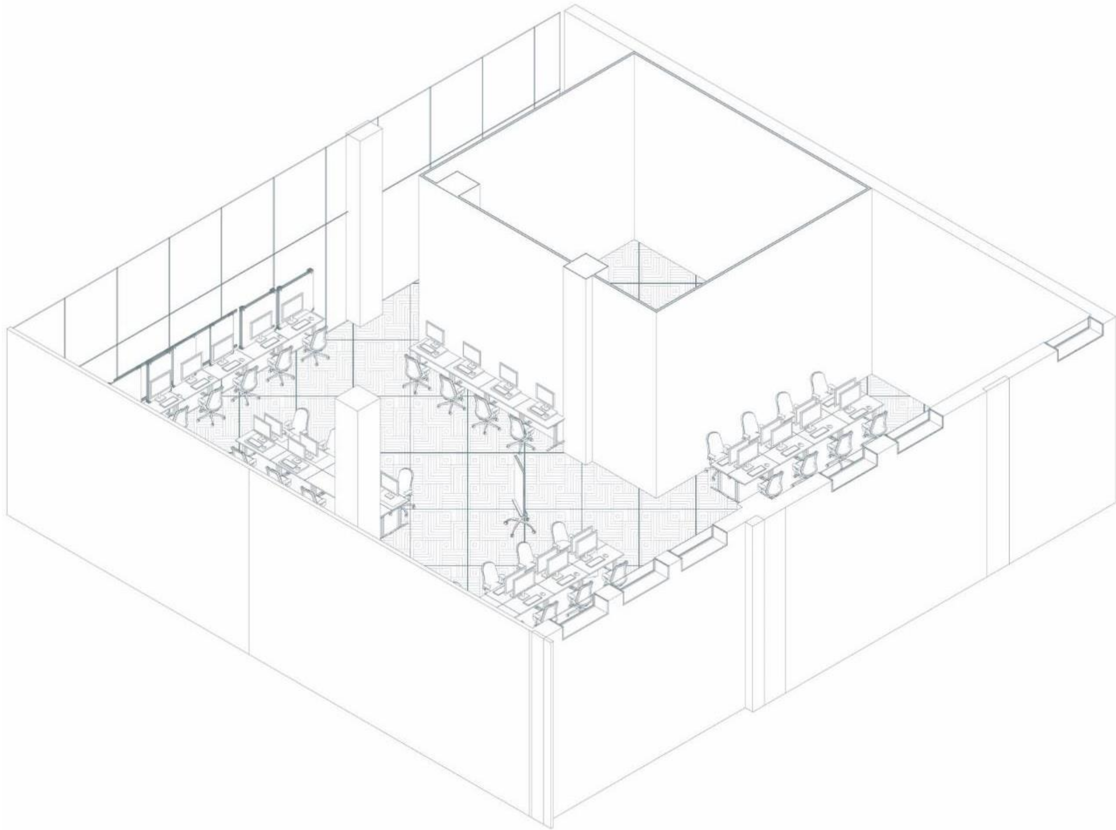


Fig.7. 120. Computer lab. (Elaborated by author)

- **The isometric drawing depicts the lounge and café area** as a common space for students, educators, and ship production personnel to convene for meals, informal discussions, or relaxation

- The café offers many seating arrangements, ranging from private tables and chairs ideal for solitary work or dining to larger communal tables designed for group gatherings.

- Certain spaces provide a more tranquil ambiance, likely furnished with plush seats like sofas or lounge chairs.
- The floor Design features an open floor plan, augmenting the sense of spaciousness and accessibility.
- It features expansive windows that allow abundant natural light, fostering a serene environment suitable for relaxation and informal engagement.

- The isometric graphic depicts a computer lab to enhance learning via innovative software and simulations crucial for contemporary ship building education and practice.

- The laboratory contains several work stations, each outfitted with a computer system. These are arranged in rows, optimized for enabling teachers to navigate effortlessly among students to offer support and guarantees visibility of all displays for demonstrations.
- Seating and desks are crafted for comfort and functionality including the unobstructed routes to facilitate prompt evacuation if required. Accessibility elements guarantee that the facility is operable by all students, including those with disabilities. Moreover, optimal lighting was taken into account to mitigate eye strain and weariness.

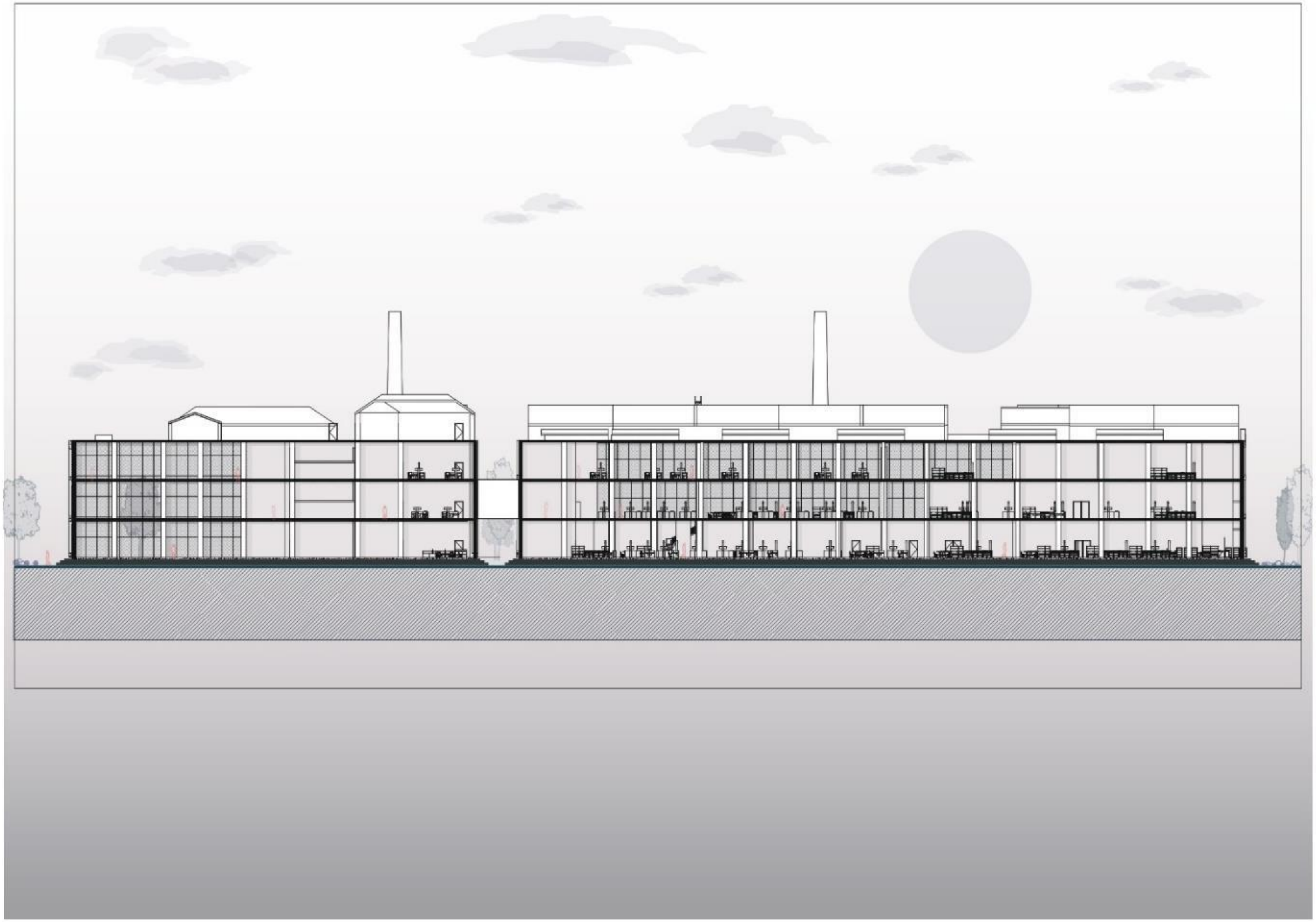


Fig.7.121. Makbas El Nile and Makbas Masr section and linkeage. (Elaborated by author)

