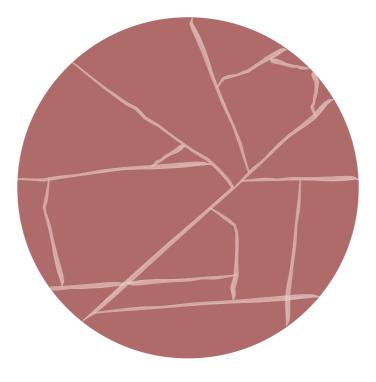*Master's degree in*
Architettura per il Progetto Sostenibile

Traditional knowledge and urban historical developments
in the Japan approach to Disaster Risk Reduction
in Cultural Heritage assets.
The Kamigyo District in Kyoto

傷口を高くする技術

Supervisor
Prof. Rosa Tamborrino
Co-Supervisor
Prof. Mesut Dinler

Candidate
Elisabetta Sanasi

Politecnico
di Torino

1859

September 2021

POLITECNICO DI TORINO

Master's degree in
Architettura per il Progetto Sostenibile

Master's degree Thesis

Traditional knowledge and urban historical developments in the Japan approach to Disaster Risk Reduction in Cultural Heritage assets.
The Kamigyo District in Kyoto

1859

Supervisor
Prof. Rosa Tamborrino
Co-Supervisor
Prof. Mesut Dinler

Candidate
Elisabetta Sanasi

September 2021

Ringraziamenti

ABSTRACT

Preventing natural disasters has become a common goal among different countries, with the ambition of not only preventing new disasters but also reducing existing ones. In this regard:

"*Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience*" (SFDRR 2015-2030).

The ambition of the Sendai Framework on Disaster Risk Reduction (2015-2030) establishes an agreement between several countries that have decided to adhere to this policy model which has the overall objective of reducing not only the risk of disasters but also the losses of human lives, with a focus also on the livelihoods and health of economic, physical, social, cultural and environmental assets of people, businesses, communities and countries (UNECE 2020).

The Framework states that commitment to this purpose lies not only in actions but also in the involvement of political leadership in each country. Indeed, it is crucial how the accountability of state and local governments plays a role in prioritising action to follow a risk reduction agenda. Their mission is to understand the demands of their respective countries, contextualising that each country is different, both geographically and culturally, and, consequently, general guidelines must be shaped according to the different factors.

As already mentioned, the sendai sets out different priorities that look not only at the safety of people but also at the protection of culture and consequently of the historical assets that make up the heritage of cities.

Japan comes to the forefront not only as a country that has achieved a remarkable degree of resilience but also because of its history, which characterises its important heritage.

In this respect, Kyoto is considered to be one of the oldest cities and the centre of Japanese culture, illustrating the development of wood architecture through the characteristic machiya (UNESCO 2021).

Through the preservation of its historical identity, Kyoto makes it possible to visualise the cultural and architectural changes over the different eras. In addition, the urban history tells the story of the process of settlement of wooden houses, the focus of this discussion.

This paper reveals a study aimed to discover the historical roots of this country, its culture and traditions and how this people became millennials in the effort to protect Cultural Heritage (CH).

Looking back at history is essential for absorbing fundamental concepts that in turn unlock different levels and unveil how machiyas have been shaped by a series of events. In this regard, this kind of wooden houses became an emblematic case for Japan, threatened not only by the advent of new materials but also by external phenomena which make these buildings particularly vulnerable.

In order to learn how these wooden houses settled, a focus will be made on a portion of the city of Kyoto, the Kamigyo district, which allows to observe the changes in urban history during the Meiji era (1868-1912) and after its ending. In addition, digital maps will be used to help understand how the district developed and how houses were shaped accordingly.

Afterwards, it will be seen how the survival of these houses is challenged, both by the advent of new constructions and by external factors such as natural disasters, which make the whole region vulnerable. In this regard, studies previously carried out by the Kyoto government will be examined to see how the densification of houses is increasingly declining.

Therefore, the aim of this thesis is to investigate the Japanese experience in dealing with natural disasters, contributing to the topic of disaster mitigation and serving as a model country for many others that have not yet joined the Sendai Framework.

The urban and architectural analysis of the machiyas makes it possible to become aware of the danger that these houses still face today and how it is urgent not only to protect them through processes of regeneration and refunctionalization, but also by giving value to a political model that prioritises the protection of the identity of the places and the people who live there.

The effort is not to erase the traces of the past and, in the case of Kyoto, the loss of machiya, a fundamental piece of the city's historical and local identity.
The implementation and constant updating of an important policy model such as Sendai aspires to globally define territories as *resilient cities*.

Key words: heritage, protection, wooden houses, natural hazards', disaster risk reduction.

INDEX

Table of Contents

INTRODUCTION

Seismic activity in Japan has a long history and this is linked to a number of factors such as its geographical position, being an archipelago located in the proximity of the convergence of three tectonic plates, respectively: Philippine, Euro-Asian, and Pacific (fig. 1). Consequently, when these plates move, they slide over each other, thus releasing enough energy to trigger a powerful seismic wave.

In this regard, the country has 'collected' a series of disasters that not only had violent seismic tremors but also saw subsequent tsunamis that have literally destroyed huge parts of cities.

The Great East Japan Earthquake (GEJE) is only the most well-known and part of the country's history which has been occurred on 11 March 2011. The GEJE registered a magnitude of 9.0 and produced a tsunami with a wave of over 40 metres.

Fig. 1. Map illustrating the three plates mentioned.
Map taken from: https://arcgisss.maps.arcgis.com

After a series of disastrous events, what Japanese people realised, in order to survive an earthquake, is that is not only important to design with anti-seismic technologies (e.g. skyscrapers built with the intention of oscillating to withstand the shocks) but also to make people aware of the concept of prevention and to react when disaster occurs (Okubo, 2014). Indeed, surviving such disasters is not only related to the quality of the buildings, but a number of factors come into play that must be properly considered.

The planning of emergency procedures such as evacuation routes during a disaster or places to be reached as safe are practices that everyone needs to learn, in order to achieve to *prevent rather than cure*.
As a matter of fact, natural disasters cannot be predicted or eliminated and, with this awareness, Japan is now known as one of the countries that believes in *building resilient cities*.

The importance that a country like Japan has assumed is not only because of its experiences in terms of disaster preparedness but also because of its national identity with respect to its heritage and culture. In order to comprehend how the country has thought to concretise the concept of resilience, thus, it is necessary to study how the importance of heritage has grown in Japan and when the need to develop a protection system arose (Kakiuchi, 2014).

