FATİH SULTAN MEHMET VAKIF ÜNİVERSİTESİ
LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ
MİMARLIK ANABİLİM DALI
MİMARLIK İNGİLİZCE PROGRAMI

ADAPTIVE REUSE AS A STRATEGY FOR CONSERVING THE INDUSTRIAL HERITAGE BUILDINGS

YÜKSEK LİSANS TEZİ

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LAYLA ZAKIEH
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Danışman
(Dr. Öğr. Üyesi, Hakkı Can Özkan)

İSTANBUL, 2022

FATİH SULTAN MEHMET VAKIF ÜNİVERSİTESİ
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LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ MÜDÜRLÜĞÜNE

Mimarlık Anabilim Dalı Mimarlık İngilizce Tezli Yüksek Lisans programı 190202001 numaralı Layla ZAKIEH'nın hazırladığı "Suriye savaş sonrası kültürel ve kentsel yeniden yapılanma stratejileri. Çalışma Örneği Bab Hud Mahallesi / Humus Şehri" / "Syrian post-war cultural and urban reconstruction strategies. The Case of Study Bab Hud Neighborhood/Homs city" konulu Yüksek Lisans tezi ile ilgili Tez Savunma Sınavı, 01/07/2022 Cuma günü saat 10:00'da yapılmış, sorulara alınan cevaplar sonunda adayın tezinin **Kabulüne Oy Birliği** ile karar verilmiştir.

Düzeltme verilmesi halinde:
Adı geçen öğrencinin Tez Savunma Sınavı 01/07/2022 tarihinde, saat 10:00 da yapılacaktır.

Tez adı değişikliği yapılması halinde: Tez adının "Adaptıve Reuse As A Strategy For Conservıng The Industrıal Herıtage Buıldıngs" / "Endüstriyel Miras Binalarını Korumak İçin Bir Strateji Olarak Uyarlanabilir Yeniden Kullanım"
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**2. Danışman varsa doldurulması gerekmektedir.*

ETİK BİLDİRİM

Bu tezin yazılmasında bilimsel ahlak kurallarına uyulduğunu, başkalarının eserlerinden yararlanılması durumunda bilimsel normlara uygun olarak atıfta bulunulduğunu, kullanılan verilerde herhangi bir tahrifat yapılmadığını, tezin herhangi bir kısmının bağlı olduğum üniversite veya bir başka üniversitedeki başka bir çalışma olarak sunulmadığını beyan ederim.

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ENDÜSTRİYEL MİRAS BİNALARINI KORUMAK İÇİN BİR STRATEJİ OLARAK UYARLANABİLİR YENİDEN KULLANIM

Layla Zakieh

ÖZET

Binaların belirli ömürleri vardır. Bir binanın kullanımının bir süre sonar sona ermesi doğal bir durumdur. Çoğu bina, başlangıçta tasarlandığı şekilde işlevini yerine getirmekten çıkar. Bu büyük ölçüde teknolojideki ilerlemelerden, ekonomik ve endüstriyel uygulamalardaki değişikliklerden, bakım maliyetinden ve insanların algılarından kaynaklanmaktadır. Böylece bu yapılar zamanla ihmal edilmekte ve terk edilmektedir.

Uyarlanabilir yeniden kullanım, toplumun mevcut, eski binaları yeni bir kullanım veya amaç için güncelleyerek veya uyarlayarak korumasını sağlayan bir mimari stratejidir. Bu strateji, mimarların mevcut ihtiyaçları karşılamasını ve yerel toplulukların sürdürülebilirliği ve geliştirilmesinde önemli bir rol oynamasını sağlar. Bu tez, endüstriyel binaların kullanımını sürdürmek için bir yaklaşım olarak uyarlanabilir yeniden kullanımı incelemektedir ve endüstriyel miras binalarını korumanın etkinliğini analiz etmeye odaklanacaktır. Bu tez aynı zamanda birkaç özel uyarlanabilir yeniden kullanım projesini analiz ederken bir yandan da onlardan uyarlanabilir tasarım ilkeleri türetmeyi hedeflemiştir. Bu çalışma daha sonra Suriye, Dummar'daki çimento fabrikasını yeniden kullanım için sistematik bir yaklaşım önermek için yönergeler belirleyecektir.

Ek olarak, tez, bu projelerin değerini ve topluma faydasını analiz etmede literatüre katkı sağlamayı da amaçlar. Ayrıca, kentsel gelişim amacıyla modası geçmiş endüstriyel binalara odaklanmanın önemini ve bunların sosyal, kültürel, ekonomik ve çevresel etkilerini tartışacaktır.

Anahtar Kelimeler; Uyarlanabilir yeniden kullanım, endüstriyel miras, kültürel miras, sürdürülebilir kalkınma.

ADAPTIVE REUSE AS A STRATEGY FOR CONSERVING THE INDUSTRIAL HERITAGE BUILDINGS

Layla Zakieh

ABSTRACT

It is a natural occurrence that a building's use will eventually come to an end, especially since buildings are designed for a specific period. Most buildings cease to be functional in the way they were originally meant to function. This is largely due to the advances in industrial technology and the high cost of maintenance, in addition to the financial reasons, therefore, these structures become deserted and empty.

Adaptive reuse is an architectural strategy that enables society to maintain existing, obsolete buildings by updating or adapting them for a new use or purpose. This strategy enables architects to meet current needs and play an essential role in the sustainability and enhancement of local communities. This thesis examines adaptive reuse as an approach to sustaining the use of industrial buildings and will focus on analyzing the effectiveness of conserving industrial heritage buildings. This thesis will also analyze several specific adaptive reuse projects while simultaneously deriving the design principles from them. This will then set out the guidelines to propose a systematic approach for adapting the cement factory in Dummar.

Additionally, this thesis will analyze the value of these projects and their benefit to society. Furthermore, it will discuss the importance of focusing on obsolete industrial buildings for urban development and their significant social, cultural, economic, and environmental impact.

Keywords; Adaptive reuse, industrial heritage, cultural heritage, sustainable development.

PREFACE

Many industrial buildings have lost their original function due to the failure to adapt to advancements in technology. This has led to negative impacts on urban communities because they serve no purpose to society. When the industrial heritage is preserved, urban communities maintain their value and aesthetics. Thus, adaptive reuse is often adopted in urban regeneration projects, which seek the historic, aesthetic, and economic elevation of degenerated areas.

The architecture and urban fabric define the identity of a community. It influences the culture, lifestyle, and economy of cities. The industrial buildings that are no longer in use are still considered an integral part of a city's identity and carry potential benefits to their surroundings. Thus, they should be preserved to honor the city's history and the local community. In this context, industrial buildings are considered an example of a community's cultural identity, and this cultural identity is maintained throughout time by adapting buildings that are no longer useful in a way that meets new societal standards.

July,2022 Layla Zakieh

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ABBREVIATIONS

TICCIH	: The International Committee for the Conservation of the Industrial Heritage.
ICOMOS	: International Council of monuments and sites.
UNESCO	: United Nations Educational, Scientific and Cultural Organization.

INTRODUCTION

The process of deindustrialization in many countries of the world led to the widespread closure of old factories in this way, the industrial structures and their locations were neglected for a long time, causing difficult problems by creating gaps in the urban fabric. This raised the question of how to reintegrate the industrial complex into the urban structure. Although the fastest way to resolve the problem of their existence is by replacing them and demolition of the degraded structures, recent studies have shown that in most cases it is more profitable to reuse an old building rather than demolish it and build a new one and the most effective strategy for revitalizing and renovating them is the adaptive reuse. Douglas stresses the sustainability of the adaptive reuse method compared to new construction features in his book:

Sustainability, "Reusing or upgrading old buildings is more environmentally friendly than redevelopment. The latter involves demolition as well as new-build activities, both of which expend more energy and waste than adaptation" (Douglas, 2006, p. 15).

Adaptive reuse has been effectively applied to many kinds of buildings all over the world. It is viewed as being key to intact government strategy and sustainable development in the US, Canada, Hong Kong, North Africa, and Australia. (Langston, 2008). It is assessed that some 70% of constructions existing today will exist for 50 years from now, thus revitalization and refreshing for current and future requirements should become focal in our ongoing practices. In this way, the right method for managing historical structures could be adaptive reuse as a strategy (Fisher-Gewirtzman, 2016, p. 1). Adaptive reuse is activating or filling an old structure with another function, dissimilar from the one for which it was at first built, and at this point, while a structure is reused, the most significant criteria are the authentic structure and the relationship between the old and the new. (Brooker, 2004)

Douglas identifies several opportunities for the reuse of redundant industrial buildings (Douglas, 2006). Because industrial buildings are typically large, single-story buildings, some industrial buildings can be converted into sports facilities, industrial museums, or art galleries. With their large open spaces and volumes, the spaces can provide space for exhibitions or be open to the public. However, converting industrial buildings to residential or office use also presents many challenges that must be overcome. It is a question of the size and conditions for reviving these spaces by reusing them (Douglas, 2006).

Author Derek Latham, known for his work in reusing historic properties, highlights the creative reuse approach to adapting buildings. In his book "Creative Reuse of Buildings" he discusses the feasibility of creative reuse. He claims that the creative reuse of redundant objects not only successfully combines old and new functions, but also brings out the character of a place more effectively. It is the lack of imagination in the adaptation approach that suppresses the process of merging historic buildings with the new moods of the times. The real limits are not archaeological, aesthetic, economic, or functional, but psychological: the limits created by prejudice and lack of imagination. When the will is there, the skill and ingenuity follow. (Latham, 2000).

1. A Literature Review n Adaptive Reuse

There are different meanings of adaptive reuse. researchers Shen and Langston who have widely investigated the strategy of adaptive reuse, characterize it as a method of reviving existing structures by leaving the essential construction and the fabric of the building intact, and changing its utilization. It forms a hard challenge for developers and designers, as it is an extraordinary type of renovation, where the functional categorization of the structures is changing, new regulatory terms may be required, and rezoning approval. Adaptive reuse of industrial buildings is a sustainable method of providing a choice for various parties in cities such as government, neighborhoods, and stakeholders (Shen, 2010). Latham defines the adaptive reuse as "prolonging the period from cradleto-grave for a building by retaining all or most of the structural system and other elements, such as cladding, glass, and interior partitions" (Latham, 2000).

When developers and architectures think about dealing with the obsolete industrial beings and their locations, they considered Balancing historic conservation and sustainability. In historic preservation literature, the adaptive reuse strategy is connected with conservation and researchers see it as a method that boosts the historical significance. (Appler Douglas, 2016). For a thorough comprehension of everything connected with adaptive reuse, it can be defined according to:

- Charters of international conservation authorities.
- The theoretical research.

Industrial heritage, like the other types of heritage, has organizations interested in preserving it, wherefore, conferences were held to discuss the concept of industrial heritage, eventually resulting in several international organizations, and this thesis will mention some of them. ICOMOS, The International Council on Monuments and Sites which was held and founded in Warsaw in 1965, stated that the adaptation includes the meaning of changing a place for existing use or new use all of which should have a compatible use (URL_1). And before one year, when The Charter of Venice was signed, the significant concept in this charter is preservation in a way creating a socially beneficial environment to raise the vitality of the urban context. The Charter of Venice, The International Charter for The Conservation and Restoration of Monuments forms the basic principles of conservation in contemporary approaches (URL-2).

One of the famous charters for conservation of the industrial heritage is The Australian ICOMOS Charter known as The Burra Charter which developed the rules and principles of the Venice Charter and includes the principles and the rules of conservation and all process related such as restoration, adaptation, reconstruction, maintenance, and compatible use. in addition, the focus of the conference was on several values and the concept of the cultural importance for the generations in the past, present and future (URL-2).

Among the famous charters is New Zealand charter, the charter for The Conservation of Places of Cultural Heritage Value which follow the same concepts and rules of preservation in The Venice Charter, explained the principles of conservation in the historical context (URL_3). In the following, the main points of the concepts about adaptive reuse in international conferences were clarified, which is mentioned on the ICOMOS's official website (URL-4).

The Venice Charter 1964: Extension and additions are permitted if do not detract from the composition balance and the distinctive and important parts of the building and its relationship to its surroundings.

The Declaration of Amsterdam 1975: Meet the people's perceptions by new functions serving their needs with retaining the building's character.

The Washington Charter 1987: The proposing function should retain the current spatial organization and be compatible with the old city.

The New Zealand Charter 2010: The building adaptation is to change its use by minimal interventions with reversible.

The Paris Declaration 2011: Adaptive reuse is to propose a new function compatible with historic buildings and provides the needs of current life.

The Burra Charter 2013: To ensure the continuity of the architectural assets by highlighting their importance and values in our societies.

Architectural Heritage Conservation Charter, Turkey 2013: To ensure the continuity of the architectural assets by highlighting their importance and values in our societies.

Council Of Europe Leeuwarden Declaration 2018: A creative adaptation should be done to the heritage sites, to highlight the values of these locations (URL-5).

The theoretical understanding can begin in the line with the purpose of this thesis, Burchell and Listokin in their book described that the term adaptive reuse is a revitalization approach, which has a plan for the reuse and management of abandoned buildings. The most important feature of adaptive reuse is that it deals with the buildings or the lands, which was suitable for their previous use and are no longer suitable in that specific building type or location, and as a result, the value of the building will increase by adaptation of the building, which has the aesthetic, economic social and cultural value, for new use (Burchell, 1981).Furthermore, they highlighted the hidden worth of the buildings and explained the main concept of adaptation as a tool to reuse these buildings, which this study concentrates on.

Douglas argued that adaptive reuse is any work on a building that goes beyond maintenance to change its capacity, function, or performance, any intervention to adapt, reuse, or upgrade a building to meet new conditions or requirements (Douglas, 2006, p. 1). Adaptive reuse is about overcoming obsolescence in buildings. It is also about securing the long-term future of buildings that are at risk of deterioration, demolition, and vacancy. The field of adaptation works is varied and it is different based on the extent of change of the original building and the function that propose to the building, as the interventions diverse between preservation works to fully reconstruction. Douglas named some terms related to the adaptation options as rehabilitation, renovation, refurbishment, renovation, remodeling, and restoration.

The performance of the building is the concept that Douglas focused on, it is an approach to achieving the required results by concentrating on the ends instead of the means, and as he mentioned, the performance management of the building is divided into two elements, the adaptation of the building which deals with substantive improvement such as to install new windows to the building instead of the old with higher performance in terms of thermal efficiency, appearance, air-tightness, sound attenuation, and the other element is the maintenance which includes fix and repair.

The term adaptive reuse was published for the first time in an article by Architectural Review magazine under the title "New Uses for Old Buildings" then the author of the article published a book in 1972 that explained the development of adaptive reuse through historical phases and evaluated it by considering types of the structures (Cantacuzino S.). Douglas examined and evaluated the problems and benefits of the adaptive reuse strategy through the main functions of the buildings, as he addressed that the characteristics of the function before the modification are significant in the process of adaptive reuse and its implementations. On the contrary, Fisher and Powell examined the adaptive reuse concept based on the new use.

In 1987 a book was published to be informative in terms of technical transformations of architectural assets, the adaptive reuse concept was evaluated by confirming the technical features of the buildings (Highfield, 1987). In addition, adaptive reuse implementations were studied in various ways and were determined in Seven strategies named “building within, building over, building around, building alongside, recycling materials or vestiges, adapting to a new function, and building in the style of”. However, Brooker and Stone, the original structure is the most important factor in adaptive reuse implementations, three strategies were determined called: intervention, insertion, and installation". On the other hand, Cramer, and Breitling considered that aesthetic standard is significant as the design strategies in adaptive reuse implementations and evaluated adaptive reuse in these two concepts (Cleempoel, 2011).

For the objective of this thesis, the most appropriate definition of adaptive reuse of industrial buildings is a preservation process in which a change of the main function is made, with minimal change in the original structure and at the same time enhancing the overall performance to fulfill contemporary requirements.

2. THE PROBLEM STATEMENT

The built environment is affected by many conditions and changes, as it is exposed to various types of deterioration resulting from several circumstances such as the neglect of the buildings and their sites after losing their original function. These buildings are existing in many cities and the obsolete power plants are a good example. The technological developments in the sector of industry and the economic shifts led to changes in the production modes and consumption. where a large number of the structures and facilities have become functionally old and outdated but still in their physical durability. These huge buildings were neglected for long periods, therefore the sites were completely deserted after the expiration of their function

The cities are exposed to constant changes which, in turn, impact land use and the urban fabric, the conversions take place in the land-use patterns and appear as a form of displacement by transferring the uses to other areas, that in turn results in the functional obsolescence of many buildings in those areas. Therefore, residential areas located in city centers may become a part of central districts. Similarly, industrial buildings once situated outside the city may become integrated into the city's urban fabric (Eyüce, 2010).

Most of the industrial buildings are left unused for so long up to these days, leaving the urban fabric with gaps. And this is the case of Dummar Cement Company which is considered one of the oldest public companies affiliated with the Ministry of Industry. It was founded in 1930 and nationalized in 1965. It supplied the country with its needs of cement and employed about a thousand workers, but since the eighties of the last century and with the urban sprawl and the production lines development lack, the countdown began in the life of the company, and the cement plant was closed in 1989, and its lands became vulnerable to infringement by citizens and other ministries, and many proposals were made to benefit from the company's real estate and infrastructure, but for more than ten years, the custodian authorities have not been able to achieve this goal.

Currently, Dummar Cement Factory industrial site is highly unprotected and at the risk of demolition because of a lack of awareness, inadequate designation, and documentation

Because of changing economic trends, environmental issues, and the problem of re-functioning these structures due to their complicated characteristics, the conservation of industrial buildings and reuse of them is a crucial subject that needs innovative and novel approaches. It should be considered a social, economic, environmental, and political process (TICCIH, 2011).

The industrial buildings are considered a landmark of their phase in terms of technological development and economic growth, however, rapidly become to lose their importance, and they have continued to remind the people of their periods despite their stopped production and original working. these structures started to be distinguished as a tool for the conservation of the city, since using adaptive reuse as a creative tool (Loures, 2008, p. 688). Therefore, these buildings and their locations should be preserved to honor the history of the place and its locals.

This cement plant is over a century old and is considered a historical landmark as the people visiting West Damascus pass by the factory on their way to other parts of the city. The site of the factory is distinguishable because of its proximity to the Barada river, and Al-Rabwa area which is recognized as “the lung” of western Damascus. It has been a popular tourist destination for hundreds of years. This shows the importance of adapting the cement factory in Dummar. Not only will this improve the area around the Barada River as a cultural and recreational hub but it will also create a direct link to the city of Damascus, further developing the urban landscape in the area. Maintaining the factory will benefit the community by developing a new structure with functions that serve the population of the area. By preserving the original architectural design and construction of the factory, its historical significance to residents will remain intact. Adapting the structure will benefit the residential areas surrounding it. The area will become more valuable and residents will utilize the building as a source for social gatherings and entertainment. The factory will adopt a new identity and continue to adapt to changes in technology to meet societal demand while also maintaining its historical significance.

3. THE AIM AND SCOPE OF THE THESIS

The preservation and reuse of abandoned industrial buildings play an important role in the process of urban regeneration. Adaptive reuse is a sustainable strategy that promotes the enhancement of urban planning and activates projects for the refurbishment of unused buildings or structures. The reintegration of those structures requires functionalization strategies, usually based on a set of architectural interventions with contemporary approaches.

The basic process of conservation of immovable cultural heritage starts with documentation, continues with definitions and assessments, and concludes with the development of related strategies and intervention decisions. Documenting industrial structures by considering old industrial processes, related machinery, equipment, records or intangible aspects which must address historical, technological, and socio-economical dimensions of the heritage place and the building is essential to their identification and conservation. It should benefit from variable sources and information including site surveys, recording, historical investigation, material and landscape analysis, oral history, and/or research in public to reach an effective evaluation and assessment. Moreover, in addition to knowledge of the industrial and socio-economic history of the heritage site, their links to other parts of the world are also necessary to understand the significance of the heritage place and structure. (TICCIH, 2011)

Within this framework, the main aim of this thesis study is to enhance the term adaptive reuse as a part of heritage conservation in particular the industrial heritage, the reasons for conserving the industrial heritage, and also the value of industrial buildings as a part of the history of our society.

This thesis will explain the practices for the culturally oriented transformation of abandoned industrial buildings, in addition to the principles and concepts of preservation that are mentioned in international charters which are dealing with an industrial heritage and adaptation strategies. And examine the successful adaptive reuse model which was derived from the precedent studies, and submit a comparative study for six international projects, that have been conservated with applying of the adaptive reuse strategy, and in the light of this study, proposed design principles will be presented to the good adaptation of the industrial buildings, to avoid these buildings from being abandoned and give negative impact towards the location and locals.

For this aim, this thesis primarily seeks to explore the relationship between the adaptive reuse of industrial buildings and social, economic, and environmental benefits through reviewing previous studies and literature, and exploring what good practice is to use these inputs in defining the design principles of successful adaptation and provide a systematic approach in reusing the cement factory in Dummar. Furthermore, understanding adaptive reuse as a solution for conserving industrial buildings through successful examples analysis and assessment is another objective of this thesis to create guidelines for other researchers about industrial building reuse and recycling.

The findings would be related to economic, ecological, and socio-cultural values, which are the pillars of sustainability, explaining the positive impacts of the adaptive reuse strategy on sustainable local development. The main research questions are below:

1- How can the adaptive reuse strategy sustain the cement factory and what is its role in the social revitalization and urban regeneration?

2- What are the principles which will apply when the cement factory is adapted for reuse.?

3- How can we benefit from the previous examples and how can we implement those strategies in the factory?