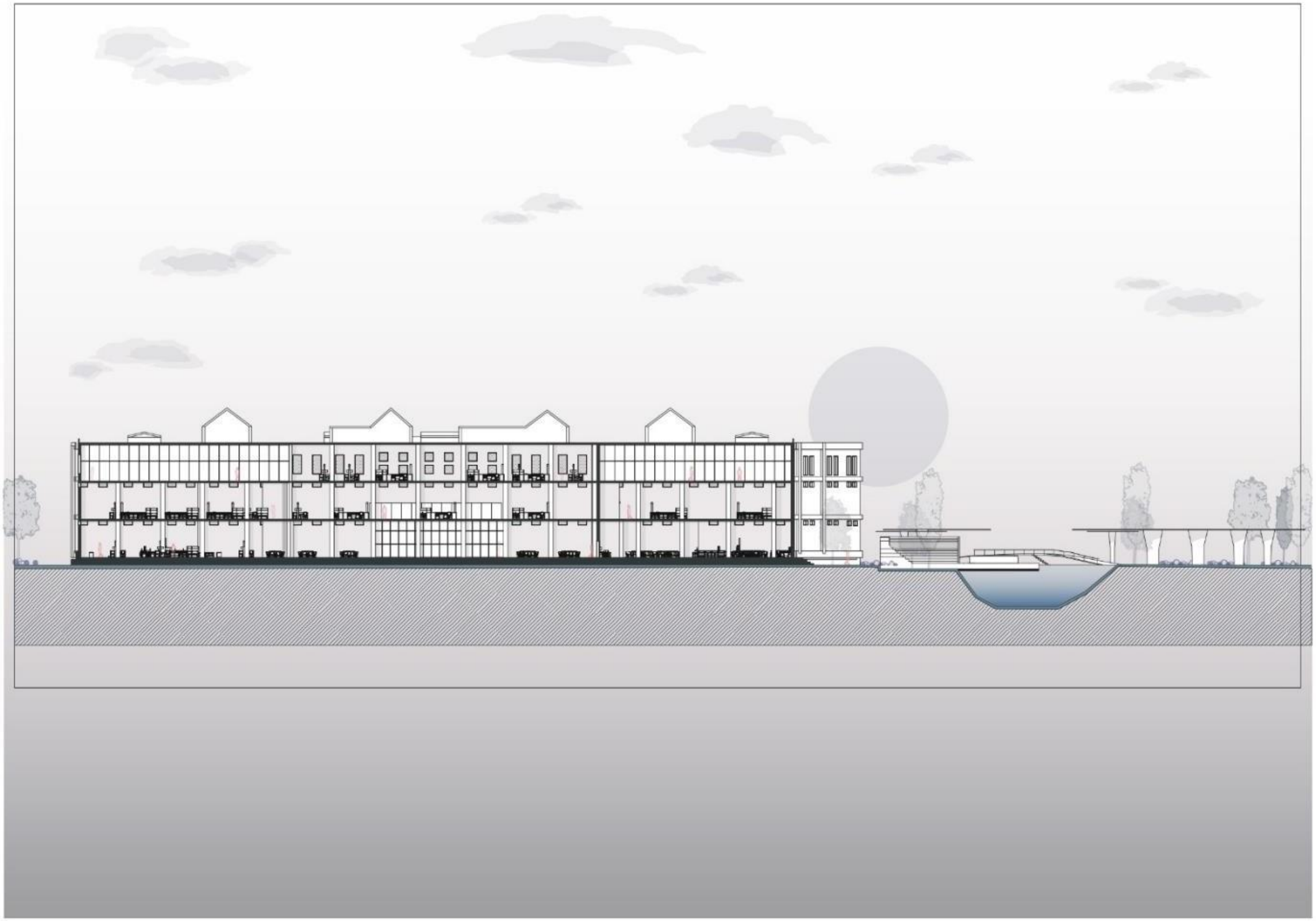


Fig.7.122. Makbas El Nile section with site scale 1:800. (Elaborated by author)

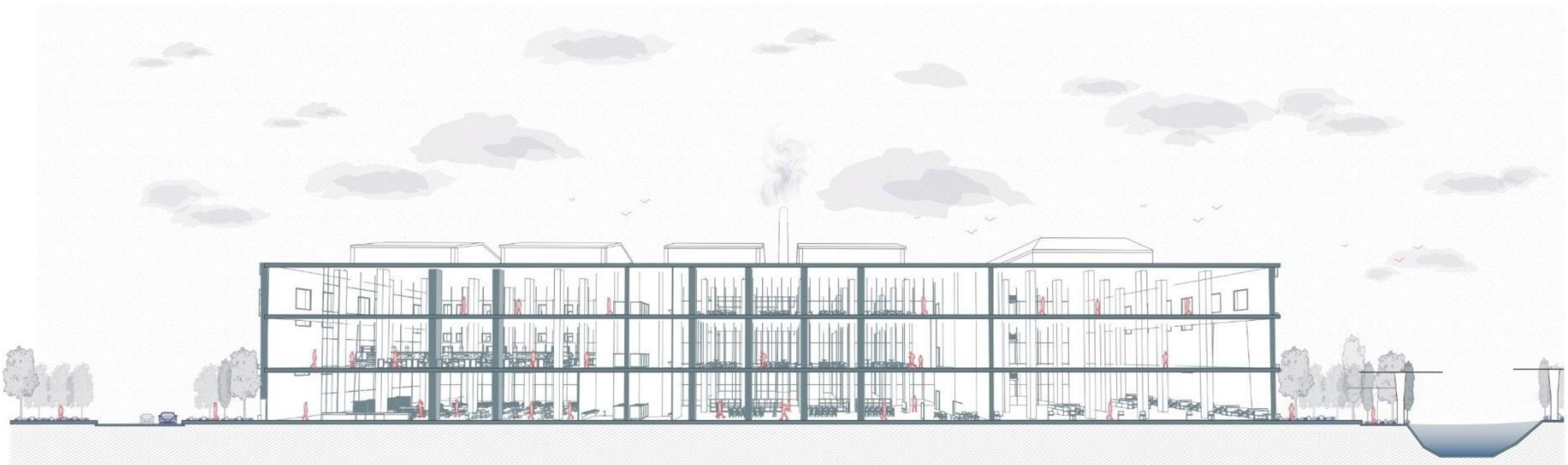


Fig.7.123. Makbas Masr 3d section. (Elaborated by author)

Fig.7.124. Makbas Masr and Makbas el Nile, 3d section. (Elaborated by author)

Fig.7.125. Makbas El Nile, 3d section. (Elaborated by author)

Fig.7.126. Lounge. (Elaborated by author)