Cultural heritage embodies the richness of a place, the identity of a population and also a long history of legislation. Heritage is the result of the work of predecessors, which provided the basis for social identity. Indeed, the concept of heritage is not only related to architecture but also to the urban or rural environment as testaments of a particular civilisation, significant development or historical event (ICOMOS 1965).
Although the history of heritage protection in Japan, which began in the second half of the 19th century, reveals a desire to conform to new constructions, on the other hand there is a strong desire to recover traditional values. In fact, the first initiatives saw the creation of a National Museum and the beginning of the study of local art history, with the first law enacted regarding the census of cultural heritage in 1871 (Gianighian and Paolucci 2010). This was followed by a series of laws, especially in the face of the disasters of the II World War (1939-1945) that destroyed entire parts of the city and razed buildings to the ground. This was a crucial moment for reconstruction but also a reason to understand the importance of wooden buildings. It will be discovered that many wooden buildings have survived disastrous impacts thanks to the use of traditional

techniques, an important value that is still handed down from generation to generation. Thus, it is not only the material that is essential, but above all the traditional handcraft.

Cities, architecture and construction systems are the foundations of Japan's identity. These traditions and historic built environment represent cultural heritage.

In this regard, it is essential to reveal the reasons why traditional buildings and cities survived the impacts of disasters in the period before they became part of the World Heritage List in 1994 (Okubo, 2016).

Therefore, the aim of this thesis is to explore how the Japanese experience of dealing with Natural Disasters, also important for its deeply rooted culture, contributed to the issue of disaster mitigation and how its approach in reducing risks resulted in the development of the Sendai Framework 2015-2030 policy model.

The Sendai Framework is an International document adopted by Member States of the United Nations on 15 March 2015, during the *World Conference on Disaster Risk Reduction* held in Sendai. This agreement was approved in June 2015 with the intention of spreading a common strategy among nations that is explained through a set of common standards (SFDRR 2015-2030).

The main reason why the conference was held in Japan is because of its experience in this field, so it was appropriate to host the conference in a country that is widely studied in the field of disaster. At this point it is important to understand how the country has gained the trust of a large number of countries, leading to the sharing of its experience and translating it into guidelines.

Accordingly, with the intention of understanding what is the link between Sendai Framework and the problems of Heritage, this thesis will see how many decisions are related to past events, to choices that shaped the urban pattern and what triggered the desire to preserve heritage. This is verified through an explanation of how Japan's urban history has evolved, focusing mainly on the Meiji period (1868-1912), in order

to understand how it has developed and expanded over time.

The analysis of the thesis covers two different scales, respectively: the urban scale, focusing on a portion of the city of Kyoto, the Kamigyo Ward; and the architectural scale, studying wooden houses typical of a past culture and still existing today.

Compared to other cities in Japan, Kyoto is primarily known for its traditional atmosphere and for its consistent heritage value. In this respect, the study particularly analyses the Meiji era and the events following its end (1912), such as the advent of wars, in particular taking a closer look at the World War II (1939-45) because it strongly influenced the designation of heritage to be protected and consequently the promulgation of a series of laws (Kakiuchi, 2014).

Furthermore, the thesis will bring forward dynamics that will clarify why Japan not only assumes importance for its response to negative events but also for its culture.

The main reason of why the land of the rising sun attracts attention from all over the world is because of its unique and pure culture. Japanese culture is rich in tradition, ancient history, rituals and styles. But the real importance lies in the skilful use of wood material which characterises most of the country's architecture (Gryko, 2017). Indeed, the engineering of disaster-resistant buildings has not obscured their strong link to traditional buildings made of wood, a material considered to be a manifestation of their thousand-year-old culture. In this context, the research focuses on the Kamigyo district, where the urban history of this district will be studied, to note how it is rich in traditional

wooden houses, the so-called **Kyo-Machiya** (京町家) (fig.2).

Machiya were home to traders and craftsmen, originated in the Edo period (1603-1867) and continued their development until the Meiji era.

The particularity of these houses lies in their settlement process, where there is a history characterised by government decisions and differences in social rank (Stavros, 2014). The highest density of these houses can be found in Kyoto Prefecture and this explains the suffix *kyo.*

Fig. 2. A typical machiya house in Kyoto.

The thesis deals with an analysis of Machiya to survey how they have developed in relation to the urban historical context and how today their densification is being threatened both by the advent of new construction and by natural threat factors. Thu, it will be crucial to understand how Japan is acting in the effort to protect them. Despite the fact that the study shows that the richness of Kyoto's heritage makes it so important over time that it has been included in the World Heritage List in 1992 (UNESCO 1992-2021), it is clear that these houses, although considered to have an important historical value, are particularly vulnerable. The analysis aims to raise awareness of how their densification is disappearing and, although it has often been difficult to find material to study their development in depth in recent years, it has been possible to reconstruct a logical framework by means of a series of previously carried out researches. This is meant to be an attempt to bring to light the efforts made so far and to encourage others in the future.

OBJECTIVES AND LIMITATIONS

The main objectives of this study are:
▪ identifying the traces of historical passages that led to political, social but above all urban and architectural changes;
▪ analysing a portion of the city of Kyoto with the intention of understanding the derivation with history and its further developments in relation to disasters;
▪ understanding why the japanese people are so attached to wood material and how this material still retains their trust;
▪ understanding some specific aspects of urban fabric and historic architecture type identifying systems of description and representation of heritage at risk;
▪ outlining the political framework of Sendai 2015-2030 as a reflection on how Japan's experience has contributed to build a model in terms of Disaster Risk Reduction (DRR).

This thesis was initially conceived as a co-tutorial of the Politecnico of Torino considering the grant to spend a period of six months collaborating with the Kyoto Institute of Technology (KIT). Unfortunately, due to Covid-19 this experience turned out to be a remote continuation. Therefore, in the writing of this thesis, I often changed my perspective because the history of Japan was unknown to me. Indeed, it will be common to encounter a series of questions spontaneously arisen that, at the end, were fundamental in terms of understanding how I was proceeding with the work. In this way, being a remote study, it was not always possible to find necessary material to answer the questions in the most exhaustive way. Often, I resorted to translating articles from Japanese because I have no knowledge of the Japanese language and their use has been essential in order to reassemble the pieces of some parts of the text content. For this purpose, the help of Prof. Akamatsu from KIT has been supporting to identify some key points and understand the documentation that allowed me to simplify the study and to unravel the various temporal knots.