Likewise, adaptive reuse of industrial buildings of cultural heritage bolsters the life cycle of material and resources and reduces waste by reusing structural elements and recycling materials, while safeguarding the world's cultural heritage (Yung, 2012)

4. METHODOLOGY AND STRUCTURE OF THE THESIS

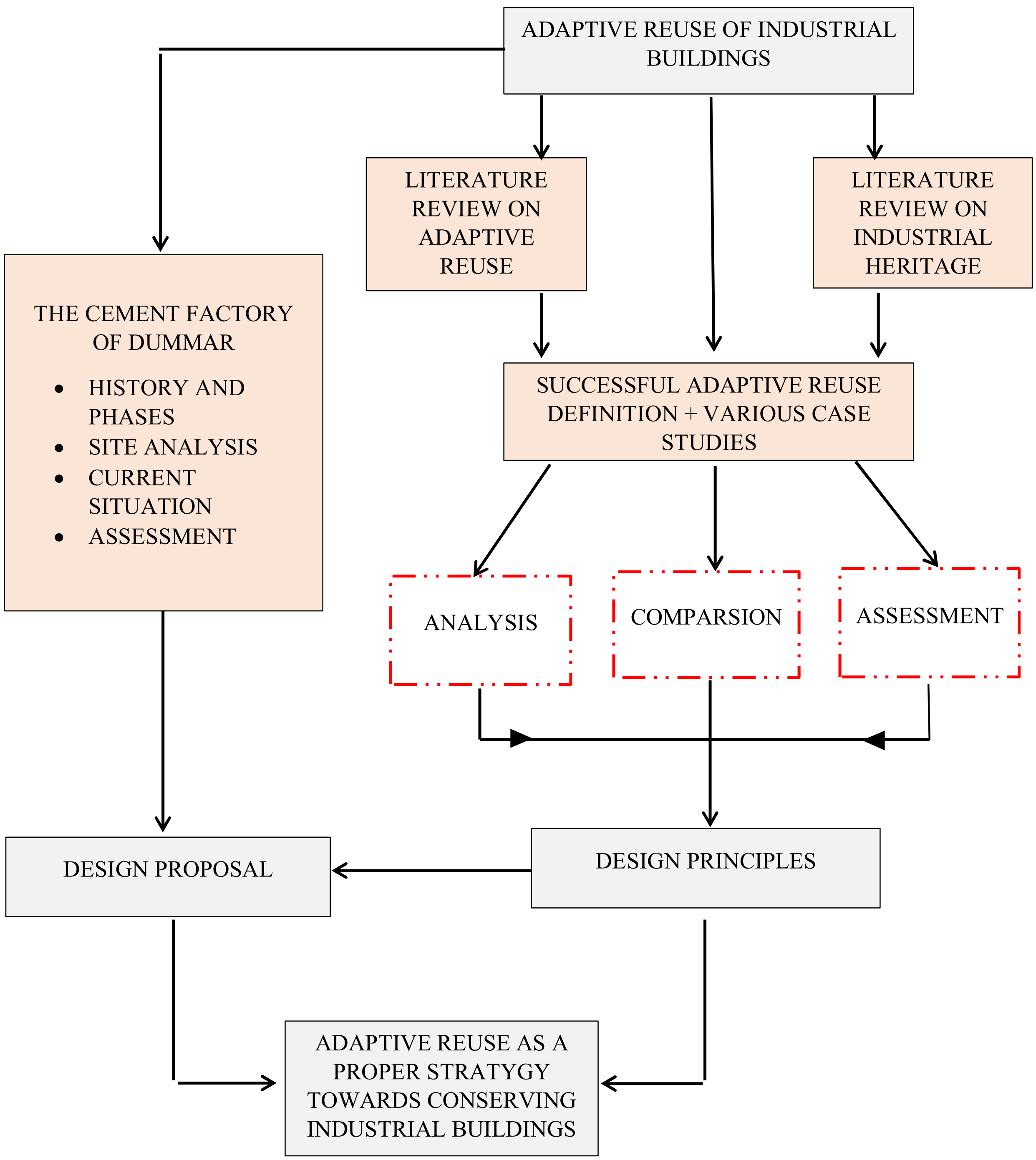
This research is conducted based on a deductive research method that looks at previous research and creates a theoretical framework involving the theoretical background of adaptive reuse, its definition, potential benefiting and influencing factors and its strategies, and also the concept of Industrial Heritage. This concept includes its definition, values, and conservation approaches which can be found in books, articles, and international documents such as the TICCIH and NIZHNY TAGIL charter, ICOMOS, and Burra Charter. As all related to the theoretical framework in this thesis were explained in chapter two.

Major sources in the thesis include research from Douglas (2006), Shen and Langston (2010), Burchell and Listokin (1981), Brooker and Stone, Plevoets, and Van Cleempoel (2013), and bullen and love (2010) which will be cited throughout this thesis.

In chapter three, a comparative analytical approach has been used with six examples related to industrial buildings that have been selected for this thesis, an analysis, and evaluation of their adaptive reuse strategies were conducted based on the contemporary approaches of the adaptive reuse strategies in literature, as well as the comparison of them to form a conceptual framework. Lastly, the degree of compliance for these examples with the conservation rules that are based on the Nizhny-Tagil Charter was assessed, and the guidelines associated with adaptive reuse of industrial heritage were drawn.

In chapter four, a descriptive and analytical method was used, comprehensive information regarding the cement factory was provided, and also a brief history, an analysis of the site, and a determination of the current state of the factory. In addition, the factory was assessed depending on the significance, challenges, and capability.

Chapter five, in light of the information gathered from the previous chapters, including the analysis, and assessments, the design proposal for the cement factory in Dummar was submitted as an example of how to adapt and conserve an industrial building, Lastly, the study results were submitted along with the necessary recommendations and proposals. In the following, the structure of the thesis.


ADAPTIVE REUSE OF INDUSTRIAL BUILDINGS
LITERATURE REVIEW ON ADAPTIVE REUSE
LITERATURE REVIEW ON INDUSTRIAL HERITAGE
THE CEMENT FACTORY OF DUMMAR
HISTORY AND PHASES
SITE ANALYSIS
CURRENT SITUATION
ASSESSMENT
SUCCESSFUL ADAPTIVE REUSE DEFINITION + VARIOUS CASE STUDIES
ANALYSIS
COMPARSION
ASSESSMENT
DESIGN PROPOSAL
DESIGN PRINCIPLES
ADAPTIVE REUSE AS A PROPER STRATYGY TOWARDS CONSERVING INDUSTRIAL BUILDINGS

CHAPTER ONE

1. A REVIEW OF THE INDUSTRIAL HERITAGE AND THE ADAPTIVE REUSE STRATEGIES

The concept of heritage has prevailed over what we think of as temples and palaces, or poetry, literature, and music, the heritage with its tangible and Intangible aspects, which include historical assets and the intellectual production of society. As for the term industrial heritage, its concept is more comprehensive than just assets. It indicates the great influence that an innovative technology or a specific industry has on society or a region. And this is one of the evaluation criteria used by heritage organizations.

In this chapter, a theoretical concept of the industrial heritage will be provided based on the cultural and the historical background, and the relationship between the adaptive reuse and industrial heritage will be explained by exploring the values and the benefits and positive impact on the urban context, as referenced in the international charters and the works of literature which form one of the major reasons in conserving the industrial beings.

1.1. A REVIEW OF THE CONCEPT OF INDUSTRIAL HERITAGE

According to The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2017) heritage is defined and divided into two types; Cultural Heritage and Natural Heritage, the cultural heritage contained a group of buildings and sites which have symbolic, historic, artistic, and aesthetic values, in addition, artifacts, and monuments. And where cultural heritage is divided into tangible and intangible cultural heritage typologies.

The tangible cultural heritage is further broken into a movable cultural heritage including manuscripts, paintings, sculptures, etc., and immovable cultural heritage including the monuments and the archaeological sites. And the underwater cultural heritage includes underwater ruins and cities, and the intangible cultural heritage contains oral traditions, performing arts, and rituals. The second type of heritage is the natural heritage which is included nature parks and reserves, zoos, aquaria, botanical gardens; and, natural sites with cultural aspects.

According to The UNESCO definition above, industrial heritage buildings are a type of tangible cultural heritage.

Existing industry structures began to become insufficient with the continuous development of production technologies and changes made in production systems. Existing factories began to lose their functions and be demolished due to their being not compatible with new production techniques, difficulties in the supply of raw materials, or they are being functionally outdated (Mengüşoğlu, 2013), or their locations being no longer suitable. The automation of production processes and the relocation of industry to areas characterized by low production costs has had a profound effect on the traditional industrial areas all over the world; and produced a vast array of obsolete industrial facilities, which faced the threat of demolition, Thus, the concept of industrial heritage, industrial archaeology appeared and the interest in their conservation. Then the term “industrial archaeology” emerged which indicates the history of economy and technology along with the industrial production and archaeology and all physical remains.(KÖKSAL, 2012, p. 18).

The first country to initiate efforts to protect its industrial heritage was the United Kingdom, a first for the cultural heritage as well, in addition, the industrial structures were included within the scope of industrial heritage. Michael Rix's article published in 1955 at the University of Birmingham was the first to use the term "Industrial Archaeology". In his article, Rix's article stressed the importance of documenting and preserving relics of the British Industrial Revolution before they are lost. There is a research committee established by the Council for British Archaeology in 1959 in an effort to conserve and record industrial remains, the government was requested to take measures. (Çerkezoğlu, pp. 3-4)

There were 8 countries present at the 1st International Conference on the Conservation of Industrial Monuments It played a vital role in the international discussion of the concept, and after the first conference, another follow-up was held. In 1975, under the name SICCIM, the second conference was held in Bochum, Germany. Then the third phase of the Stockholm conferences in 1978 resulted in the creation of a new organization. The name was changed to “Third International Conference on the Conservation of Industrial Heritage” instead of “Third International Conference on the Conservation of the Industrial Monuments” and TICCIH, the International Committee for the Conservation of Industrial Heritage, was formed at this meeting.

The Industrial Archaeology Award was created in 1997. By focusing on industrial heritage instead of industrial monuments, the new organization permitted industrial structures to be considered heritage. (Saner, 2012, p. 53). The International Committee for the Protection of Industrial Heritage presents the idea of industrial heritage in the "NIZHNY TAGIL" charter which was signed in 2003 and was explained as follows:

“Industrial heritage consists of the remains of industrial culture which are of historical, technological, social, architectural or scientific value. These remains consist of buildings and machinery, workshops, mills, and factories, mines and sites for processing and refining, warehouses and stores, places where energy is generated, transmitted and used, transport and all its infrastructure, as well as places used for social activities related to the industry such as housing, education etc.” (TAGIL, 2003).

Additionally, the charter addresses industrial heritage values, legal protection, maintenance and conservation, education and training, presentation, and interpretation. By 2011, the mission of the Joint ICOMOS - TICCIH Principles, also known as "The Dublin Principles," embraced the recognition of Industrial Heritage Sites, Structures, Areas, and Landscapes. This includes the documenting, understanding, and valuing of industrial heritage in order for them to be effectively protected and conserved, in addition, Preserving and maintaining industrial buildings and presenting and communicating the heritage dimensions and values of industrial heritage to increase awareness among the public and corporate audiences and to support training and research (URL-7, 2011).

In 2019, the TICCIH website published the Sevilla Charter for Industrial Heritage 2018- the challenges of the 21st century, the charter intends to guide research topics and administration of conservation of industrial heritage, by stating the Problems and Perspectives related to industrial heritage conservation, and emphasis on the need for new heritage typology instead of present "methodological and conceptual frameworks" and is defined as "transdisciplinary" due to the places of work are affected by a variety of factors, additionally, the recommendations of methodologies, conceptualization, proposals, and tools and actions in Support of the Industrial Heritage (URL-8, 2018).

Modernization leads to changes in the built environment, and the industrial buildings are a reminder of our past industrial heritage and part of our culture (Wong, 2017, p. 32). Thus, the preservation of these memories in the evolving built environment is therefore critical. Heritage preservation is an intervention strategy that can be implemented in a variety of ways and accordance with the ICOMOS Burra Charter of 1981 and 2013, conservation intervention strategies are usually divided into five categories: Maintenance, preservation, Restoration, Reconstruction, and Adaptive Reuse, Additionally, maintenance should be viewed as a continuous process (URL-9, 2013).

Moreover, there are societies, governmental organizations, and non-governmental organizations that conduct research into the industrial heritage, and a growing number of organizations are listed on the TICCIH website (URL-6).

In view of the variety of structures used in industrial sites and buildings, describing their architectural characteristics and development is nearly impossible, and depending on their purpose, industrial structures differ in type (Falser, 2001). In his analysis, he provides a systematic way to follow the types of industrial structures in the world by referring to the classification system, and under this system, structures are classified under ten main titles of industries that include a wide variety of subcategories. Figure 1-1 shows the main categories of industries and some of their subcategories.

EXTRACTIVE INDUSTRIES (EXTRAC): Such as: Iron Mining (IRON), Anthracite & Bituminous Mining (COAL), Crude Petroleum & Natural Gas (OIL), Non-Metallic Minerals (Dimension stone, Crushed and broken stone, Sand & Gravel, Chemical and fertilizer minerals, Gemstones, Salt, etc.), Non-Ferrous Ores (Copper, Lead and Zinc, Gold and Silver, Bauxite and Aluminum)
BULK PRODUCTS INDUSTRIES (BULK): Such as: Agriculture and Rural Industries (Agriculture engineering, Farm buildings and machinery, Ginning, Tobacco products, etc.). Thermally produced products (Brick & structural clay works, Pottery, Glass works, *Cement plants*, Charcoal Kilns, etc.). Chemical Industry (Industrial organic and inorganic chemicals, Plastics & synthetics, Pharmaceuticals, Soaps, detergents, and animal products, etc.). Food Processing, Primary Metal Industries, Textiles, Lumber, Timber, and Paper Industries…
MANUFACTURING -INDUSTRIES (MFG): Such as: Machine Manufacture, Fabricated Metal Products Manufacturers, Transportation Equipment Manufacturers, General Manufacturing…
UTILITIES (UTIL): Such as: Municipal Water Supply, Sanitation, Gas, Electricity, BLANK.
POWER SOURCES AND PRIME MOVERS (PS&PM): Such as: Human and Animal Power, Water Wheels, Water Turbines, Wind, Steam Reciprocating, Steam Turbine, Internal Combustion, Electric Motors, BLANK.
TRANSPORTATION (TRANS): Such as: Railroads, 9. Canals and Inland Navigation, Marine and Harbor Works, Air, Pipelines, BLANK.
COMMUNICATIONS (COMM): Such as: Telephone and Telegraph, Radio and Television, BLANK.
BRIDGES, TRESTLES, AND AQUEDUCRS (BT&A): Such as: Beam or Girder, Arched, Trussed, Movable Bridges…
BUILDING TECHNOLOGY (BLD TECH): Such as: Foundations, Framed Superstructures, Floor Systems, Fenestration, Ancillary Components, BLANCK.
SPECIALIZED STRUCTURES AND OBJECTS (SPEC STRUC): Such as: Dams, Tunnels, Hydraulic Works, Specialized Construction, Materials Handling and Equipment, Elevators & Silos, Tanks & towers, Power and Energy Transmission.

Figure1. 1: Major industries in the industrial structures categorization system (Falser, 2001)

1.2. VALUES OF INDUSTRIAL HERITAGE

The heritage situation or what is indicated as a heritage designation is an obligated protective measure conferred by heritage advocates to particular sites, monuments, and buildings. These are imposed by governmental and planning agencies as well as non-profit organizations. (AlSayyad, 2001). During the heritage designation process, a state's membership in an organization like UNESCO or ICOMOS requires its commitment to the ICOMOS and UNESCO charters. Thus, the state determines its heritage policies by these international charters. When determining whether a property or building should be given a form of heritage designation, the cultural heritage value of that property or building must be acknowledged. According to de la Torre and Mason, "heritage values are, by nature, varied, and they are often in conflict" and they argued that the value has always been the driving force behind heritage conservation, the obvious conclusion is that no society will conserve something it does not value. (Marta, 2002, p. 3).

Bullen and Love argued that there is a growing recognition that historic buildings are important components of the social and the urban fabric and that heritage preservation improves urban communities on an economic, cultural, environmental, and social level (Bullen, 2001).

Nizhny Tagil Charter for Industrial Heritage listed the values in the definitions section of the Charter (TAGIL, 2003, pp. 1-2) It stated the following:

The historical value: The industrial heritage reflects activities that influenced history profoundly and continue to do so. conservation of the industrial heritage does not depend on it being unique, but rather on its great value

The socio-Cultural Value: In addition to giving an important sense of identity and belonging to societies, the industrial heritage is a witness to many eras. These buildings reflect a variety of values at all levels, such as scientific, aesthetic, technological, Spiritual, etc.

The architectural and Aesthetic Value: These values are rooted in the site itself, its fabric, components, machinery, and setting, in the, written documentation, documentary records, archives, and also the intangible records of industry contained in human memories. Additionally, the survival of particular processes, site typologies, or landscapes, adds special value and should be carefully evaluated.

Overman and Mieg are stating that the conflicts in heritage and planning practices are based on differences in values. They argued that two main lines of conflict challenge industrial heritage sites. One relates to culture as a driving factor in urban development, the other to architecture and its current production. Practicing what they called heritage management involves more than dealing with the protection and conservation of the heritage site itself; it also encompasses the urban transformation of the city and the site. Consequently, heritage management practice has to balance heritage conservation concerns and the interests of development, which often include a new production of architecture; thus, the heritage practices must create compatible solutions to balance. These three aspects are differed in the understanding of the concepts and motives, as their practices follow different objectives, and adopt diverse values. (Harald A. Mieg, 2014).

The reuse value lies at the center of all three aspects, and this is what heritage practices should strive for, in addition, to Integrating main values and activating shared values, to act as bridges between different points of view. See table

An adaptive reuse strategy can integrate the main values of preserving heritage and shared values of the urban development, as Canaran argued and classified preserving the neglected industrial buildings into two categories: The first one considers the possibilities and chances of preserving industrial buildings within the urban context, as she mentioned the opportunity of increasing accessibility, stimulating revitalization of the site, promoting the urban voids, maintaining the identity and collective memory, improving environmental performance, reinforcing the physical and social fabric, and enhancing the quality of the built environment.

Then the other one related to the benefits and advantages of obsolete industrial buildings and Sites, she argued that the industrial buildings offer multi-layer values to the built environment such as aesthetic, landscape, economic, historical, and educational values. (CANARAN, 2009).

Table 1. 1: List of values and different three aspects regarding the preservation of industrial heritage (Harald A. Mieg, 2014). Rewritten by the author.

Value	Discourses / Aspects
Accessibility	Architectural production, Heritage conservation, Urban development
Authenticity	Heritage conservation
Bottom-up	Heritage conservation, Urban development,
Character	Architectural production, Heritage conservation, Urban development
Design	Architectural production
Development	Urban development
Economic value	Urban development
Environmental value*	Urban development
Esthetics	Architectural production
Historic values	Heritage conservation
Image	Architectural production, Urban development
Integrity	Heritage conservation
Re-use	Architectural production, Heritage conservation, Urban development
Sensitivity	Architectural production, Heritage conservation
Vision	Urban development
= Core value	

1.3. APPROACHES FOR CONSERVATION OF INDUSTRIAL HERITAGE

Conserving industrial heritage isn't only about modifying and organizing places; it's also about enhancing the feel of a place through conservation. The modifications in the technical and socio-political structure of the industrial sites led to their abandonment and obsolescence, Often, these sites have been redeveloped or modified as a result (Burke, 2001).

Based on the Venice Charter (1964), it is crucial to agree on and set down the principles guiding the preservation of ancient buildings on an international scale, as every country is responsible for implementing the plan according to its own culture and traditions (URL-2).

When industrial structures lose functioning validity, they are usually repurposed for new functions by rethinking their design, these new purposes for industrial heritage can be categorized into three categories. In the first approach, industrial beings like thermal structures and bridges are retained with minimal intervention as they are, as Lands haft Park. Lands haft Park in Duisburg, Germany had been a coal and steel plant that was closed in 1985 and left the area significantly polluted, instead of trying to reject the industrial past, the remains of the old installations were conserved as valuable industrial heritage. The site has been transformed into a public park with a focus on its connection to the original use of the site. Figure 1.2.

Figure1. 2: General view Lands haft Park in Duisburg, Germany (URL-10).

The second approach is reusing the industrial heritage as technological museums or industrial museums related to its original function. Such as the Paper Factory in Kocaeli which was converted into Paper Museum and Science Center. Construction of the pulp and paper mill began with a groundbreaking on August 18, 1934. The first domestic paper was produced on April 18, 1936. Exactly 80 years after its establishment, the mill was redeveloped into a museum by the Metropolitan Municipality of Kocaeli on November 6, 2016. It is the country's first, and the world's largest, paper museum. The museum consists of 16 halls in a four-story building. Machinery and equipment used in the papermaking process are an essential part of the museum, see figure1.3. (URL-11).

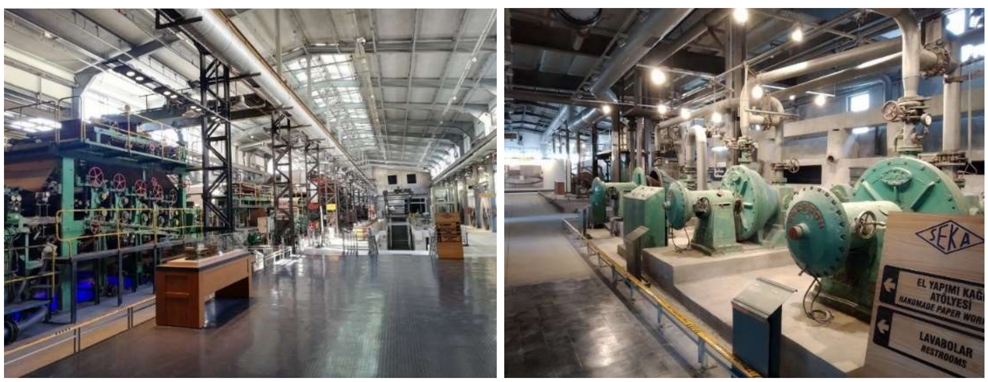


Figure1. 3: Images from SEKA Paper Museum showing the galleries and the printing machines (URL-12)

In this thesis, the third approach, which is referred to as adaptive reuse, is a way to conserve the industrial heritage with a new use. this strategy can adapt buildings and sites to accommodate mixed-use functions and these new purposes can be cultural, educational, commercial, or residential, depending on the requirements of the site and the building conditions. The Energy Museum is an example of a mixed-use development in Turkey. The site includes several industrial buildings related to energy production, as the station worked to produce electricity between the years 1918 to 1983. The Ministry of Energy has allocated the industrial site of Bilgi University, and many industrial buildings have been reused in it see figure 1.4. the power plant building with all its mechanisms has been preserved with minimal interventions and it was opened as Energy Museum, in addition, to converting some other buildings for educational purposes and adding other buildings. The project was completed in 2007 with many public and private initiatives. (URE-13).

Figure1. 4: The Energy Museum, İstanbul Turkey. (URE-13)

Preserving industrial heritage is a multidisciplinary field, depending on several factors that influence the decision-making process towards its reuse and consequently its preservation. And since industrial facilities and sites differ in their sizes and functions, the way to think about reusing them for new purposes follows their characteristics, many industrial facilities in the world have been reused as multifunctional facilities after they were neglected for long periods (URL-14).

For example, The Zollverein Coal Industrial Complex in Essen, Germany, was a coal factory that ceased operations in 1986 and was listed as a UNESCO World Heritage Site in 2001. See figure 1.5. Many of its buildings have been reused for commercial, administrative, and other purposes. Today, it is a symbol of culture, creative design, and an example of merging the historical industrial structures in the urban context (URL-14).

Figure1. 5: The Zollverein Ice Rink (URL-15)

1.4. ADAPTIVE REUSE AS A METHOD FOR CONSERVATION OF INDUSTRIAL HERITAGE

1.4.1. Brief History of Adaptive Reuse

the theoretical debate over the adaptive reuse of cultural heritage started in the 19th century between two attitudes; the restoration movement led by Eugène Emmanuel Viollet-le-Duc (1814-1879), and the anti-restoration movement, led by John Ruskin (1819-1900) and his fellow William Morris (1834-1896). Emmanuel considered adaptive reuse as a solution to preserve historical monuments, The argument was that the best way to preserve a building is to find a new use for it to choose the best new use that in the future would not be necessary to make further changes to the building. In the early 20th century Alois Rigel (1858-1905) attributed the conflict in theories to the different values of the buildings and monuments. He classified different types of values, which he grouped as commemorate values including age value, historical value, and intention commemorative value; on the contrary to present-day value including use value, art value, and newness value (Cleempoel, 2011).

