

INTERVENTION STRATEGIES FOR REHABILITATION OF THE  
ARCHITECTURAL HERITAGE IN TRIPOLI CASTLE IN RED SARAYA  
DISTRICT

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Submitted by **Fatma Ahmed ABUSHOUFA**

Approval of the Graduate School of Natural and Applied Sciences, Çankaya University



Prof. Dr. Can COĞUN  
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.



Asst. Prof. Dr. İpek MEMİKOĞLU  
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.



Asst. Prof. Dr. Ceren KATIPOĞLU  
ÖZMEN  
Supervisor

**Examination Date: 13.09.2018**

**Examining Committee Members**

Asst. Prof. Dr. Ceren KATIPOĞLU ÖZMEN (Çankaya Univ.)



Instructor Dr. Gülşah ÇELİK BAŞOK (Çankaya Univ.)



Asst. Prof. Dr. Elif GÜNEŞ (Atılım Univ.)



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Name, Last Name: Fatma Ahmed ABUSHOUFA

Signature : 

Date : 13.09.2018

## **ABSTRACT**

ABUSHOUFA, Fatma Ahmed

M. S. Interior Architecture Department

Supervisor: Asst. Prof. Dr. Ceren KATIPOĞLU ÖZMEN

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Rehabilitation of the architectural heritages refers to the intervention of the structures that are implemented on historical and heritage structure in order to preserve their existing elements and utilize their spaces in a way that protects their historical and cultural values and convey them. In this thesis, Red Saraya/ Tripoli Castle in Tripoli is selected as case study in order to propose rehabilitation strategies for the historical buildings which suffered with the damages. In the literature review, the current rehabilitation strategies and techniques are discussed. In the case study, the dangers and risks facing the rehabilitation plan are reviewed from different perspectives. In the conclusion, rehabilitation strategies for the Red Saraya/ Tripoli Castle are discussed with five main objectives to preserve the structures; achieve a historical landmark, attract tourism, attract financial income, study and define the archeological eras that formed the existing structures.

**Keywords:** Rehabilitation, Intervention Strategies, Red Saraya, Tripoli Castle, Libya

## ÖZ

ABUSHOUFA, Fatma Ahmed

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Mimari mirasın rehabilitasyonu, yapının mevcut unsurlarını korumak ve mekanlarını tarihi ve kültürel değerlerini koruyacak ve iletecek şekilde kullanabilmek için yapılan müdahaleleri içermektedir. Bu tezde, hasar görmüş tarihi binaların rehabilitasyon stratejilerinin geliştirilebilmesi amacıyla Trablus Kalesi örnek çalışma olarak seçilmiştir. Literatür taramasında, mevcut rehabilitasyon stratejileri ve teknikleri tartışılmıştır. Örnek çalışmada, rehabilitasyon uygulamalarının karşılaştığı tehlikeler ve riskler farklı perspektiflerden gözden geçirilmektedir. Çalışmanın sonucunda, Trablus Kalesi (Red Saraya veya Kırmızı Kale) için yapıları korumak, tarihi bir dönüm noktası oluşturmak, turizmi çekmek, finansal gelir elde etmek, araştırmaları ve ortaya çıkan arkeolojik dönemleri tanımlamak için bir rehabilitasyon stratejileri tartışılmıştır.

**Anahtar Kelimeler:** Rehabilitasyon, Müdahale Stratejileri, Red Saraya, Trablus Kalesi, Libya

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# CHAPTER 1

## INTRODUCTION

There are plenty of structures that were built throughout the different historical periods for several reasons; such as sheltering, social gathering or military use. In our days, most of the previously built structures were demolished by natural or human reasons, while the ones that remained are an evidence on the national heritage of the country through the one or few civilizations that formed its political, social and cultural dimensions. Therefore, the rehabilitation strategies form an important part of architectural practices, which connects the past, present and future, providing the possibility to use the historical structures while presenting its historical depth.

The significance of historic buildings emerges from their importance historically, culturally, socially, and environmentally. Therefore, any strategy that aims to rehabilitate a historic structure shall first raise awareness to these aspects, followed by maintaining the remaining structure, strengthening it, and then apply finishing and decoration works to it in an aligned manner with the its historic and present contexts (Pinto, De Medici, Senia, Fannricatti, & De Toro, 2017). Moreover, any rehabilitation works that are performed on historic structures has to follow certain guidelines that ensure that the rehabilitation and the intended future function preserves its value, while enabling the people to use it in a beneficial way that let them appreciate its historic value (Campagnol, 2011). Thus, the governments in developed countries have issued generic and specific guidelines in order to ensure that any rehabilitation of the architectural heritage is conducted in a way that establishes the connection between the community and the historic structure (Heritage Council, 2008).

There are certain concepts that need to be taken into consideration when rehabilitating a building, which includes analyzing the needs of the current community, defining the constraints that are imposed by the existing structure, recovering the building to the best state possible, and providing an alternative design that satisfies the preservation objectives and the refunctioning purpose (Pinto, De Medici, Senia, Fannricatti, & De Toro, 2017). Therefore, the refunctioning of the building, also known as adaptive reuse, is basically a strategy to preserve the historic building, giving it a new context that keeps its value and allows the local community to use it in a beneficial manner (Ragheb, Ragheb, & Ragheb, 2017).

Furthermore, there are specific challenges that face architects and developers when planning and performing rehabilitation including compliance with preservation laws, building codes, and implementing modern utilities provisions into buildings that are not designed to have them. Moreover, structural issues maybe faced as the building may not be ready to receive loads that are associated with the new rehabilitation plan (Hein & Houck, 2008). In this thesis, the Tripoli castle is chosen as the case study due to its historical importance to the capital of Libya. The castle includes several structures that were built during different time periods extending to the Phoenician civilization.

The major problem on the rehabilitation process of the Tripoli Castle is the lack of architectural and archeological studies that attempted to rehabilitate the castle structures and refunction them with a strategy that establishes the connection between it and the local community. Moreover, there are no national codes or guidelines for rehabilitation, adaptive reuse or refunctioning of historic structures in Libya. Therefore, this thesis is an attempt to study the challenges that are faced during the rehabilitation of the historic buildings in Libya, in addition to setting a strategy that allows the preservation of the castle archeological structure, while allowing the local community to use it to promote the history and culture of the city.

## 1.1 Aim, Scope and Objectives of the Thesis

Tripoli constitutes lots of historic buildings including traditional residential houses, most of which are in Tripoli Castle. This castle illuminates the combine influence of various historical ages such as, Phoenician (7<sup>th</sup> century B.C.), Roman (2<sup>nd</sup> century B.C.), Byzantine (533-643), Muslim (643-1140), and the Spanish (1510-1525) and Ottoman (1551-1711), Karamanli (1711-1835) periods (Akbar, 1999).

Tripoli Castle and other historic buildings have suffered with several structural and cultural damages among which, some of them were natural and other tend to be human made. The rehabilitation strategies will allow the city to restore and preserve the traditional landmarks and houses in Tripoli. Furthermore, it will replenish the traditional local architecture and illuminate the Libyan identity and character that is important in the study and analysis of the architectural factors of these buildings to improvise their compatibility with their present urban architectural surroundings. From this perspective, this thesis aims to state the problems of the rehabilitation process of these houses as they have been prone to various misuses and negligence regarding restoration efforts.

Thus, the main question of the research is; what are the rehabilitation strategies that are used for historic buildings in order to preserve their values and use them to connect the local community to their heritage, and how to implement these strategies to the current case study of the Tripoli castle?

The main aim of the study is to analyze the rehabilitation process of the structures in Tripoli castle in Red Saraya district in order to improve the cultural heritage buildings from further damages and efforts to enhance the appearance for long period of time. Therefore, the objectives of the research are as the following:

1. Study the rehabilitation strategies that are used in developed countries and were implemented in previous case studies worldwide.
2. Understand the implementation methods for the rehabilitation strategies and apply the required adjustments for the Libyan case study.

3. Evaluate the current status of the structures of the Tripoli castle in Red Saraya from structural and functional point of views.
4. Propose a rehabilitation strategy for the Tripoli castle based on the social, cultural and historic values of the local community.
5. Provide recommendations to the Libyan architects and local government in order to take steps forward in implementing this project.

## **1.2 Research Method and Structure of the Thesis**

In order to conclude the objectives of the thesis, the literature on the issue is studied. The thesis is divided into five main chapters, of which the introduction chapter have provided an overview about rehabilitation and introduced the case study of the research. Moreover, the main aim of the research, as well as the research questions and objectives have been narrated in order to set the research's corner stone.

In the second chapter provides a historic background of the case study and the different rehabilitation attempts that were applied to its structures during the different time eras.

In the third chapter, a theoretical review is carried out for the literature on the subject. The main purpose of the literature survey is to study the concepts of rehabilitation and the strategies used and the challenges faced in the planning and implementation process. Moreover, case studies that are applied to historic buildings around the world are reviewed for comparison with the theoretical framework, and for lessons learned.

In the fourth chapter, the case study's structure is evaluated in order to understand the challenges and the issues that are potentially to be faced. Therefore, an architectural assessment is performed on the structures' elements.