In addition, in a period of emergency due to Covid-19, consultation of texts in libraries was also restricted. In this respect, the use of digital sources have been essential in the search for core documents and articles that allowed access to data of relevant importance in the study of the historical urban context. In addiction, in methodology it was fundamental the use of digital tools for searching and using data, learned in the digital history course held by Prof. Tamborrino.

METHODOLOGY

This study involves several sections which are closely linked to each other due to a series of events. In this regard, to explore this aspect further, digital tools were of fundamental relevance in supporting this analysis.

The transformation analysis of the city of Kyoto, with a special focus on the districts around the Imperial Palace of Kamigyo and Shimogyo, required the support of cadastral maps available in Digital Archives. Thus, were used the archives of Gallica-BnF, the digital library of the Bibliothèque Nationale de France, widely used during the Digital History course and, under the advice of Prof. Akamatsu, the site of LUNA Japanese Historical Maps, a library of the University of California (Berkeley), in which were found most of the historical cadastres with reference also to the Edo period. The research was supported by these two archives until I realised that the availability of maps referring to the two particular districts was a bit limited.
Fortunately, I had the opportunity to consult a student of KIT, Aoi Tanaka, who was very helpful in directing me to a digital site set up by Ritsumeikan University where it was possible to superimpose the historical maps on today's one. The cartographic maps available have a narrower time range but are in accordance with the historical period considered. On the following pages there are two examples.
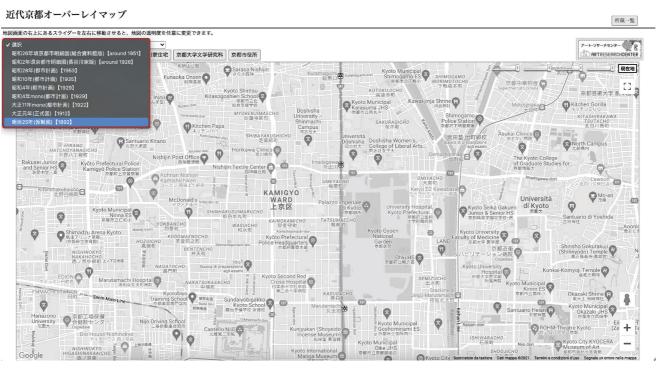
Fig. 3. Graphical interface of the digital archive of the historical city of Kyoto.
From https://www.arc.ritsumei.ac.jp/archive01/theater/html/ModernKyoto/

The image above shows the different choices that can be made. Since the site is in Japanese only the dates of the maps can be clearly displayed. Indeed, the time frame considered sees maps from 1892 (25th year of Meiji) to 1953 (28th year of Showa period).

Fig. 4. Overlay of two historical maps with focus on Kamigyo ward. The most distinctive feature is the old Dadairi (Imperial Palace).
From https://www.arc.ritsumei.ac.jp/archive01/theater/html/ModernKyoto/

The image above shows the superimposition of two maps. This site allows the superimposition of the maps of the different historical periods but also the adjustment of the different transparencies, making it easier to find any changes in the urban terrain.

The analysis supported by the superimposition of the maps was fundamental in understanding that the division of the land, a decision taken by the emperor based on the hierarchy of the ranks, was decisive for the shaping of these houses. In this respect, the narrow and elongated shape of the machiya reflects the piece of land that was originally allocated to the lowest rank of the population, that of craftsmen and merchants.

In addiction, the Digital Archive of the Historical City of Kyoto includes not only the map section but also content such as literary works, paintings and photographs. In this regard, Kyoto Prefecture is collaborating in the scanning of photographs that have been donated to the Prefectural Library and Archives.
The photographs can also be displayed on the map with the location of the place shown.

The first chapter focuses specifically on the Meiji era (1868-1912) a fundamental period made of transition to the modernization age but also characterised by the interest of protecting the historical heritage.
Thus, part of this chapter focuses on the various laws that were enacted when it was realized that heritage was in danger of being lost, especially around the time of the wars following the end of the Meiji era. Among the cities threatened by air attacks are mentioned Kyoto, Hiroshima, Yokohama, Kokura and Nagasaki.
As previously mentioned, Kyoto is one of the cities in Japan that holds a large number of monuments that are part of the historical heritage and, if they are still in existence today, it is thanks to the fact that it was spared from the air attacks during the World War II (1939-45). However, Kyoto is not only rich in Temples and Shrines but also in Kyo-machiyas, houses which have a story to tell which begins in the Edo period (1603-1867) and continues its development into the Meiji era. Indeed, what they tell is a real story because it was found that the changes in urban history, occured in those two periods, were due to the settlement of these houses.

The second chapter turns its attention to wood as a primary material in Japanese culture and focuses on construction techniques as well as conservation. The intention is to discover what is the secret that keeps up not only the historical heritage but also these houses, which have survived a series of negative events, it was useful to understand the construction methods. With respect to conservation techniques, it will be interesting to see how their method of keeping architecture alive sometimes involves the technique of dismantling and reassembling (e.g. the case study of Ise Temple).

Studying Japanese approach to Cultural Heritage through the case of Ise Temple shows the differences between their culture of conservation compared to our western culture. This does not mean that their methods are wrong, on the contrary: for the Japanese people it is fundamental the importance to transmit a sense of tradition to future generations through the protection of traditional techniques, in this case used for wood, a material which is a fundamental part of their culture.

The third chapter explores the machiya, specifically those settled in Kamigyo district. The peculiarity of these houses lies in the word itself: **machi** means *city* and **ya** *house*. This gave the input to understand how I should carry out the analysis, beginning with an examination of the urban scale and then moving to the architectural profile. Thus, it was carried out an urban analysis, trying to understand the densification of these houses and and the outline of this district and its connotation.

In this regard, my intention was to get hold of data that would allow me to visualise the geolocation of these houses today, to actually understand how much they have been lost over time. Thus, through the use of the virtual portal of the **Geospatial Information Authority of Japan** I got the basic attributes to visualize the shape of the Kamigyo district. However, when I asked the Japanese Professor and her student for information, the machiya data was not easily accessible because it required special consent practices.

As a result, I searched for reference materials to show how the loss of these houses is clearly visible and I found a study conducted in 2009 by survey teams consisting of the Kyoto City Government, Ritsumeikan University, Architects and voluntary citizens. In order to make maps available with the data of the machiya and their visualisation, the team used various tools such as ArcPad, Mobile Gis and PDA.

This research follows two others that were already conducted, one between 1995 and 1998 and the other one between 2003 and 2004. All this is to say that the concern about the loss of these houses was already matured some time ago and the advancement of the research has only increased this concern.