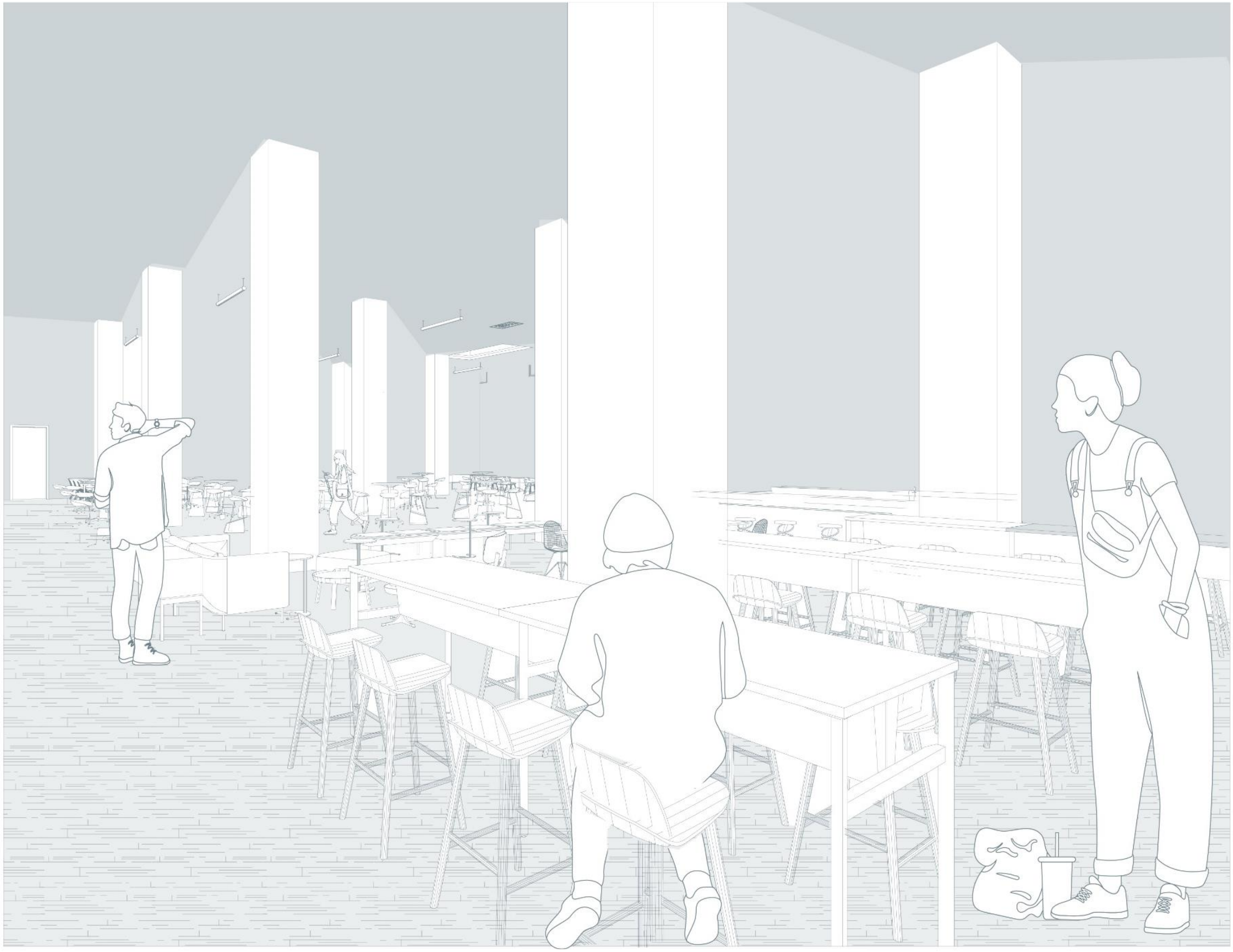


Fig.7.127. Library. (Elaborated by author)

Fig.128. Open court. (Elaborated by author)

Fig.7.129. Green court. (Elaborated by author)

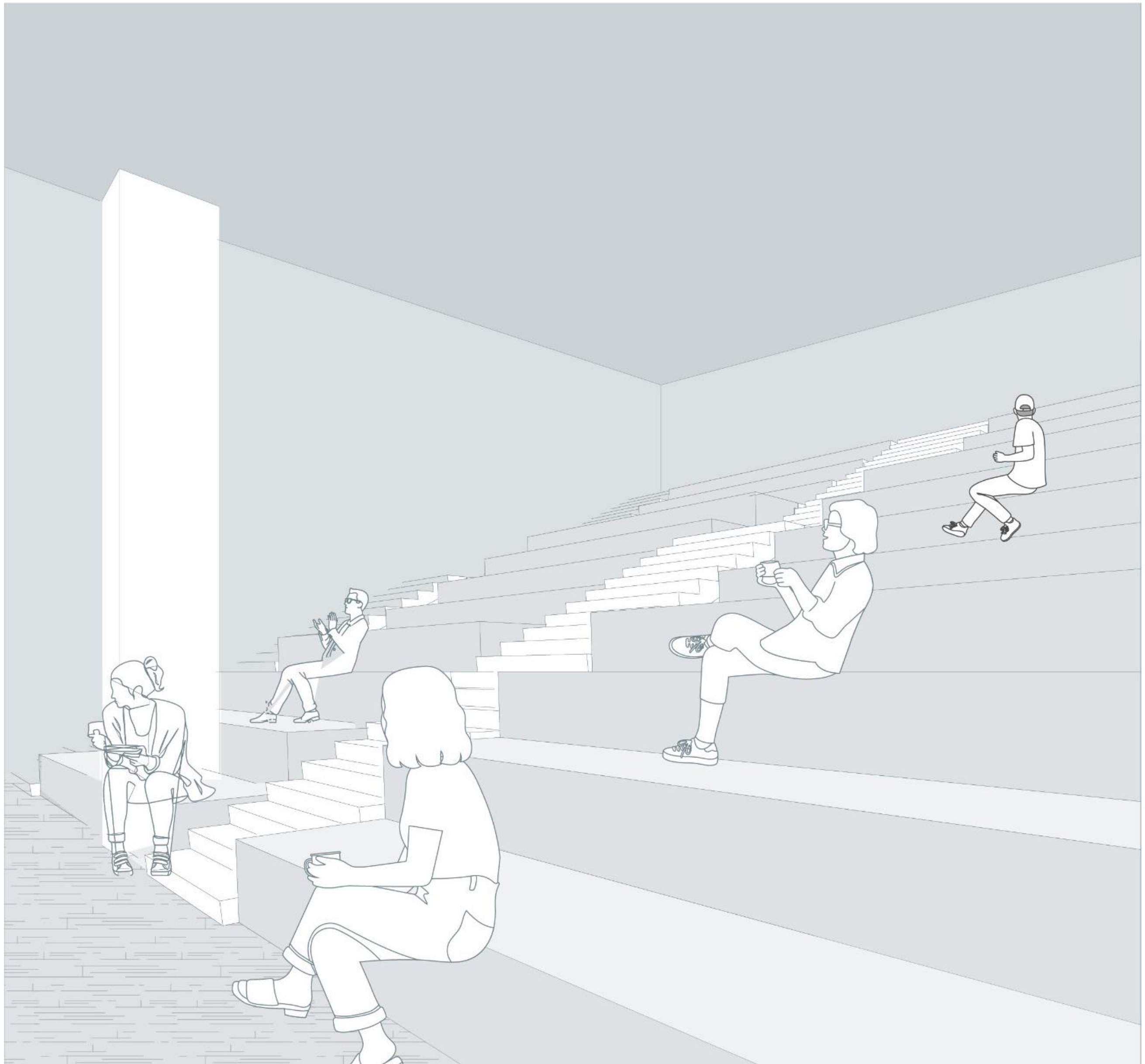


Fig.7.130. Presentation & Open Lecture Hall. (Elaborated by author)

Fig.7.131.Offices. (Elaborated by author)

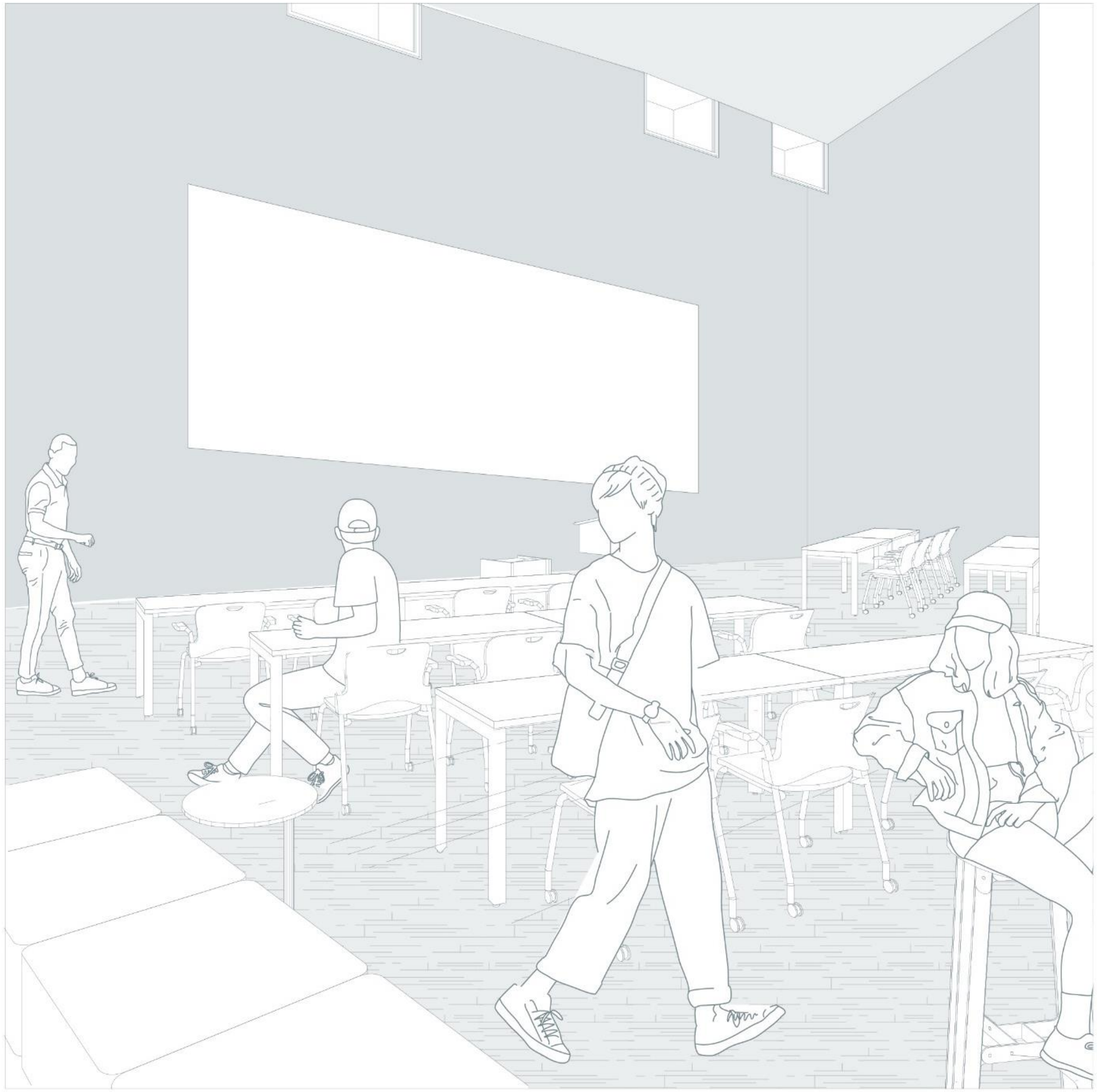


Fig.7.132. Class Room. (Elaborated by author)