During the 20th century, architects strived to create new buildings, new structures, and new urban layouts, by the mid-20th century there was an increasing number of buildings that were demolished or abandoned, this led architects to react toward the destruction by focusing on the preservation and conservation of old buildings (Cantacuzino, 1975). Architects started to work with historical buildings and sites to avoid the cases of abandonment, much of the true inspiration came from adaptive reuse practices documented in Sherban Cantacuzino's works which indicates valuable examples of adaptive reuse. During the 1970s, a book was published by Barbaralee Diamonstein titled "Buildings Reborn: New Use, Old Place" which described how to find a new use for the existing buildings that will benefit the public (Diamonstein, 1978). The list of examples of buildings being used was provided and exhibited in 22 cities. Both the book and the exhibition had an impact on society concerning preservation and adaptive reuse. After the success of the exhibition, adaptive reuse was widespread as a social revolution and as an architectural criticism. Rejecting new buildings in favor of historical ones, showed the concern and awareness in society that soon became known as a postmodernism movement.

The author Diamonstein stresses the importance of people's changes in taste they preferred the authenticity of the past reflection that existing buildings had to offer with a twist of modern interior use of the buildings. The reason adaptive reuse evolved into a movement, Diamonstein considers different factors. The first factor was the urban renewal program which raised many cities in the US and often ignored the historical value of the buildings. Soon the Urban renewal was rejected by the activists who protested for the preservation and environment of their neighborhoods. The second factor was the awareness of the society toward their historical setting. Third and fourth was the energy and economic decline in 1973, which increased the unemployment rate. Historical preservation was seen as a solution to increasing employment in the construction section, lowering the building cost, and saving energy. The last factor included the decline of modernist architecture and the rise of postmodernism (Diamonstein, 1978).

1.4.2. Methodology of Adaptive Reuse

According to a number of researchers, adaptation is primarily a typological process. An approach such as this tends to confirm the building that embraces and considers it the basic premise for developing an adaptation strategy (Mohseni, 2018). "The New Uses for Buildings" author has mainly determined different typologies and argued the implications of particular new functions for each of them, and emphasized that the type of the host building is a crucial factor before adaptation (Cantacuzino S. a., 1980). The adaptation must therefore place a strong emphasis on typology, preserving as much of the original character as possible. In other words, new uses must reflect the original function or be integrated into it. He also emphasized a thorough understanding of new usages for the original buildings. In order to illustrate the importance of typology in deciding the reusability of a building, the author discussed a number of examples from around the world. However, the contemporary demand on new functions have not been evident in the field of study (Cantacuzino S. a., 1980). Additionally, the author James Douglas also discussed diverse possibilities of the new uses for the old buildings (Cleempoel, 2013).

Another approach for adaptation is the technical approach, as heritage buildings are evaluated in terms of their ability to be reused for new functions on the basis of their technical aspects, this approach focuses on a comprehensive understanding of all the challenges and obstacles related to the building's technical aspect. The technical objectives of building adaptation have been identified by James Douglas, and he argued in order for a building to be sustainable, several technical aspects, such as insulation, thermal efficiency, fire resistance, and structural stability must be considered (Cleempoel, 2011).

Based on the degree of integration between the host building and the new elements, Broker and Stone provide three types of building reuse in their book

“Rereading”. These strategies include intervention, insertion, and installation, as defined below:

Installation: The old and new buildings are considered separate entities. However, the new additions are located within the boundaries of the existing building. It may influence their design, but it does not mean that they are compatible with the existing building. The building may revert back to its original state once the installations have been removed.

Insertion: The creation of a new, independent element that perfectly matches the existing envelope. This element is constructed to fit within the confines of the existing building.

Intervention: Major modifications are made to the existing structure so that it can no longer function on its own. The old and the new additions are fully integrated see table 1.2.

In practice, all three remodeling and transformation concepts are pragmatic and well accepted. In order to determine which strategy is most appropriate, the expertise and designers in the field must examine the building from a holistic viewpoint (Brooker, 2004).

Derek Latham, the expert in reusing historical properties, emphasizes the creative approach to designing reuse strategies, and he argued the reuse of heritage buildings is an effective method for highlighting the character of places. Technology, economics, and urban development of societies are reflected in these buildings. They represent different values for the urban fabric, and they give people a sense of place. As a result of a lack of imagination in developing an adaptive approach, the new state of the building cannot be integrated with the heritage building, this is one of the key limits in designing a creative approach rather than functional, economic, or aesthetic limits (Latham, 2000). As part of the creative reuse approach, a comprehensive analysis of the building's current architectural characteristics has to be conducted in order to find out the advantages that will be generated by the new uses (Mohseni, 2018).

Table 1. 2: The extent of transformation of an existing building, including the three categories (Brooker, 2004) Edited by the author.

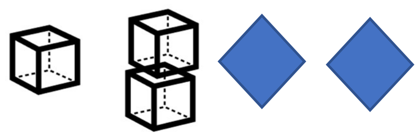
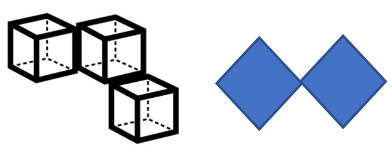
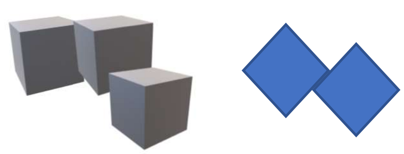
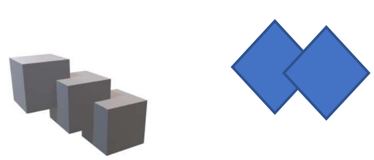
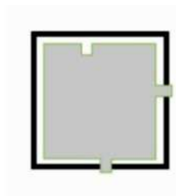
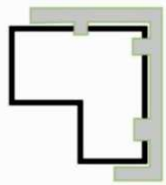
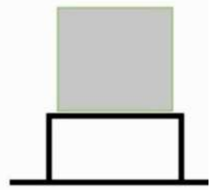
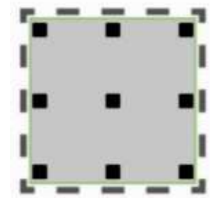
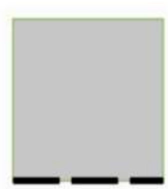
<table>
<tr><td>NO CONTACT – SPACIAL TENTION</td><td>1</td><td rowspan="4">Installation
The old and new buildings are considered separate entities. However, the new additions are located within the boundaries of the existing building. It may influence their design, but it does not mean that they are compatible with the existing building. The building may revert back to its original state once the installations have been removed.</td></tr>
<tr><td rowspan="2"></td><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>EDGE TO EDGE CONTACT</td><td>4</td></tr>
<tr><td rowspan="2"></td><td>5</td><td rowspan="4">Insertion
The creation of a new, independent element that perfectly matches the existing envelope. This element is constructed to fit within the confines of the existing building.</td></tr>
<tr><td>6</td></tr>
<tr><td>SURFACE TO SURFACE CONTACT</td><td>7</td></tr>
<tr><td rowspan="2"></td><td>8</td></tr>
<tr><td>9</td><td rowspan="4">Intervention
Major modifications are made to the existing structure so that it can no longer function on its own. The old and the new additions are fully integrated</td></tr>
<tr><td>INTERTWINED VOLUMES</td><td>10</td></tr>
<tr><td rowspan="2"></td><td>11</td></tr>
<tr><td>12</td></tr>
</table>

Table 1. 3: Types of adaptive reuse, formal analysis, based on Bollack 2013, created by Donghwan Kim (KIM, 2017). Rewritten by the author.

			
Insertions	**Parasites**	**Parasites-stacks**	**Peeling**
			
Transplanting	**Parasites-Jaxtapositions**	**Wraps**	**Weavings**

depending on the new directions in architectural transformations, Bollack proposes five adaptive reuse typologies and categorizes them as follows: insertions, parasites, wraps, juxtapositions, and weavings (Bollack, 2013). Based on Bollack's conceptual diagrams, Kim modified the diagrams into eight different types see table 1.3.

The type of "insertions" is a method that involves the utilization of existing old structures. This helps to protect the old buildings while simultaneously inserting new spaces into them. To help preserve the existing atmosphere of the historic district, it is crucial to preserve the existing structure of the old building with its old materials, forms, and proportions while simultaneously inserting new functions inside thus, a preserved outside shell with memories reflects the authenticity of the place. In return, this creates an attractive, emotionally experience for the locals (Bollack, 2013). For example, 'Salt Galata, Istanbul' Primary Function of the building is The Headquarters of the Ottoman

Bank until 1999, the building has been restored in 2011 and at present, is being functioned as a public library with ottoman archives collection and modern scientific books and research in various languages and Art Gallery, Cultural Research Centre, see figure 1.6. The building is known for being a unique structure in Istanbul, due to its monumental scale as well as the surprising difference in neoclassical and orientalist architectural styles used on the front and rear facades (URL-16).

The type of "parasites" encompasses the original building and the new additions, which are clearly visible. According to Bollock, the host otherwise known as the 'old building', and the parasite otherwise known as the 'new building' should have an integrative and beneficial relationship to achieve the goal of reuse. While the old building is maintained in its form and material and reflects its historical identity, the new added parts are visually distinct and readable, thus the new building after adaptation becomes distinctive and represents a symbolic and historical value.

Figure1. 6: Interior façade with the main façade of the building (URL-16).

The type of “wraps” is a way of containing and preserving an older building, retaining its original materials and forms. While this strategy maintains the original volumes and structures, the old façade cannot be seen from the exterior.

The type of “weaving” it is the process of weaving the new additions to the old building by reusing the older parts and elements of the building, and in terms of proportions, materials, and façade design the new additions are compatible with the old building while still being distinguishable. This type of building transformations used after disasters and post war, as some buildings have been partially demolished and decision makers must decide whether to demolish or preserve and restore them. distinct (Bollack, 2013).

1.4.3. Criteria And the Influencing Factors of Adaptive Reuse

Because preserving industrial heritage buildings and reusing them is a multidisciplinary process, the decision for conservation has to be based on a variety of factors, as architects, developers, stakeholders, and owners face obstacles and barriers to deciding on the conservation process. It is important to know the successful adaptive reuse of industrial buildings requires that the existing building be respected and preserved while providing new features and benefits for future users. The challenges resulting from this decision cannot all be considered obstacles, but some can be considered catalysts, considering the benefits and advantages of the new use on a social, cultural, and economic level, Likewise, addressing the problems caused by the preservation of an old building and the associated costs (Bullen P. a., 2011).

Researchers have examined ways to develop the process of preserving and reusing industrial buildings and based on these studies, they identified several factors that contribute to the success of the preservation process, including economic, environmental, political, physical, and social factors, which can be considered as the potentials that justify the decision to conserve. The following research is deductive research from the literature, that attempts to answer the thesis research questions by providing several reasons why adaptive reuse of industrial buildings of cultural heritage is essential to sustainability, according to the sustainability pillars. Utilizing theoretical and empirical sources relevant to this study, adaptive reuse of industrial heritage buildings will be evaluated based on these criteria and factors.

1.4.3.1. Cultural Factor

The Cultural capital is the sum of a society's cultural and traditional resources, as a result of the accumulation of diverse experiences, including history, identity, customs, traditions, and values, and this concept is very important in this thesis because the industrial heritage buildings are part of that concept. (Roseland, 2012, p. 1). Historic industrial buildings are considered to serve as contexts for daily activities, and preserving and reusing them reflects societal civilization at the local and national levels. they represent the authenticity and the roots of the nations, as well as the phases it has passed through in terms of technology, education, and economics (CANARAN, 2009). In order to demonstrate how adaptive reuse of industrial heritage building is shared in the cultural refreshment to heritage areas, (Florentina-Cristina, 2014) presented a case study approach that found a community's industrial heritage is an important part of its culture and reflects its level of civilization at a certain time. Deindustrialization takes place after a period of industrialization. Therefore, the longer the gap between industrialization and deindustrialization, the more that industry becomes a landmark, and the more it identifies with the community's cultural heritage. Additionally, they concluded that the conversion of former industrial buildings into cultural tourist attractions was the best method of capitalizing on the economic decline of formerly industrial regions.

If the location, building, and community meet the criteria for cultural use, derelict industrial buildings can be adaptably repurposed into cultural spaces, demonstrating the value of industrial heritage in the process of repairing its negative effects associated with deindustrialization (Xie, 2015). This pertains to the fact that, for adaptation to be successful as a new cultural space, certain factors need to be present, such as appropriate location, building, or community. He believed that industrial heritage buildings play a crucial role in the memory of societies and individuals' affiliations (Xie, 2015).

The heritage industrial buildings can serve as a link between the past and present of societies if they are conserved in accordance with international conservation principles, which emphasize the necessity of preserving their original character and considering the site's characteristics while reusing them for new functions. These assets tell the story of the place's past, its development, and its prosperity. In addition, they provide a tourist attraction environment because of the many possibilities their spaces offer.

1.4.3.2. Environmental Factor

During the lifetime of a building, large amounts of energy are consumed. New building materials and other resources generate a lot of pollution as a result of extraction, fabrication, transportation, packaging, and assembly. Also, they contribute to global warming and carbon emissions that harm human health and quality of life. As such, adaptive reuse is associated with several environmental benefits. The green adaptive reuse of buildings can extend their useful life and reducing resource consumption, reduce their carbon footprint while safeguarding their cultural heritage values (Langston, 2008).

According to (Conejos, 2013), building adaptive reuse contributes to emissions reduction and global climate protection. By adapting existing buildings, we can reduce energy consumption and enhance the buildings' environmental performance throughout their life cycle hence, reduce construction waste and environmental pollution. in addition, the original qualities and energy that they contain are incomparable to those found in new construction and demolition.

After the study of the former factories which utilized adaptive reuse strategies, Xie developed a life cycle model of industrial heritage development and observed that tearing down an old industrial building can lead to hazardous materials spilling onto the ground and pollution (Xie, 2015). This pollution disturbance was increased by the destruction of these former industrial buildings because their foundations and adjacent lands often contained higher levels of contaminants than other types of structures. The results demonstrate how additional environmental contamination and disturbance may result from demolition, which is relevant to this thesis. Langston argued even after losing the industrial buildings their original function, the old buildings are built with high quality, and they retain their structural integrity, walls, ceilings, and floors, which makes it more appealing to reuse them rather than build a new one. hence, the benefits of adaptive reuse can be seen not only for society and national heritage but also for the environment. (Langston, 2008). Furthermore, buildings consume a high amount of energy during their life cycle, additionally, the construction works need new materials and other resources which possess high embodied energy, and as a result of the reusing of industrial buildings, the environmental damage will be reduced and sustainability increased.

1.4.3.3. Economic Factor

Utilizing existing structures and infrastructure can reduce the overall project cost through the utilization of adaptive reuse. Adaptive reuse is also a more efficient method that reduces the amount of time required to construct a building. This has a direct impact on inflation as well as direct capital requirements. Numerous studies have shown that adaptive reuse of buildings only requires half the time it takes to demolish and rebuild a new one, which can result in significant reductions in the cost of the construction workers. (Langston C. S., 2007).

The process of rebuilding involves equipment, labor, landfill, and the transportation of materials, etc. Demolishing a building and constructing a new building is more costly than reusing it (Douglas, 2006). In addition to the reduction of energy and rebuilding costs, the green agenda also contributes to the local community by providing jobs for construction and ongoing maintenance (Bond, 2011). Further, adaptive reuse of industrial heritage buildings will also result in an increase in tax revenue, which will attract tourists to the area, hence, when former industrial buildings are adapted into tourist attractions, industrial heritage can be an incentive for economic development. The needs of today's travelers have also changed, as visitors have become more interested in learning about the stories that shaped the history of a place (Bullen P. A., 2009).

The Heritage buildings can contribute to urban regeneration through adaptive reuse. However, although adaptive reuse is supported as a strategy for urban regeneration, key stakeholders have doubts about its viability, particularly in terms of financial incentives. The provision of financial incentives was identified as a criterion for encouraging adaptive reuse of heritage buildings. The study found that financial contributions were the most persuasive incentive to building owners and developers when it came to deciding whether to adaptively reuse buildings. Therefore, adapting or demolishing heritage buildings is driven by economic interests and the desire to maximize short-term profits (Bullen P. a., 2011).

The researchers examined the heritage development projects and found that the high cost of adapting the heritage structures was a barrier to adaptation. While some projects cost more than demolishing and building a new building, not all do, and the benefit of adapting heritage buildings is almost always greater than that of demolishing and building new (Shipley, 2006). Former industrial properties often contribute to local economic development, create new housing opportunities, reduce infrastructure costs, revitalize city areas and enhance their image and quality, decrease urban sprawl and improve the urban voids. When reusing old industrial buildings, these benefits can be realized (Wigle, 1998). Before determining whether a building should be adaptively reused, the new function should be examined accurately and its extent of compatibility with the original structure. Adaptive reuse projects are more likely to be cost-effective and successful if they are adapted correctly (Pavlovskis, 2016).

In order to assess the success and challenges posed by the adaptive reuse of industrial heritage buildings, economic factors should be considered as criteria for evaluating the decision to adaptively reuse industrial heritage buildings.

1.4.3.4. Social Factor

One of the six types of community capital is shaped by buildings, which represent the identity and character of cities, serving as educational, cultural, and service facilities, workplaces, and homes. There is a view that industrial heritage is a derivative of social capital and that abandoned or unused industrial buildings are often seen as blighted. (Roseland, 2012). According to (Jacobs, 1961, p. 187), many towns and cities depend so heavily on old buildings that they are almost impossible to flourish without them. (Cho, 2014, p. 73) points out that adaptive is a good preservation strategy for industrial structural forms, like the other historical heritage buildings, that lose validity and original functions due to obsolescence.

A proactive adaptive reuse plan for industrial heritage conservation must take into account and create cultural values for neglected industrial facilities, in addition to their social recognition as historical and heritage sites. The adaptive reuse strategy preserves old buildings and enhances the quality of life in cities. In addition to the reinforcement of the physical and social fabric of the cities, improving the aesthetic appeal of the built environment, and offering resources for the communities from the unproductive buildings. The adaptation of obsolete buildings improves the aesthetic appeal of the built environment, builds a relationship between the city and the abandoned buildings and the scattered obsolete districts, offers better levels of urban amenity and grants visual amenity, and preserves the cultural heritage which is linked people to their past. (Langston F. W., 2008) (Bullen P. a., 2011).

The adaptive reuse strategy tends to emphasize economic growth over the social quality of life (Yung E. H., 2014). We must keep in mind that “sustainable” pertains to more than just maintaining natural resources. Sustainability also pertains to the importance of community and culture (Stubbs, 2004, p. 292). As (Xie, 2015) pointed out, the adaptation of industrial buildings and sites, that becomes a witness to the era of industrialization, express the essence of local identities; thus, they become landmarks for local communities. Besides cultural and historical values, it is important to add new educational, social, and aesthetic values when preserving and adapting industrial heritage buildings for new functions (Cho, 2014).

It is difficult to measure the social impacts of adaptive reuse, which is why the social impacts of adaptive reuse have received less attention than environmental and economic ones. Thus, one of the more persuasive arguments for adapting the industrial structures is to link it with efficient tourism and economic growth. For example, The Tate Modern in London, a former power plant converted into a cultural center and art gallery, is the most visited modern art museum in the world, along with being one of London's most popular attractions (URL-35).

Figure1. 7: The Tate Modern Art Gallery (URL-35)

CHAPTER TWO

2. PRACTICAL STRATEGIES ON ADAPTIVE REUSE OF INDUSTRIAL HERITAGE THROUGH SELECTED PROJECTS

The In his book, Douglas argues that the redevelopment of buildings consumes a lot of energy when new building techniques and demolitions are used, and this will result in increased waste and pollution. In contrast, reusing old buildings for new purposes and upgrading them is an eco-friendly practice (Douglas, 2006).

However, reusing existing buildings, and repairing and restoring them for continued use is considered a challenge in architectural design. as not every vacant building can qualify for adaptive reuse, architects, developers, and stakeholders who wish to become involved in renovating and reconstructing must first make sure that the finished product will serve the need of the society and market, and will be valuable and useful for its new purpose.

In this chapter, an evaluation research method was adopted, which is broken down into two, the literature review of practical strategies on adaptive reuse of industrial buildings, and trying to find out what is the "successful reuse". In addition, the investigation of the selected case studies and evaluation according to the adaptation principles of the conservation .as well as provide a comparative analysis of the selected case-studies according to the pillars of sustainability. Since one of the objectives of this thesis is to develop a conservation proposal for the cement factory in Dummar, this part of the chapter explores what successful reuse is to use these inputs to set a design proposal for the Factory, in the next Chapter.

2.1. A REVIEW OF DESIGN STRATEGIES IN ADAPTIVE REUSE

According to many studies, adaptive reuse is the most effective strategy for preserving most types of buildings, the fact that industrial facilities and sites provide good possibilities and opportunities for reuse makes them one of the best heritage buildings, however, It is a difficult strategy that requires creative developers and architects, as this multidisciplinary approach starts with decision-making for stakeholders, including owners, users, governments, etc., and then analyzing the heritage, historical, symbolic, and architectural values of the building as well as examining structural, technical, and material characteristics, in addition, local governments' decisions regarding conservation and financing options. Different authors have defined three categories of reuse strategies in the literature and theories on adaptive reuse, namely, a typological approach, a strategic approach, and a technical approach. (Cleempoel, 2013)

The first approach is "the typological approach" which classifies buildings by their functions before or after transformation (Cantacuzino S.).The buildings and sites of the former industrial facilities are now used for a variety of new purposes, they have been used for educational purposes, such as in universities and schools, In addition to cultural spaces, such as galleries and interactive museums, and for administrative or residential functions, moreover, the mix-use functions for the industrial complexes as well as reusing the sites as public parks in creative ways, for example, converting gas depots into diving schools and using the walls of chimneys as climbing walls, In addition to rehabilitating places to allow the possibility of experimenting with different artistic activities, including concerts and exhibitions within an open environment, surrounded by memories of the past (YILDIZ, 2018, p. 23). See table 2.1.

A critical component affecting the development of architectural characteristics of industrial buildings is technological functionalism, In the case of outdated industrial buildings, the museum is the first idea that comes to mind, there are many examples of industrial museums around the world, as it is the common way to preserve the industrial heritage and historical and architectural value of the industrial building case of industrial buildings (FÖHL, 1995).

Table 2. 1: The typological approach Classifications (Cantacuzino S.) (Cleempoel, 2011). Rewritten by the author.

INDUSTRIAL BUILDINGS	**RELIGIOUS BUILDINGS**	**SEMI-PUBLIK BUILDINGS**	**RESIDENTIAL BUILDINGS**	**MILITARY BUILDINGS**	**COMMERCIAL BUILDINGS**
FACTORY	CHURCH & CHAPEL	CITY HALL	CASTLE	FORTRESS	CRAFT SHOP
WAREHOUSE	CONVENT	MUSEUM	COUNTRY HOUSE	BARRACK	DEPARTMENT STORE
BARN	BEGUINAGE	SCHOOL	FARM	GATE	EXCHANGE
GRANARY	PRESBYTERY	HOSPITAL	TOWN HOUSE		BANK
MILLS		OBSERVATORY			MARKET
BREWERY		COURT HOUSE			BOUTIQUE
MALTING		OFFICE			PASSAGE
MINING SITE		LIBRARY			
RAILWAY STATION		THEATRE			
		HOTEL & HOSTEL			
		POST OFFICE			

To propose any other function for the former industrial buildings than to convert them into a museum of industry would be contrary to the archaeological value of these buildings, according to industrial archaeologists (Rogıc, 2009). Due to this, their necessity in each case should be considered.