Subsequently, discussions will focus on the decisions taken by the Kyoto government in the interests of protecting the historic landscape characterised not only by wooden houses but also by the landscape.

Lastly, a closer look will be taken at the architectural elements that distinguish this type of wooden house.

Although they are houses that characterise many of Kyoto's neighbourhoods, making it a city visibly rich in tradition, these houses are threatened by the advent of new construction, but not only.

As a result of these numerous investigations, it has become clear not only how vulnerable these houses are in the face of the arrival of new buildings but also for the succession of natural disasters that have and continue to threaten the loss of these houses, besides the historical heritage.

The fourth chapter deals with the issue of natural disasters, confronting a series of events that have occurred in the past which have strongly shaken the Japanese territory but also the population. In this specific section it will be essential to distinguish a series of hazards ranging from earthquakes, to fires (particularly dangerous for wood material), to tsunamis.

The closer examination of this issue was essential for me to understand what kind of efforts this people made to protect not only the city but also the safety of its citizens. In relation to this, it will become clear how the behaviour of the population with respect to these phenomena is one of the most important keys in the process of saving and safeguarding property.

The solutions adopted by the Japanese government to prepare evacuation routes, suitable for each type of prefecture and district, derived from detailed studies carried out with the intention of propagating a policy of disaster preparedness. And here, there is a particular connection to the urban history discussed in the first chapter. Specifically, some decisions taken in the past have been reflected in the present and, in the case of Kamigyo, inherited barriers that prevent evacuation, so-called *cul-de-sacs*.
In this regard, I have reported a study translated from Japanese that gives a clear idea of how this type of path is particularly vulnerable to disasters.
Consequently, last reference will be made to how the Kyoto government decided to cope with each disaster, focusing on each one and outlining the different solutions.
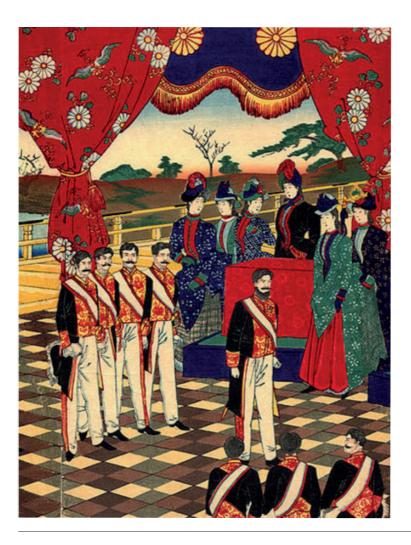
The final intention is to translate the Japanese experience into a system of risk mitigation that today is one of the best known and most important in the world: the **Sendai Framework** (SFDRR 2015-2030) which has the overall objective of reducing not only the risk of disasters but also the losses of human lives.

The five chapter considers not only the policy of risk mitigation as a possibility to stimulate the protection of citizens and heritage, but also a look at the systems of re-functionalization of machiya. Therefore, the first part will see several pieces extracted from the SFDRR 2015-2030, with a reference to the previous international

political frameworks of **Yokohama Strategy 1994** and **Hyogo Framework for Action (HFA) 2005-2015**. Subsequently, we will specifically discuss the behaviour of the Kyoto government and how they are supporting their prefecture with advanced systems to prepare citizens to become aware of disasters and how to prepare themselves to reduce their vulnerability. Then, I researched through Japanese sites, specifically that of Kyoto City Official Website, where it was possible to find risk reduction preparedness maps for each district, including Kamigyo. The fact that Japan has become one of the powers to be followed on the subject of disasters has contributed to the implementation of preparedness measures. Consequently all these measures resulting in the protection of historical properties and houses such as machiya.

The shaped scenario of machiya preservation, involves not only keeping them alive but also performing appropriate refunctionalisation processes. This practice is common when it is realised that a machiya is not attractive anymore to serve as conceived. For this reason,many people have moved in trying to save them from a condition that often contemplates their dismantling, saving them through appropriate processes of refunctionalisation, with respect to what is the demand. In this respect, the last part reports a case of parallelism between two machiyas, one renovated and one refunctionalized.

1. Architectural and urban history of Kyoto and development of the legal background of the heritage management system in Japan

A woodcut with the Emperor during the Meiji Constitution.
Work made by Yōshū Chikanobu.

1.1 Architectural Culture during the Meiji Era

Japan's history can be divided into a large range of time which in turn is explained by "periods" or "epochs". These shorter intervals of time could be the highest accomplishment that marked the most important events and their evolution to the modern era. Indeed, these passages are fundamental to understand how these ancient people have been affected by such events and their reaction to protect its historical and traditional assets.

The Meiji Restoration (明治維新, Meiji Ishin), declared in 1868, led significant changes for Japan both in the political and social structure.

This was a radical age because it led to the collapse of Tokugawa Shogunate[1], also known as **Edo Period** (feudal military government), and to the restoration of the emperor power after centuries under the military dictators named **Shōgun**. By this time, the new government wanted to guarantee to the people a new order based on justice and opportunities.

In 1871, the new government needed to increase its recent authority, abolishing the domains on Japan and establishing the innovative system of **prefectures**. These last, were endowed by militar strengths and political wills within a decentralized power structure.

---

1. Shogunate, Japanese bakufu or shōgunshoku, government of the shogun, or hereditary military dictator, of Japan from 1192 to 1867.
From https://www.britannica.com/topic/shogunate

The goal of the Meiji leaders was to build a modern country without the worry to become a colony under the control of one of the great powers.

Therefore, in order to consolidate this process of modernization and to defend better the country, Japan realized that it was necessary to remove the feeling of hate towards the foreigner.

Thus, it gets in touch with the Western knowledge to implement their modernization perspectives and to emerge as a civilized military power[2]. As a result, were organized diplomatic missions to the United States and Europe to grasp the foundations of the power of those countries.

During these years, Japanese art also change its perspectives because of the decision of the emperor to promote Western Art style by sending students abroad to teach and school.

As a result, Japanese art during Meiji period was a combination of both cultures, Eastern and Western, and this influence is visible in the following artworks, produced by this time, especially in architecture.

It is important to note that before this period of revolution, Japan had been affected by other countries but the main characteristics of Japanese architecture had been preserved unchanged during the previous two thousand years. Indeed, it was in the nineteenth century that the general political transformation led Japan towards modernity.

During this new era were lost the traditional wooden building system for leaving space to brick or stone construction, coming from Western Architecture. In addition, the trabeated style had to give way to the new arcuated style.