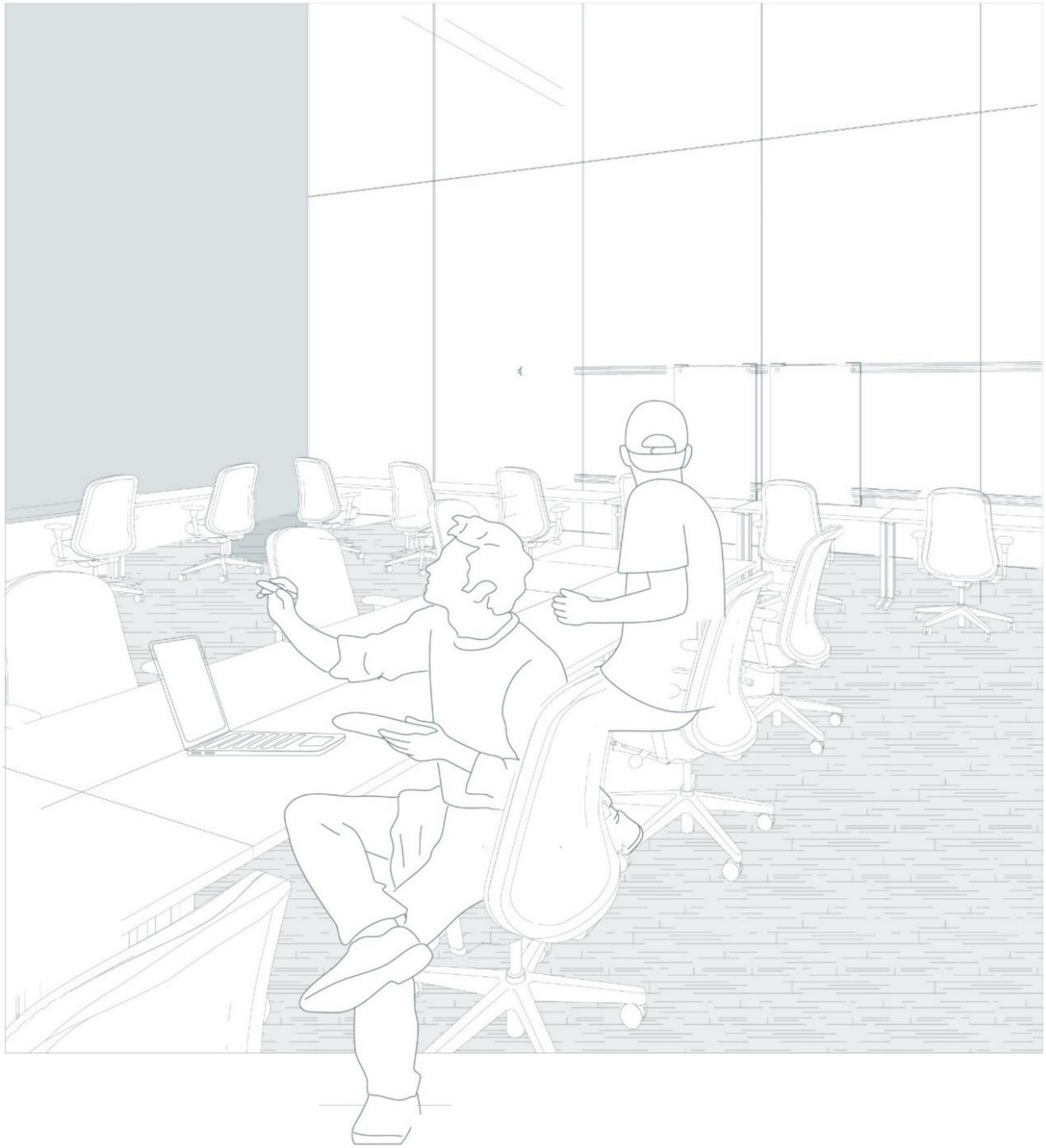


Fig.7.133. Computer Lab. (Elaborated by author)

Fig.7.134. Fabrication Room. (Elaborated by author)

Fig.7.135. Outdoor-shadings and park. (Elaborated by author)

Fig.7.136. Bridge and outdoor park. (Elaborated by author)

Fig.7.137. Socila Street connecting both buildings. (Elaborated by author)

Conclusion and Recommendations

The Mina El-Bassal region, formerly the vibrant center of Alexandria's industrial operations, has experienced a deterioration over the decades, reflecting the obsolescence prevalent in several industrial zones around Egypt. This area has significant potential for revitalization because to its historical importance and strategic proximity to essential maritime connections.

The adaptive reuse of Makbas Masr and Makbas El Nile in this setting represents not only architectural preservation but also a catalyst for socio-economic revitalization. These industrial edifices provide various intrinsic features for developers, such as high ceilings, abundant windows in both quantity and size, open floor layouts, and unique character. Structures without these features are less distinctive however appealing for reconstruction. The concept of the project enhances local economic revival by repurposing old structures for vocational education and ship production, simultaneously fulfilling the community's educational requirements. The adaptive reuse seeks to restore the community's connection to its industrial heritage. By including local stakeholders in the planning and execution phases, the project guarantees that the redevelopment satisfies the requirements and standards of the neighborhood while nurturing a sense of dignity and responsibility amongst the local population.

This thesis offers an in depth analysis of the adaptive reusing of the Makbas Masr and Makbas El Nile, important elements of Egypt's industrial heritage. These edifices, formerly pivotal to Egypt's industrial powerfulness, especially in Alexandria, are reimagined to fulfill modern economic and educational roles. The project exemplifies a refined integration of historical preservation with contemporary functionality that augments future value, situated in the Mina El-Bassal area—a locale historically connected to Egypt's marine and industrial evolution.

Previous case studies demonstrated the imperative of tackling environmental contamination and trash disposal while repurposing existing environmental resources, as illustrated by transforming the Marseille River’s shores into a public playground. The revised design plan for Mina El-Bassal includes previously omitted elements for urban environmental interventions at several dimensions, such as contrasting the refurbished Mahmoudiyah Canal with neighborhood-scale green areas in the center and the previous industrial sector.

The project's methodology has been meticulous, ensuring that structural alterations honor the original architectural integrity and historical context, maintaining the existing spatial configuration while integrating modern technologies and educational facilities essential for vocational training and shipbuilding. The equilibrium between tradition and modernity is essential for preserving the historical integrity of the sites while assuring compliance with current functional standards.

The project integrates sustainable practices, conforming to global environmental standards, with a focus on material reuse, energy efficiency, and minimal ecological impact. This sustainable strategy not only improves the project's viability but also establishes a standard for future reconstruction initiatives in Egypt and analogous environments globally.

Egypt's extensive industrial heritage, marked by a diverse collection of historical industrial sites, represents a significant yet underexploited resource. Notwithstanding their potential, numerous sites experience neglect. This project serves as a vital intervention, demonstrating how industrial legacy may be utilized to promote sustainable development, ensuring their relevance to current urban life and providing practical spaces that benefit the community. The project exemplifies sustainable urban development by illustrating the transformation of industrial relics into vibrant hubs that foster educational advancement and economic revitalization. It establishes a benchmark for the reevaluation and conservation of similar sites across the country, promoting a more knowledgeable and deliberate strategy for industrial architectural heritage. The sustainable restoration of post-industrial urban environments is intricate, and there are no universal remedies for the reactivation of abandoned industrial districts. The comparative case studies demonstrate that the transferability of urban solutions is limited once a specific concept is applied in a different context. Therefore, urban design principles must be flexible and cannot be rigidly established.