The second is "the strategic approach", which is related to the design principles of interventions, this kind of literature anchors mostly on how intervention should have been done to allow the building of a new function. The relationship between existing structures and new interventions is an important criterion for the definition of design principles. Interventions and decisions are made in compliance with the original building, and all new elements are derived from the original building. Some design strategies are defined within the framework of this approach, and the defined strategies of various designers are analogous. (Cleempoel, 2011).

Based on the modifications of the existing building, design principles can be divided into three classes: Low, Medium, and High. This approach has been named several different times by different researchers in the literature. Philippe Robert (Robert, 1989) named the types of design interventions as; building within, building over, building around, building alongside, and others mentioned in the table 3.2. As (Brooker, 2004) used the term “insertion” for the introduction of a new element into, between or beside an existing structure. They specify some necessities about the host building; to be sufficiently powerful, and relatively physically unaltered. In this thesis, injecting new structures inside an industrial building will be focused on as an intervention strategy. See table 2.2.

Table 2. 2: Strategic approach which establishes analogy between design strategies and their expressions on architecture (Cleempoel, 2013). Rewritten by the author

<table>
<tr><th colspan="4">DESIGN STRATEGIES</th><th>ARCHITECTONIC EXPRESSIONS</th></tr>
<tr><td>ROBERT 1989</td><td>BROOKER & STONE 2004</td><td>JAGER 2010</td><td colspan="2">CRAMER & BRETTLING 2007</td></tr>
<tr><td>BUILDING WITHIN</td><td rowspan="3">INSERTION</td><td rowspan="3">TRANSFORMATION</td><td rowspan="3">MODERNISATION</td><td rowspan="3">CORRESPONDANCE</td></tr>
<tr><td>BUILDING OVER</td></tr>
<tr><td>BUILDING AROUND</td></tr>
<tr><td>BUILDING ALONGSIDE</td><td rowspan="2">INTERVENTION</td><td rowspan="2">ADDITION</td><td rowspan="2">ADAPTATION</td><td rowspan="2">UNIFICATION</td></tr>
<tr><td>ADAPTING TO A NEW FUNCTION</td></tr>
<tr><td>BUILDING IN THE STYLE OF</td><td rowspan="2">INSTALLATION</td><td rowspan="2">CONVERSION</td><td>REPLACEMENT</td><td rowspan="2">JUNCTION AND DELINATION</td></tr>
<tr><td>RECYCLING MATERIALS OF VESTUGES</td><td>CORRECTIVE MAINTANANCE</td></tr>
</table>

The third approach is “the technical approach” associated with interdisciplinary aspects of reuse, including conservation, architecture, interior architecture, and everything related to the building envelope as the facades and internal surfaces, etc. Another key aspect of this approach is energy efficiency, and everything related to the technical specifications of the building, such as fire resistance, acoustic performance, thermal performance, and others, as (Bullen P. A., 2009) emphasized that an assessment of the potential of the new use needs to be made based on the original building value, existing condition, and ability to meet the conditions. This approach is based mostly on how intervention should have been done to allow the building of a new function. See table 2.3.

Table 2. 3: The technical approach to adaptive reuse (Cleempoel, 2011). Rewritten by the author.

UPGRADING	LITERATURE
LOAD-BEARING STRUCTURE	
FRAMES (Timber Structures, Iron Structures,)	
FLOORS	
WALLS	
ROOFS	
UNDERPINNING	
HEAVY-LIFTING	
BUILDING ENVELOPE	
INTERNAL SURFACES	
INTRODUCTION OF NEW FLOORS	
FACADE	
ACCESSIBILITY AND CIRCULATION	
COMFORT, SAFETY AND ENERGY EFFICIENCY	
FIRE-RESISTANCE	
THERMAL PERFORMANCE	
ACOUSTIC PERFORMANCE	
PREVENTING MOISTURE AND DAMPNESS	

2.2. THE SUCCESSFUL ADAPTIVE REUSE

The topic of successful adaptive reuse projects has been investigated extensively in theoretical literature and empirical examples, however, it is not simply a case of defining a "successful adaptive reuse project" in one way, but rather an integration of factors combined to create overall success (Burchell, 1981). for the aim of the thesis, it is crucial to understand the concept of successful adaptive reuse, since it will help with selecting the examples and evaluating the practices of intervention, hence, exploring the design principles of the adaptation strategy.

It is a very important point in preserving the industrial heritage is to honor and respect the components of the architectural and urban fabric via the execution of a creative design, where the Successful adaptive reuse projects aim to harmonize between retaining the historic story of the building and revitalizing the spaces for contemporary uses (URL-37, 2017). Successful adaptive reuse of heritage buildings is defined by ICOMOS as the modification of space for a compatible function while preserving its cultural heritage significance (URL_3, 2010) and according to (Zushi, 2005) successful adaptation improves both the building and its environment, but this strategy require careful planning that considers the surrounding environment as well as good design.

In the field of conserving the industrial heritage, Canara discussed that Successful projects preserve and respect the industrial heritage while introducing new elements that enhance the place's value for the future, and she emphasized that understanding the building and its context and evaluating its significance are two essential principles before beginning the intervention. additionally, intervention practices have to consider the building status and, uses and respect its values, as the goal is to change as much as important to serve the contemporary needs but as minimum as possible. (CANARAN, 2009)

Walker, argues that the size and shape of the building may be major factors in its significance, and he argues that it is important to preserve the structure and site so that its previous use can be obvious, even if a change of use cannot be avoided, however, the industrial building should not be regarded as an incubator that can be used for a variety of purposes. moreover, the equipment, machinery, and contents found in industrial sites are signs of their previous use and therefore reflect the history of the site, and as a result, any new additions must be easily recognized as modifications. (Walker, 2000).

In addition, this thesis assessed the success of the adaptation strategy of the industrial buildings based on the general TICCIH and The Nizhny Tagil Charter for contemporary conservation guidelines of the industrial heritage, as well as the degree of compliance with these standards, was evaluated. The Nizhny Tagil Charter for the Industrial Heritage stated (TAGIL, 2003):

1. Conservation of the industrial heritage depends on preserving functional integrity, and machinery and components to maintain the value and authenticity of the industrial site
2. Examining and assessing former uses with reflecting the previous various industrial uses.
3. Preservation in situ should always be given priority consideration.
4. New uses should respect the significant material and maintain original patterns of circulation and activity, and should be compatible as much as possible with the original or principal use.
5. The continuity that resulted from reuse may provide psychological stability for communities.
6. Interventions should be reversible and have a minimal impact. Any unavoidable changes should be documented and significant elements that are removed should be recorded and stored safely.
7. Avoiding reconstruction, or returning to a previous known state, which is only appropriate if it benefits the integrity of the whole site.
8. Preservation of documentary records, company archives, building plans, as well as sample specimens of industrial products

All previous definitions and concepts have been taken into account for this thesis. Due to this, the selection of case studies was based on the standards for successful adaptive reuse described above.

2.3. SELECTED CASE STUDIES

In this section, the impact of the adapting process on the industrial buildings was analyzed and examined to determine the sustainable effects of the adaptive reuse strategy on the local communities. This process was also assessed using case studies. Six case studies were selected from the world to explore the different "successful reuse" strategies mentioned above. The selected case studies of this research involve industrial buildings that were transformed into contemporary museums, galleries, and/or cultural centers. Each example will be identified and compared using tables containing architectural programs, intervention strategies, technical aspects, and before and after images of the adaption of both the interior and the exterior of the buildings. To avoid repetitive examples, I have selected a wide variety of case studies that include buildings that didn't necessarily of former cement factories. However, the examples do include some similarities with the cement factory in terms of scale, materials and/or construction technique, landscape, and the environment. In addition, each case utilized in this thesis can be shown to possess at least one approach that leads to successful reuse strategies.

2.3.1. Mill City Museum

Minneapolis was known as the "Flour Milling Capital of the World" and was called the "mill city". Mill City was built in Minneapolis, USA, in 1880 with the latest technological machines. In the 1880 and 50 years after, the mill served until 1965 and was seriously damaged during the fire in 1991.See figure 2.3. At the end of the 90s. The structure was rehabilitated for public use in both the exterior and interior of the intact and ruinous portions, and it was transformed into a museum and multifunction spaces (URL-18).See figure 2.1.

The museum Located within the burned-out walls of the mill complex, occupies the first two floors of the structure, which includes the West Engine House, East Engine House, the A Mill ruin courtyard, Millstone Plaza, and the rail corridor, The rail corridor features a historic railcar and remnants of original tracks. Upper floors of the complex from consist of offices. See figure 2. 2.. The museum included exhibit rooms with original artifacts still in place, and the observation deck that overlooks the ruin courtyard, and the Flour Tower as an attraction, within a service elevator that takes visitors vertically through all eight stories of the building, passing an exhibit on each floor that highlights different rooms and activities that would have occurred while the building was operating as a flour mill. The majority of the original features of the structure remained intact and the profile of the ruin walls has been retained, and the possibility of materials spalling off the walls and potentially injuring visitors is a key ongoing safety concern in the ruin courtyard (URL-34).

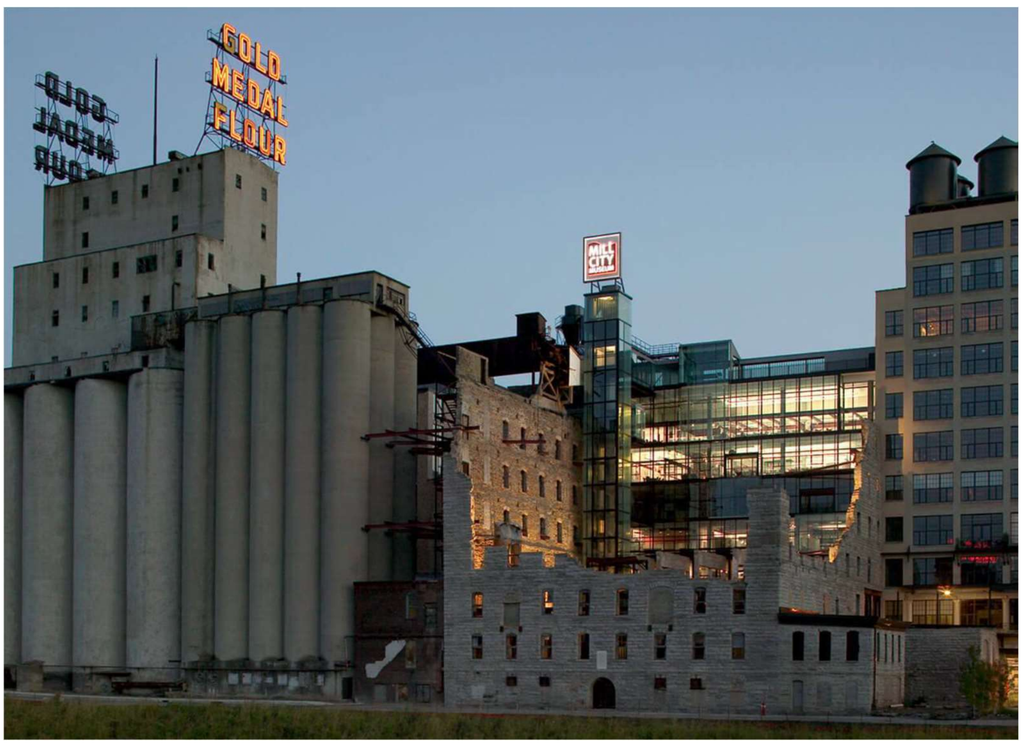


Figure 2. 1: The Washburn A Mill from the Mississippi River. The Washburn A Mill Complex includes what is now Mill City Museum as well as the buildings and grain elevators to the left. (URL-17).

Table 2. 4: Mill City Museum. Written by the author.

Location: **Original built** **Original use** **Area** **Financing source**	Minneapolis, America 1988 A grain **m**ills 11613 sqm A mix of state and private funds
Adaptive Program	The building was converted into a museum and offices.
Intervention strategy	Intervention; The old structure cannot exist independently. The new additions are completely integrated with the old building
Architectural program	Components: Old buildings transformed into: Museum (lower three floors) Rail corridor, Exhibit Gallery, Lobby Ruin yard, Head house (potential expansion) Silos (energy distribution)
	Additions: New façade with drawing of the mill. Flour tower history theatre in an elevator. Express elevator to the observation deck. Observation deck Offices five floors above the museum.
Structural system	Adopting the new structure over the old; Retaining the existing structure without harming, with non-reversible interventions.
Materials compatibility	New and old are clearly independent, the old has been preserved as it is.
Spatial characteristics	The machines and the components were kept in their places, the space was converted for an exhibition purpose. Flour Tower as an attraction and an express elevator to the observation deck that overlooks the ruined courtyard were added.

Potentials and challenges:

Economic challenges*:* The original rehabilitation project was funded through a mix of state and private funds. Much of build revenue comes from facility, rentals, events, and museum entrance tickets. Thus, the project able to produce a large portion of its own revenue.

The Minnesota Historical Society, which operated the museum, indicated the economic factors were also a top concern for them. The decision to maintain the courtyard as a ruin with the dramatic wall profile was recognized as an expensive endeavor. Original funding sources came from mostly public sources but spurred a lot of private economic development in the area. Additionally, the museum has been able to provide nearly half of its own funding through its own revenue. The original project was also undertaken at a time of good national economic climate. However, maintenance issues have been on ongoing challenge, economically as well as physically, due to the preservation approach, weathering, and ruin wall heights.

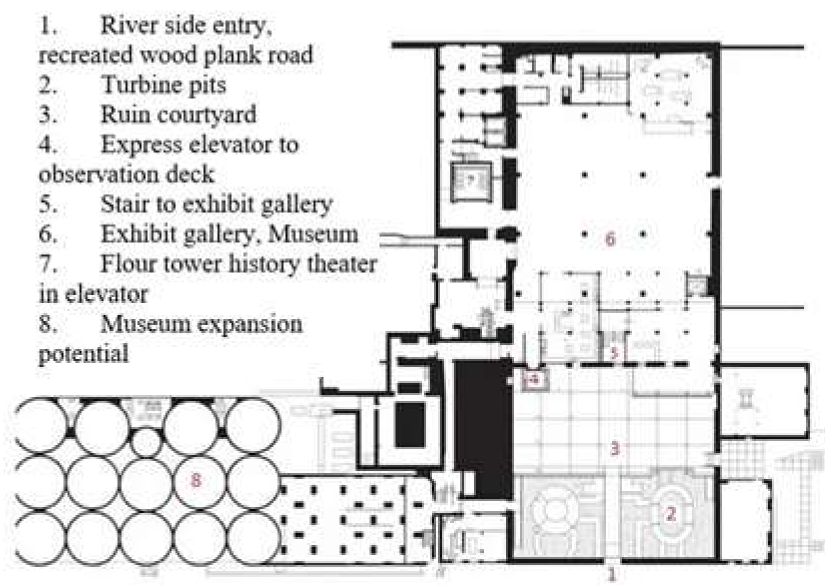


Figure 2. 2: Floorplan of Mill City Museum (URL-34).

Figure 2. 3: Abandoned Washburn A Mill (URL-18), 1976, day after the fire 1991, ruin 2000 (URL-34).

Socio-Cultural potentials: The mill museum considered as National Historic Landmark, the building played an important role in the city's goal of redeveloping the abandoned industrial area into a new neighborhood that would reconnect the city to the riverfront, and the building is accessible via multiple modes of transportation. The place was chosen for rehabilitation and to house an industrial history museum as part of a larger revitalization of the former milling district. Major factors that indicated the site's potential as a mixed-use site with a large museum were the building's size, beauty, central location, public familiarity, and significance to the city and its development.

The architectural idea is interconnection, exterior and interior, near space and distant historic objects, existing building fabric and exhibits, extant artifacts and new components and spaces. The design seeks to sensually engage the body in the tangible experiences between the old and new by movement through diverse spaces. Organizing circulation so people move relatively long distances horizontally and vertically through engaging experiences and experience a fun education. And incorporating exterior spaces, all year round into the movement patterns, Rail Corridor, ruins Courtyard, and Observation Deck, thus integration with landscape. The majority of the original features of the structure remained intact. In addition, the profile of the ruin walls has been retained, the historic mill retains integrity of materials, design, workmanship, and location, and therefore, feeling and association.

Location potentials: The museum considered a part of the recent history of the site, and major draw point for the visitors. The structure is located on the Mississippi River, opposite St. Anthony Falls, and lies within the U.S. National Park Service Mississippi National River and Recreation Area. It was added to the National Register of Historic Places in 1983. The various ways allow to arrive easily to the location. For example, if a visitor walks into the building from downtown, he or she can descend a few floors to the courtyard, and then out to the riverfront. With different parts of the museum and different connections to the city accessible on multiple floors (Demarais, 2015).

2.3.2. The Prada Foundation

In 2015 one of major cultural venues inaugurated in Milan. Fondazione Prada locates in a former distillery dating back to the 1910s in the Largo Isarco where is an industrial complex on the southern edge of Milan. It is an arts and culture institution created in 1993 dedicating to the creation of art exhibitions, cinema, photography, philosophy, dance and architecture. See table

It was designed by OMA led by Rem Koolhaas. Since the beginning of designing, it took 10 years to finish the project (2008-2018). it's available for every visitor. Its land area is 19,000 sq m and includes multiple uses, such as exhibition spaces, cinema, stores, a library, offices, and a cafeteria. (URL-33).

The Prada complex in Milan has considered one of the most important contemporary art complexes in Italy. Prada Industrial Complex has seven buildings which are distillation laboratories, chimneys, warehouses, and offices. The designed office has added three new blocks to the seven old, buildings that have been carefully restored See figure 2.4. These distinctive blocks occupy multiple functions and have been named the podium, cinema, and Torre, which was completed in 2018, Torre is an elegant white tower consisting of nine floors. art in Italy (URL-33).

Table 2. 5: The Prada Foundation. Written by the author.

Location: **Original built** **Original use** **Area** **Financing source**	Largo Isarco, Milan, Italy 1910 Distillery Factory 19000 sqm private sector
Adaptive Program	The building was converted into cultural complex, one of the largest art centers in Italy
Intervention strategy	Insertion: A new component that is independent of the existing fabric. Surface-to-surface contact
Architectural program	Components: Old buildings transformed into a museum/gallery, a restaurant, offices, a library, services, and public spaces.
	Additions: Cinema, podium, tower building
Structural system	The new and old structures work separately and independently.
Materials compatibility	Visual contrast is clear between the new and the old, the old still retain a large part of its original look. New is dominant.
Spatial characteristics	Renovated structures and the new buildings created a rich and spatially diverse setting. The difference in the exhibition spaces was intended for a distinctive effect, and the new buildings placed in the courtyard created creative interactive spaces.

The Prada foundation was distinguished by its unique covering materials and high techniques, the mirror-clad cinema is an independent structure partially sunken underground, see figure 2.5, The new Podium building was constructed in the center of the complex which is an exhibition pavilion covered with glass, and consisting of translucent gallery space on the ground floor and a second gallery space clad in aluminum foam on top, additionally it was constructed around another building known as the Haunted House see figure 2.6. A multimedia auditorium with large bi-fold doors, which can be used in multiple spatial configurations in combination with the outdoor courtyards.

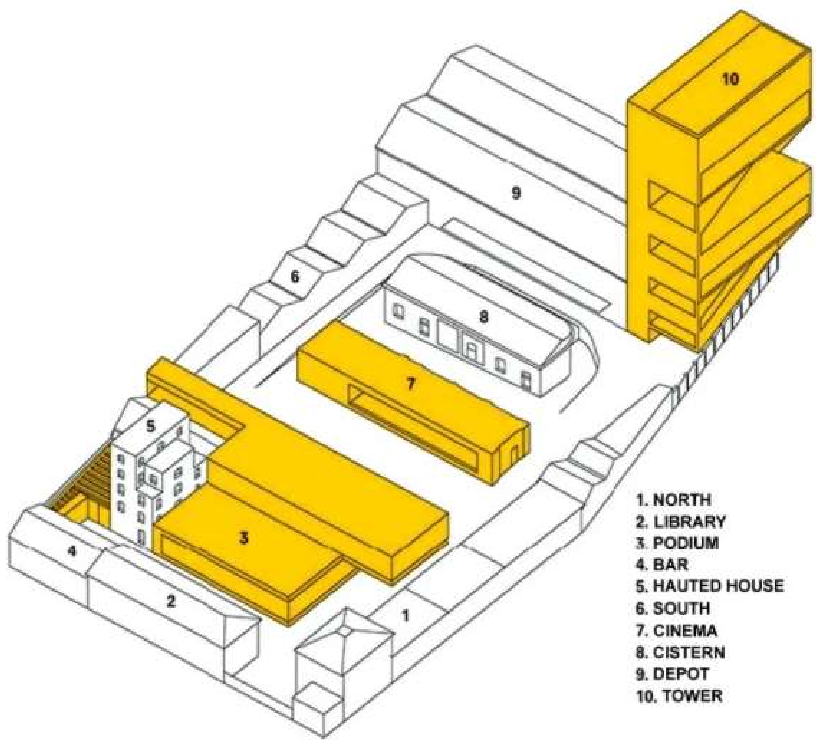


Figure 2. 4: Diagram of the site and program (URL-33, 2019)

The haunted house is the focal point of the complex which hosts part of the permanent collection the foundation is a four-story building with a narrow shape and golden color, and it has been used four kilograms of 24-carat gold leaf for the painting works. Generally, a simple look distinguishes the old buildings, while the new buildings provide a nice sense of contrast see figure 2.6.

Figure 2. 5: Prada Foundation. The mirror-clad cinema (URL-19)

Figure 2. 6: Prada Foundation. Haunted House at the left with the Podium (URL-33)

Figure 2. 7: Torre, the white tower at the left (URL-32).

The tower Torre for art display and cultural events, which located on the north-western corner of the Fondazione Prada, a composed of nine levels, six of them are exhibition spaces, while the remaining three floors host a restaurant and other visitors' facilities. A 160m² panoramic terrace completes the structure offering a spectacular view of the city. See figure 2.7. The white vertical building on the Prada Foundation compound, Torre, now makes the Prada Foundation visible and distinctive in the center of the city, making it a symbol for visitors of Milan (URL-32).

2.3.3. The Energy Museum

Within an industrial complex of the electricity production in Istanbul, a former power plant has been converted into an energy museum, it is the first power plant in the Ottoman era, and due to technological developments, its operational efficiency decreased, and ceased working in the eighties of the last century, leaving the site neglected for several years. The rehabilitation strategy was developed for the reusing of the site by the founder of Bilgi University in Istanbul. It was proposed to convert the site for cultural and educational purposes. The Museum of Modern Art, the Energy Museum, the university, and other facilities were established and the place was officially opened in 2007 as a university campus for the Istanbul Bilgi University (URL-20).

Previously were arranged, the site was a mix of production units, storage areas, raw materials, and administration buildings. Machines bases were arranged in the shape of comb and boiler rooms were grouped together so the production units could be more efficiently used for electricity production. The museum building consists of two adjacent buildings, each containing the machinery and equipment of the factory, and the boilers rooms, the structure is constructed of a steel framework and cast iron with a thin outer shell, the boiler room was cleaned and hazardous materials were removed, and in order to preserve the historical integrity of the building, the structural system of the building was reinforced and rehabilitated with minimal intervention (Hussein, 2017). Recovery of this neglected region and renovation of the building was intended to create a center for creativity, art, and education, in addition, to be as a cultural center for heritage tourism and entertainment.