The conclusion chapter as the last chapter provides the final remarks and recommendations to assist the architects and the local government in the implementation of the project and the rehabilitation projects in Libya.

### 1.3 The Study Area

This study is limited with Red Saraya district, which is mainly located within the premises of Tripoli Castle. From the sea, Saraya comes across directly and not separated by roads like the rest of the city. A city wall whose thickness is not less than the walls of the fortification surrounds it. However, many governors have done restoration work on this castle in the past, which contributed into extensively restoring its structure, but a limited part of the structure have survived to the current days. Figure 1.1 shows an overview of the Red Saraya district within the Tripoli castle that is included as the case study of this research. The study includes also a theoretical review of the strategies and considerations that have to be applied for the rehabilitation of the historic buildings. Thus, it is significant to include previous case studies that applied these strategies to different case around the world in order to understand the challenges the effective measures that were taken to ensure the success of these projects.



Figure 1.1: Red Saraya within the Tripoli Castle



## **1.4 The Importance of the Research**

The study encourages the preservation and rehabilitation of historical buildings and landmarks in Red Saraya. The importance of this study is apparent in its distinction of being one of the few studies that address the rehabilitation of the Red Castle and the historic traditional buildings of Tripoli and their maintenance.

Red Saraya and the historic buildings are considered one of the most important landmarks in Tripoli that still exist, reflect the old civilizations of Roman, Knights of Yohna, Ottoman, Italian and crusaders that have lived in Libya. The history of its civilization and its importance to the present times has made it hub for many who are interested in archaeology and the Libyan heritage. Subsequently, it must be revived and rehabilitated according to various strategies and findings, as a continuation of the presence of the heritage of Libya. The Red Saraya and its historic traditional buildings are, likewise, material examples of the culture of past and present societies, which reflect and demonstrate human endeavors and their capability to improve the quality of life and promote understanding of self-reliance and societal values. At the same time, this research increase opportunities for social and economic development through challenging situations as what Libya is going through.

## **CHAPTER 2**

### **HISTORICAL BACKGROUND ON THE HOUSES IN TRIPOLI CASTLE**

It is important to understand the architectural heritages in Tripoli Castle, the history of the Red Saraya district is crucial. Tripoli castle, and its different structures that exist within them are in form a complete picture about the rehabilitation processes that will be carried out to preserve. Therefore, this chapter provides a thorough history about the Tripoli Castle in Red Saraya, as well as the building structure within the case study and the changes that were imposed by the different changes that occurred during the consecutive time periods.

#### **2.1 History of Tripoli Castle in Red Saraya**

##### **2.1.1 History of Tripoli**

Since the first millennia BC, the Phoenician realized the importance of establishing trade hubs at the southern coast of the Mediterranean. Therefore, they established in the 6<sup>th</sup> century BC the city of Outhya or Awyat in the same location of the city of Tripoli currently.

Despite the connection between the city and the Phoenicians (Haynes, 1981), researchers show that a city or a trading hub was established in the same location before that (Altlisi, 1985). Since the establishment of the city, it has been through several political events, as it played a major role in the political and religious events in the region. In the third century, Tripoli became one of the most important centers for the Christian religion, while it became a capital for the region in the fourth century under the Roman rule (Alzawi, 2009).

In 641 and following the Islamic rule of Egypt, Tripoli has formed a significant obstacle in front of the advancement of the Muslim leaders, as it had strong walls from the eastern, western and southern sides. Thus, a siege was placed by the Islamic army on the city for one month without any results. Thereafter, an agreement was reached between the people of Tripoli and the Islamic army, which led to the Islamic control on the city (Alzawi, 2009). The city formed a link between the eastern and the western parts of the Islamic empire and continued being a trade hub for the region. Due to its importance, the Muslims continued to reinforce the structures of the city as several European forces showed forceful interest to control the city (Ezis, 1985).

During the tenth century, a control race had started between the Middle Eastern and the European forces to control the Mediterranean region. As the closest point with a strategic location, the Spanish forces strived to occupy Tripoli in order to face the Ottoman forces (Alzawi, 2009). Due to several attempts, the Spanish succeeded in occupying Tripoli in 1510, where they destroyed the city, except for the palace used by them. However, due to the geographical distance between Spain and Tripoli, the city was handed over to the Maltese Knights who demolished several structures, affecting architectural heritage of the city. Thus, the several occupations and destructions performed by invaders in the city reduced the amount of archeological traces that accumulated over hundreds of years (Bowen, 2016).

Due to the destruction caused by the European invasion on the city, the people of Tripoli asked the Ottoman forces for help, which led the Ottoman caliphate at the time Suleyman

I to retain Tripoli from the Spanish forces in 1551. Figure 2.1 shows an illustration of Tripoli in 1559. The architectural and artistic development of the city increased during the Ottoman rule of the city until 1711, where they used the city as one of their important marine army bases. During that period, the Ottoman rulers were interested in building the city and restoring its archeological features, including its walls, castles and forts. Moreover, a new city market, as its seen in Figure 2.2, hotels and neighborhoods were constructed to accompany the increasing commercial activities (Wright, 2016).



Figure 2.1: Illustration of Tripoli city in 1559 (Hamed, 2010)



Figure 2.2: The Ottoman market in Tripoli during the Italian occupation (Hamed, 2010)

Following 1711, the Karamanli family ruled Tripoli as a province through a political confederation with the Ottoman empire, similar to the Egyptian case. The Karamanli era started with a stream of violence and instability as the new ruler, Ahmed Pasha Karamanli, had a violent policy internally and externally. Ahmad Karamanli succeeded in unifying the Libyan province by including the continental areas, which led to controlling the trade roads with the African cities (Lea & Rowe, 2001). In the Karamanli period, several castles and forts were constructed in order to increase the strength of the city against any possible attacks. Furthermore, significant structures were built including the grand mosque in the city (Warfelli, 1976). The Ottoman rule returned to Tripoli in 1835, which was accompanied with instabilities due to the weakness of the central government in Istanbul and as a result of the high taxation imposed on the local residents, which led to slowing down the development of the city (Kologlu, 2008).

### **2.1.2 Tripoli Castle/ Red Saraya**

Since the building used to be painted in red color, the Tripoli castle was also known as the Red Saraya. The Castle is located in the Northern East of the Tripoli old city and looking into the seaport of the city, which allowed it to be used for defense purposes against attacks and invasions. Several changes have been made to the castle according to the different rules and time periods. The total area of the Tripoli Castle is 1300 m<sup>2</sup> and has four sides; Northern East is 115 meters, Northern West is 90 meters, Southern West 130 meters, and Southern East is 140 meters, with a highest point of 21 meters. The castle is considered one of the most important archeological remaining of Tripoli as it provides a timeline for the different periods. The eldest current remaining structure is referred to the Spanish invasion in 1510 (Hamed, 2010).

Following the Spanish forces withdrawal from Tripoli and surrendering it to the Maltese Knights, the Ottomans succeeded in regaining control over the city in 1551, where the castle was used as the ruling quarter (Altijani, 1981). The Ottomans paid attention to strengthening the castle in order to defend the city and ensure their control against invaders and revolutions. The Ottomans took into considerations the weaknesses in the castle that led to the defeat in front of the Spanish forces. Therefore, an armory was built in the southern part of the castle in order to close a gap between the castle wall and the Jewish neighborhood of old Tripoli (Altlisi, 1985).

During the Karamanli period, the castle remained as the quarters for ruling, where Ahmed Pasha Karamanli added several structures and was concerned with the ornamental works in the mosques and the halls of the castle. Several ornamental ceramic tiles were used with ornaments from Anatolia and Europe.

During the Italian occupation of the city, the Italians continued to use the castle as the ruling quarters. Figure 2.3 shows an ally within the Red Saraya during the Italian occupation. Following the independence of Libya, the castle is used for governmental entities that are concerned with the archeological and historical heritage of Libya. Furthermore, the castle was used to host several museums including a Roman museum and a natural history museum. However, all the museums were turned into a one museum in 1983 that conveys the Libyan history during the different eras under the name of the Red Saraya Museum, as shown in Figure 2.4 (Albahnasi, 2004).

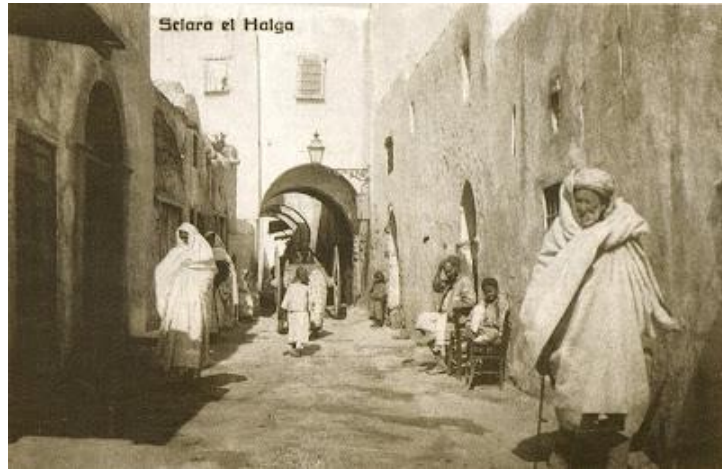


Figure 2.3: An alley within the Red Saraya during the Italian occupation (Author's collection)



Figure 2.4: The entrance to the Red Saraya Museum (Author's collection)

## 2.2 Current Structure

The Tripoli castle can be divided into two main sections depending on the different time periods that it was built in; the Spanish Red Saraya and the Karamanli courtyard.