Recommendations for Upcoming Initiatives to Preserve and Repurpose Industrial legacy:

1. **Policy Formulation:** Create extensive policies that emphasize the conservation and adaptive repurposing of industrial heritage sites. These strategies ought to promote the assimilation of these places into the wider economic and cultural frameworks of their communities.

2. Stakeholder Engagement: Augment stakeholder participation via inclusive planning methodologies that address the needs, expectations, and aspirations of local communities. This method guarantees that adaptive reuse initiatives are both economically feasible and culturally as well as socially sustainable.

3. Technical and Financial Assistance: Enhance accessibility to technical proficiency and financial resources for adaptive reuse initiatives. This can be accomplished via governmental incentives, public-private collaborations, and international cooperation, especially with entities focused on cultural preservation.

4. Educational Programs: Design and execute educational initiatives that emphasize the importance of industrial heritage. These programs should seek to enhance public understanding on the significance of conserving such assets and their potential for community development.

5. Enhancement of Legal Framework: Augment the legal framework to more effectively safeguard industrial heritage sites. This entails amending current laws or enacting new legislation that establishes explicit standards and support for the preservation and adaptive reuse of industrial structures.

6. Recording and Research: Promote continuous recording and research to evaluate the condition of industrial heritage sites, thereby establishing a robust foundation for planning and intervention. This must encompass comprehensive inventories that evaluate the historical, architectural, and cultural significance of these places.

7. Integrate historic industrial assets into large-scale urban revitalization projects. This integration must account for the spatial and functional linkages between these sites and the urban fabric, ensuring their beneficial contribution to the urban landscape.

8. An enhancement of governmental and community support for the maintenance and sustainable development of industrial structures, aligning cultural preservation with contemporary urban requirements and ensuring these edifices have relevance rather than becoming mere historical artifacts.

By adopting these proposals, Egypt can preserve its industrial legacy and convert these historical places into dynamic, useful venues that enhance the nation's cultural and economic vitality.

Bibliography

Ackermann, K., & Aicher, O. (1991). Building for industry.

Aggour, H. (2017). Virtual Reality: Towards Preserving Alexandria Heritage By Raising The Awareness Of The Locals. Archnet, 11(3), 95-106.

Alexandria Governorate (2019) Information and Decision Support Center in Alexandria Governorate statistical reports 2019.

Alfrey, Judith, & Putnam, Tim. (2003). The Industrial Heritage: Managing Resources and Uses. Routledge. ISBN 9781134912278.

Anderson, J. (2013). Architect and Patron (pp. 127-139).

Andrei Eugen Lakatos. (2015). Recovering the Memory: Conversion within the Context, Acta Technica Napocensis: Civil Engineering & Architecture Vol. 58, No. 4.

Adrienn Lepel. (2006). CHANGING THE FUNCTION OF INDUSTRIAL BUILDINGS – SURVEY, Facta universitatis - series Architecture and Civil Engineering 4(2).

Antar Ismail Ahmed, & Hossam Ahmed Mokhtar. (n.d.). Shortened Guide to Historical and Archaeological site in Alexandria, Mossasst Shabab El Gamaa, 24-25.

Aref, Y. (2013). Alexandria Forgotten Architecture Reintegration of Industrial Heritage of Alexandria in Urban Development Plans. Retrieved from http://www.aaha.ch/cahiers/aaha-cahier-70-aref.pdf

Aslan, Z. (2016). Conservation of Cultural Heritage in Arab Region. Sharjah: ICCROM-ATHAR, 1.

Awad, Mohammed Fouad. (1996). In the Heart of Alexandria's European Centre. Revue Mediterraneans/Méditerranéennes, 8-9, 42-58.

Baer, Gabriel. (1964). Egyptian Guilds in Modern Times. Israel Oriental Society.

Bateman, H., Harris, E., & McAdam, K. (Eds.). (2005). Dictionary of Leisure, Travel and Tourism (Third Edition). A & C Publishing, London.

Behrens-Abouseif, Doris. (2006). 'The Visual Transformation of Egypt during the Reign of Mohammed Aly.' In: Behrens-Abouseif, Doris & Vernoit, S., (Eds.), Islamic Art in the 19th century. Tradition, Innovation, Eclecticism. Leiden; Boston: E.J. Brill, 109-130. (Islamic History and Civilization, Volume: 60)

Bell, James. (1832). A System of Geography, popular and scientific, or a physical, political, and statistical account of the world and its various divisions, vol. III. Glasgow: Archibald Fullarton and Co., p. 338, fn. 15.

Black A. K., Ross B. E. and Rockow Z. 2019. Identifying physical features that facilitate and impede building adaptation Smart Innovation, Systems and Technologies vol 131 (Springer Science and Business Media Deutschland GmbH) pp. 52–62.

Bodenstein, Ralph. (2010). 'Industrial architecture in Egypt from Mohammed Aly to Sadat: A field survey.' In Workplaces: The Transformation of Places of Production. Industrialization and the Built Environment in the Islamic World. Istanbul: Istanbul Bilgi University Press; Geneva: The Aga Khan Award for Architecture, 41-80.

Brooker, G., & Stone, S. (2004). Re-readings. Interior architecture and the design principles of remodeling existing buildings. RIBA Enterprises: London.

Brooker, G., & Stone, S. (2008). Context + Environment. Lausanne: ava publishing sa, p.22.

Carlebur, O. F. D. (2015). Adaptive School Buildings Determination Method – Adaptief onderwijsvastgoed; Beoordelingsmethode voor schoolgebouwen. Delft University of Technology, Delft, the Netherlands.

Clerget, Marcel. (1934). Le Caire : étude de géographie urbaine et d'histoire économique. Le Caire: Imprimerie E. & R. Schindler.

Cramer, J., & Breitling, S. (2007). Architecture in existing fabric. Basel, Birkhauser.

Crowewrite, Christina. (2009). "The History of Sloss Furnaces". Bwcitypaper.com. Archived from the original on 2013-10-30. Retrieved 2014-01-29.

Cunnington, P. (1988). Change of Use: the Conversion of Old Buildings. London: Alpha Books.

Della Spina, L. (2021). Cultural heritage: A hybrid framework for ranking adaptive reuse strategies. Buildings, 11.

Douet, James. (2016). Industrial Heritage Re-tooled: The TICCIH Guide to Industrial Heritage Conservation. Oxon: Routledge. p. 232. ISBN 9781629582030.

Douglas, J. (2006). Building Adaptation. Oxford: Elsevier.

Edwards, J.A., & Liurdés I Coit, J.C. (1996). Mines and quarries: Industrial heritage tourism. Annals of Tourism Research, 23(2), 341-363.

El-Dakhakhny, F. (2018).

Elina Amiri, Elena Guidetti, & Matteo Robiglio. (2019/2020). methods to read adaptive reuse strategies and capacities in industrial buildings. Master Thesis. Politecnico Di Torino.

Fahmy, H., & UNESCO, t. (2013). Egyptian Legislations In Relation To the Rehabilitation of Historic Cairo. Cairo: UNESCO.

Fahmy, k. (2012). The 'new look' of Cairo train station. Retrieved from https://egyptindependent.com/new-look-cairo-train-station/. [Accessed on 22Dec. 2024]

Fisher, A. (1992). New life in old buildings. Stuttgart & Zurich: Verlag.

Foster, G., & Saleh, R. (2021). The Circular City and Adaptive Reuse of Cultural Heritage Index: Measuring the investment opportunity in Europe. Resources, Conservation and Recycling, 175.

Frishkopf, M. (2008). Nationalism, Nationalization, and the Egyptian Music Industry: Muhammad Fawzy, Misrphon, and Soot El-Qahira (SonoCairo). Asian Music, 39(2), 28–58. Retrieved from http://www.jstor.org/stable/25501585

Gelfand, L., & Duncan, C. (2012). Sustainable Renovation. Strategies for Commercial Building Systems and Envelope. Hoboken, New Jersey: John Wiley & Sons, p.4.

Geraedts, R., & Matthijs, P. (2015). The CE Meter; An instrument to assess the circular economy capacity of buildings. Conference: CIB International Conference Going North for sustainability; London South Bank University, UK, November 2015.

Geraedts, R., & Prins, M. (2016). FLEX 3.0; an instrument to formulate the demand for and assessing the supply of the adaptive capacity of buildings. CIB World Building Congress WBC2016. N. Achour. Tampere, Tampere University of Technology, Department of Civil Engineering, 2016.

Geraedts, R., & Remøy, H., & Hermans, M., & Groep, B., & van Rijn, E. (2014). ADAPTIVE CAPACITY OF BUILDINGS, A determination method to promote flexible and sustainable construction. International Union of Architects World Congress UIA 2014, Durban SA, August 2014.