The museum building has been preserved in its original form and its structural details are visible from the inside, see figure 2.11. It displays the generators and turbines in the center of the hall, considering that industrial facilities house huge machines, they are built with dimensions that are suited to their requirements, and so they must be reused to suit human measurement and size.

Table 2. 6: The Energy Museum. Written by the author.

Location: **Original built** **Original use** **Area** **Financing source**	Istanbul, Turkey 1991-1950 Electrical Power Station NA private sector
Adaptive Program	Former coal-fired power station converted into industrial museum.
Intervention strategy	Installation: The new elements exist independently with the possibility to restore the existing building to its original situation when removing them.
Architectural program	Components: Old buildings transformed into: Exhibition Area -Service -Offices
	Addition: escalators, bridges in around the upper floors, moving exhibits.
Structural system	The old is dominant, the existing structure retained as it is, with reinforcing from inside.
Materials compatibility	The character of the existing building is preserved, and Interventions are in minimum.
Spatial characteristics	Old spatial organization is preserved

This was done in the Energy Museum in Istanbul, where a platform with a wooden floor and glass sides framed in steel, was hung at a height of 12 meters to allow visitors to get a panoramic view of all the equipment displayed figure 2.10. The platform was connected to the turbine floor with modern glass escalators that replace the old coal conveyors. A self-directed spatial route was designed to reveal all aspects of the museum in addition to the bridges through which all museum mechanisms may be accessed (URL-20).

From the platform, visitors reach the control room, which has been preserved in its original condition, complete with its equipment, and on the ground floor of the museum, there is a space dedicated to interactive exhibitions where science and fun are combined, and as part of the tour, visitors can learn how electricity is generated and take part in interactive activities. The power station in Istanbul was preserved successfully Based on preservation principles as the new design respects the character of the building and its new use reflects the original purpose by considering the site's history, as well as, integration with the urban context to become a symbol of the region.

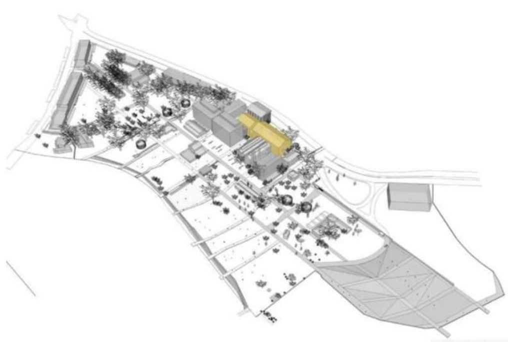


Figure 2. 8: Position of The Energy Museum. (Hussein, 2017).

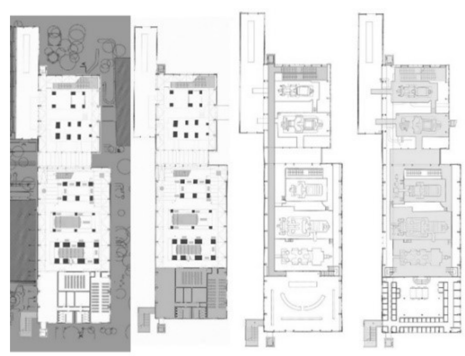


Figure 2. 9: Plans of the Energy Museum (Hussein, 2017).

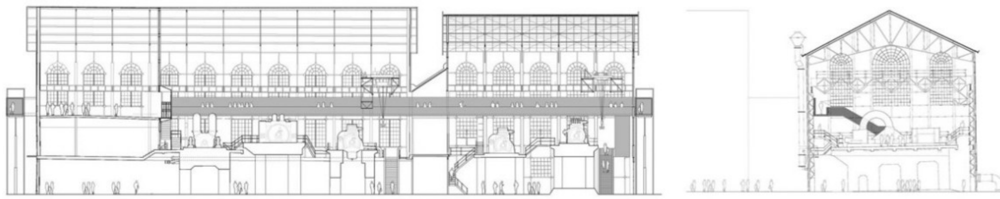


Figure 2. 10: Energy Museum with the platform and stairs (Hussein, 2017)

Figure 2. 11: The steel framework and the original machines with minimum interventions (URL-20)

2.3.4. Kadir Has University

Cibali Tobacco Factory is a historical factory designed in 1884 in the Ottoman era during the reign of Sultan Abdelhamid. During the next years, another architect redesigned the factory, and until 1925 it was operated by the French, in 1995, the factory ceased operations and lost its original purpose, and it remained vacant until 1997. The tobacco factory is regarded as an example of early industrialization's cultural heritage1997 (Günçea, 2015).

The building attracted the attention of many in the field due to its strategic location and the desire to rent it and reuse it for new purposes. And after being rented by Kadir Has for 49 years, it was repurposed as a university. The architect Mehmet Alper designed the renovation project, which was awarded the Europa nostra Prize in 2003. Presently, the factory building serves as an administrative and educational facility for the university. The restoration of the building was successful in preserving its structural integrity, load-bearing parts, and original beauty.

All interventions were related to partitioning the space and adding necessary additions such as the partitions and stairs. Different historic phases distinguish the building most significantly. The heritage building includes three different historic elements which are, a Byzantine water tank from the thirteenth century and an Ottoman bath from the sixteenth century on the basement floor, a tobacco factory from the nineteenth century. In 2002 new additions were installed the factory (Misirlisoy, 2011) With minimal intervention, the tobacco factory was preserved as the cultural, aesthetic, and historic values were present in the new design and in addition, both the original beauty and the safety of the construction structure were preserved. This is the main objective of the adaptive reuse strategy of the industrial buildings. See figure 2.12.

After the function of the building was changed, the space organization was modified by leaving the original walls intact and proposing partition walls. The historical museum was designed to be part of the fine arts faculty of the university, named Rezan Has Museum, located on the basement floor of the university, it includes The Byzantine water tank from the thirteenth century and an Ottoman Bath from the sixteenth century, and temporary exhibitions and permanent galleries, the historical walls were preserved and, due to structural issues, new flooring was installed, it was reinforced with steel columns as it continues till the floor of the museum, at some points, the museum floor is covered with glass to provide visual contact between the museum and the galleries. See figure 2.13.

Table 2. 7: Kadir Has University. Written by the author.

Location: **Original built** **Original use** **Area** **Financing source**	Golden Horn, Istanbul, Turkey 1884 Former tobacco factory 35000 sqm private sector
Adaptive Program	Former tobacco factory converted into a university.
Intervention strategy	Insertion: A new block adjacent to old is constructed, new independent elements located within the boundaries of the existing building and suited to the existing envelope
Architectural program	Components: Old buildings transformed into: Museum and university.
	Additions: For university function and museum: Partition walls, stairs in courtyard, linkage between A and B block. Block D the cultural center.
Structural system	(Stone)the old is dominant, the existing structure is retained as it is, and (steel) the new supported the existing building from the inside. Interventions are at the minimum.
Materials compatibility	The character of the existing building is preserved, and Interventions are in minimum.
Spatial characteristics	The original organization spatial is still the same except for some changes due to the new function. The museum floor is covered with glass at some points to have visual contact between the museum and the galleries.

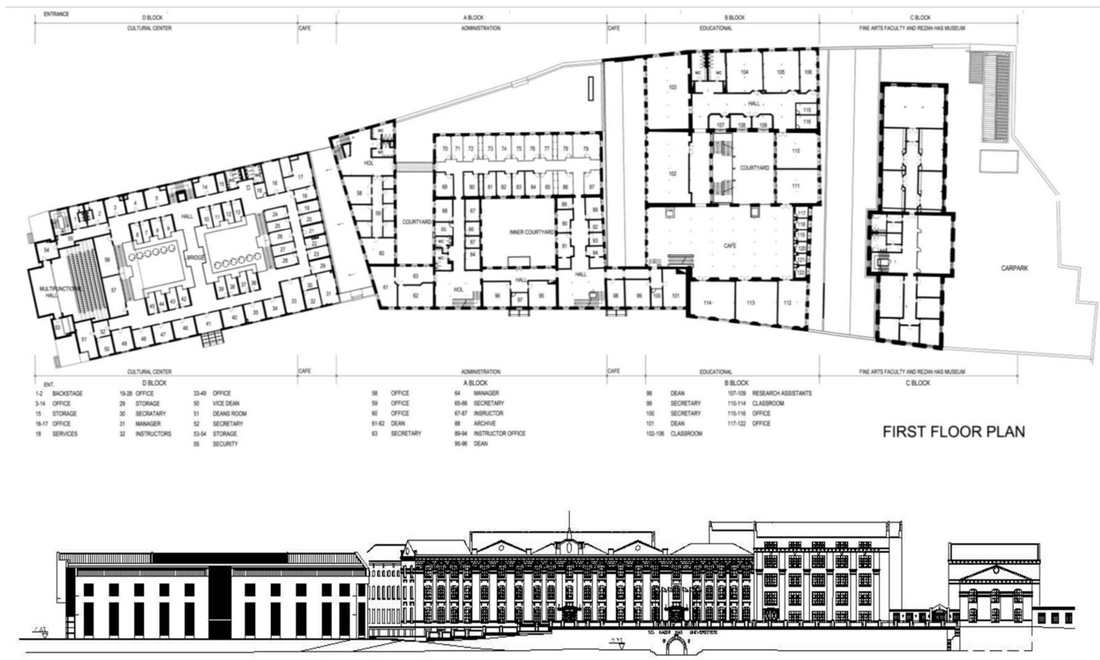


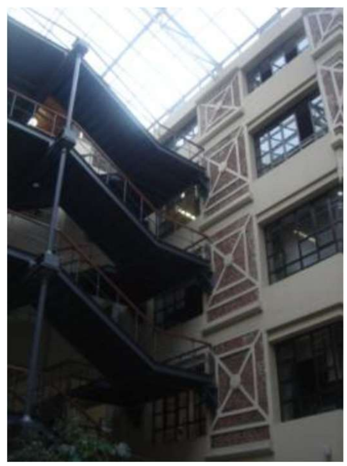
Figure 2. 12: Plan drawings and the main Façade of the Kadir Has university. (Günçea, 2015).

In addition to the existing factory, there is a new part attached those functions as the center of culture for the university. The new addition is harmonious with the existing one in terms of color, proportion, and space organization and follows the rules and principles of contemporary conservation. See figure 2.13.

There are no parts today that belong to the industrial archaeology related to machinery and the system of the factory (Günçea, 2015) . According to TICCIH (TAGIL, 2003) taking machinery or components out of an industrial site, or demolishing subsidiary elements that make up the entire site can greatly diminish its value and authenticity of it. As a whole, the adaptive reuse project had a successful outcome in that it was able to preserve the cultural significance and identity of the industrial heritage of the place.

The old factory building

Bridge addition



Offices spaces

Ottoman Hamam in Museum

Cafeteria

Figure 2. 13: Old photographs of the factory, the factory after renovation, and the new interventions (Misirlisoy, 2011).

The former Bankside power station was designed by Sir Giles Gilbert Scott and constructed in 1891. It has generated electricity from 1891 to 1981. Located on the south bank of the river Thames, in the Bankside area, in London, See figure2.14. That building was made of brick-clad and steel structure. The structure was built symmetrically and was presided by a central chimney which was standing up to 99 meters, the structure also contained a 152 m long and 35m high turbine room, and a room for cauldrons. It was a massive building interrupted by numbers of thin and long vertical windows that allow a controlled sunlight to get inside the building, see figure2.15. The former Bankside Power Station stopped operating in 1981. The Tate modern is one of the good examples of industrial reusing and urban redevelopment. After the Bankside Power Station had stopped operating, and after the prevention from its demolition; the Tate gallery which focuses on the collection of modern art purchased the abandoned power station to transform it into a museum of modern art (URL-22).

Figure 2. 14: The view of the London Bankside Power Station with thin and long vertical windows (URL-22).

Figure 2. 15: The view of the London Bankside Power Station. (URL-22).

The process of transformation started with the removal of the industrial machines in 1995, and then leaving the structure empty like a brick shell with steel structural skeleton. Further, other demolition of some old buildings outside and of the roofs of both the power station’s boiler house and the turbine hall were done between the year 1996 and

1997. In the same years, the repairing and repainting of the remaining steel structure and the sandblasting of the area took place. The design provided by the architect emphasizes on the preservation of most of the parts of the former power station, and using it as a source of energy and power for the design. The roofs of the boiler house and the turbine hall are then replaced by a two-floor glass roof structure, which with the chimney intensify the presence of the building. See figure 2.16. The building is accessed on the west side by a ramp that leads straight to the huge long turbine hall, which is recycled as a dazzling internal square space receiving light from both the vertical windows and above from the 524 glass panels. See figure 2.17.

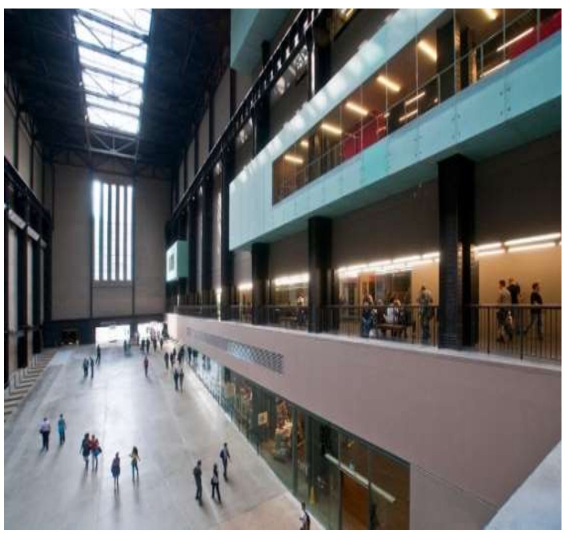


Figure 2. 17: The turbine hall from the plaza level and the slope of the ramp and light from above (URL-22).

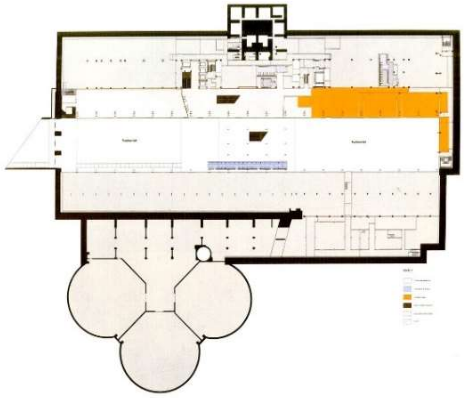
Figure 2. 16: The turbine hall and the balconies created with the green boxes (URL-22).

Table 2. 8: The Tate Modern. Written by the author.

Location: **Original built** **Original use** **Area** **Financing source**	London, United Kingdom 1947, 1963 Power Station 24,000 sqm Private sector
Adaptive Program	Former power station converted into art gallery.
Intervention strategy	Integration: Great modifications are conducted to the original structure and it cannot exist independently, new parts are integrated into the existing structure.
Architectural program	Components: Turbine Hall, boiler rooms, and tanks are transformed into museums and art galleries.
	Additions: The turbines in the turbine hall were removed. Additional floor spaces are created for exhibition purposes. Additional mass producing an interior façade which is shown in extension of mass in the Turbine Hall. A ten-story tower was built above the oil tanks.
Structural system	The old is dominant, which is a brick masonry building, contrasting with the new elements which are steel and glass. Interventions are at the minimum.
Materials compatibility	The character of the existing building is preserved. New is dominant.
Spatial characteristics	The turbine hall serves as a major spatial route, as the connection between the large space and the art galleries is emphasized by the glassy boxes which are used as a balcony. There is a strong visual and spatial connection.

The wonderful internal square space is used as an exhibition place for giant installations and sculptures. The three levels of art galleries are accommodated in the former boiler room adjacent to the turbine hall, having a strong visual and spatial connection with the large square of the turbine hall. The connection between the large space and the art galleries is emphasized by the glassy greenish boxes on the surface of the galleries' walls which are used as a balcony. These greenish boxes create a contrast with the dark black metal structure supporting the building. See figure 2.20. The two-story glass roof accommodates offices for the members of the Tate and a restaurant with great views, including the view of the cathedral St. Paul and the waterfront. The glass roof is a contrast to the massive volume station made of brick, and at night, it illuminates the area (URL-22). There have been some extensions done in the project and some other extensions are planned (URL-22). There have been some extensions done in the project and some other extensions are planned.

There are many buildings in this complex, and plans were underway for its expansion. Three large circular oil tanks were reused, as the purpose of converting them was to open other exhibition spaces with their facilities see figure 2.18. However, it was closed in 2012 to be reopened after the end of the expansion of the tower in 2016. The new tower building is accessed from the turbine hall at the ground level through a corridor that leads to the fourth level of the tower building see figure 2.19. To complete the construction of the new tower, part of the original building was demolished, which 10 story building 65 meters high above the oil tanks, concrete was used to make the Switch House, which is covered with bricks that are formed into a lattice that allows daylight to pass through, along with the long horizontal windows that show off the new landscape and brick details. spacious areas offer various galleries and interactive museums and are unique, there are also educational halls, a restaurant, and a balcony with a view of the city (URL-23).



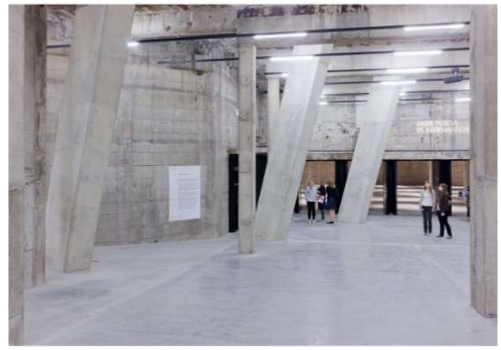


Figure 2. 18: The interior exhibition of the Tank, the expansion of the project (URL-22).

Figure 2. 20: The balconies created with the green boxes (URL-22).

Figure 2. 19: Tate Modern Switch House (URL-23).

The intervention in this project is minimal, the brick walls of the old power station are conserved as they were, and a glass roof structure is added at the top of the building and floors to host the new gallery. The Tate modern project has enlivened the region of the city where it's located by connecting many important parts of it, and affect widly the urban life ans architecture of the city (URL-24). The project sets an example of historic preservation, urban renewal and sustainable development, and one of the best examples in terms of highlighting how state should invest and contribute to its own industrial heritage and how can convert it into modern institution became a magnet for the tourists. Today the Museum participates to the cultural tourism as well as adding value to the regional economy with its employment rates, increased land values and the visitor numbers.

2.3.6. The Gasworks Park and Museum complex

For more than thirty years, this industrial heritage was neglected, but today it is a museum and cultural center. It was a gas factory for Coal gas production located in the Hasanpaşa neighborhood in the Asian region of Kadikoy, which was built during the Ottoman era in 1891 to supply energy to the Asian side and after Istanbul was supplied with natural gas, The gas station closed in 1993 and became deserted as a witness to a vanished industry.

Without the initiative of the citizens of the Kadikoy region, this industrial complex would not have been converted into an art center and park. A neighborhood citizen association of Kadikoy was established with the main objective of protecting the commons and the environmental responsibility and preserving the industrial heritage by Listing the gas factory as a heritage site and then repurposing it as a public space for cultural purposes instead of commercial use, and after more than 20 years, the reuse of the industrial complex was accepted by the Istanbul municipality for reusing the complex into a cultural center and public industrial park. In 2013, the Municipality started the restoration process of the historically neglected structures. This project is a wonderful example of how to preserve and appreciate historical symbols of places through directed community efforts (URL-36). See figure 2.21.

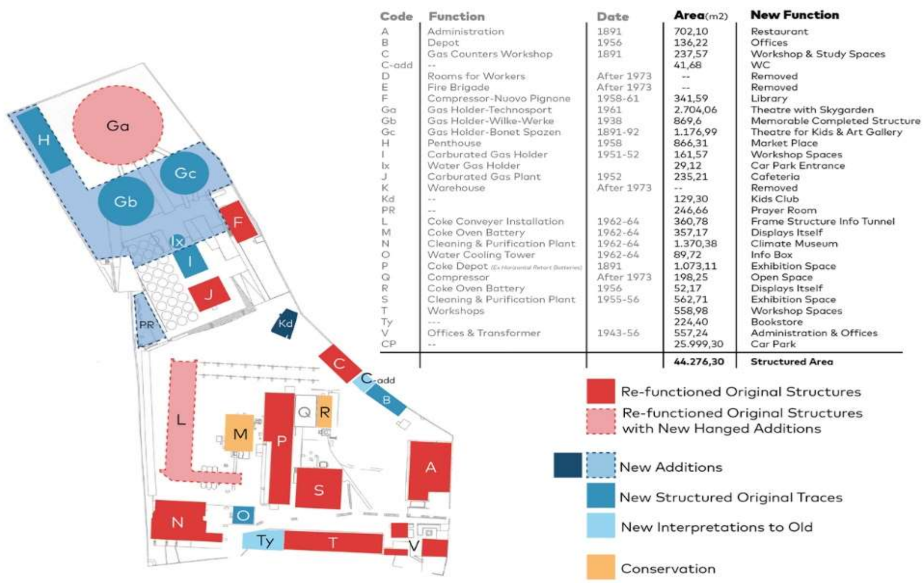
Any industrial building goes through multiple phases to improve productivity and increase the efficiency of the product, and one of the principles of contemporary conservation is to reuse the building in a way that shows all of the historical stages of a place and allows them to be read clearly; Since historical integrity plays a vital role in a successful adaptation experience. In terms of the former gas factory, it went through three main stages. In the first stage, the factory only contained one gasometer and workshops and the first stage lasted until 1938. in addition to what was obtained from German maps in Istanbul, no sufficient documents survived from the construction period of the factory.

To increase the plant's capacity, a new gasometer was added to produce carbon gas in the second period. During the last phase, which lasted for 10 years, huge batteries were built and new equipment and machines were added to increase production efficiency, as well as a new gasometer is also installed, which is the larger. When this industrial facility was repurposed, the previous mechanisms and equipment were visible. Creatively, these rehabilitated machines as a symbol of the urban environment told the story of the technological development of this industry and create a feeling of nostalgia. Many detailed studies and accurate analyses of the site and the characteristics of the industrial structures and the existing buildings were carried out before the start of the adaptation strategy was made, and the guidelines were developed based on their findings. Many buildings have been renovated, and to complete the historical story of the building, two gasometers that no longer exist were simulated to reach the conservation objective (URL-25). See figure 2.22.

Figure 2. 21: Bird’s eye view of Gasworks Park (URL-25)

Table 2. 9: The Gasworks Park and Museum complex. Written by the author.

Location: **Original built** **Original use** **Area** **Financing source**	Istanbul, Turkey 1891 Gasworks 18277 sqm Istanbul Municipality
Adaptive Program	Former gasworks converted into public space for arts and culture.
Intervention strategy	Insertion: The element is constructed to fit, and is located within the boundaries of the existing building (gas holder, coke conveyor). Installation: The new elements exist independently.
Architectural program	Components: Gas-holders, production equipment, stores, and service buildings were transformed into theaters, museums, galleries, and a library.
	Additions: Theater with garden on the top, theater for kids and art gallery, memorable completed structure, marketplace, info box, kids club
Structural system	The old is dominant, preserving the image of the existing structure but, there are also irreversible interventions.
Materials compatibility	The character of the existing building is preserved, and the new is distinguished from the old with modern materials.
Spatial characteristics	The old spatial organization was almost preserved, and interventions are at a minimum.