As already mentioned, history is marked by epochs and the Meiji Revolution developed two different approaches to building in Japanese Architecture.

The intention was to keep up with modernity and to absorb western notions but the Japanese people had their own way of interpreting western architecture. Most people thought that western architecture consisted of details such as mouldings and capitals. Later, with the experience and contact with various foreign architects, the Japanese people understood the essential qualities of Western architecture.

Essentially, the westernisation of buildings has seen two different schools of thought, influenced by the builders:

- the *first type* is a compromise between Western and Japanese styles, adopted by Japanese builders;
- the *second type* is purely western because it was adopted by foreign builders who came to Japan.

The common point between these two ways of building culminates in eclecticism.

Eclecticism[3] refers to an architectural style that includes structural as well as decorative elements, where styles and traditions of other countries are combined.

---

2. Kakiuchi, "Cultural heritage protection system in Japan: current issues and prospects for the future".

3. In architecture and interior design, these elements may include structural features, furniture, decorative motives, distinct historical ornament, traditional cultural motifs or styles from other countries, with the mixture usually chosen based on its suitability to the project and overall aesthetic value.
From https://www.hisour.com/eclecticism-in-architecture-29007/

The difference between the first and second type of architecture is not only represented by the figures and their culture but lies in the use of materials for architecture.

Talking about the first type, considered semi-westernised architecture, it involves two major japanese builders, who tried to create a fusion between the traditional and the new style, using the stone as a cladding for wooden structure[4].
The interventions were mainly about shops and public buildings, while those on residential houses came years later because there were difficulties in obtaining the new material, both in terms of supply and because of their high prices. These buildings, considered eclectic, were made of wooden frames and then covered with stucco or faced with stone at the corners of the outer wall.
These architectures can be considered as the first approaches to western architecture, even if more in an ornamental than in a constructive way.

In this regard, Shimizu Kisuke and Hayashi Chujo II were the first local architects[5] arrived in two different periods but both are remembered for their mainly buildings constructed in Tokyo.
Shimizu came to Edo (now Tokyo) in 1830 to work as a carpenter. Hotel Tsukiji (fig. 5) (1867-68) can be considered as one of his first works of westernised

architecture. Instead Hayashi, also a carpenter, came to Yokohama in 1865. He built several buildings in those years such as the Kaisei Gakko (fig. 6) (1873), the predecessor of Tokyo University.

The second type of westernised architecture involves a group of styles introduced by the foreigners.
T.J. Waters came to Japan in 1868 and was commissioned by an english merchant to build the Mint (fig. 7) . This was a group of buildings situated along the river. Two of these, the foundry and the reception building, were built entirely of brick, with a clean and simple design, devoid of ornamental excess. The foundry was particular for the portico and stone columns. The reception building was unusual because of its Renaissance style.
R. P. Bridgens requires another mention as a foreign architect. He came to Japan also in 1868. Among his works were the Shimbashi Railway Station (fig. 8) (1872) ,the Yokohama Railway Station (1872) and the Hōraisha office building (1872).
Therefore, the particularity of this second type of westernised architecture involves the exclusive use of bricks and stones, crowned by a simple design[6].
After 1874, the number of foreign architects and civil engineers increased and consequently the production of cement and bricks. At the end of the Meiji era, Japan was able to build according to the correct western technique.

---

4. Abe, "Early Western Architecture in Japan", 13-18.
5. Ibidem.

6. In brief, the meeting point between the first type and the second type is the use of stone materials. Specifically, the former retains the wooden structure while the latter is purely aimed at the use of concrete and stone materials.

Fig. 6. **The Kaisei Gakko**, Tokyo, by C. Hayashi (1873).
From Abe, "Journal of the Society of Architectural Historians", 13-18.
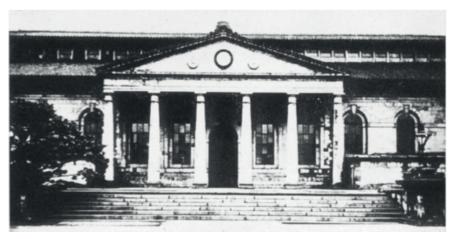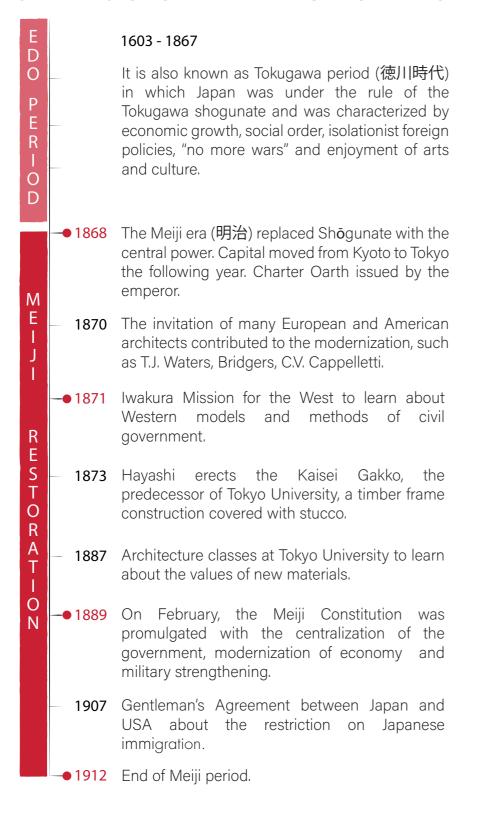
Fig. 7. **The Mint**, the main foundry, Osaka, by T. J. Waters (1871).
From Abe, "Journal of the Society of Architectural Historians", 13-18.

Fig. 8. **Shimbashi Railway Station**, Tokyo, by R. P. Bridgens (1872).
From Abe, "Journal of the Society of Architectural Historians", 13-18.

Fig. 5. **Hotel Tsukiji**, Tokyo, by K. Shimizu (1868).
From Abe, "Journal of the Society of Architectural Historians", 13-18.

JAPAN HISTORICAL TIMELINE DURING THE MODERNIZATION PERIOD

EDO PERIOD

MEIJI RESTORATION

1603 - 1867

It is also known as Tokugawa period (徳川時代) in which Japan was under the rule of the Tokugawa shogunate and was characterized by economic growth, social order, isolationist foreign policies, "no more wars" and enjoyment of arts and culture.

1868 The Meiji era (明治) replaced Shōgunate with the central power. Capital moved from Kyoto to Tokyo the following year. Charter Oarth issued by the emperor.