Geraedts, R. (2016). FLEX 4.0, a practical instrument to assess the adaptive capacity of buildings. SBE16 Tallinn and Helsinki Conference; Build Green and Renovate, Tallinn and Helsinki, 2016.

Ghali, et al., A. (2013). Re-stitching Mina Al Basal A Once Sustainable Hub. American University in Cairo.

Glavanis, Pandelis Michalis. (1989). Aspects of the Economic and Social History of the Greek Community in Alexandria during the Nineteenth Century. Thesis Submitted For The Degree Of Doctor Of Philosophy In The University Of Hull, 1989.

Godoli, Ezio, & Giacomelli, Milva. (2016). Italian architects and engineers in Egypt from the nineteenth to the twenty-first century. Maschietto Publisher May 18, 2016.

Government, A. (2014, January 1). City of Alexandria in Egypt. Retrieved from Alexandria Government: http://www.alexandria.gov.eg/Government/districts/garb/default.aspx

Hastaoglou-Martinidis, Vilma. (2014). The Cartography of Harbor Construction in Eastern Mediterranean Cities: Technical and Urban Modernization in the Late Nineteenth Century. In Cities of the Mediterranean from the Ottomans to the Present Day, edited by Biray Kolluoğlu and Meltem Toksöz, 1st ed., 78–99. New York: I.B. Tauris.

Hathaway, J., & Barbir, K. K. (2008). The Arab lands under Ottoman rule, 1516-1800. Harlow, England: Pearson Longman, pp.141.

Hernandez, P., & Kenny, P. (2010). From net energy to zero energy buildings: Defining life cycle zero energy buildings (LC-ZEB). Energy and Buildings, 42, 815–21.

High, S. (2022). DEINDUSTRIALIZATION, FORCED FORGETTING AND THE CHANGING PLACE OF INDUSTRIAL HERITAGE IN CANADA TICCIH Bulletin No. 97, 3rd quarter.

Highfield, D. (1987). The rehabilitation and re-use of old buildings. London & New York: Spon Press.

Huri, Théo J. (1935). Alexandrie, Portique de l'Orient. Alexandria: Impr. Procaccia. Archives Centre d'Études Alexandrines (CEAlex), Alexandria, Egypt.

Ibn-Mohammed, T., Greenough, R., Taylor, S., Ozawa-Meida, L., & Acquaye, A. (2013). Operational vs. embodied emissions in buildings - A review of current trends. Energy and Buildings, 66, 232–45.

ICOMOS (2010). The Conservation of Places of Cultural Heritage Value. New Zealand: ICOMOS, p.9.

ICOMOS: "Proposals for achieving a more representative sample of the cultural heritage on the World Heritage List" (1999).

ICOMOS-TICCIH (2003). The Nizhny Tagil Charter for the Industrial Heritage. Page 1. July 2003. Retrieved April 23, 2022, from https://www.icomos.org/18thapril/2006/nizhny-tagil-charter-e.pdf

ICOMOS-TICCIH (2011). Joint ICOMOS-TICCIH Principles for the Conservation of Industrial Heritage Sites, Structures, Areas and Landscapes. "The Dublin Principles". Adopted by the 17th ICOMOS General Assembly on November 28, 2011. Retrieved April 23, 2022, from https://www.icomos.org/Paris2011/GA2011_ICOMOS_TICCIH_joint_principles_EN_FR_final_20120110.pdf.

Ishizawa, M. and Westrik, C. (2021). Analysis of the Global Strategy for a Representative, Balanced and Credible World Heritage List (1994-2020) https://whc.unesco.org/en/documents/187906

Jack Krakovsky, Fernando Maio, & Mirza, T. (1954). 'Commercial Directory of Egypt'. Cairo: The Modern Publishing Company. Archives Centre d'Études Alexandrines (CEAlex), Alexandria, Egypt.

James Sutherland, Dawn Humm, & Mike Chrimes. (2001). Historic concrete: background to appraisal. Publisher: Thomas Telford, London.

Jonathan M. Bloom. (1999). MAMLUK ART and Architectural History: A Review Article. MAMLUK STUDIES REVIEW VOL. 3.

KHALID 'AZAB. (2007). Dar al-Saltana in Egypt: Architecture and Political Transformations. Cairo: al-Majlis al-A'la lil-Thaqafa, p.155.

Keck, S. (1996). Further material for history of conservation. In: N. Price, M. Talley, & A. Melucco Vaccaro (Eds.), Historical and Philosophical Issues in the Conservation of Cultural Heritage. Los Angeles: The Getty Institute, pp.265.

Khalil, M. A. (2009). Thesis in the Italian Architecture in Alexandria. Egypt: Kore University.

Kidney, Walter C. (1976). Working Places: The Adaptive use of Industrial Buildings: A Handbook Sponsored by the Society for Industrial Archeology. Ober Park Associates, Pittsburgh.

Kim, M., & Ben-Josep, E. (2013). "Manufacturing and the city", Paper presented at the annual meeting for the American Collegiate Schools of planning, Dublin, Ireland, July.

Lamprakos, M. (2014). Riegl's "Modern Cult of Monuments and the Problem of Value. Change over time, 4(2), pp.418-435.

Landau, Jacob M. (2017). Jews in Nineteenth-Century Egypt. Routledge; 1 edition.

Latham, D. (2000). Creative re-use of buildings. Shaftesbury: Donhead.

Lebon & Cie: Un Centenaire 1848-1947, Paris: La Compagnie Lebon, 1947.

Lepel, A. (2006). Changing the function of industrial buildings – survey. Budapest University of Technology and Economics, Hungary. Architecture and Civil Engineering, Vol. 4, N 2.

Levernay, François. (1873). Guide-Annuaire d'Egypte: Statistique, Administrations, Commerce, Industries, Agriculture, Antiquités Etc. Avec Les Plans d'Alexandrie & Du Caire. Cairo: Delbos-Demouret.

Loures, L., Vargues, P., & Horta, D. (2008). "Landscape aesthetical and visual analysis facing the challenge of the development of sustainable landscapes – the case study of the post-industrial area to the left margin of the Arade River." International Journal of Design & Nature and Ecodynamics 3.1, pp. 65-74.

Mabro, Robert. (1972). The Egyptian Economy, 1952-1972. Oxford: Oxford University Press.

Mahdy, H. (2017). Approaches to the Conservation of Islamic Cities: The Case of Cairo. Sharjah: ICCROM- ATHAR Regional Conservation Centre.

Mansel, P. (2010). Levant: Splendour and Catastrophe on the Mediterranean. John Murray.

Marc Crinson. (1996). Empire Building. Orientalism and Victorian Architecture. London: Routledge, p. 171.

Marsden, S., & Spearritt, P. (2021). The Twentieth-Century Historic Thematic Framework: A Tool for Assessing Heritage Places. With contributions from Leo Schmidt, Sheridan Burke, Gail Ostergren, Jeff Cody, and Chandler McCoy. Los Angeles: Getty Conservation Institute. Retrieved April 23, 2022, from https://hdl.handle.net/10020/gci_pubs_historic_thematic_framework_tool.

Mendes Zancheti, S., & Similä, K. (2011). Measuring heritage: conservation performance. In: 6th international seminar on urban conservation. Olinda & Rome: CECI & ICCROM.

Meyer, Martin; Oevermann, Heike; Damir, Mirhan; Elmouelhi, Hassan; Aziz, Hellen; & Hamdy, Mohamed. (2022). Modern Heritage to Future Legacy - Industrial Heritage in Egypt. Publisher: Technische Universität Berlin. ISBN: 9783982036731

Meyer, Günter. (1988). "Wirtschaftsgeographische Probleme der Industrieansiedlung in den neuen Entlastungsstädten der ägyptischen Metropole" [Economic-geographic Problems of Setting up Industries in the New Overspill Towns of the Egyptian Metropolis]. Erdkunde 42, pp. 284-294.

Michael Falser. (2001). Global Strategy Studies Industrial Heritage Analysis World Heritage List and Tentative List. UNESCO World Heritage Centre Asia-Pacific Region; Austria, 4-6, https://whc.unesco.org/archive/ind-study01.pdf

Mihić, I.G., & Makarun, E. (2017 a). Policy Learning Guidelines on Industrial Heritage Tourism. Retrieved from https://www.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1517754714.pdf

Mihić, I.G., & Makarun, E. (2017 b). State of the art in Industrial Heritage and responsible tourism workshop industrial heritage tourism 14-15 March 2017. Retrieved from https://www.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/CFIH_UOR_State%20of%20the%20art%20in%20IH.