Code	Function	Date	Area(m2)	New Function
A	Administration	1891	702,10	Restaurant
B	Depot	1956	136,22	Offices
C	Gas Counters Workshop	1891	237,57	Workshop & Study Spaces
C-add	--		41,68	WC
D	Rooms for Workers	After 1973	--	Removed
E	Fire Brigade	After 1973	--	Removed
F	Compressor-Nuovo Pignone	1958-61	341,59	Library
Ga	Gas Holder-Technosport	1961	2.704,06	Theatre with Skygarden
Gb	Gas Holder-Wilke-Werke	1938	869,6	Memorable Completed Structure
Gc	Gas Holder-Bonet Spazen	1891-92	1.176,99	Theatre for Kids & Art Gallery
H	Penthouse	1958	866,31	Market Place
I	Carburated Gas Holder	1951-52	161,57	Workshop Spaces
Ix	Water Gas Holder		29,12	Car Park Entrance
J	Carburated Gas Plant	1952	235,21	Cafeteria
K	Warehouse	After 1973	--	Removed
Kd	--		129,30	Kids Club
PR	--		246,66	Prayer Room
L	Coke Conveyer Installation	1962-64	360,78	Frame Structure Info Tunnel
M	Coke Oven Battery	1962-64	357,17	Displays Itself
N	Cleaning & Purification Plant	1962-64	1.370,38	Climate Museum
O	Water Cooling Tower	1962-64	89,72	Info Box
P	Coke Depot (Ex Horizontal Retort Batteries)	1891	1.073,11	Exhibition Space
Q	Compressor	After 1973	198,25	Open Space
R	Coke Oven Battery	1956	52,17	Displays Itself
S	Cleaning & Purification Plant	1955-56	562,71	Exhibition Space
T	Workshops		558,98	Workshop Spaces
Ty	---		224,40	Bookstore
V	Offices & Transformer	1943-56	557,24	Administration & Offices
CP	--		25.999,30	Car Park
			44.276,30	**Structured Area**

Figure 2. 22: Site plan of Gasworks Park with legend. Gb and Gc are the non-existing gasometers (URL-25).

Entertainment, education, and culture are all intertwined in this mixed-use complex, the program satisfies the needs of all segments of society. There are six galleries, as well as a museum dealing with environmental issues and an art museum see figures 2. 23, 24, 25. Additionally, there is a library, cafeteria, public halls, workshops, administrative buildings, and a number of stores see figures 2. 27, 30. One of the gasometers has a theater and a green garden at the top, while the other has a concert hall, additionally, the site has underground parking. Small modifications have been made to the buildings and equipment at this industrial complex, and due to the large open spaces of the site, it was repurposed as a public industrial park as events and cultural activities are held there frequently, which enhances community interaction, and this is considered one of the principles of contemporary conservation. And in order to connect the buildings of the complex and their various functions, the site's large areas have been reorganized to serve the new purpose of the place, in addition to green spaces and play areas for children, some small shops are also available.

Restorations were generally carried out with minimal intervention to the structures and machinery and reused as a massive symbol in their location hence, representing the identity of the place such as the concrete structure in the coal yard and the masonry furnace kiln see figures 2. 25, 28. Ultimately, the strategy of reusing the industrial complex was successful as respecting the character of the facility and introducing effective programs to make it a cultural and artistic platform.(URL-36).

Figure 2. 24: Exhibition space, block P, refunctioned original structure (URL-25).

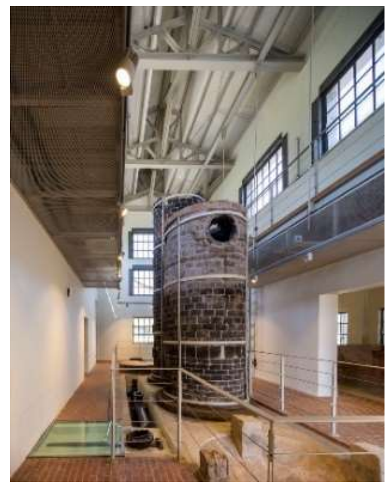


Figure 2. 23: Old equipment in the gallery (URL-25).

Figure 2. 25: Display itself, block R, conservation (URL-25).

Figure 2. 26: Exhibition space, block S, refunctioned original structure

Figure 2. 27: Info box, block O, new structured original traces (URL-25).

Figure 2. 28: Display itself, block M, after and before conservation (URL-25)

Figure 2. 30: Public industrial park (URL-25).

Figure 2. 29: Library, block F, refunctioned original structure (URL-25).

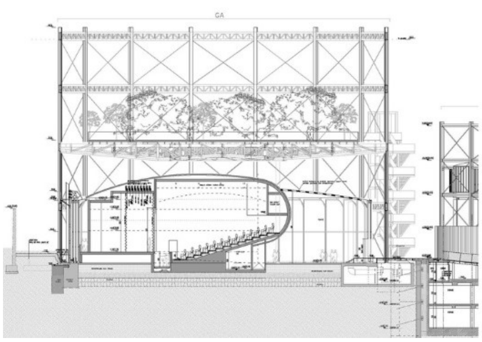


Figure 2. 31: Theater and new hanged sky garden, block-GA, new additions (URL-25).

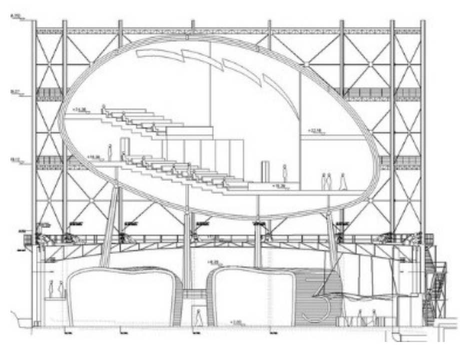


Figure 2. 32: Theater for kids and art gallery, block Gc, new additions (URL-25).

2.4. EVALUATION OF SELECTED ADAPTIVE REUSE PROJECTS

In this section, practical strategies on adaptive reuse and understanding what exemplifies "the successful reuse" are assessed, which were pointed out through contemporary literature. And several adaptive reuse projects which were selected from various geographic locations were investigated to see how theoretical principles and strategies are applied to the industrial buildings and complexes in practice. These six selected reused projects, even though they differ in terms of location, scale, size, a branch of industry, and so on, they were planned as single, large spaces due to their construction purpose that was manufacturing. And this feature of industrial buildings, and their natural potential for adaptive reuse enables a large variety of practices in the sector from different perspectives. All the above-mentioned projects have their conservation approach, but primarily, they represent successful relationships between old and new.

Within the scope of these case studies, they were evaluated according to their programmatic approach, selected cases are culture-based adaptation examples of the variety of functions, which are museums, a university, and an art-cultural centers to see different transformations in the building scale, design principles of intervention such as material compatibility, structural system, and spatial characteristics and intervention strategies to explore what successful practice is, and use these inputs in defining the design principles of successful adaptation to present a conversion proposal for the factory.

In addition, adaptive reuse, as being a strategy to conserve the industrial heritage, has a wide range of direct and indirect environmental, social and economic impacts. The abovementioned examples are also good practices of transformation due to having benefits of them. Core factors of local sustainable development by the adaptive reuse of industrial buildings of cultural heritage projects and their indicators developed from the case studies. Table 2.10 demonstrates the core factors, according to the pillars of sustainability, and their positive indicators generated from the previous case studies and literature review of adapting industrial buildings of cultural heritage.

Table 2. 10: Core factors of sustainability and their indicators by adapting industrial buildings of cultural heritage. Written by the author.

Factors	indicators
Cultural	Maintain Local Memory Aesthetic Enhancement Retain industrial past environmental awareness and education
Environmental	Protection of resources Landscape redevelopment Integration with landscape Environmental management
Economic	Enhance local economy Promoting cultural tourism Benefits to local economy
Social	Potential to support community Promoting quality of life Cultural sites provide

The specific information derived from the case studies analytics is summarized, and provided in a comparative analysis clarified in Table 2.11, under five headings; Functional alterations, structural alterations, spatial alterations regarding the circulation route, material alterations, and façade alterations, to assess the intervention degree to each case study. As the case studies of this research consist of buildings that were originally built as industrial buildings, we focused on if the new function reflects the original industrial process of the building, in terms of functional alterations, because of what is done with those spaces during the adaptive reuse process is critical.

The most important criterion for successful adaptation is to provide sustainability through a new attributed program that meets the new requirements while preserving the authenticity; in other words, to associate the old and the new. As it is seen in the selected cases, even though the degree of new interventions differs in terms of low, medium, and high, the common principle for all of them is preserving the old by providing the requirements of the new.

For instance, in the case of Mill City Museum, as being an example except for the museum approach, to provide the new requirements, the rubble walls of the building were edited in the form of envelopes and a glass mass was placed in this envelope. this independent structure was designed inside the existing building by distinguishing them with the new materials such as glass and steel. In this way, modular and flexible spaces were generated for the new program without harming the existing structure.

Table 2. 11: A comparative analysis of the selected case studies. Written by the author.

	Mill City Museum	**Fondazione Prada**	**The Energy Museum**	**The Tate Modern**	**Kadir Has University**	**Gasworks Museum**
Functiona alteration	Reflect the original industrial process.	Not reflects the original industrial process	Reflect the original industrial process.	Not reflects the original industrial process	Not reflects the original industrial process	Reflect the original industrial process.
Structural alteration	New and old are clearly distinguisha ble	New and old are clearly distinguisha ble	New and old are clearly distinguisha ble	New and old are clearly distinguisha ble	New and old are clearly distinguisha ble	New and old are clearly distinguisha ble
Spatial alteration	Old spatial organization was preserved	Old spatial organization was preserved	Old spatial organization was preserved	Old spatial organization was preserved	Old spatial organization was preserved	Old spatial organization was preserved
Material alteration	New and old equally dominant	New dominant	old dominant	New dominant	old dominant	old dominant
Façade alteration	Contrast between new and old	Contrast between new and old	Minimal alteration	Minimal alteration	Contrast between new and old	Minimal alteration
Alterati on to existing fabric	medium	high	low	medium	medium	low

This design approach may be very appropriate when the new function requires more space. In the case of Prada Foundation in Milan, the abandoned industrial space is enlivened with exceptional architectural gestures. three distinctive new buildings within seven industrial existing buildings created an attractive contrast, the diversity is intended to meet the requirement of the new function as one of the biggest cultural centers in Milan. While it is seen as a successful relationship between the new and old, it also affected positively its surroundings by leading new actions through its initiatives and program.

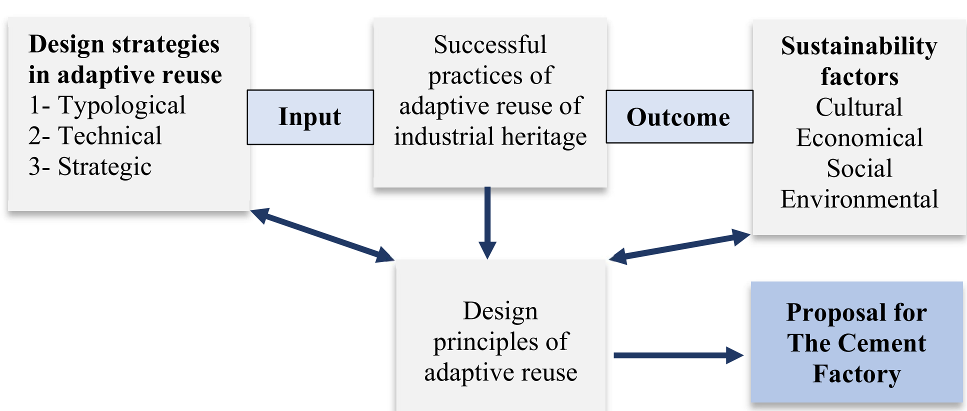
In the case of industrial museums, it is one of the best ways to preserve the existing structure. However, while converting the building into a museum, the characteristics of the building should be analyzed comprehensively. As seen in all cases, all of the industrial buildings exhibit themselves due to reflecting their manufacturing process and demonstrating their history of industrial occupations. wherefore preserving functional integrity and components of the process is considered the main criterion through museum conversion.

As seen the Energy Museum and the mill city museum have many valuable industrial elements inside, converting them into a museum is a successful decision. The example of Kadir Has University in Istanbul shows that the museum approach is often used, even though the main function is different. The Byzantium and the Ottoman parts of the building which are located on the basement floor of the factory that is converted into the Faculty of Fine Arts are being used as a museum for their exhibition today. Other requirements for new function were provided through minimum interventions which are reversible divisions for the classes and offices that differ from the old to read all layers of history.

On the other hand, the place of the building in the societal memory which describes an important part of the area's history and reflects the roots of the society is another important criterion and as seen in the museum of the art gallery, The Tate Modern. In that case, even after all industrial elements have been removed, it has symbolic value for the societal memory. Therefore, it becomes a revival of industrial history in the place, The former power station which is located on the south bank of The River Thames, in the Bankside area at the heart of London, is one of the successful examples of industrial reusing and historic preservation, urban renewal, and sustainable development.

Furthermore, the importance of societal memory, preserving the environment, and the sense of identity were the main motivation of the local initiatives of Kadıkoy district's citizens who have been fighting for the protection of this area for 26 years, transformation into a green area and culture center. The opening of Gasworks Park and the museum are examples of productive community cooperation in preserving their culture and industrial heritage and the local residents' efforts to revive the place. Overall, the project was minimally affected by interventions; minor additions were made to the original structures. In this case, giving priority to preservation on site is a very important criterion, as several methods of interaction with history and memory are promoted, such as the isolation of some types of machinery which are maintained as exhibit monumental elements which act as an urban landmark, where people can interact with history at the plaza via existing structures in the site which leave unaltered the volumetric quality of the old industrial complex, and finally the insertion of the present over the past with the new function which has been added to the gas holders.

The flow diagram below is developed shows the Conceptual framework for reusing the factory, depending on the theoretical framework and the analysis and comparison studies.



Assessing the level of compliance with the rules and objectives of the Nizhny-Tagil Charter in conserving the industrial heritage by evaluating the building performance after the applying an adaptive reuse strategy, as clarified in the following table 2.

Table 2. 12 : The degree of compliance with the conservation rules based on Nizhny-Tagil Charter. Written by the author.

	Charter Items							
	1		2		3	4		
	Preserving functional integrity	Preserving machinry or components	Reflecting various industrial processes	Examining all former uses	Preservation in situ	Respecting the significant materials	Maintaining original patterns of circulation	Being compatible with the original or principal use
Mill City Museu	+	+	+	+	+	+	+	+
Prada Foundat ion	-	-	-	-	+	+	+	+
The Energy Museu	+	+	+	+	+	+	+	+
The Tate Moder	-	-	-	-	+	+	+	+
Kadir Has Univer	-	-	-	-	+	+	+	+
The Gasworks Museum	+	+	+	+	+	+	+	+

Charter Items							
5	6				7	8	
Continuity/psychological stability for communities.	Reversible interventions	Minimal impact.	Documenting unavoidable changes	Safely recording and storing elements that are removed.	Avoiding reconstruction, or returning to a previous known state, expect if it benefits the integrity of the whole site.	Preservation of documentary records, company archives, building plans, as well as sample specimens of industrial products	The degree of compliance with the main 8 standards
+	-	-	+	+	+	+	**7**
+	-	-	-	-	+	-	**4**
+	-	+	+	+	+	+	**7**
+	-	-	-	-	+	-	**4**
+	+	+	-	-	+	-	**4**
+	+	+	+	+	+	+	**8**

CHPTER THREE

3. THE CEMENT FACTORY OF DUMMAR

3.1. HISTORICAL BACKGROUND OF THE CEMENT FACTORY OF DUMMAR

Dummar Cement Factory is the first cement factory that was built during the French Mandate period in 1930, headed by Faris Al-Khoury and managed by Khaled Al-Azm, who was among the intellectuals and politicians in Syria at that time. This means the age of the factory is now more than 90 years. The plant has gone through different stages since its establishment, marked by events related to production and changing systems see figure 3.1. It was nationalized in 1965, continue to supply the local market's needs and support the urban movement until the time of its closure, and in the eighties of the last century, because of the urban sprawl and the lack of development of production lines, the government began towards gradually stopping the cement plant from the end of 1980, then the factory was closed in 1989 and its lands became abandoned and at risk of abuse by citizens, and many proposals were submitted to take advantage of the company's real estate and infrastructure, but the sponsors were unable to achieve this goal (URL-26; URL-27).

The plant belongs to the National Company for the manufacture of cement and building materials, which is affiliated with the General Organization for Cement and Building Materials. The company has been offered for tourism investment within investment forums and in 2008 it formed a committee composed of the ministries of industry, finance, local administration, and tourism, whose mission is to determine appropriate investment formulas for adoption in investing sites affiliated with the Ministry of Industry and the proposed change of its activity and offering for investment, which are 15 sites, including Dammars cement factory, and the committee decided at the end of May

2010 to assign the governorate of Damascus and draw up an urban development plan and submit it to the Ministries of Industry and Tourism, but it has not yet appeared.

Figure 3. 1: View of the cement factory in Dummar (Rangous)

In 2006, a committee was formed at the presidency of the Council of Ministers to study the possibility of establishing a museum of technology and science in the company's Dummar lands. Several meetings were held and a topographical study was conducted Currently, the Ministry of Agriculture has been asked to cancel all previous allocations to the Ministry of Information, the Ministry of Tourism, and the General Housing Corporation, and to make use of the company's lands, which amount to 2,188 dunums, for the benefit of the Ministry of Industry in the future, or to build an entire complex that accommodates the buildings of the Ministry and its affiliated institutions and to benefit

from the company's facilities as warehouses and the garage and benefit from the infrastructure (Al-Shami, 2018)

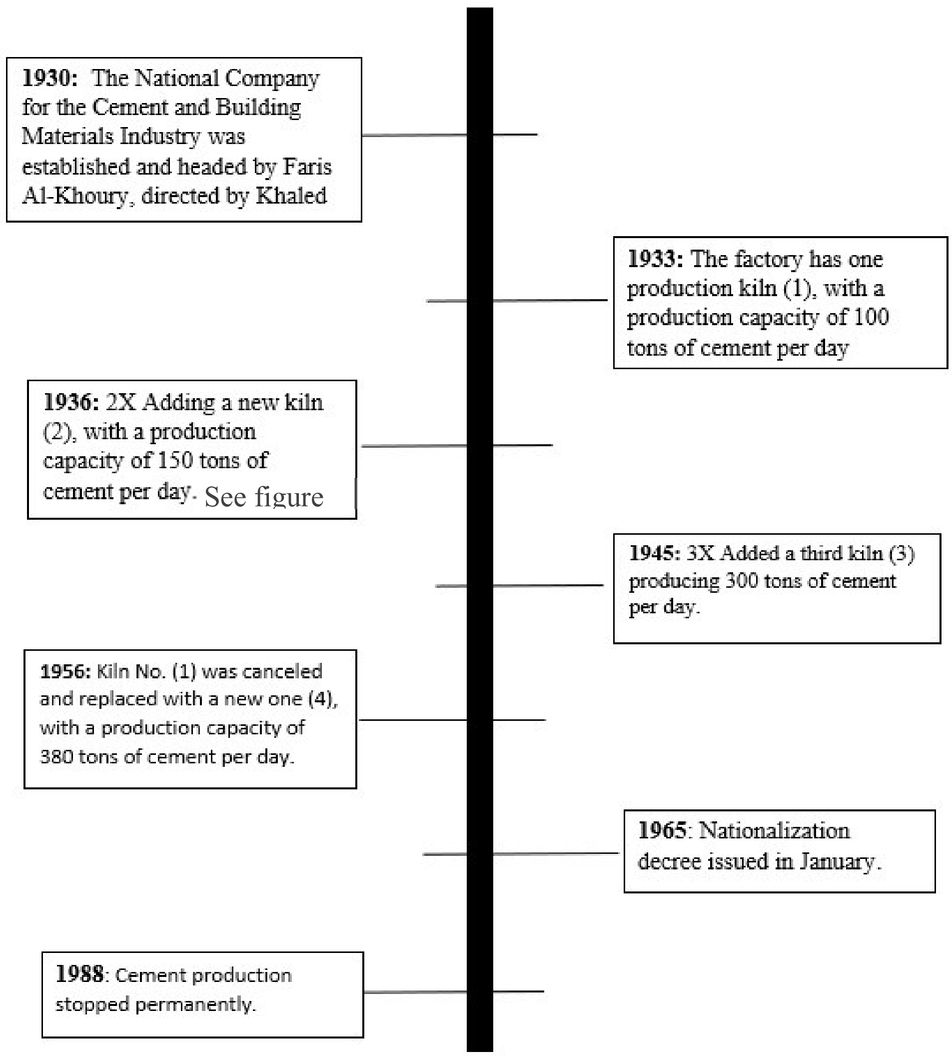


Figure 3. 2: The timeline clarifies the Phases of the Cement Factory. Written by the author.

3.2. THE SITE AND ITS FEATURES

The factory is located to the northwest of Damascus City, in the eastern Dummar area, which is about 5 km from the center of the city and is formed part of Wadi Barada Basin, one of the most important environmental and natural determinants of the urban fabric in the city. The land of the factory is connected to the center of the city by two main roads, the first passing through the old Beirut road, which passes through Al- Rabwah area, and the other through Qasioun mountain, which passes through the knot (Dummar Bridge), connects several areas, such as Jamraya, the research, Wadi Barada, Dummar and New cham (Dummar project), Qudsaya and Al-Hama. The entry to the factory is via a secondary road that runs along the old Beirut road which leads to Qudsaya and Alhama. See figure 3. 3.

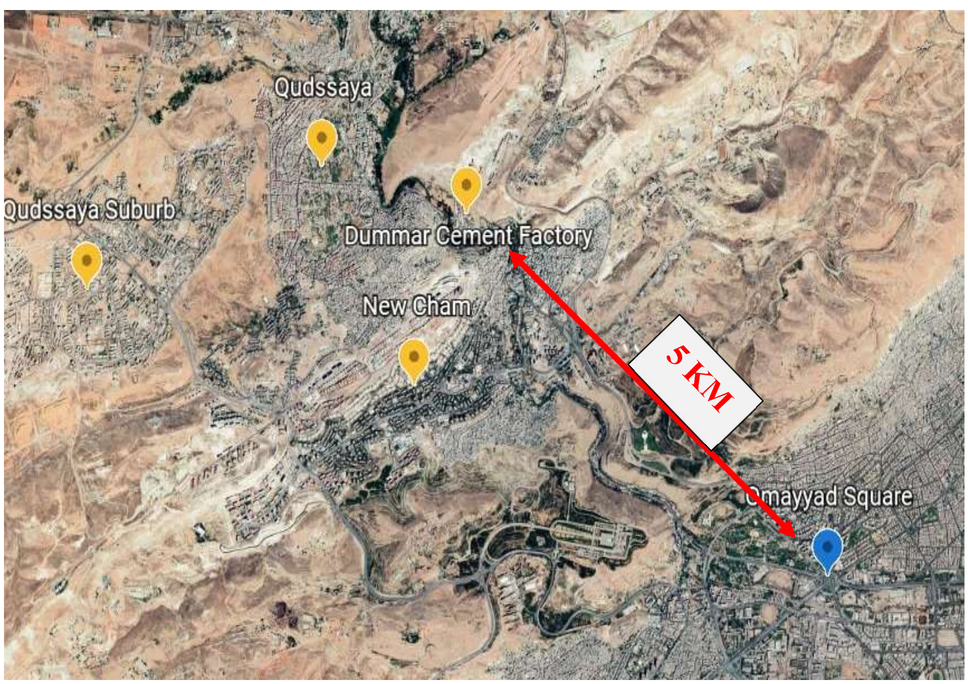


Figure 3. 3: Map of the center of the city and the districts around the factory. Edited by author.