Moreover, there are several miscellaneous structures, which are remaining items from the Roman, Byzantine and Islamic rule periods. The researcher surveyed the castle in order to provide examples and figures of the current remaining structures within the castle. Figure 2.5 shows an external view of the Tripoli castle from the seaside. The high defensive walls built from stone and mud are shown in the Figure 2.5, as well as parts of the inner walls of the Red Saraya structure, which can be seen painted in red color. The picture also shows part of the structure behind the Red Saraya, which was built during the Karamanli period. The three layers that are presented in the figure convey the history of the castle and the periods in which it was built in. Furthermore, Figure 2.6 shows a view from the Red Saraya towards the seaport.



Figure 2.5: An external view of the Tripoli Castle from the sea side (Author's collection)





Figure 2.6: A view from the Red Saraya towards the seaport (Author's Collection)

The majority of the structures built within the Tripoli castle are referred to the Spanish invasion period, where the architectural structure was built around courtyards. Figure 2.7 shows an alley that leads to the main courtyard of the castle. Figure 2.8 is a view from the courtyard looking into the main building of the castle consisting of five floors. The entrance from the courtyard is provided through stairs to the main floor, which is a yard containing remaining columns from the Roman and Byzantine periods, as well as a fountain from the Karamanli period, as shown in Figures 2.9 and 2.10.



Figure 2.7: An alley leading to the main courtyard of the Red Saraya



Figure 2.8: A view from the bottom of the courtyard towards the main building (Author's Collection)



Figure 2.9: The main floor of the courtyard (Author's collection)



Figure 2.10: A yard in the Red Saraya with Roman and Byzantine remaining columns and a fountain from the Karamanli period (Author's collection)

There are parts of the castle that show the transition between the Red Saraya built during the Spanish rule and the Karamanli and Ottoman periods. The Red Saraya was mainly used for ruling purposes and defending against any invasions; however, the structures built during the Karamanli period were used as residential structures for the ruler, his family and close elites. Figure 2.11 shows a view from the Karamanli structures towards the Red Saraya built during the Spanish rule. Several columns, plant pots and sculptures from the Roman and Byzantine periods, which are used for ornamentation or structural purposes, can be observed.

Moreover, the red painting that is shown in the various figures are recently performed as part of the rehabilitation plan of the castle. Parts that were not painted nor rehabilitated can also be noticed, as shown in Figure 2.12. It can be observed that no painting has been performed, in addition to unorganized and unfixed stairs, planting areas and arches.



Figure 2.11: A view from the side of a building built during the Karamanli period into the Red Saraya (Author's collection)



Figure 2.12: Parts of the Red Saraya that were not included in the rehabilitation plans (Author's collection)

The second section of Tripoli castle was built during the second Ottoman and Karamanli periods. Figure 2.13 shows a building integrated within the castle that was built during the Ottoman time and used as offices for the Ottoman rulers at that period. The architecture of the building is different from the previously reviewed Red Saraya, which was built during the Spanish rule. The Red Saraya external view shows flat walls with red color painting with windows flushed within the wall structure. Nevertheless, the middle floor of the building shown in Figure 2.13 contains arched structures around the windows with stone wall textures.



Figure 2.13: A building built during the second Ottoman period (Author's collection)

During the Karamanli rule of Tripoli, the main buildings that were added to the castle structure are the residential units for the ruler and his entourage. Figures 2.14 to 2.17 show the interior parts of the Karamanli residences. The house is structured around a main courtyard and the different rooms are distributed around in an open structure. Moreover,

a passage between the courtyard and the rooms is provided, where the arches in the wall adjacent to the courtyard are supported by ornamented columns and the walls adjacent to the rooms are fully ornamented with ceramic tiling of different colors and artworks. Depending on the level of the person residing in the house, the level of ornamentation differs from a residence to another.



Figure 2.14: The courtyard of Karamanli ruler residence looking into the rooms (Author's collection)



Figure 2.15: A karamanli residence for entourage (Author's collection)



Figure 2.16: Interior walls of the Karamanli ruler's residence with colored mud accents and ceramic artwork (Author's collection)



Figure 2.17: The courtyard of Karamanli ruler's residence showing the middle fountain and the internal ornamented walls (Author's collection)



Similar to the Red Saraya case, there are parts of the Karamanli courtyards and residences that has not been rehabilitated, as shown in Figures 2.18 to 2.21. The different views of the houses and examples show unclean wall finishing and broken windows and doors. The internal view also indicate that the houses has been ignored from the rehabilitation works with limited and uncoordinated fixations for some doors, stairs. Several uncoordinated piping and wires can be noticed in the figures. The courtyard between the houses is also not rehabilitated with planting areas with several damages and adjacent walls that need structural and aesthetical rehabilitation.



Figure 2.18: A front view of a house in Tripoli castle that has not been rehabilitated (Author's collection)



Figure 2.19: An internal view in a house in Tripoli castle that is not rehabilitated (Author's collection)



Figure 2.20: A Karamanli residence with required rehabilitation (Author's collection)



Figure 2.21: A courtyard between houses in Tripoli castle that needs rehabilitation (Author's collection)

The current heritage included in Tripoli castle is the resultant of the several ruling eras of the city from the Roman empire era to the Ottoman rule after the city retention from the European invaders. Figure 2.22 shows a plan of the Tripoli castle from the author's collection, which was retrieved from the heritage architecture of Tripoli. The difference in layout between the different parts emerge from being built in different historical eras.

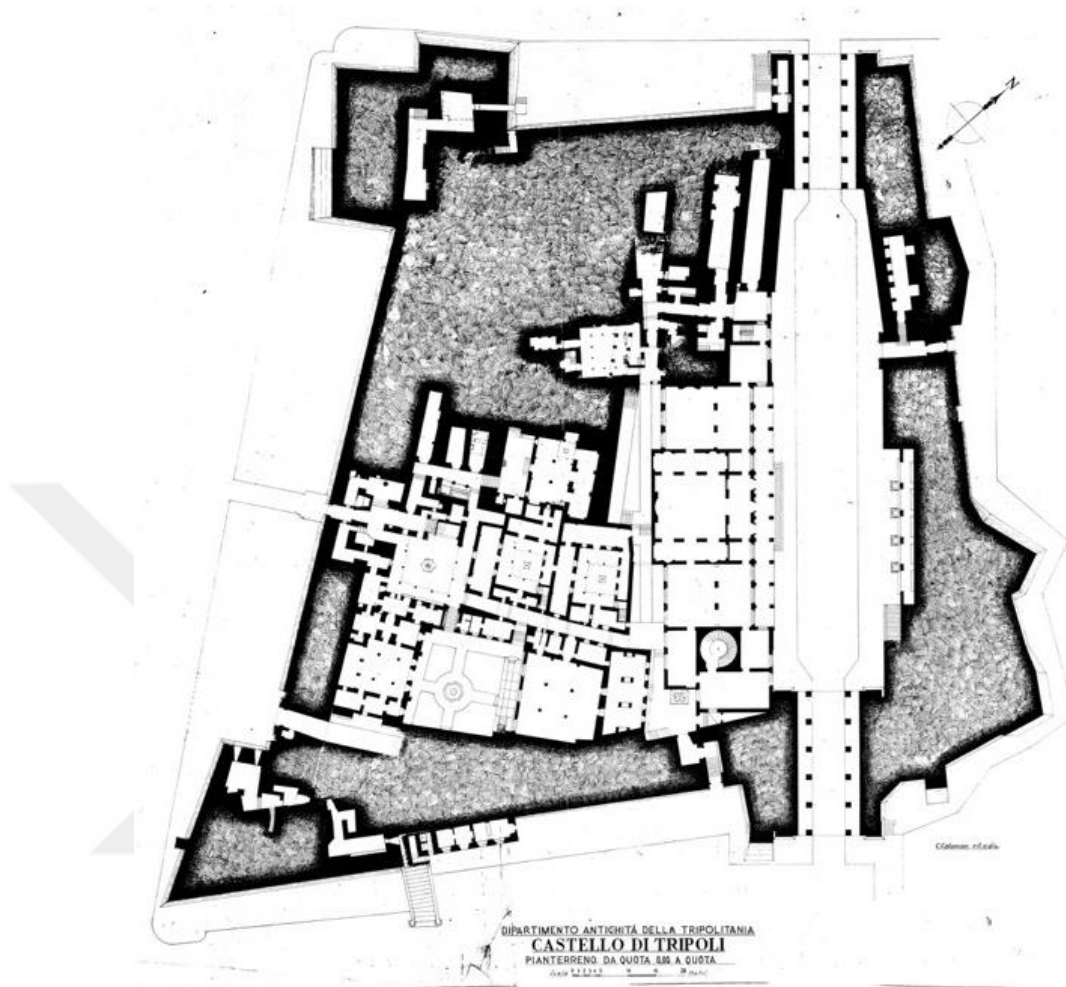


Figure 2.22: Plan of Tripoli castle/ Red Saraya (Author's collection)

### 2.3 Changes in the Historical Heritage

Due to the commercial, political and strategic importance of Tripoli, the fight over its control led to demolishing and building several structures during the different eras. In 701, the armies destroyed significant parts of the city, as they attacked the Islamic rule. Moreover, several revolutions in the years 701, 804 and 859 resulted into changes in the city (Ibrahim, 2005). The city went through development until the Spanish invasion in

1510, when the majority of the city landmarks were demolished. Nonetheless, the city continued its development during the Ottoman rule, especially between 1551 and 1711, as the Ottoman rulers established the city as a strong military base, structured the commercial activities in Tripoli, and used the prosperous returns to build several structures (Wright, 2016). During the Karamanli period, several architectural changes occurred in the city, especially building new forts and castles; however, due to political instabilities, few architectural and artistic changes occurred (Lea & Rowe, 2001).