Mohamed Ali Mohamed Khalil. (2008-2009). The Italian Architecture in Alexandria, Egypt: (the conservation of the Italian residential buildings). Master Thesis submitted to University Kore of Enna.

Mohamed Shreen Amin, Hosam Refai and Rasha Kamal. Mapping Industrial Heritage Sites in Egypt: Identification & Management. International Journal of Heritage and Museum Studies, 2020. https://ijhms.journals.ekb.eg/article_188747_e48d0193082adc5dfe72345b3a2b01c0.pdf

Morice, Peter, & Tottenham, Hugh. (2011). "The early development of reinforced concrete shells," in Mike Chrimes, Dawn Humm, and James Sutherland (Eds.).

Müller, Anita. (1992). Schweizer in Alexandrien, 1914-1963: Zur Ausländischen Präsenz in Ägypten. Stuttgart: F. Steiner, 1992.

Naguib Ibrahim Bey. (1935). The Development of Irrigation and Drainage in Egypt. In: Egypt Today 1935: 115. Archives CEAlex, Alexandria, Egypt.

Nasr ElDin, Amr. (2006). Railroads in the Land of the Nile: The Story of Egyptian Railroads. Economic and Business History Research Centre 1, no. 3: 19–22. Retrieved from https://www.academia.edu/7639131.

NOUH. (2017). The boundaries and foundations of preserving areas of outstanding value In Alexandria: Alexandria Governorate, National Organization for Urban Harmony.

Owen, Roger. (1993). The Middle East in the World Economy, 1800-1914 (revised, illustrated, reprint). London and New York: I. B. Tauris, 400.

Pascal Coste. (1877). Mémoires d'un artiste. Notes et souvenirs de voyages (1817- 1877), 2 vols. Marseille: Typographie et Lithographie Cayer et Cie.

Peerapun, W. (2012). Participatory Planning approach to urban conservation and regeneration in Amphawa community, Thailand. Asian Journal of Environment-Behaviour studies, 35-44.

Pellegrini, I. (2011). Agordini a Kosseir: Storia Di Una Communità Nelle Miniere Di Fosfati in Egitto. Feltre: Agorá Libreria Editrice. July 2011, in 8th, pp. 248, ill., br.

Peters, E. (2009). The Napoleonic Egyptian Scientific Expedition and the Nineteenth-Century Survey Museum. Master of Arts. Seton Hall University.

Philippot, P. (1996). Historic preservation: philosophy, criteria, guidelines I. In: N. Stanly, J. Talley and A. Vaccaro, ed., Historical and Philosophical Issues in the Conservation of Cultural Heritage. Los Angeles: The Getty institute, pp.2016-220.

Politi, Elie I. (1932). Études Financière Annuaire Des Société Égyptiennes Par Actions. Alexandria: Impr. Procaccia. Archives Centre d'Études Alexandrines (CEAlex), Alexandria, Egypt.

Politi, Elie I. 'Annuaire Des Société Égyptiennes Par Actions, 23eme Edition'. Alexandria: Imp. du Commerce, 1952. Archives Centre d'Études Alexandrines (CEAlex), Alexandria, Egypt.

Politis 1930: 304. "L'Industrie du Cuir en Egypte" in: 'La Chambre de Commerce Egyptienne d'Alexandrie' (Alexandria: Akhbar El-Yom, 1951). Archives Centre d'Études Alexandrines (CEAlex), Alexandria, Egypt.

Pottgiesser, U., & Dragutinovic, A. (2022). ConCom and MoMove. Approaches to Industrial Heritage. In U. Pottgiesser, & A. Dragutinovic (Eds.), MoMove Modern Movement and Industrial Heritage: Contributions to the Docomomo virtual exhibition - momove (pp. 24-29). Technische Hochschule Ostwestfalen-Lippe.

Powell, K. (1999). Architecture reborn. Converting old buildings for new uses. New York: Rizzoli international publications, inc.

Price, N., Talley Jr, M., and Vaccaro, A. (1996). Historical and Philosophical Issues in the Conservation of Cultural Heritage. Los Angeles: The Getty Conservation Institute.

Prix de Rome, The. (n.d.). Historical overview and information. Retrieved [Date], from http://[source]. Note: Placeholder for actual reference if applicable.

Rafi'i, Abd al-Rahman. (1982). Asr Mohammed Aly / bi-qalam Abd al-Rahman al-Rafii. Al-Qahirah, J.M.A : Dar al-Ma`arif. pp. 341-342.

Raafat, Samir. (2010). The Egyptian Bourse. Cairo: American University in Cairo Press.

Raymond, André. (2002). The Glory of Cairo: An Illustrated History. Co-publisher: Ghislaine Alleaume. Publisher: American University in Cairo Press.

Reimer, Michael J. (2019). Colonial Bridgehead: Government and Society in Alexandria, 1807-1882. Routledge.

Relli Shechter. (2013). ‘Selling Luxury: The Rise of the Egyptian Cigarette and the Transformation of the Egyptian Tobacco Market, 1850-1914’, International Journal of Middle East Studies 35, no. 1: 51–75. OJ: https://www.jstor.org/stable/3879927

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

Rob GERAEDTS. (2014). FUTURE VALUE OF BUILDINGS, Faculty of Architecture, University of Technology, Delft, the Netherlands.

Saul, Samir. (1997). La France et l’Égypte de 1882 á 1914: Intérêts Économiques et Implications Politiques. Paris: Histoire Économique et Financière de la France.

Scharabi, M. (1992). Industrie und Industriebau in Ägypten: Eine Einführung in die Geschichte der Industrie im Nahen Osten Paperback. Publisher: Verlag Wasmuth & Zohlen

Schoelcher, Victor. (1846). L’Egypte En 1845. Scanned by. Paris: Pagnerre.

Schuetze, T. (2009). Designing Extended Lifecycles, 3rd CIB International Conference on Smart and Sustainable Built Environment. A. v. d. Dobbelsteen. Delft, the Netherlands, Delft University of Technology.

Sée, Henri. (2004). Modern Capitalism Its Origin and Evolution. 2nd ed. eds. Homer B. Vanderblue and Georges F. Doriot, Batoche Books, Ontario

Shura Council, Fifth Ordinary Session. (1985). Report of the Production and Manpower Committee on Industrial Policy in Egypt, (government Media office Egypt: 1985)5-4

Sloss Furnaces National Historic Landmark. Retrieved 2014-01-29 in https://en.wikipedia.org/wiki/Industrial_archaeology

Society for Industrial Archeology. "About the Society for Industrial Archeology (SIA)". Retrieved 2014-01-29.

St. John, James Augustus. (1834). Egypt and Mohamed Ali; or Travels in the Valley of the Nile. Volume I. London: Longman, Rees, Orme, Brown, Green, & Longman.

Steinberg, F. (1996). Conservation and rehabilitation of urban heritage in developing countries. In: HABITAT INTL. Elsevier Science Ltd., pp.463-475.

Stoop, J. (2015). Office up to date; development of an instrument to determine the adaptive capacity of office buildings - Het ontwikkelen van een instrument om het adaptief vermogen van kantoren te bepalen. Delft University of Technology, Delft, the Netherlands.

Tan Y., Shuai C., & Wang T. (2018). Critical success factors (CSFs) for the adaptive reuse of industrial buildings in Hong Kong. International Journal of Environmental Research and Public Health, 15.

Team, T. (2019). هنا القاهرة كيف يمكن لمدينة عريقة ان تفقد تراثها؟ نون بوست. Retrieved from https://www.noonpost.com/content/26588

Thenews.com.pk. (2018). Egypt struggles to restore Cairo´s historic heart. [Online] Available at: https://www.thenews.com.pk/latest/390477-egypt-struggles-to-restore-cairos-historic-heart [Accessed 22 Dec. 2024].

The Antiquities' protection Law no.117. (2010). Retrieved from https://en.unesco.org/sites/default/files/egypt_law3_2010_entof.pdf

Turiano, Annalaura. (2016). 'De La Pastorale Migratoire à La Coopération Technique: Missionaires Italiens En Égypte. Les Salésiens et l'enseignement Professionnel (1890-1970)'. Aix-Marseille University, 2016.

UNESCO World Heritage Centre. Retrieved 17 September 2023 from http://whc.unesco.org/

UNESCO World Heritage Centre (2021). Analysis of the Global Strategy for a Representative, Balanced and Credible World Heritage List (1994-2020) https://whc.unesco.org/en/documents/187906

UNESCO: Balanced and Credible World Heritage List (2014-2020). March. Paris.