The land of the factory is characterized by an important geographical location where the Barada River passes next to it, surrounded by a large number of orchards in addition to its view of the hills on which several residential areas are distributed, see figure 3. 7. (Al-Shami, 2018). It is close to The Rabwah area, which is considered the lung of western Damascus and this is due to its proximity to the capital, thus, making it the first tourist destination for the residents of the city. It is one of the oldest Damascene parks ever since the Mamluk period until now, and it achieved renown historically as it was a path to travel between Damascus and Beirut in the past (URL-28).

The factory has an important and visual connection with historical points in the vicinity, such as Al-Asadiya Mill, an ancient wheat mill that witnessed the Ottoman period, and Safsaf Park. The cement factory is part of a group of important industrial facilities such as the ethernet lab and the glass lab (Al-Shami, 2018). See figure 3. 4.

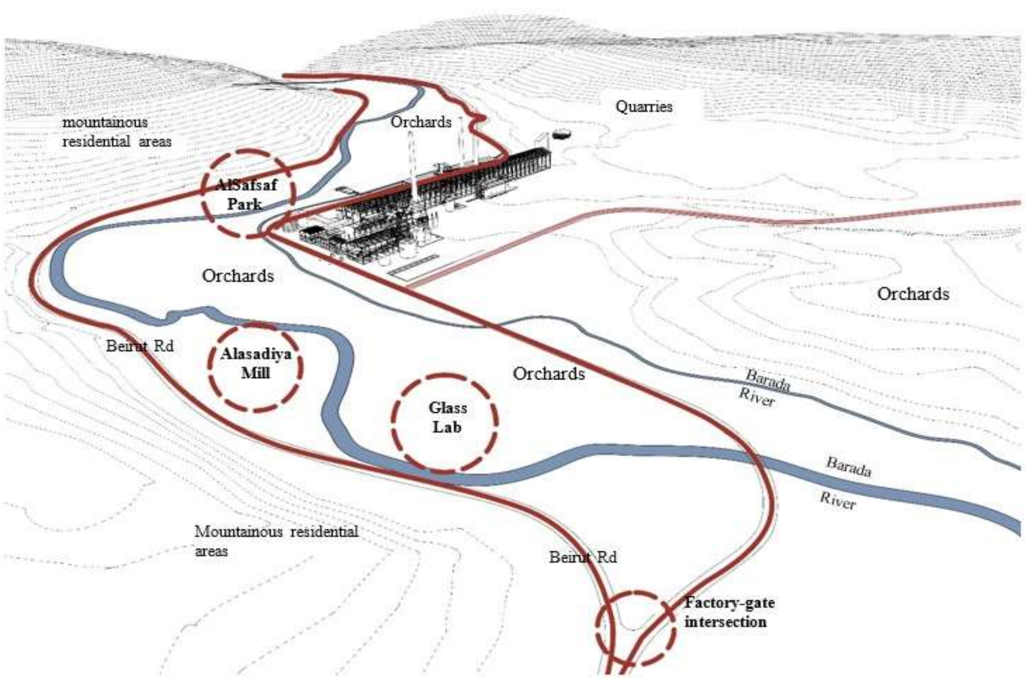


Figure 3. 4: Analysis of the site and the important visual points (Al-Shami, 2018).

Figure 3. 5: Map of the districts around the factory (Rangous).

Figure 3. 6: Photo for the factory from the district near it (Rangous).

Figure 3. 7: The surrounding districts around the factory and River Barada, Branch Yazid (Rangous).

The land of the factory overlooks a wide residential area, where it is located near several residential areas with a diverse local population and from other cities, such as Qudsaya suburb, which is currently filled with people coming from other Syrian cities after the crisis it witnessed, and The New Cham (Dummar project) area whose residents are still present in their homes, and Al- Hama the area which a large part of it was destroyed, all of that gives an important role for the land of the factory and the possibility of reusing it will give multiple advantages and an opportunity for social interaction and acquaintance, while enhancing interaction and tourist attractions, as it is a significant social and cultural common point. See figure 3.3. and figure 3.6.

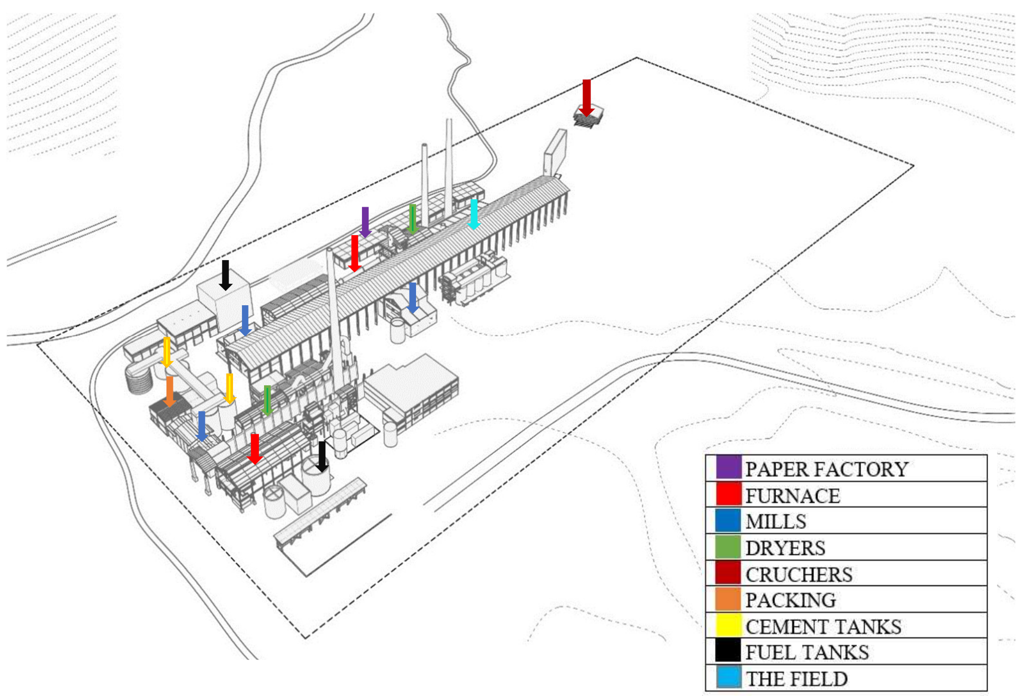


Figure 3. 8: Perspective drawing showing the current blocks of the factory (Al-Shami, 2018). Edited by the author.

3.3. GENERAL CHARACTERISTICS OF THE FACTORY

3.3.1. The Blocks Forming The Factory

In this part, each block will be identified and named to describe them in terms of volumetric-structural features and with an assessment of the Physical status which will help in the description of the spaces. Figure 3.8, the general drawing layout of the current situation of the factory. Block number one, the paper bag factory with maintenance workshop, a rectangular plan type, located on the western edge of the complex, one-story building, concrete structure with a height of 6 meters, and the building is empty. The 3rd block is the boiler room and the next are the fuel tanks, followed by the oil depot, all previous blocks have a rectangular shape, with concrete structures and medium physical status. They are located on the western edge of the complex.

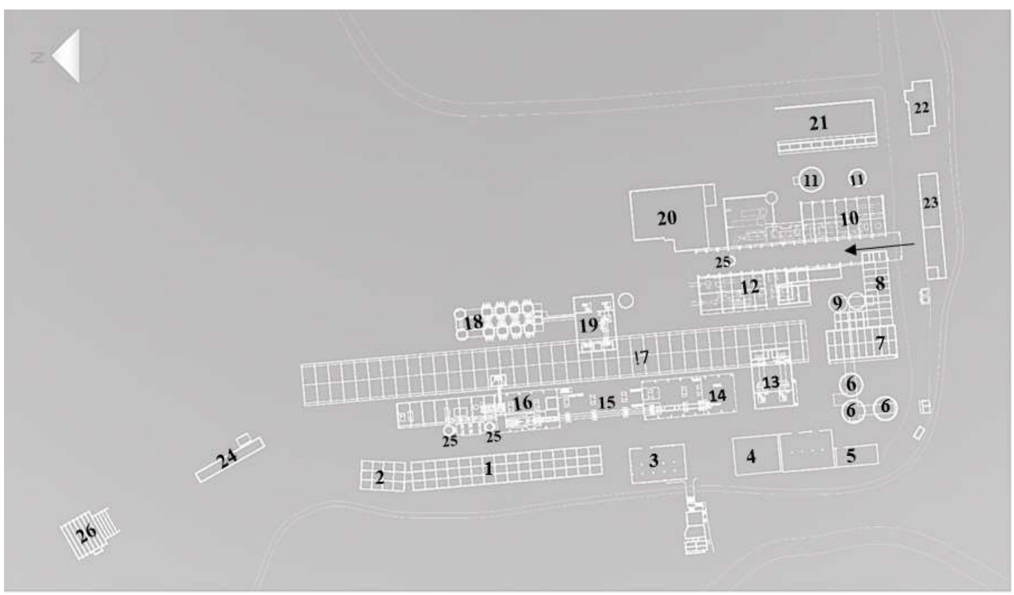


Figure 3. 9: Drawing layout for the cement Factory of Dummer. Edited by the author.

Block No. 6, is a cement tank, which are three empty cylindrical tanks with a diameter of 12.5 m, and a height of 12 m, the area of the tank is 120 sqm with metal structures, and medium physical status, it is located in the southwestern edge of the complex, appears on the entrance front. The seventh block, which is the packing section for stacking the sacks of the cement, has a rectangular plan, it is in good condition, built of cement. block No.8, The mills, were built of cement and have poor physical status with a rectangular plan and the furnace, which is located on the right side of the entrance has a metal construction. After the furnace appears two cylindrical structures, the block number 11, which are fuel tanks with an area of 63 sqm and a diameter of 9 m, and 136.8 sqm and a diameter of 13.2 m, built of cement with medium physical status, they are appearing on the southern facade next to the entrance.

Block No. 12 is the dryer has a rectangular plan, built of metal, in medium physical condition. Block No. 17, which is called the field, see figure 3. 10 & 12, is the highest facility in the factory and the longest, with a rusty gable roof and many successive columns on its sides. It extends about 290 meters and rises at the highest point to 24 meters. This part was called the field because it is a semi-open warehouse, and it is the part that contains the raw materials during the cement manufacturing process. It is located in the center of the plant and on both sides, along the large and small production lines that remain so far. Finally, the high-rise chimneys which become a symbol of the historical factory, appear clearly to all people and draw the attention of the passengers who move from Damascus to its suburb, see figure 3.11. There are three chimneys, in good physical status, two of them are 96 high and one is 61 high (Al-Shami, 2018). All blocks are described in table 3.1. with illustrations.

Figure 3. 10: View from the eastern side revealing the massive concrete blocks as the silos, and the chimneys (Rangous).

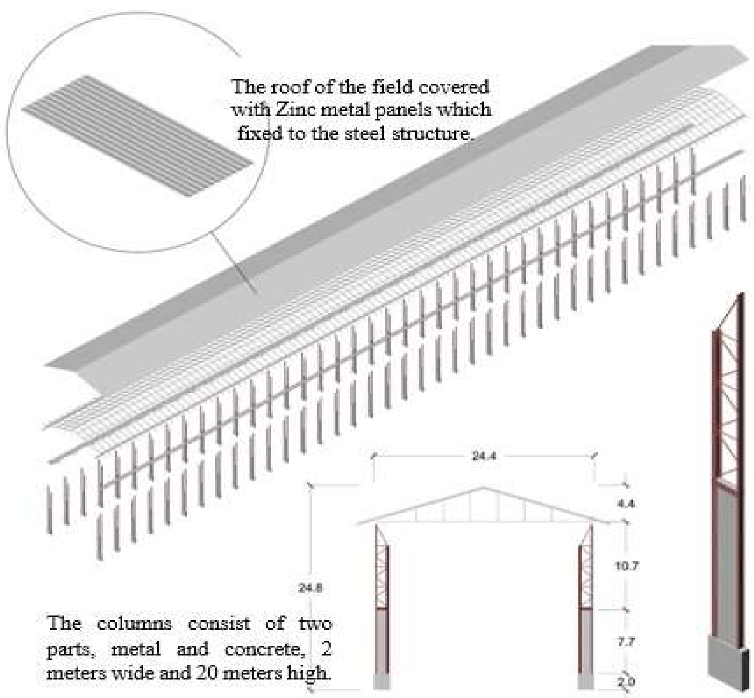
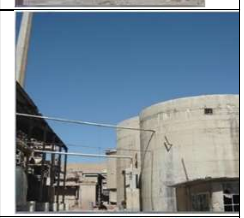
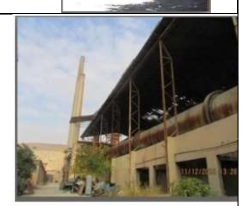


Figure 3. 11: Detailed construction for the field (URL-29).

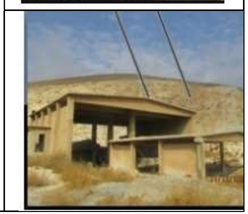
Figure 3. 12: View of the field, the interior view of the field (URL-29).

Table 3. 1: The blocks forming the factory (Al-Shami, 2018). Edited by the author.

BLOCK NO.	NAME OF THE BLOCK	AREA	CONSTRUCTION TYPE	PHYSICAL STATUS	PLAN TYPE	
1	The paper bag factory	196.4 m2				
2	Maintenance workshop	330 m2				
3	Boiler room	604 m2	Concrete		Rectangle	
4	Fuel tanks	974 m2		Medium		
5	Oil depot	345.6 m2				
6	Cement tanks (3)	120 m2	Metal		Cylindrical	
7	Packing section	588 m2	Concrete	Good	Rectangle	

8	Mills	547 m2	Concrete	Bad	Rectangle	
9	Cement tanks (2)	66.5 m2	Concrete + Metal		Cylindrical	
10	furnaces	1183.5 m2	Metal		Rectangle	
11	Fuel tanks (2)	63-136 m2	Concrete	Medium	Cylindrical	
12	Dryer	1295.7	Metal		Rectangle	
13	The mills	638.4 m^2	Concrete			
14	Fuel tank	278 m^2	Concrete	Medium		
15	Furnace	2211 m^2	Metal			
16	Dryer	1375.7 m^2	Concrete + Metal	Bad	Rectangle	

17	The field	6472 m^2	Metal	Medium		
18	Raw material tanks (6)	28.3 m^2	Concrete	Good	Cylindrical	
19	The mills	597 m^2		Medium	Rectangle	
20	Generator and boiler	1235.3+319.6+402 m^2		Good		
21	Stone walls	1282.6 m^2		Medium		
22	Public department	410.2 m^2				
23	Physical and chemical laboratories	331.8 m^2				

24	Stone smoothing	268.45 m^2		Good		
25	Chimneys		Concrete		Rectangle	
26	Crushers	491 m^2				

3.3.2. The Current Physical Status of the Factory

The physical status was classified according to 4 degrees, from very good to bad, see figure 3.16, with a detailed analysis of the elements of each space (columns - slabs - beams - walls - cladding) with an assessment on a scale of 10 and adoption of the average for the entire space. In addition, the registring of the missing machines, see figure 3.15, and the empty buildings, as can be used for the activities that will be proposed (Al-Shami, 2018).

Furthermore, a detailed drawing of the structural units, machines, and spaces constituting the factory elements was made with the greatest accuracy through visiting the factory site, as the dimensions were confirmed. The following table presents a perspective of the factory parts, explaining the spaces, tiles, mechanisms, and covering structures. Table 3.2.

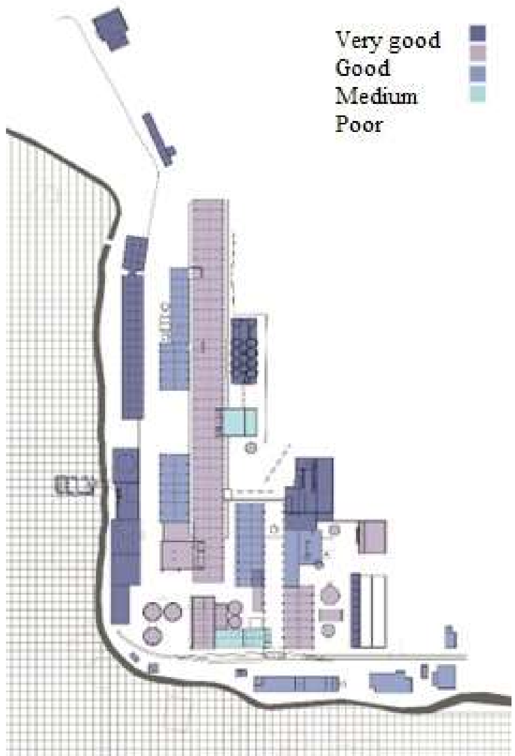


Figure 3. 15: Layout clarifying the physical status (Al-Shami, 2018)

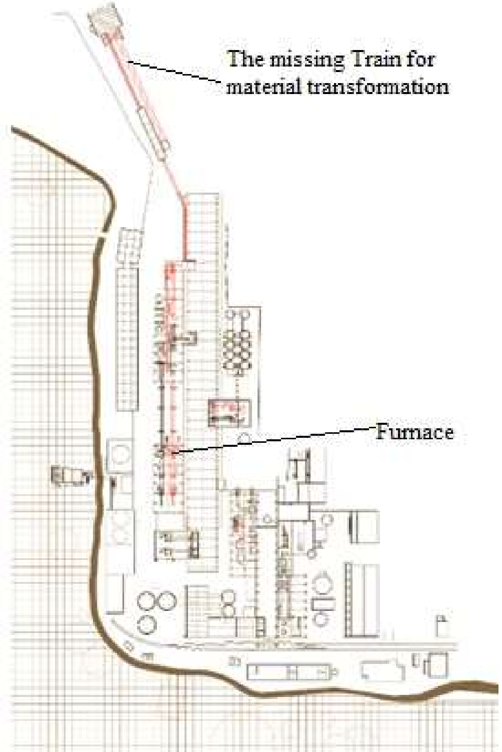


Figure 3. 14: Layout clarifying the missing machines (Al-Shami, 2018).

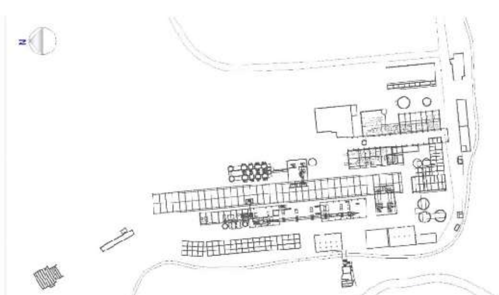


Figure 3. 13: General layout of the factory (Al-Shami, 2018). Edited by the author.

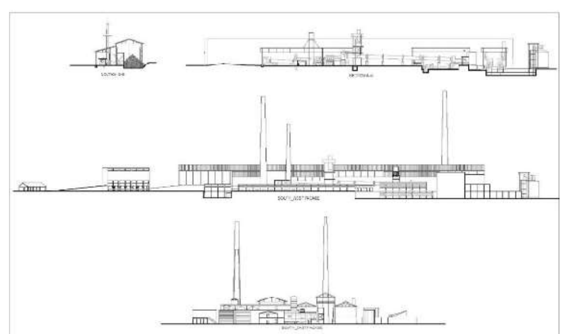
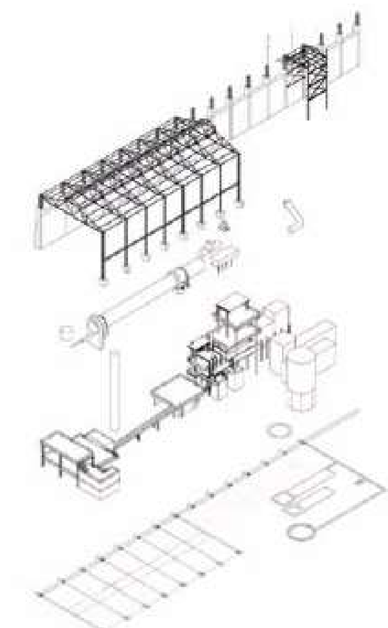
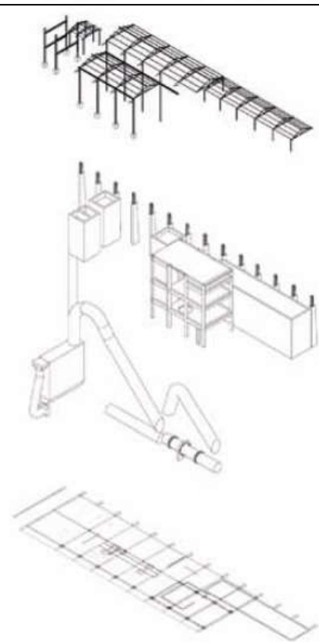
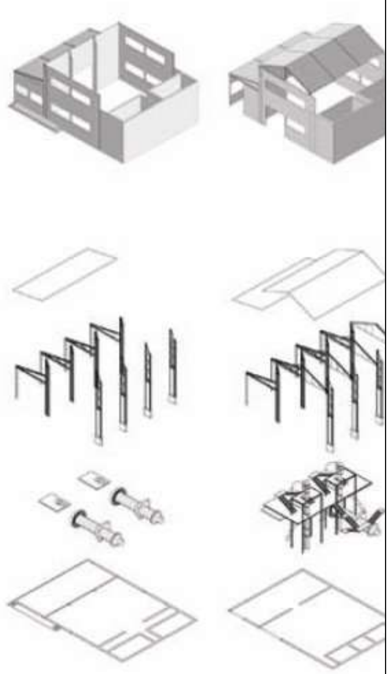
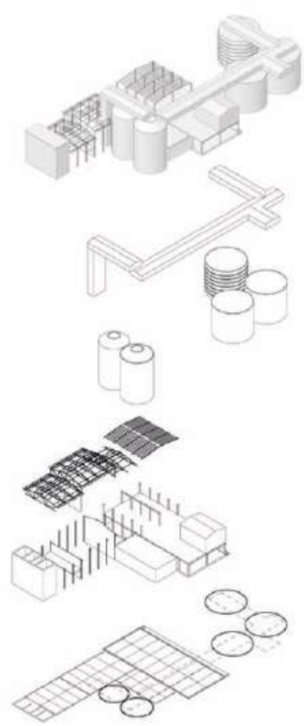
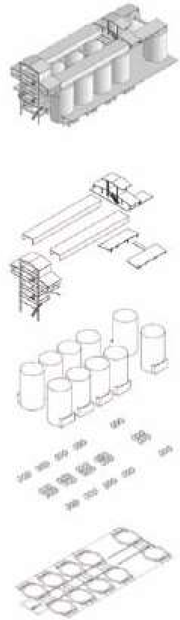


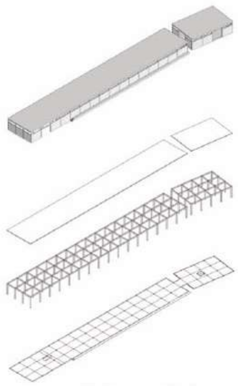
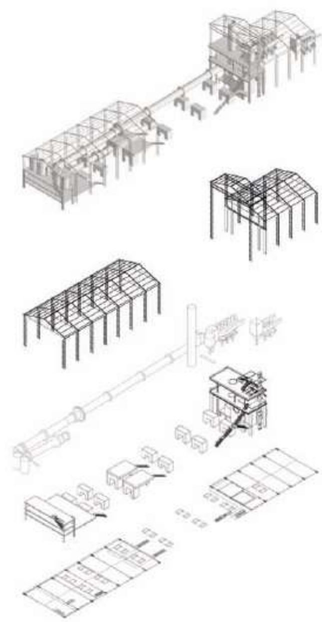
Figure 3. 16: Façades and sections layout of the factory (Al-Shami, 2018). Edited by the author.