The historians and archeologists have few opinions on the establishment time of the castle; where some say that it was built by the Romans, others refer the first structures to the Byzantines. However, due to the several invasions that led to the castle destruction, the remaining structure shows that the eldest current structure is referred to the Spanish invasion and rule between 1530 and 1510, as they were concerned with reinforcing the castle to stop the Ottoman attacks. The Spanish built two towers for the castle, which were called Saint Jacob tower and Saint George tower, and named the court at the main entrance Saint Barbara courtyard. Moreover, the Spanish turned the biggest hall in the Castle into a church and named it the church of Leonardo (Hamed, 2010).

After the Ottomans regained control on the city in 1551, rehabilitation for the castle walls and structures were performed under the orders of the Ottoman ruler Murat Agha. Furthermore, a new tower was constructed by Dargut instead of the constructed tower by the Maltese knights, which was called the tower of Dargut, as well as an armory that was built in the Southern part of the castle next to the Manshia gate in 1565. For the church that was established by the Spanish invaders, it was turned into a mosque during the rule of Murat Agha, which was later rehabilitated and kept for the same use during the rule of Mohamed Pasha Sakzli (Altisi, 1985).

During the Karamanli period, new buildings were added to the castle, including an authority to issue currency and residential units around a courtyard known now as the Karamanli courtyard. The general structure of the of the castle turned into square-shaped

with four main gates; two gates opening towards the old city. One gate opening towards the seaport and one gate opening towards the backside of the castle for the agricultural lands. The inside of the castle contained several halls for the throne, offices for high ranked officers, the ruler's housing and the housing for his family and servants. Moreover, other structures were included in the castle such as storage areas for grains, a bakery, hammam (Turkish shower), Pharmacy, a prison, and a hospital which is claimed to be the building shown in Figure 2.23 (Albahnasi, 2004).

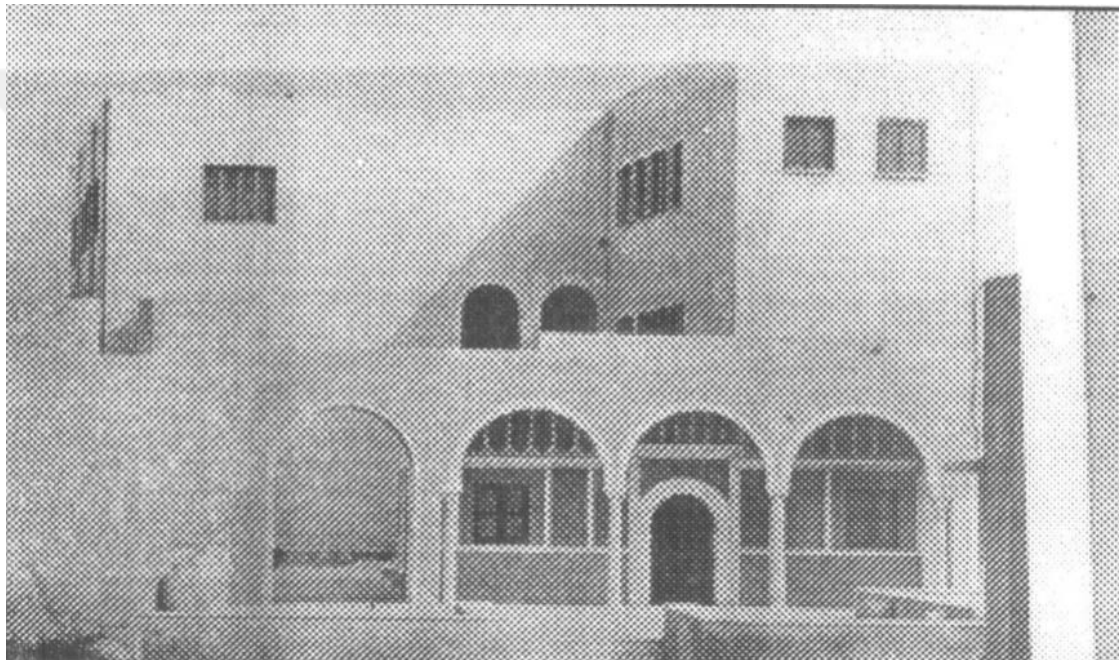


Figure 2.23: A building within the Red Saraya claimed to be used as a hospital during the Karamanli ruling period (Albahnasi, 2004)

The Italians during the occupation started the changes in the castle by building a link between the Red Saraya, which was used for the government and the Karamanli courtyard, which was used as a private area for the Karamanli rulers of Tripoli and their family. Moreover, the different courtyards of the castle were ornamented with fountains that were brought from the old houses of Tripoli. In the current time, the castle is used as

the headquarters for the Libyan Archeological Authority and included several museums. Nonetheless, these museums were demolished and the Libyan through different eras museum was established in its place, which is also known as the people's museum. Since then the Tripoli castle was also famous with the name "Red Saraya", as its walls were always painted with the red color. The name of "Red Saraya" is believed to be a new title for the Tripoli castle as it was not mentioned in the historian books who spoke it (Albahnasi, 2004).



## CHAPTER 3

### AN OVERVIEW OF THE INTERVENTION STRATEGIES

#### 3.1 Rehabilitation Approaches in General

Rehabilitation of historical buildings is a practice that has been adopted since fourteenth century, which was first performed to the ancient city of Rome in Italy. However, early trails for preserving archaeological structures can be traced back to Egypt 3000 BC, where parts of Ramses II's statue was endangered and therefore supported using stone blocks. In the fifteenth century, the concept of restoration and rehabilitation developed in Italy in order to preserve buildings, statues, sculptures and monuments from the Roman era. The restoration works continued during the following centuries to restore several monuments that were of great historical, architectural and archaeological value. In the Seventeenth century, the concept had spread to England then France, which led to new theories and concepts to emerge (Jokilehto, 1986).

During the twentieth century, countries started to develop guidelines for restoration and rehabilitation works in order to ensure that the essence of the historical structure and artwork is conveyed and not abolished by the new works (Jokilehto, 1986). Stanley-Price (2009) defined the difference between reconstruction and restoration by the addition of any new elements to a place. If the process of returning the place to its early state involves adding new material to the fabric, then it is categorized as reconstruction.



Moreover, the need for reconstruction is decided through a case by case evaluation, where supporters of the concept is justified through the symbolic value of the structure for the national heritage, the need to re-use the buildings, educational and research purposes, promoting tourism in the country, and protecting historical sites from development that could damage the historical value of the structures. Nonetheless, reconstruction principles are objected against through the arguments that reconstruction hurts the evocative value of the buildings and impossible to achieve the authenticity preserved within the ruins. Furthermore, reconstruction and restoration works may lead to the destruction of original evidence and disrupt the landscape value of the site (Stanley-Price, 2009).

The restoration and rehabilitation processes are commenced through performing a comprehensive assessment of the structure, which should include several approaches. It is important that non-destructive testing and analysis is performed in order to ensure none of the available ruins are damaged. The analysis process starts by identifying the elements from different time periods and surveying for any hidden structural elements. Thereafter, the building process and techniques shall be identified and the structural performance of is evaluated. Damages and defects are identified and classified, along with any previous maintenance that has been performed on each element (Sandbhor & Botre, 2013). During the restoration process of the archaeological ruins, there are three main types of challenges that are faced (Sandbhor & Botre, 2013):

1. Physical condition of the element.
2. Availability of resources for the rehabilitation process.
3. Cultural and social importance of the restored element.

Based on that and the guidelines of the American standards for restoration of historic and archaeological elements, Sandbhor & Botre (2013) developed a systematic approach for the restoration and rehabilitation process. As shown in Figure 3.1, the process starts with the required analysis to understand the condition of the restored element. Following a thorough evaluation, the variation between the current conditions and the original

conditions are identified in order to understand the gap between them. Furthermore, the treatment strategy is chosen according to the results of the analysis; restoration, reproduction or reconstruction. Some elements may need to be completely replaced, while others can be kept for certain types of maintenance. One of the most important concepts in the treatment strategies is to ensure that elements are protected against the conditions that caused its deterioration (Sandbhor & Botre, 2013).