Urban regeneration project for historic cities final report of activities. Retrieved from https://www.urhcproject.org/Content/studies/Report_2014_AR.pdf

Vatikiotis, P.J. (1991). The History of Modern Egypt: From Mohammed Aly to Mubarak, 4th rev. and enl. ed. London: Weidenfeld & Nicolson, pp. 255-256 & 261.

Volait, Mercedes. (1988). L’architecture moderne en Égypte et la revue al-‘Imâra (1939- 1959). Cairo: CEDEJ.

Wiet, Gaston. (1959). Mohammed Ali et Les Beaux-Arts. Cairo: Dar al Maaref.

Wilkinson, S. J., James K., & Reed R. (2009). Using building adaptation to deliver sustainability in Australia. Structural Survey, 27, 46–61.

Wilkinson, S. J., & Remøy, H. (2011). Sustainability and within use office building adaptations: A comparison of Dutch and Australian practices. Pacific Rim Real Estate Society, Gold Coast, Bond University.

Williams, Caroline. (2018). Islamic Monuments in Cairo: The Practical Guide (7th Ed.). Cairo: The American University in Cairo Press.

Wong, L. (2017). Adaptive reuse, extending the lives of buildings. Birkhauser Verlag GmbH, Basel.

Workplaces: The Transformation of Places of Production Industrialization and the Built Environment in the Islamic World Edited by Mohammad Al-Asad. First Edition, Istanbul, December 2010.

World Heritage Committee, 24th session Report; Cairns, Australia December 2000. Under 3.2.ii

World Heritage List. UNESCO World Heritage Centre. Retrieved 17 September 2023.

Xie, P. F. (2015). A life cycle model of industrial heritage development", Annals of Tourism Research Vol. 55 No. pp. 141–154.

Xie, Philip Feifan. (2015). Industrial Heritage Tourism. Bristol: Channel View Publications. p. 59. ISBN 9781845415136.

Xuereb K. & Parkin I. P. (2016). Adapting building structures to new uses in the future. Proceedings of the Institution of Civil Engineers: Engineering Sustainability vol 169 (ICE Publishing) pp. 233–42.

Zayn al-Abidin, Shams al-Din Nagm. (2007). Misr fi Ahday Abbas wa Said [Egypt During the Reigns of Abbas and Said]. Cairo: Dar al-Shuruq, pp. 155-157.

Arabic References

بدر، أحمد سعيد عثمان. (2004). التطور العمراني والمعماري بمدينة الإسكندرية من عهد محمد علي إلى عهد إسماعيل، مخطوط رسالة دكتوراه، كلية آثار، جامعة القاهرة.

مبارك، علي. (2008). الخطط التوفيقية الجديدة لمصر والقاهرة ومدنها وبلادها القديمة والشهيرة، ج7، القاهرة: الهيئة المصرية للكتاب.

البهتيمي، مصطفى علي. (1952). تاريخ زراعة القطن في مصر وأهم أصنافه، مصر.

عباس، رؤف. (2011). الملكيات الزراعية ودورها في المجتمع المصري 1837-1914، القاهرة: المجلس الأعلى للثقافة.

كلوت بك، أ. ب. (2011). لمحة عامة إلى مصر، ترجمة محمد مسعود، القاهرة: دار الكتب والوثائق المصرية.

الصعيدي، إسلام محمد سيف. (2019). ترعة المحمودية وأثرها على التطور الاقتصادي والعمراني والاجتماعي لمدينتي الإسكندرية والبحيرة 1817-1863، رسالة ماجستير، كلية الآداب، جامعة طنطا.

عبد الحكيم، محمد صبحي. (2007). مدينة الإسكندرية، القاهرة: الهيئة المصرية العامة للكتاب.

الدسوقي، عاصم. (1975). كبار مالكي الأراضي الزراعية ودورهم في المجتمع المصري 1914-1952، القاهرة: ا

Glossary

-ANPIEMED Foundation: is an Egyptian non-Governmental Cultural Association: The Foundation aims to establish channels of cultural, humanitarian and social dialogue between the Mediterranean countries to develop and exchange experiences especially in the field of human and culture development.

- Dar El-Watha'iq El-Qawmeya (National Library and Archives, NAE): was founded in Cairo in 1828. It is among the most ancient repositories globally, with a rich history originating in the first decade of the nineteenth century, when Mohammed Aly founded it as the inaugural repository for official government files within the fortress.

- Diwan Al-Emara: The house of architecture.

- The European Economic Community (EEC): was a regional body established by the Treaty of Rome in 1957, with the objective of promoting commerce between its member nations.

- Hawass, Z. (1947–present): An Egyptian archaeologist.

- Herzog & de Meuron Basel Ltd.: It is a Swiss architectural business based in Basel, Switzerland, established by Jacques Herzog and Pierre de Meuron.

- Kuttab: Basic school in Islamic education.

- Rawk: Institution dedicated to land survey.

- Saiid Pasha (1822–1863): Ottoman viceroy of Egypt.

- Sabil: A public water fountain in Islamic countries.

- Sir Michael Craig-Martin CBE RA (born 28 August 1941): is a modern creative artist and painter of Irish origin

- The Centre d'Etudes Alexandrines (CEA or CE Alex): It was founded in 1990 by Dr. Jean-Yves Emperor as a research institution focused on various facets of Alexandrian heritage.

- The Alexandria and Mediterranean Research Center (Alex Med): It is a center that catalogs and investigates the real and abstract patrimony of Alexandria and the Mediterranean region.

- Waqf: An Arabic, Islamic term referring to the permanent dedication of any tangible or intangible asset for purposes recognized by Muslim law, often related to religious or philanthropic activities with no intention of reclaiming the assets.

- Wikala: A building that housed merchants and their goods, serving as a hub for commerce, preservation, negotiations, and many economic operations.

Annex

Interview Questionnaire

Survey on Mina El-Bassal District area Issues and Improvement Ideas

Serial Number: ____________________

Name: ____________________

Age: ____________________

Occupation: ____________________

Residence: ____________________

What are the main problems facing the region? (Please select the most relevant answer)

1. Unemployment
2. Insufficient number of schools (Primary - Secondary - High School - Vocational)
3. Canal pollution
4. Accumulation of garbage
5. Lack of medical services
6. Spread of drug trafficking
7. Lack of recreational parks
8. Other problems (Please specify): ______________

What is your opinion on the old industrial buildings in the region? (Please select the most relevant answer)

1. Many parts of the buildings are damaged and should be demolished.
2. The buildings are historical and need restoration to become a tourist attraction.
3. The buildings are historical and need restoration and repurposing for various activities.

What kind of activity do you think could be conducted in these buildings if they were renovated? (Please select the most relevant answer)

1. Industrial activity to revive the region's historical industrial significance.
2. Educational activity.
3. Recreational activity (such as restaurants and cafés).
4. Retail and commercial stores.
5. Residential buildings.

Please complete the survey carefully, as your feedback will help improve and develop the region. Thank you for your participation.

استبيان حول مشاكل المنطقة وتصورات التحسين

الرقم المسلسل_: ____________________

الاسم: _____________________

السن_: ____________________

الوظيفة : _____________________

الإقامة_: ____________________

ما أهم المشاكل التي تعاني منها المنطقة؟ (يرجى اختيار الإجابة المناسبة)

1- البطالة

2- عدم توفر مدارس كافية (ابتدائي - إعدادي - ثانوي - صناعي)

3- تلوث القناة

4- تراكم القمامة

5- قلة الخدمات الطبية

6- انتشار تجارة المخدرات

7- عدم توفر متنزهات

8- مشاكل أخرى (يرجى ذكرها)

ما رأيك في المباني الصناعية القديمة في المنطقة؟ (يرجى اختيار الإجابة المناسبة)

1- أجزاء كثيرة منها مهدم، ويجب استكمال هدمها

2- مباني أثرية تحتاج إلى الترميم لتكون معلمًا سياحيًا

3- مباني أثرية تحتاج إلى الترميم وإعادة تأهيلها لأنشطة متعدد

ما النشاط الذي يمكن أن يُمارس في هذه المباني إذا تم تأهيلها؟ (يرجى اختيار الإجابة المناسبة)

1- نشاط صناعي لإحياء أهمية المنطقة كمركز صناعي

2- نشاط تعليمي

3- نشاط ترفيهي (مثل المطاعم والكافيهات)

4- متاجر ومراكز تجارية

5- مباني سكنية

.يرجى تعبئة الاستبيان بعناية، وستساعد آراؤكم في تحسين وتطوير المنطقة. شكرًا لمشاركتكم