1870 The invitation of many European and American architects contributed to the modernization, such as T.J. Waters, Bridgers, C.V. Cappelletti.

1871 Iwakura Mission for the West to learn about Western models and methods of civil government.

1873 Hayashi erects the Kaisei Gakko, the predecessor of Tokyo University, a timber frame construction covered with stucco.

1887 Architecture classes at Tokyo University to learn about the values of new materials.

1889 On February, the Meiji Constitution was promulgated with the centralization of the government, modernization of economy and military strengthening.

1907 Gentleman's Agreement between Japan and USA about the restriction on Japanese immigration.

1912 End of Meiji period.

Fig. 9
The Charter Oath as officially published.

It's true that the Meiji Era brought a wind of change and a significant process of urbanization. However, against this background, in which the government focuses its attention to manage new reformers and to take advantage of western teachings and Japanese people put their efforts into integrating the new architecture, there was a strong desire to protect the traditional style.

It's no coincidence that this period was nicknamed *revolutionary*, because while on the one hand it allows the approach to the new technologies and possibilities of the modern era, on the other hand it awakens the feeling of protecting history. This could be seen as a kind of consequence with the construction of the new buildings: by looking at the pre-existing architecture it was noted that the buildings of the past telling the country's history and with them also the use of traditional materials, mainly wood. However, this didn't stop the advance of the new constructions, but saw the introduction of laws that looked at the protection of antiquities. And this concept of laws will be reinforced mainly towards the end of this epoch, when the period that follows will be marked by a series of catastrophic events that will threaten the historical heritage. And this will only serve to insensify the care of protecting everything that could be considered as a manifestation of the past, as the identity of the city of Japan.

After the end of Meiji era (1912), Japan is threatened by significant events that disrupt this positive atmosphere: the World Wars.
During this epocal events, many cities were destroyed by atomic bombs and Japan is worried about its historical assets. As a result, Japan decided to adopt a protection system to safeguard its historical buildings.
Despite this epochal event deleted centuries of history and many pieces of historic cities, Japanese people look beyond: Kyoto City survived the attacks because it was removed from the atomic target list.

It is well known that Kyoto hold a rich sense of culture and history and many districts show this through temples, shrines, palaces and gardens. But Kyoto achieves prominence in its historical identity precisely because it was spared from air attacks. Therefore, to safeguard these historical agglomeration of buildings and natural places, the governement decided to place a strong focus toward the protection of **Cultural Heritage**.
Accordingly, Japan increase the protection measures of these precious artifacts, buildings, and other valuable items that preserve the essence of culture and traditions.
The aim of the next few paragraphs is to explore these aspects in greater depth.

1.2 The effects of World War II on Japan's cities

"War has been one of the greatest geographers[7]".

In the previous paragraph it was mentioned how Japan was a target of several attacks that had an impact on its economic and urban development. The intention of the phrase above is to highlight *how air strikes razed several cities to the ground*.

At the end of World War II (1939-45), two events had a huge impact, both physical and psychological, on the Japanese people: the nuclear attacks on Hiroshima and Nagasaki.
In May 1945, during a meeting in the United States it was decided which cities should be under attack in order to destroy the Japanese people.
The initial intentions were to attack a larger number of cities, such as: **Kyōto, Hiroshima, Yokohama, Kokura and Nagasaki**.
Kyoto's choice was influenced by the fact that it was a cultural centre and this would devastate the Japanese people. But, for unknown reasons, it was spared. Finally, the choice fell on Hiroshima and Nagasaki.

The strategy was to strike Hiroshima (fig. 10) because it was a city of great military importance, therefore equipped with military bases, while Nagasaki (fig. 11) was one of the major ports fundamental to its industrial activities. The bombings took place a few days apart, respectively: Hiroshima 6 August and Nagasaki 9 August 1945.

Due to the fact that the Japanese archipelago is prone to earthquakes, many buildings survived the attacks because they were built in reinforced concrete. Specifically, remained the skeletons' structures.
The Hiroshima Peace Memorial (広島平和記念碑), now called the Genbaku Dome (fig. 10), still exists today as a memorial of the people who were killed. In 1996 was designated a UNESCO World Heritage Site.

Fig. 10. **Hiroshima Peace Memorial (Genbaku Dome)**, Hiroshima, 1945. From https://whc.unesco.org/en/list/775/.

7. Goldie, "Geographical ideals", 8.

The Hiroshima Peace Memorial (fig. 9) is designated as a historic site under Japanese 1950 Law for the Protection of Cultural Properties, and is managed by Hiroshima City under the guidance by the Hiroshima Prefectural Government and the Government of Japan.

The protection of Peace Memorial Park was enhanced in 2007 with its designation as a Place for Scenic Beauty under the 1950 Law for the Protection of Cultural Properties[8].

Fig. 11. **Hiroshima Peace Memorial (Genbaku Dome)**, Hiroshima, by Giovanni Boccardi, 2006. From © UNESCO.

8. From https://whc.unesco.org/en/list/775/

MAPS OF HIROSHIMA AND NAGASAKI BEFORE AND AFTER THE AIR RAIDS

Fig. 12. **Hiroshima city** before and after the nuclear attack.
From http://beforeafter.altervista.org/hiroshima-nagasaki/
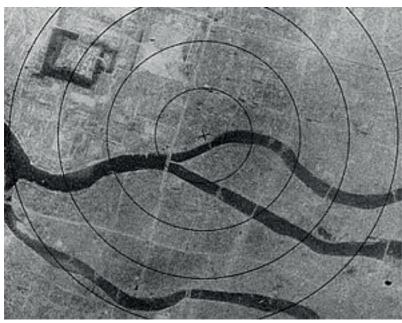
Fig. 13. **Nagasaki city** before and after the nuclear attack.
From http://beforeafter.altervista.org/hiroshima-nagasaki/

At the end of the War, Japan inherited ghost towns and entirely destroyed districts.

But Japan, especially today, is recognised as a resilient country, which is able to absorb bad events and react. At the time, this was made possible by the signing of the **Treaty of San Francisco** (8 September 1951) which allowed Japan to concentrate on its economic expansion. As mentioned above, Japan's major cities were destroyed, even Tokyo came under attack. Thus, the country began a new way of rebuilding, taking into account the high population growth as a result of economic expansion.

Industrialization in Japan since 1920 has seen two distinctly different development paths:

▪ firstly it has been characterised by a predominant development in the central cities ("urban core");

▪ later there was a decline in central urbanization caused by a focus on peripheral areas.