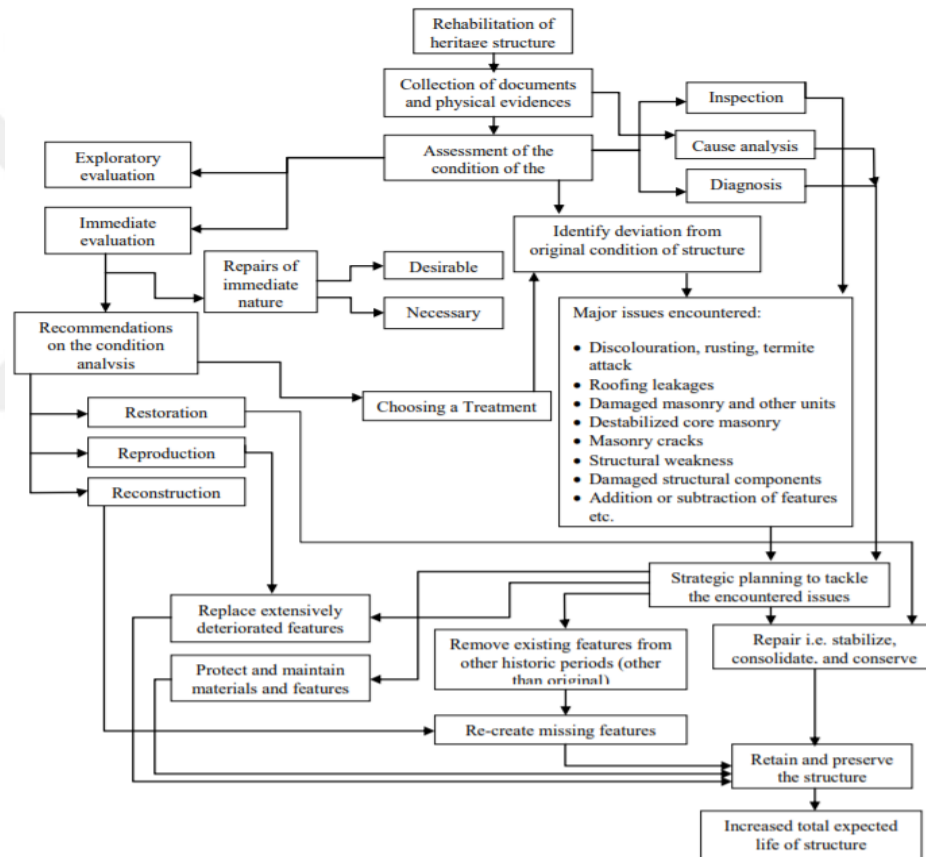


Figure 3.1: A systematic approach for historical ruins restoration and rehabilitation (Sandbhor & Botre, 2013)

Pinto et al. (2017) provided specific assessment criteria that need to be implemented in order to ensure that the historical building is rehabilitated and refunctioned according to the user requirements. The authors divided the refunctioning plan into four main stages:

1. determining the requirements and needs of the users
2. definition of constraints including the historical and artistic factors
3. designing the recovery solution
4. evaluating the recovery solution

The criteria that are used to evaluate the building and design proposed for the refunctioning are categorized into environmental and technological systems. The environmental system is assessed based on aesthetic features, such as space visibility and element recognition, usability features, such as elements flexibility and space adaptability, and manageability features, such as elements reversibility. The technological systems are evaluated based on safety features, such as stability, fire safety and user safety, comfort features, such as thermal, acoustic and visual qualities, and usability features, such as elements adaptability and adaptability of surface finishing and mechanical systems. The weights of the criteria as determined by the authors are presented in Table 3.1 below.

Table 3.1: Criteria used to evaluate the refunctioning strategy of archaeological structures (Pinto, De Medici, Senia, Fannricatti, & De Toro, 2017)

	<b>Main Criteria</b>	<b>Sub-criteria</b>	<b>Weight</b>
Environmental System	Aesthetics	Space visibility	0.135
		Element recognition ability	0.090
	Usability	Elements flexibility	0.090
		Space adaptability	0.135
	Manageability	Elements reversibility	0.150
Technological System	Safety	Stability	0.038
		Fire safety	0.038
		User safety	0.038

Table 3.1: Criteria used to evaluate the refunctioning strategy of archaeological structures (Pinto, De Medici, Senia, Fannricatti, & De Toro, 2017)

	<b>Main Criteria</b>	<b>Sub-criteria</b>	<b>Weight</b>
	Comfort	Thermal quality	0.003
		Acoustic quality	0.006
		Visual quality	0.010
	Usability	Element adaptability	0.025
		Surface finishing and mechanical systems	0.051

A Chinese case study identified the benefits of refunctioning and adaptive reuse of historical buildings under different categories. Achieving economic sustainability is one of the most important benefits, which are indicated through the increase of land value and enhancement of economic efficiency. Furthermore, social benefits are expected from historical buildings' refunctioning as it enriches the sense of place, increases social interaction, conserve the social heritage of the city, and improves the life quality and living environment. Political and institutional benefits are also part of the adaptive reuse outcomes as it gives the opportunity for society members to participate in their heritage and simulates the government to issue compatible policies (Yung, Chan, & Xu, 2013).

Ragheb et al. (2017) concluded with eight main principles that shall be considered during the refunctioning process of historical buildings. The first principle is to analyze and understand the importance of the building that is used for refunctioning. Subsequently, the new function of the building shall be aligned with its historical, political, cultural and social significance. The refunctioning plan shall adopt material and methods that can be reversible and does not impose any damages to the historic fabric, promote minimum intervention, promote maximum retention of historic fabric, and conserving the position of the historic building in the archaeological context. Furthermore, the adaptive reuse plan

shall include a management strategy that could monitor the condition of the original historic fabric in periodical manner and maintain the visibility of the historical value of the structure (Ragheb, Ragheb, & Ragheb, 2017).

### **3.2 Intervention Methods: Selected Cases from Italy**

Italian restoration and rehabilitation of historic buildings commenced in its modern form since the fourteenth century, which built the base to the current principles and processes of restoration worldwide (Jokilehto, 1986). Therefore, it is significant to understand the methods, processes and management strategies of restoration in Italian historic structures through professional studies. In a study that targeted the restoration of monumental facades in Italy, the authors applied a 3D laser scanner to the elevation in order to be able to visualize the building façade during the design stage. Moreover, a ground penetrating radar was used to assess the foundation of the monument and to be able to perform a structural analysis on the targeted elements. Such analysis helped the authors to select the methods and materials for the restoration and rehabilitation process. Subsequently, a finite element modeling analysis was performed on each element of the façade in order to assess the original state, the current damages and the required restoration measures that should be implemented (Lignola & Manfredi, 2010).

Another study targeted the restoration of ancient mortar in a specific section in the Ducal Palace in Italy. Study started by analyzing the characteristics of the mortar in terms of moisture, mercury intrusion porosimetry, soluble salts content, manual disaggregation and sieving, XRD on binder and aggregate, and carbonates content of binder and aggregate. Following the determination of the results of each of the elements for the case study, the authors determined the characteristics of the mortar chemically, microstructurally and physically. According to the discussion, the extracted properties of

the mortar assists the restoration and rehabilitation of facades of historic and archeological values in order to ensure the most matching finishes (Sandrolini & Franzoni, 2010).

A case study on San Maurizio church signifies the importance of the analysis and assessment process for the restoration and rehabilitation of the historic buildings. The authors used a structural inspection, petrographic analysis, climate monitoring and testing for salt content in order to understand the different conditions that are imposed on the building prior commencing the design and implementation of the restoration process. The results of the study show that the building is built from different types of stone and mortar that are essential to match in the restoration process in order to achieve authenticity (Sammartino, Cau, Reale, Ronca, & Visco, 2014). Due to the plenty historical houses and villas that are spread across Italy, it is a common practice to restore them and sell them as luxurious getaway places. Several examples can be found; however, the common practice on conserving and restoring Italian houses is to ensure that the house is sound structurally, preserving the historic look in the exteriors and providing modern appliances with a historic style interior. Figures 3.2 to 3.4 show Villa Elia in the South Eastern coast of Italy after restoration.

Another example of restoration of Italian villas and houses is Le Torri, which is a historic Italian Villa built in the beginning of the 1800s by the Florentine family. The current owners of the villa have restored it and turned it into a luxurious lodging facility for getaway travelers. The restoration process included dismantling parts of the villa in order to use it in the restoration of other parts, as the owners wanted to use the authentic material in the process. Other facilities were added such as the swimming pool in order to adapt to the needs of the guests and increase the usability comfort. Figures 3.5 and 3.6 show villa Le Torri before and after restoration in the mid-1990s (Le Torri, 2013).