Table 3. 2: Detailed drawing of the structural units, machines, and spaces of the factory (Al-Shami, 2018). Edited by the author.

Factory elements	Layered perspective of the structure	Photos
Small production furnace Block No.10		
The dryers Block No.12		

The mills Block No.8		
Packing Block No.6+7		 

The Tanks Block No.19		
The dryers Block No.16		

The paper factory Block No.1		
large production furnace Block No.15		
Crushers and storage Block No.24+26		

3.3.3. Assessing The Factory Through, The Significance, The Challenges and The Capabilities

In this section of this chapter an examination of the general characteristics of the factory, its history, location, and surrounding environment as well as the physical status was conducted, and in the light of previous the assessments related to the factory will be classified into three categories, the significance, the challenges, and the capability, in order to develop a proposal for reusing the factory.

3.3.3.1. The Significance of The Factory

Each industrial site has its own unique properties and its own significance to the local community, and according to the Nizhny Tagil Charter for The Industrial Heritage, it is important to study industrial heritage buildings, teach their history, and make clear their meaning and significance to everyone, in addition, Identify, protect, and preserve the most significant and characteristic examples.(TAGIL, 2003, p. 1)

The Site Significance: The Wadi Barada area is a famous valley in Syria, located in the north-western part of the Syrian capital of Damascus, in the Qalamoun district. It is known for being a mountainous area and in direct contact with the eastern mountain range of Lebanon. And the most important summer tourism area is in the Damascus countryside. Where there are the most ancient Damascene resorts, such as Dummar, Al Hama, and many other tourist areas located within the valley's itinerary (URL-28, 2015). The project land is considered part of this area, which is considered one of the most important natural, and environmental determinants of the urban fabric of the city

The Cultural Significance: The cement factory in Dummar, Damascus is an important symbol of Syrian industrial heritage, and a witness to decades of the city's history, as well as cultural concepts which its population has been holding since its establishment. The Factory is the first cement factory that was built during the French Mandate period in 1930, as the age of the factory is now more than 90 years (URL-27).

The Symbolic Significance: The factory has always been a part of the road to the capital and the high-rise chimneys which become a symbol of the historical factory, appear clearly to all people and draw the attention of the passengers who move from Damascus to its suburb (URL-29, 2019).

The Socio-cultural Significance: The project overlooks a wide residential area, where it is located near several residential areas with a diverse local population and from other cities such as Qudsaya suburb, and The New Cham (Dummar project) area, and Al-Hama. The factory has an important and visual connection with historical points in the vicinity, such as Al-Asadiya Mill, an ancient wheat mill that witnessed the Ottoman period, and Safsaf Park which is located in Al-Rabwah area, it is a very popular area with its touristic character

The Technical-Artistic Significance: The building has technical and artistic value due to including production process traces. It is still possible to read the technological layers of the factory through history. This mechanical equipment that gives technical value to the building also creates an artistic value.

The Economic Significance: Because the area is attractive to tourists, the adaptation of the factory for cultural and entertainment purposes will encourage economic development, which increases tax revenue.

3.3.3.2. The Challenges

Among the main problems of the factory is a lack of electronic information and inadequate paper about the factory's history, as well as finding reliable studies about the case study (URL-30) additionally, with the company turning off its manufacturing, it suffers from debt, and its credit companies are experiencing financial problems (URL-26) and the company land is constantly being overtaken because of its scattered lands before it became a military area and cannot be reached.

3.3.3.3. The Capabilities

The site retains its industrial identity, additionally, the natural resources on site can be seen in the existing two branches of the Barada River, as well as the surrounding orchards and farms and some of the nearby mountains, which give the site its natural significance and therefore the capability of the building to incubate new uses for cultural, entertainment purposes.

In addition to its proximity to several residential areas, the site has economic potential since it is adjacent to Al Rabwa area which considers the lung of western Damascus, it is a tourist area for the residents of the capital to enjoy the beautiful nature away from the city. Spatial and architectural advantages, as well as extended land spaces containing industrial elements and machinery have the opportunity to revive the neglected industrial site into public unusual, dynamic, attractive parks. Moreover, cement production equipment is still found in the factory building, which makes it an ideal site for converting into an interactive museum that offers a unique opportunity to learn about the history of the place and allows visitors to explore the site. factory.

CHAPTER FOUR

4. THE ADAPTIVE REUSE METHODOLOGY OF THE CEMENT FACTORY

4.1. DESIGN PROPOSAL OF THE CEMENT FACTORY

The concept of the proposal is the transformation of the complex from a factory producing cement material to a factory producing knowledge and pleasure, and the transformation of the spaces from a place containing huge machines to a space embracing people. Additionally, transforming the area into an artistic and cultural hub in order to promote learning in an entertaining environment, as well as enabling social interaction by providing vital functions that revitalize the area, as making industrial facilities more closely connected to their surroundings is the main principle of conserving them.

As we discussed in chapter three, various strategies were used to assist in the success of reusing the industrial buildings. The criteria and principles discussed previously were summarized in six points. The principles will be applied to the cement factory's adaptation process which includes:

- Minimal interventions and preserving the old.
- Flexible design and reversible spaces.
- Diversity and driving new actions through initiatives and programs.
- Maintaining functional and component integrity.
- The symbolic value of societal memory.
- Prioritizing on-site conservation.

The principles of preserving the old and the idea of utilizing flexible modular spaces are crucial strategies for the reuse process of the factory. One way to achieve this is to establish a new section inside the building. This new section will be in the largest structure in the factory "the field", see figure 3.11, with enough space to house a community center. Thus, we would be preserving the existing structure without damaging it while simultaneously meeting the needs of the local population by having a community center that meets their requirements. When reviving the abandoned industrial spaces, a diverse atmosphere must be created to positively affect its surroundings by creating a welcoming environment. A great example of this is apparent in the Prada building, where their diversity, initiatives, and programs led to the revitalization of the area surrounding the building and made it stand out. thus, a new building will propose in the empty lot next to the factory as a health center, focused on improving public health and providing psychological support and services through the use of non-traditional therapy methods.

One of the most important principles that lead to a successful reuse process is to maintain the functional integrity of the building along with its components, as in The Mill City Museum and The Energy Museum. It is also important to utilize the existing structure and components, it is crucial to maintain the historical elements of the factory while also implementing the modern elements. To follow this vision, it is proposed to transform a section of the factory into an industrial museum. This industrial museum will uphold its historical and symbolic value in various ways such as portraying the different stages of cement manufacturing. Also, existing machines will be displayed for the visitors to see and a simulation of the missing equipment will be presented to show visitors how the machines were used and how they used to function. This will create a great tourist attraction that provides entertainment while also implementing cultural aspects.

The Gasworks Park and Museum complex is an example of a similar adaptation where the architects valued and prioritized on-site conservation. The historic buildings on the site were preserved as they are, allowing tourists to learn about the building's history through its existing structures while also preserving the old industrial complex. Similar to the Gasworks Museum, an industrial public park is recommended around the machines that cannot be used inside the museum. These machines will be displayed to the public and act as an urban landmark. The visitors will be able to utilize seating areas, bike paths, and various other service areas while enjoying the factory's historical and symbolic landmarks.

Ultimately, it's not just about maintaining the cement factory, it is including how the people enjoy their cultural heritage and landscape and interaction through their spaces, as the old buildings and machines will give a special sense and unique identity to the district of the valley of Barada River, in addition, it is a great opportunity to bring daily life into the place, as promotes social interaction and inspirit the site with preserving the significance of the place. The following table 4.1, is the statement of the proposal which is defining the new function program, the significance of the case study, and the objectives and issues related to it.

4.2. PRINCIPLES RELATED TO THE ADAPTIVE REUSE STRATEGY OF THE CEMENT FACTORY

After analyzing the adaptive reuse practices and exploring the successful adaptive reuse, and evaluating the performance of the strategy according to the degree of compliance with the principles of conserving the industrial heritage, guidelines were conducted to reuse the Factory in Dummar, therefore, when considering a new use for the cement factory, the following points should be considered:

- Integrate the industrial site into the urban context, preserving its identity and history.
- The proposed function is compatible with the original structure.
- Assessing the structure and site in light of barriers, values, and capabilities.
- Preserving the industrial machinery and equipment on site
- Flexible design respects the building's character with the possibility. of a readable intervention.
- Interventions should be minimal.
- New interventions should promote reversibility.

- Utilizing building materials that are compatible with the original. structure and reflect modern technology.
- Promoting the sense of the place through initiatives and programs of the new function

Table 4. 1: The statement of the design proposal. Written by the author.

The design proposal	
To design a proposal telling the story of the historical cement factory, the proposal should include reusing the factory as a mixed-use building as the previous examples, considering the existing socio-cultural needs of the area. Thus, three functions will be proposed in an environment that provides community support, and educational and recreational activities suitable for all levels and ages. The program was identified as composed of three major functions: An industrial museum, a community health center, public industrial entertainment park.	
The purpose	**The issues**
Adapting the factory as a cultural center and an industrial museum to increase the awareness of the industrial heritage and the importance of preserving it. Establishing a public industrial recreational park, within an organic and ecological fabric, that restores the vitality and freshness it lost and a large part of its vegetation cover as a result of the cement factory presence. Adapting the scheme as a landmark for locals to provide a strong identity based on a local character.	The heritage buildings are neglected There is no promotion of the local culture Damage of surround vegetation cover The need for art cultural, and community centers, to accommodate the desires and the interests of the population in this region. The lack of the sense of the place.

4.3. RATIONALE OF THE NEW FUNCTION PROGRAM

Syrian people have suffered from the constant years of war, and all community categories suffered from the war psychologically and socially. The war's impacts varied according to cities in terms of the severity degree, therefore, mental health is an essential point to focus on due to its great importance for the growth and development of the society, in addition, to the necessity of providing a healthy lifestyle for individuals to be able to meet their lives' demands.

During displacement circumstances, the relations of society weaken sharply, so there will be an urgent need to support some community's activities to reshape the relations between individuals and rebuild the open interactions between groups of people, their values, and interests aiming to reduce discrimination and inequality to the minimum level. Reconstruction of humans before building and infrastructure is a major target for societies and countries, especially those that have been exhausted by wars and crises. So, it is necessary to establish facilities and institutions concerned with humans serving, rebuilding, rehabilitating, and supporting their health and psychological needs.

Therefore, it is very appropriate to propose the establishment of a community health center to provide services and activities, meet the individuals' needs, and enable them to participate in social activities to entertain, learn, take advantage of livelihood programs and share information and many other things, in addition to a rehabilitation health center to improve their mental and physical health, and to provide primary health care services and much other non-traditional therapy such as meditation, yoga, art, and music therapy centers and others. These centers empower and strengthen the communities, IDPs from the areas of war, and the host communities by providing forums to support and enhance their ability to make decisions that impact their lives, and these centers will be established for people of all different ages' groups. On the other hand, reusing part of the building as an industrial museum also helps in promoting the idea of boosting health through art. This research calls for the first time to use art to improve the general health of people, by giving people a treatment prescription and "free entry to museums". The report says that this initiative is the first of its kind in the world, and under this initiative, each doctor who is a member of the "Francovin" can write up to fifty recipes based on the use of art and enter the museum, which will provide people with a safe and quiet place, and an active environment, in addition to providing an opportunity to build relationships with the people who love, which help improve their health (URL-31, 2018).

4.4. THE PROPOSAL PROGRAM OF THE CEMENT FACTORY

The main motive for re-adapting this industrial facility was to link it to its surroundings as a means of preserving it, in addition to creating a common space that serves the local community in proportion to the local identity of the region, where the historical value of the factory, which combined the past and the present. See Tables 4.1 & 4.2.

An industrial museum: The section that still preserves the production mechanisms, which is the axis of large production, is proposed as the symbolic continuation of the cement-production-based function of the factory, in this context, will be reused as an industrial museum that simulates the cement production experience. Starting from crushers, through the furnaces, the mills, and the paper factory to packing. To preserve the vast majority of the plant's facilities and mechanisms, which retain scientific value and be a large part of the production process.

A community health center: The center will occupy two locations, one of them is the field, the extended tallest facility in the complex. which will embrace the community center (insertion strategy). The field is a simi-open storage area, 290 m long and 24 m wide with 24m Hight. It has the potential to insert a new mass into its void.

The community center will compose of four blocks each one for a particular category which are children, women, young, and elders, that grant social, cultural, educational, and amusive services, through a function program composed of:

Educational support halls, production and training spaces, exhibition spaces, workshops, multi-purpose hall, library, and services.

The second site is located in the free space next to the building of the factory, see figure 4.1, which will embrace the health center.it will be a new building separated from the old buildings (installation strategy). The function program is composed of:

Swimming pool and its related services, conference and meeting room, fitness section, gymnasium, training rooms, health services section, multifunctional consultation rooms, health consultation rooms, physical therapy rooms, psychological therapy rooms, administrative Services, independent cafe, and office facilities.

A public industrial entertainment park: The remaining area, which is located on the eastern side of the factory is proposed as a public industrial park as the intervention must maintain the remains of the old installations as valuable industrial heritage, and makes them available for the public. This area includes some machines and facilities that belong to the smaller production lines, which have changed repeatedly over time, and also includes the cement storage cylinders, fuel tanks, small furnace, chimney, and other elements that we can reuse innovatively, by simulating many industrial parks in the world as former water bunkers rethought in use for recreational climbing.

The proposed garden includes open parts of the factory as public entertainment places to visit, contains an open landscape, sittings, a biking path, art exhibitions for the products of the community center, in addition, commercial services such as the restaurants that take an industrial character and mini shops that sell art goods related to the factory, and places to buy the tickets.

The conceptual approach is to provide a healthy stimulating environment, inspired by the benefits of contact with nature and community, with the underlying message of health promotion and sustainable design. The organizing idea for the site and building aimed to maximize the potential for the building to engage with the community, and a spectrum of users from different generational and cultural backgrounds access the services provided, so it is important the building be welcoming and engaging.

Table 4. 2: The Cement Factory Museum Complex. Written by the author.

Typological approach	**Location:** **Original built** **Original use** **Area** **Financing source**	Damascus, Syria 1930 Cement Factory 67160sqm Governmental
	Adaptive Program	Former cement factory converted into public space for education and cultural center.
Strategic approach	**Intervention strategy**	Insertion: The community center (new) is constructed to fit, and is located within the boundaries of the existing building (the field). Installation: The new elements exist independently (the health center)
	Architectural program	Components: Old buildings will transform into an interactive museum with a public industrial park and service areas.
		Additions: The health center, the community center, services related to the park: restaurant, small shops, seating areas, bike paths, and symbolic landmarks.
Technical Approach	**Structural system**	Limiting interventions to the minimum
	Materials compatibility	Selecting compatible material with the existing one.
	Spatial characteristics	Preserve the old spatial organization, interventions are in minimum.

Table 4. 3: The positive indicators resulted from adapting the factory. Written by the author.

Cultural	Maintain Local Memory Aesthetic Enhancement Retain industrial past environmental awareness and education	✔
Environmental	Protection of resources Landscape redevelopment Integration with landscape Environmental management	✔
Economic	Enhance local economy Promoting cultural tourism Benefits to local economy	✔
Social	Potential to support community Promoting quality of life Cultural sites provide	✔

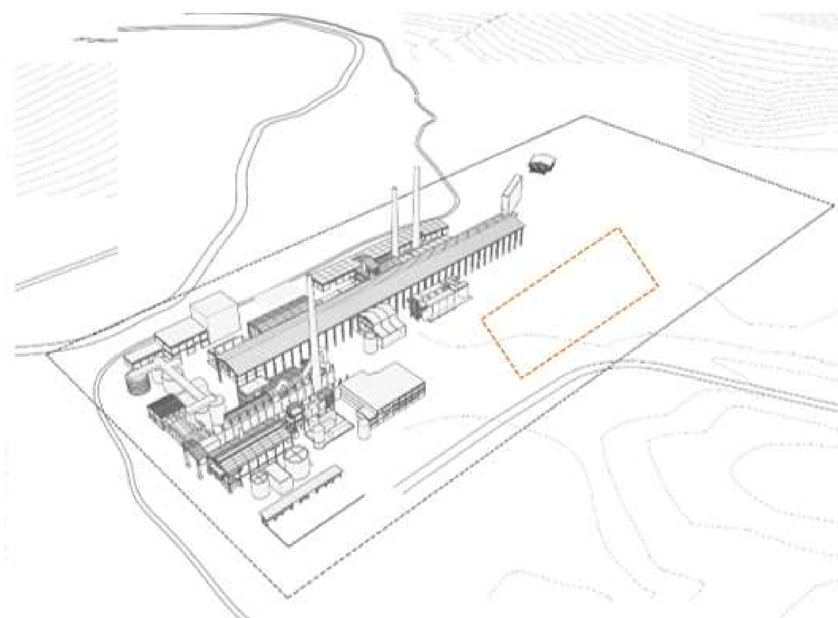


Figure 4. 1: The location of the proposed new building, the health center. Edited by the author.

Table 4. 4: The degree of compliance with the conservation rules based on the Nizhny-Tagil Charter of the factory proposal. Written by the author.

The charter Items		
1	Preserving functional integrity	+
	Preserving machinery or components	+
2	Reflecting various industrial processes	+
	Examining all former uses	+
3	Preservation in situ	+
4	Respecting the significant materials	+
	Maintaining original patterns of circulation	+
	Being compatible with the original or principal use	+
5	Continuity/psychological stability for communities.	+
6	Reversible interventions	+
	Minimal impact.	+
	safely recording and storing elements that are removed.	-
	Documenting unavoidable changes safely recording and storing elements that are removed.	-
7	Avoiding reconstruction, or returning to a previous known state, except if it benefits the integrity of the whole site.	+
8	Preservation of documentary records, company archives, building plans, as well as sample specimens of industrial products.	-
6		

RESULTS AND RECOMMENDATION

1. RESULTS

The study began with an explanation of the strategies and approaches to adaptive reuse in the contemporary literature and then investigated industrial heritage buildings for adaptive reuse in three categories: The typological approach, the strategic approach, and the technical approach. As well as exploring successful adaptive reuse based on previous research and international charters. Six adaptive reuse examples were selected within this scope to gain a deeper understanding of each adaptive reuse process and assess the level of intervention in each case study based on a comparative analysis, moreover, finding out what successful practice entails.

As the case studies of this research consist of buildings that were originally built as industrial buildings, we focused on if the renovated function reflected the original industrial process of the building, it is crucial what happens in those spaces during the adaptive reuse process. Finally assessing the level of compliance with the rules and objectives of the Nizhny-Tagil Charter in conserving the industrial heritage for those examples. In addition to defining the core factors of sustainable development through the adaptive reuse of industrial buildings and their positive indicators.

The key principles of the adaptive reuse strategy of the industrial buildings have been derived from the case studies analytics to meet the objectives of this research. For a successful adaptation of an industrial building, it is important to maintain the historic integrity of the building with a minimal amount of intervention, also preserving the industrial process and equipment and the level of intervention will be determined by the building's evaluation according to three categories: material compatibility, structural system, and spatial organization. Understanding the historical, cultural, economic, and social values of the industrial heritage site is very important, as is an understanding of the buildings and their industrial activities.

Following the guidelines drawn from the study, a design proposal was submitted for the reuse of the cement plant. As well as trying to comply with the rules and objectives of the Nizhny-Tagil Charter, and because the preservation of historical importance is a priority, an interactive museum offering an experience similar to the production of cement was proposed by preserving machinery and equipment that reflect the industrial process as a way to achieve it. And to achieve the charter objective of preserving the site and its equipment, an industrial park, with green spaces and memorable industrial components was proposed. The proposed community health center will serve residents who live near the factory. This building's programs and initiatives will facilitate the interaction of residents with each other and establish psychological stability within the community around the factory, and this is what the Nizhny-Tagil Charter recommends as well.

There's no way to prevent the demolition of some buildings due to their poor physical condition, and others because of their necessity for the proposed use. However, buildings that are in good physical condition can be kept with minimum interventions and reversible modifications for the museum and the public park. Documentation is a problem in the plant, which needs to be addressed. During the war, some equipment was stolen, and some documents showing the history and development of the plant went missing, However, there are still some records that tell the history of the factory and how it developed over time. According to the updated proposal, most of the preservation rules related to the Nizhny-Tagil Charter were met. The degree of compliance with the proposal has been indicated in Table 4.4.

2. RECOMMENDATIONS

This thesis focuses on the principles that must be followed when reusing industrial facilities for cultural purposes. A strategy has been proposed for reusing the factory and based on this proposal, It is recommended to make some changes to the spatial organization on the site and the spaces need to be determined in accordance with the new function, Rehabilitating some stores that have accumulated cement and damaged their shape in addition to canceling some stores in poor physical condition, and moving some of the machinery to the area of the proposed interactive museum, to develop a unique experience that simulates the cement production process in a realistic manner. Detailed reports must be prepared regarding the physical status of the building, where these analyses are done by experts through certain tests.

Future research on the adaptive reuse of the cement factory in Dummar can be future developed by focusing on, new technologies and innovation, through choices and alternatives more efficient and sustainable towards the environment, such as using recycled materials or which are known as environment-friendly materials.

3. CONCLUSION

Due to their open volumes, deserted industrial structures offer a unique opportunity for adaptive reuse. The site can also be transformed into a mixed-use development for generating new uses and enhancing urban vitality. With adaptive reuse, old industrial buildings can be preserved while providing new experiential spaces in urban areas. Therefore, reusing former industrial buildings for new functions represents an alternative through sustainable solutions for the conservation of these important vacant buildings. The land of the factory formed part of Wadi Barada Basin, one of the most important environmental and natural determinants of the urban fabric of the city, it has an important geographical location as the Barada River passes next to it, surrounded by a large number of orchards, in addition to its view of the hills on which several residential areas are distributed. It is close to The Rabwah area, the first tourist destination for the residents of the city. Accordingly, this thesis contributes to the development of the urban environment by giving guidelines to adapt the vacant industrial buildings which are derelict being and have potential and benefits to their surroundings and locals, and bringing awareness of reusing the industrial buildings as a sustainable strategy for the development of the urban environment. Thus, this thesis seeks to design a proposal to reuse the cement factory in the context of cultural heritage.

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