Although the urban core saw a tendency towards decentralisation, Japan focused its energies on rebuilding cities to fill the void left by the bombs with the growing population. Indeed, in the case of Tokyo, the government employed the reconstruction of the city as an expression of its renaissance potential. Tokyo saw the growth of vertical buildings, skyscrapers capable of accommodating the increasing number of people. However, flats were reduced in size in order to obtain more space and, above all, because of the high costs involved. In fact, this was one of the reasons why people started looking for houses more in the suburbs.

Nevertheless, means of transport such as the underground and railway lines were avant-garde to meet these needs.

It's clear that Japan plays a role, using its best weapons and taking advantage of western influences inherited during the Meiji period. And, despite the fact that the Post-War period and the Meiji period differ by almost a century, they have one factor in common: the evolution's desire.

Evolution is not about erasing the past, as bombs have done with the existing cities. Evolution is a step forward and this also concerns the improvement of what already exists. For instance, by improving existing techniques, as Japan did by rethinking the use of materials to make the buildings taller and more resilient, as in the case of skyscrapers.

It's not a coincidence that Meiji was called "the Meiji (R)evolution". It opens up to the Westernization, not forgetting its history. The intersection of the past (Meiji) and the present (Post-War) occurs in 1949. This year marks an event that triggers a strong feeling about historic buildings and their preservation.

About this time, it's important to remember the city of Kyoto, which was the capital for almost a millennium (from 794 to 1868).

As a result of the United States' rethinking, Kyoto has a rich sense of tradition and a remarkable concentration of historic buildings, most of them protected by Unesco. However, this kind of protection it's not enough to protect them totally. Indeed, the danger of damaging or losing them is not only linked to the human factor.

They are faced with another problem that is out of control: the natural hazards' phenomenon.

1.3   The dualistic vision and the approach for the protection of Cultural Heritage

Before dealing the issue of natural disasters, need to understand the tradition of this country.
How and when they have thought to protect it?

Although this people reincarnate the conservative and traditionalist culture, in history it's possible to find some contradictions. Indeed, perplexities arises when considering Japan's behaviour facing the modernization process.
While on the one side there is a strong desire to protect the riches inherited from history and survived over time, on the other side Japan goes along with the modernization by demolishing buildings and structures to leave space for the 'new', almost forgetting tradition[9].
These juxtaposing features highlight Japan's dualistic vision.

It's curious to notice that Japan's dualistic vision it's omnipresent, in both periods. They share a variety of similarities. During the Meiji era, Japanese people were focused on accepting changes, opening up to western culture but *not forgetting Cultural Heritage*[10]. The historical assets was threatened by this period of transition and consequently the government enacts the first Law for the Preservation of Antiquities (1871).
While the Post-War period required reconstruction but also *initiatives to protect the remains*.

At the end, modernization was able to trigger a strong focus on tradition.
Thus, the answer to the question: there isn't a specific moment. Rather, there were events that had sparked this devotion to the history of the country. Japanese people always possessed this natural feeling of tradition.
But there is a *how* by looking at the Laws, their enactment and their evolution.
The new programme involves the economic and political fields, bringing changes to the social structure (division into prefectures). In addition, were enacted a series of laws to protect the National Heritage.

---

10. Cultural heritage is the legacy of cultural resources and intangible attributes of a group or society that is inherited from past generations.
The term cultural heritage encompasses several main categories of heritage:

• Tangible cultural heritage:
  - movable cultural heritage (paintings, sculptures, coins, manuscripts)
  - immovable cultural heritage (monuments, archaeological sites, and so on)
  - underwater cultural heritage (shipwrecks, underwater ruins and cities)

• Intangible cultural heritage: oral traditions, performing arts, rituals

• Natural heritage: natural sites with cultural aspects such as cultural landscapes, physical, biological or geological formations

• Heritage in the event of armed conflict

From:http://www.unesco.org/new/en/culture/themes/illicit-trafficking-of-cultural-property/unesco-database-of-national-cultural-heritage-laws/frequently-asked-questions/definition-of-the-cultural-heritage/

---

9.   Gianighian and Paolucci, *Il Restauro in Giappone: architetture, città, paesaggi*.

In 1871 was enacted the: **Proclamation for the Protection of Antiques and Old Properties**.

The intention of this law was to conduct surveys and registering and collecting antiques in thirty-one specific categories, except immovable ones[11]. From this moment, started a lot of campaigns which allowed to find dispersed objects around the cities. One of these was the campaign led by the Ministry of Education in the regions of Osaka and Kyoto.

As a result of these studies, were allocated the funds for the **Preservation of Ancient Sanctuaries and Temples** (from 1880 to 1894). Subsequently, passed into the **Ancient Shrines and Temples Preservation Law** (1897). This law states that owners of the properties are allowed to apply for grants to maintain their preservation.

From 1913, the Protection of Antiquities moved from the Minister of the Interior to the Minister of Education, who is still responsible today.

Until that moment, the historical timeline (next page) shows that were negletted the Natural Places.
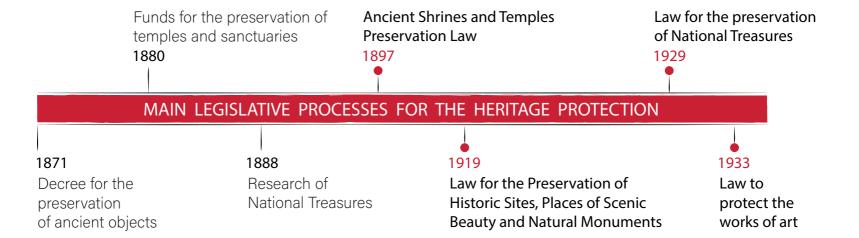
This prompted various reactions as the Japanese region is surrounded by natural landscapes.

Thus, their attention was stimulated by a group of researchers who spread the knowledge of the existence of protection systems in the United States and in some European countries.

Thus, in 1919 was enacted the **Law for the Preservation of Historic Sites, Places of Scenic Beauty and Natural Monuments** (1919–1950) that were at risk of deterioration[12].

The management of these historical sites and others could be left to local governments.

In addiction, financial funds were supported by the government which also had the authority to limit actions that could deteriorate the sites.