Figure 3.2: Exterior of Villa Elia (The Thinker Traveller, 2018)



Figure 3.3: Patio of Villa Elia (The Thinker Traveller, 2018)



Figure 3.4: Interior of Villa Elia (The Thinker Traveller, 2018)



Figure 3.5: Villa Le Torri before restoration (Le Torri, 2013)





Figure 3.6: Villa Le Torri after restoration (Le Torri, 2013)

Furthermore, the majority of heritage and historical buildings were built with no remaining plans or sections that could show the original design. Therefore, it is significant during the rehabilitation and restoration process to develop plans for the final rehabilitated structure in order to facilitate maintenance and further restorations, if needed. The Italian structures that were rehabilitated during the past two centuries have the distinguish element of being documented during and after the rehabilitation process. An example of developed plans after the rehabilitation of historical buildings in Italy is presented in Figure 3.7, showing Piazza del Campidoglio, which its structures were originally built in the BC time, rebuilt from ruins in 1536 and restored in 1940 (Wikiarquitectura, 2016).

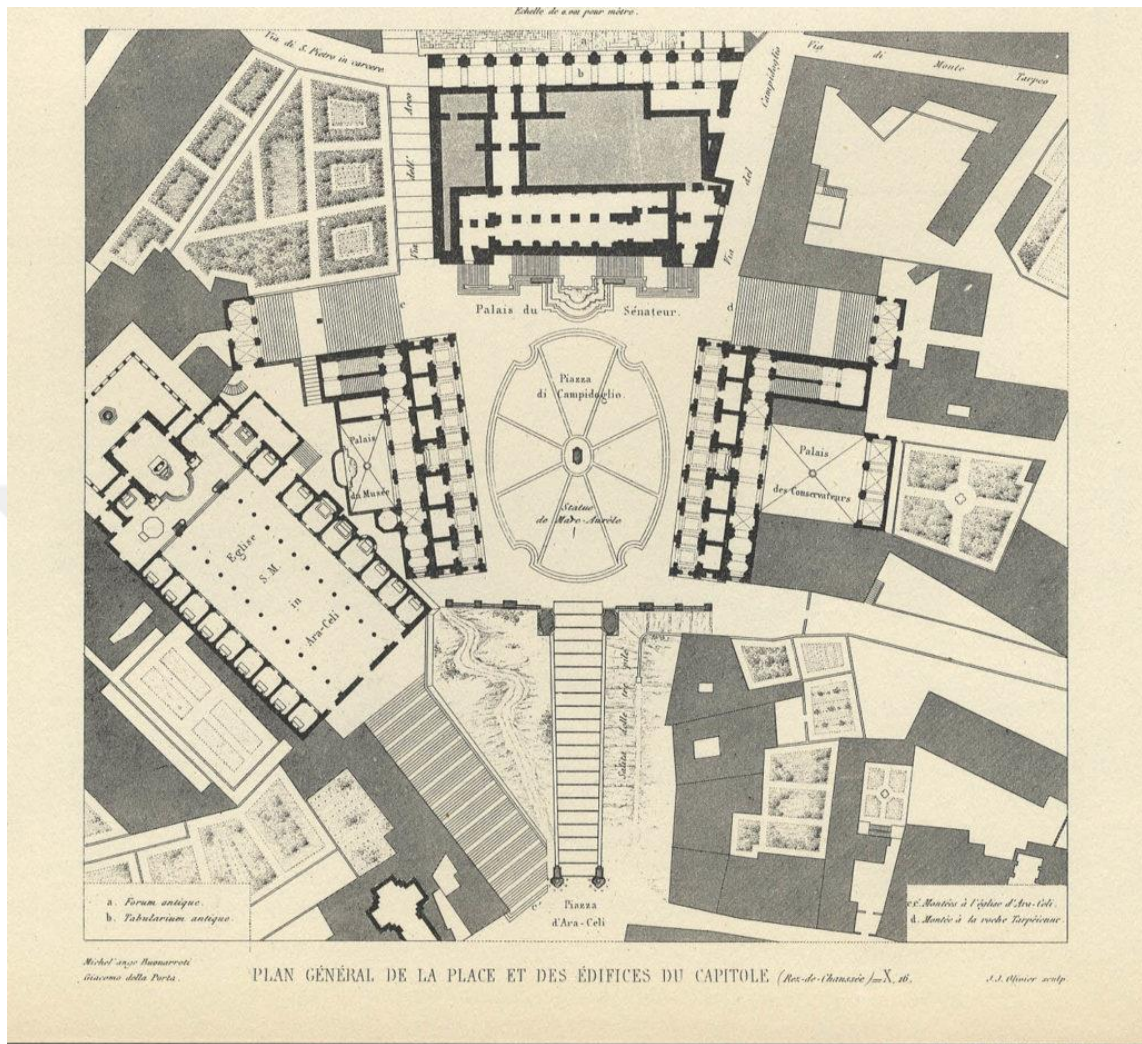


Figure 3.7: Plan of Piazza del Campidoglio in Rome (Wikiarquitectura, 2016)

## **CHAPTER 4**

### **INTERVENTION PROPOSES FOR REHABILITATION OF THE STRUCTURES IN TRIPOLI CASTLE**

The main aim of the rehabilitation process is to produce a compatible use for a structure by addressing the damages that occurred to it, which includes reinforcing, repairing and preserving parts of it, each according to its need, without affecting the archeological and historical values that are conveyed through it. The need for rehabilitation emerges from the need to enhance the existing buildings and alter them in a way that can be utilized for current use purposes. Moreover, the rehabilitation methods are great means that conserves the archeological and architectural values of structures. Due to weathering and aging conditions, buildings develop a condition that cannot allow usage according to the initial intent of their design. Even relatively new buildings may be in conditions that need further enhancement in order to be used in current times. There is a continuous motivation in developed countries to maintain existing buildings in order to preserve the architectural and archeological heritage of the local communities.

Since the majority of archeological structures were built in eras where technological advances were humble, the rehabilitation process includes adopting the structures to the current technologies, which means adding modern electrical, water, drainage and communication utilities. Rehabilitation processes are described as sustainable development practices, which requires an extensive effort on the governmental and social levels in order to raise awareness to their importance.

The structural safety of heritage buildings is one of the most crucial challenges for rehabilitation, which is also one of the most complex procedures to be performed due to the complex procedures. The materials that form heritage buildings are of archeological value that does not allow extensive destructive testing or the addition of new material. Thus, intervention methods and materials have to be monitored in order to ensure that the structure does not lose its value.

There is a range of intervention method that are used to rehabilitate heritage buildings, where the simple form is to perform limited maintenance on limited areas of the structure. A more complex intervention would aim to increase the structural and service performance of the structure. In order to be able to construct a rehabilitation plan for the structures within the Tripoli Castle, it is critical to comprehend the architectural concepts that they were based on in the past. Furthermore, understanding the challenges and destruction sources that caused the deteriorations is important to prevent any future damages to the structure. After all information is gathered, a comprehensive rehabilitation plan can be designed for that purpose.

#### **4.1 The Dangers Facing the Historical Buildings in Tripoli**

The risks and dangers that are associated with the rehabilitation process of the Tripoli Castle is divided into two main categories; risks and dangers associated with the structure and risks and dangers associated with the process. The structure of the Red Saraya faces many challenges including structural and non-structural cracks, lack of maintenance, war status in Libya and motivations for government interest. Moreover, the challenges associated with the rehabilitation process include material originality and endurance, threats to the historic and cultural values, structure misuse, and implementation of modern services.

The identification of these challenges of risks is inspired by the structure status and the risk management plan and process suggested in the literature (Thaheem & De Marco, 2014). However, the focus in this study are for immediate risks that are hindering the adoption of a maintenance, rehabilitation plan based on the judgement of the researcher.

#### **4.1.1 Risks Related to the Structure and the Government**

##### ***4.1.1.1 Structural and Non-Structural Cracks***

Through a survey of the structure of the Red Saraya, several cracks have been observed that jeopardize the structural integrity of the buildings and the aesthetic value of the surfaces. The main classification of cracks in any structure categorizes them into structural and non-structural cracks, where structural cracks are found in structural elements like columns, beams and slabs due to flexure, shear, torsional, corrosion. The structural cracks result from extra load on the main structure that causes its failure (Arvind, 2016). Furthermore, there are other cracks that are caused by local stresses within the building material, which do not weaken the structure, called non-structural cracks. The cracks within structures has several causes varying from moisture content changes, thermal changes, deformations, creeps, chemical erosion, foundation settlement and growth of vegetation (Kunal & Killemsetty, 2014).

There are several cracks that are observed within the different buildings in Red Saraya. Figure 4.1 shows a structural crack within the stair slab from the bottom side and the width of the Crack exceeds 10 millimeters. The presented crack example has several consecutive cracks that are close to each other, which requires an extensive treatment and strengthening. The ancient wall shown as the back surface of the stair was rehabilitated in an earlier period; however, several cracks can be observed that requires assessment and

treatment. Figures 4.2 show other examples of cracks within the walls and slabs of Red Saraya in Tripoli Castle.



Figure 4.1: Structural and unknown cracks in a stair and backwall at Red Saraya. (Author's collection)



Figure 4.2: Deep cracks in the walls and slabs of Red Saraya. (Author's collection)

#### ***4.1.1.2 Lack of Maintenance***

The maintenance performed to the structure of the Red Saraya was not extensive, as it addressed some of the main structure within the castle, while ignoring other parts. Despite the time passed since the last maintenance performed, some of the structure is still keeping the same acceptable condition. Nonetheless, these areas require a minimal intervention in order to inspect the surfaces and repair the painting and any broken elements. Figure 4.3 shows the rehabilitated parts of the castle, while Figure 4.4 shows some parts that have been ignored in the last rehabilitation plan.



Figure 4.3: Parts of the Red Saraya that received rehabilitation measures and requires minimal repair and intervention. (Author's collection)

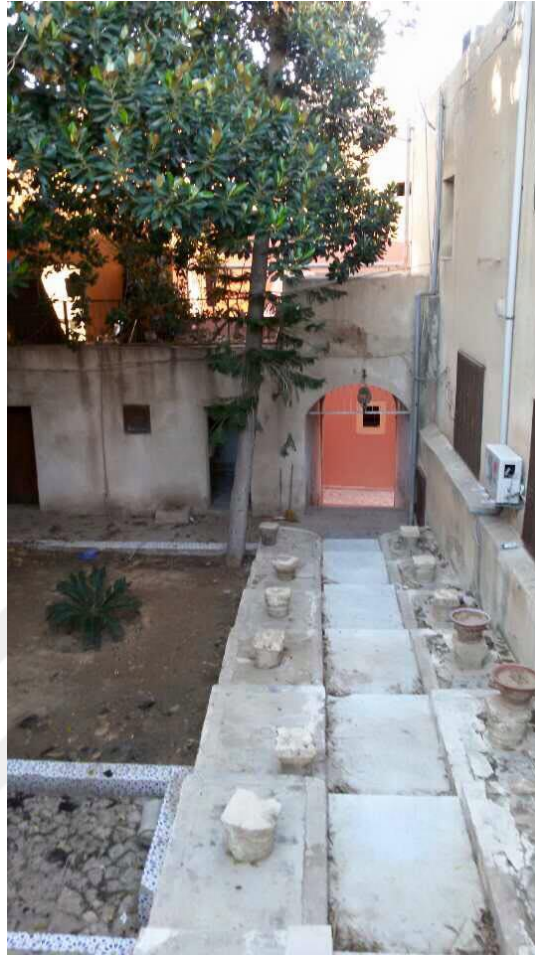


Figure 4.4: Parts of the Tripoli Castle that were not included in the rehabilitation plan before and requires further intervention. (Author's collection)

It is apparent from the condition of the different parts of the structure that no clear and periodical maintenance plan is in place, as some parts were addressed, and others were ignored. Moreover, it can be observed that modern services have been added to the ignored parts and used as offices or gallery halls from the other side. Thus, the maintenance plan shall include all the parts of the castle, while ensuring that parts from different era are identified and presented.



#### *4.1.1.3 War Status in Libya*

After the revolution in Libya in February 2012, the political and military control of the city has been unstable since then. Several historical and archeological structures have been affected as they were used by rebels and militias. Moreover, the Red Saraya structures have been impacted by the war status in the country, where some of them were demolished or damaged. Figure 4.5 shows a courtyard in the Saraya before and after a war attack on it with rockets.



Figure 4.5: A courtyard in the Saraya before and after a war attack. (Author's collection)

#### ***4.1.1.4 Motivations for Government Interest***

The governmental interest in rehabilitating the buildings within the Tripoli Castle is another risk that affects any rehabilitation plans. The heritage authority has the custody over the structures; however, there is no serious consideration for the current condition of the buildings as they are under constant threat by political and security instabilities. Furthermore, the lack of budgets and technological capabilities are crucial obstacles for maintenance and rehabilitation. As the heritage administration is left alone to manage the structure, none of the other governmental bodies are interested in initiating any attempts to preserve the historical and archeological structures. The country is also suffering from the lack of necessary legislations that monitors the protection of heritage structures.

The abovementioned factors resulted into the lack of structural and architectural testing and assessments for the structures within the castle, jeopardizing the possibility to sustain the historical and cultural values undamaged. There are no trials from the government to initiate plans or implement them towards the rehabilitation, preservation or maintenance of the Saraya buildings, which is illustrated in the weak management infrastructure, reporting systems and security plans (Azlitni, 2009). As some citizens own parts of the Saraya, the coordination between them and the government is another challenge that prevents the implementation of rehabilitations.

## **4.1.2 Risks Related to the Process**

### ***4.1.2.1 Material Originality and Performance***

In historical building rehabilitation, the plan shall ensure that the finishing material for surfaces matches in color, texture and properties those of the original structure. Buildings that are originally finished with stone and clay can be matched with raw material from the surrounding environment that was used to build the historical structure. Nevertheless, in order to increase the integrity of the structure new material resulting from technological advances can be used in invisible areas. Structural and non-structural cracks can be filled with epoxy or polyurethane, which can prevent the passage of any leaking chemicals from the cracks and maintain the needed structural strength (Subramaniam, 2016).

Furthermore, columns with exposure to water can be wrapped with waterproofing chemicals, such as EPDM and polymers, and then finished with material matching those of the original structure (Mulani & Kumthekar, 2015). Moreover, the most common material that are used to treat issues like peeling is Mughal plaster, which has a lime base. Other issues like mold stains can be washed with high pressure water with soap and vegetation can be resolved by applying Glyphosate, Ammonia and lime mortar (Subramaniam, 2016). The material used in the Red Saraya are mainly lime mortar covering limestone structures. Some of the more recent buildings are constructed from clay and wooden material. Further solutions are narrated in the rehabilitation procedure in the third section of this chapter.

#### ***4.1.2.2 Threats to Historic and Cultural Values***

When assessing a heritage structure for rehabilitation, it is important to understand its historical and cultural significance, which shall be balanced with the social, touristic and economic outcomes of the rehabilitation plan (Kutut, Zavadskas, & Lazauskas, 2013). The main aim of the assessment and plan should be the conveyance of the historical and cultural essence of the heritage structure while enabling the society to benefit from it through investment in the touristic domain. A spatial analysis shall be performed in order to understand the urban morphology of the targeted structure within its surroundings. Such an analysis enables designers and planners to incorporate the local rehabilitation plan into a global one for the civilization area around it (Coteli, 2016). For the Red Saraya, Figure 4.6 shows the morphology of Tripoli around the castle, which includes several historical monuments, including the seaport and the old city of Tripoli. The rehabilitation shall represent the castle as the center of attention and the ruling courts of the city. This can be easily shown due to the high walls of the Castle and its location on the coast. The connection between the old city and the Saraya shall be seamless but distinguished in design elements. Therefore, developing a global rehabilitation plan for the old city is one of the challenges that may face any specific local plans for the Tripoli Castle.



Figure 4.6: Tripoli areas surrounding the Red Saraya

#### ***4.1.2.3 Structure Misuse and Implementation of Modern Services***

It is possible to find some misused buildings or parts within the targeted heritage structure, which mainly are the result of ignorance of the governmental bodies and NGO's. In the Red Saraya, misuse is observed in a few parts, where buildings have been used for offices and storage spaces without paying attention to their historical and cultural value. Figures 4.7 and 4.8 show some examples of misuse, as modern utilities have been added and structure has been ignored, leading into the deterioration of the structures' conditions. Moreover, some areas have witnessed the addition of inappropriate finishing material that does not match the original material used.



Figure 4.7: A building in Tripoli Castle where modern utilities have been added without a clear rehabilitation plan, ruining its historical and cultural values. (Author's collection)



Figure 4.8: A house in Tripoli castle with the addition of inappropriate material and utilities. (Author's collection)

As discussed in the previous section, the historical and cultural values shall be conveyed with the rehabilitation of architectural heritage. In the Red Saraya case, buildings have been rehabilitated in a limited manner of the heritage purposes, where museums are located. The remaining buildings are used from administrative purposes, which led to the loose of using them into the overall refunctioning to convey the historical significance of the structure.

## **4.2 Rehabilitation Levels of Historic Buildings in Tripoli**

The plan developed for rehabilitation for the buildings of Red Saraya and the old city of Tripoli globally shall be encountered on different levels using certified methods. Furthermore, the methods and plans shall be specific to the historical and cultural needs of the city according to its historical and geographical considerations. There are several styles for rehabilitation according to the purpose and understanding of the process objectives. For instance, Italians tend to be stringent during the implementation of rehabilitation methods, while Americans allow modern and innovative solutions to be used in the process. Unfortunately, no clear direction in rehabilitation style has been adopted in the Arab world, including Libya, where the architects determines the objectives based on the client's needs and desired outcomes. The size and building type are of the most important determinants of the levels of rehabilitation, as well as the historical and cultural significance of the building to be preserved. Therefore, the levels of rehabilitation can be classified as the following:

- Rehabilitation of the architectural heritage: ensuring the safety of archeological elements using scientific methods through restoration and treatment.

- Refunctioning of the architectural heritage: a level that aims to convert the historical buildings into museums or touristic destinations following the restoration and treatment.
- Rehabilitation by local authorities: designing the rehabilitation plan in a way that integrates with other conserved parts of the structure.
- International level rehabilitation: developing rehabilitation models for a specific case while sharing it with international organizations that are concerned with the domain, such as the UNESCO.

In the Red Saraya case, a conservative approach can be followed for the most ancient structures, while parts of the recent structures can adapt the innovative additions. Areas for tourists can be used as cafes, gift shops, ticketing offices. Any developed plans can be shared with the UNESCO in order to ensure its conformity with international standards, while experts from the organizations can be employed for consultancy and advice.

### **4.3 Plans and Procedures for the Rehabilitation of Historic Buildings in Tripoli**

A comprehensive plan shall be constructed with the cooperation of all concerned governmental, private sector and NGO entities in order to ensure the success of any rehabilitation plan. The objectives of the rehabilitation plan of the Red Saraya as part of the general rehabilitation plan of the old city of Tripoli shall be well defined and clear in order to attract the interested parties and facilitate smooth communication channels between the different entities participating in it. Based on the study performed on the case study and the process identified in the course of this research, the suggested objectives for the rehabilitation plan of the Red Saraya/ Tripoli Castle are:



- Preserve the archeological and historical heritage of the existing structures, as a social and national commitment for the next generations of the country.
- Achieve historical objectives from the preserved structures and monuments as part of registering the historical area in Tripoli, and specifically the Red Saraya, as a UNESCO certified site.
- Attract touristic traffic to city as one of the essential income sources for the city, which can be used for further development of the site.
- Achieve economic and financial incomes that can be used for the development of other historical sites in the city and the country.
- Define the historical eras that contributed into the existing structures of the Red Saraya, which shows the variety of civilizations and historical events.
- Use strict rehabilitation strategies in the preservation of the existing structures, while allowing innovative and modern ideas to be used in accordance with international standards.

Subsequently, the guidelines for implementing the rehabilitation plan of the Red Saraya, are as follows:

- Designate an initial budget that can be used to rehabilitate the first phase from the global plan, guaranteeing further income is generated gradually to fund the remaining phases. A national tax system can be used in order to collect the initial budget.
- Motivate private investors to invest into the rehabilitation plan by providing them with touristic and cultural investment plans.
- The rehabilitation plan shall be based on minimal intervention that preserves the historic and cultural values of the existing structures, with strict international practices and methods. A summary of rehabilitation methods are provided in Table 4.1, addressing the different methods according to their costs, durability and adaptability.

- Original structures and sites shall be protected against any theft or aggression, while rehabilitation processes shall not impose any damages to the archeological fabric on site.
- A historic timeframe shall be created for the different structures within the Red Saraya, with detailed descriptions, which can be documented and presented through the touristic tours in different languages.
- Innovative and modern features and utilities shall be added to the site with extreme care in order not to disturb the historical context, while services shall not be apparent or vocal.
- The priority shall be given to repair processes over replacement in order to preserve as much as possible of the original fabric and structure.
- Visible material shall strictly match the original material intended for the site, while modern technology material can be allowed for strengthening and increasing the performance of the structure while remaining not visible.
- Rehabilitation plans of other surrounding sites shall be fully coordinated with the measures taken within the Red Saraya.

Table 4.1: Rehabilitation methods and solutions for problems in historical structures (Subramaniam, 2016)

Issue	Solution	Decision Parameters		
		Cost	Durability	Adaptability
Crack	Polyurethane	H	L	E
	Epoxy	H	H	D
	Stitches	L	L	D
Roof Leakage	Sealant and tile replacement	M	M	LD

	Asbestos and refill sealant	L	L	E
	Lead flashing	H	H	D
Peeling at wall or ceiling	Mughal plaster	M	H	M
Mold stain	High pressure water with soap	M	H	LD

LEGEND

H= High    M= Medium/ Moderate    L= Low  
E= Easy    LD= Light Difficult    D= Difficult

Furthermore, the basic procedures of rehabilitation are identified in order to enable designers and contractors to apply the plan and guidelines within the expectation and in accordance with international standards used for similar structures. Therefore, the following points summarized the procedures that can be used in each process for the Red Saraya rehabilitation strategies:

- The priority for any process shall always be given to identifying the historical value of the element, retaining and preserving in accordance with international standards and methods.
- According to priority and significance, each of the elements of the historical structure shall be protected against damages and well maintained against weather conditions and human misuse.
- During the repairing the elements of the historical structure each material shall be repaired in accordance with the recommended procedures with the minimum possible intervention. Repair is defined as treating a part of the element without compromising the overall value of the element.

- Replacement of elements shall be only in the case of the impossibility of using the original element. The original element shall be replaced with matching ones in terms of material and aesthetics.
- Missing historic features can be added according to need as seen suitable by the designer and as recommended by international guidelines. Options shall be provided, where the most matching option that conveys the historical value and context should be adopted.
- Alteration of the historical context can be performed as necessary in low profile areas with minimal historical values, such as parking spaces, retail spaces and administrative offices.

## **CHAPTER 5**

### **CONCLUSION**

Since the beginning of civilization, structures were constructed for different purposes, which they were mainly for protection, shelter and aesthetical reasons. The significance of historical buildings emerges from the archaeological evidence found and the opportunity to generate benefits for current and future generation. Moreover, as societies became more crowded, chances to use existing buildings arose in order to save space, while conserving the values of the used buildings. Therefore, rehabilitation of architectural heritage commenced in order to preserve historical evidence and facilitate the usage for different purposes.

The main aim of this thesis is to analyze the rehabilitation process of the structures in Tripoli castle in Red-Saraya district in order to improve the cultural heritage buildings from further damages and efforts to enhance the appearance for long period of time. Furthermore, the study aims to propose strategies that allows the preservation of the structure through empowering the social, historic, and cultural values of the city of Tripoli. With that aim, the main question of the research was constructed as; what are the rehabilitation strategies that are used for historic buildings in order to preserve their values and use them to connect the local community to their heritage, and how to implement these strategies to the current case study of the Tripoli castle?

A literature study was performed in order to understand the historical and archaeological values of the case study, which is the Red Saraya in Tripoli Castle, Tripoli, Libya. Since the Phoenicians understood the importance of the city location, several military bases and cities were constructed to reinforce their position in the Mediterranean. The current structure of the castle provides archaeological evidence that the first castle with many remaining elements. The city developed during the Roman, Islamic, Spanish and Ottoman rules, where the castle was the center of this development. The structures within the Tripoli Castle were constructed mainly during the Spanish rule and the second Ottoman rule of the city by the Karamanli family.

The rehabilitation of architectural heritage is described through a process that is faced with three main challenges; physical condition of the element, availability of resources for the rehabilitation process, and cultural and social importance of the restored element. The procedure for rehabilitation is assessed based on different criteria that are described in the literature, which evaluates the environmental system and technological system that are used in the process. Several examples were provided that show the influence of rehabilitation strategies on putting unused historical buildings into a more efficient use.

The case study of the Red Saraya shows two different types of dangers and risks associated with the rehabilitation plan; risks associated with the structure and the government, and risks associated with the process. In the structure, several structural and non-structural cracks were observed, which are essential to be resolved prior any further rehabilitation works. It is evident that the lack of maintenance and maintenance plans and strategies in the past contributed to worsening the condition of the structure, in addition to the current war status in Libya that directly affected parts of the structure with damages. In the past and in current times, the lack of interest of the Libyan government to implement an implementation plan with international standards added to the issues facing the Red Saraya.

In a rehabilitation plan, maintaining the original aesthetic and historic material is essential for the process, while current material that are developed to enhance structural performance can be used in invisible manner. A great attention should be paid to not impose any threats to the historic and cultural values that are conveyed and shall be conveyed by the heritage structure. In the case of the Red Saraya, several misuse practices were observed by implementing modern service and inadequate finishes to the historical buildings. Such practices shall be reversed and returned to the best matching condition of the original structure. Moreover, any rehabilitation plans shall be based on four main levels; element rehabilitation, element refunctioning, local rehabilitation and international rehabilitation.

Furthermore, a plan and procedures for rehabilitation in the Red Saraya in Tripoli Castle were provided. Firstly, the objectives of the plan were identified to preserve the existing structure, achieve historical objectives, attract tourism, achieve economic and financial incomes, define and study the historical eras that formed the Saraya, and use strict methods for the process. The plan presented stressed on developing a financial system that contributes into the budgeting for the project, which includes encouraging investments from different sectors. It was also instructed that all archaeological and historical elements within the Castle to be protected, through security and documentation.

The research outcomes show different guidelines and process that could be used into the rehabilitation procedures, where the priority is given to identifying and preserving the historical elements. Moreover, repairs are recommended over replacements in order to preserve the maximum possible parts of the Red Saraya and its historical and cultural value. In future research, a comprehensive design based on archaeological survey of the Saraya can be carried out using the provided plan and procedures described in this study. The research could include parts, if not all of the Saraya, with the aim to preserve and utilize the great values behind the Tripoli Castle.

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