---

11. Kakiuchi, "Cultural heritage protection system in Japan: current issues and prospects for the future".

12. Ibidem.

Funds for the preservation of
temples and sanctuaries
1880

**Ancient Shrines and Temples
Preservation Law**
1897

Law for the preservation
of National Treasures
1929

MAIN LEGISLATIVE PROCESSES FOR THE HERITAGE PROTECTION

1871

Decree for the
preservation
of ancient objects

1888

Research of
National Treasures

1919

Law for the Preservation of
Historic Sites, Places of Scenic
Beauty and Natural Monuments

1933

Law to
protect the
works of art

In 1930, Japan has to face the economic depression, which was aggravated by the devaluation of yen. Thus, in order to resolve the current situation, it was enacted a Law to prevent the exports of important artworks. The **Law for the Preservation of Important Objects of Arts** stopped the exports in order to preserve these antiques until could be designate as a National Treasures. Under this law, were restricted the exports about not only the artworks but also regarding the buildings (able to be dismantled and reassembled). In addiction, the intention was to inhibit the illegal exports. Thus, the result was to focus the attention on a various categories (also integrating pre-war tangible heritage), to restrict the exportation and to undertakes a range of measures for protection which includes both preservation and utilization. Some year later, at the end of the WW II, Japan was devasted and it needs to rebuild the razed cities. This factor seems to slow down the process of heritage designation which had already been interrupted during the war.

However, in 1949 an accident fire at the oldest wooden structure of the Horyu-ji temple, destroyed outstanding wall paintings in its Buddha Hall.
This event induced a strong national feeling for cultural protection, which led to the enactment of the **Law for the Protection of Cultural Properties** (LPCP) in 1950.

Beyond the national government, this innovating protection system contributes to the democratization of the country because local government can also designate the cultural properties. Indeed, **LPCP** can be shared by the entire nation, while the other properties that having regional interest needed to be protected by the local government.

As shown in the next diagram[13], were introduced three categories of Cultural Properties to be protected by LPCP which in turn are divided in subcategories.

---

13. Kakiuchi, "Cultural heritage protection system in Japan: current issues and prospects for the future".

1. TANGIBLE CULTURAL PROPERTIES

▪movable cultural properties
such as crafts, paintings, folk materials, sculptures
▪immovable cultural properties
that means buildings and structures

2. NATURAL CULTURAL PROPERTIES

▪not only monuments
but also historic and natural sites
▪places of beauty
such as gardens, gorges, and mountains

3. INTANGIBLE CULTURAL PROPERTIES

▪stage arts, music and theatrical performing arts

In 1951, Japan call for the International Community through the ratification of the San Francisco Peace Treaty and its membership in **UNESCO**.
Later, when Japan join the world body, its diplomacy was declared to be governed by "Three Principles":

▪ identifyng the role of the United Nations,
▪ combining forces with the free world,
▪ fortifying Japan's position as a member of Asia.

In 1954, was done a revision of the LPCP reclassifying the above-mentioned three categories of cultural properties into four categories, where folk materials were separeted from the first category to add a new one.

In 1960, due to the economic growth, this emerging interest for the heritage protection has to face different kinds of social problems such as excessive centralization and depopulation of rural areas.
Furthermore, during this new transitional phase, determined by changes in the industrial structure and in people's lifestyles, were lost the use of traditional costumes and some folk arts.

In 1965 born a civic movement to protect not only the historic buildings but also the historic landscapes. The movement was triggered by the building of houses in the backyard of the famous Tsurugaoka Hachimangu (fig. 9), a city near Tokyo. This "rebellion" led to public support not only for historical buildings but also for historical landscapes. As a result, the government makes a review of the **Law for the Preservation of Ancient Capitals** such as *Kyoto*, *Nara* and *Kamamura*[14].

---

14. Kakiuchi, "Cultural heritage protection system in Japan: current issues and prospects for the future".

Following these changes, Japanese people have increased the importance to preserve the historic atmosphere and cohesion for local identity. In order to safeguard the tradition reflected on both buildings and arts, Japan confirm its partecipation to the **UNESCO World Heritage Convention**.

Thus, in 1992 heritage sites of Japan has been inscribed on the **World Heritage List**. Neverthless, many buildings and structures with significant historic value that, in the past, were not designated by LPCP were lost.

During these years, consisting of continuous revisions due to uncertainties about which properties were appropriate for the list, were made several changes to the previous laws. Consequently, in 1996 the LPCP was modified in order to registrate the traditional buildings that, due to the modernization and their different styles, were in danger of demolition.

In 2004 the protection system, encouraged by registration on the World Heritage List, was extended to Monuments and Folk Cultural Properties. According to the Unesco website, today Japan has 23 World Heritage Sites, 19 cultural and 4 natural.

Later, between 2006 and 2010, the International Council on Monuments and Sites (ICOMOS) organized eight relevants workshops in different cities of the world[15]. The purpose of these meetings was to detect the new threats and challenges to historical cities and rethinking their contemporary role. The action's plan saw the inclusion of concepts such as cultural diversity, intangible heritage and the role and traditions of local communities.

RELEVANT WORKSHOPS TO PLAN THE HERITAGE CONSERVATION:

JERUSALEM / June 2006
PARIS (UNESCO's seat) / September 2006
SAINT PETERSBURG, RUSSIAN FEDERATION / January 2007
BRAZIL, Olinda / November 2007
INDIA, Chandigarh / December 2007
PARIS (UNESCO's seat) / November 2008
ZANZIBAR, Stone Town / December 2009

As shown in the next page, the World Bank's List identifies several historical sites, monuments, landscapes, prefectures, which should be protected. Among these, the historical site of Kyoto city requires a special attention. It holds great importance in the country's history, especially since it was the capital for almost a millennium (from 794 to 1869). The old Heian-Kyo, than the other cities of Japan, contains a relevant agglomeration of historic buildings.

---

15. From https://whc.unesco.org/en/list/

THE 23 UNESCO WORLD HERITAGE SITES OF JAPAN

Cultural (19)

- Buddhist Monuments in the Horyu-ji Area, 1993
- Himeji-jo, 1993
- Historic Monuments of Ancient Kyoto, 1994
- Historic Villages of Shirakawa-go and Gokayama, 1995
- Hiroshima Peace Memorial (Genbaku Dome), 1996
- Itsukushima Shinto Shrine, 1996
- Historic Monuments of Ancient Nara, 1998
- Shrines and Temples of Nikko, 1999
- Gusuku Sites and Related Properties of the Kingdom of Ryukyu, 2000
- Sacred Sites and Pilgrimage Routes in the Kii Mountain Range, 2004
- Iwami Ginzan Silver Mine and its Cultural Landscape, 2007
- Hiraizumi – Temples, Gardens and Archaeological Sites, 2011
- Fujisan, sacred place and source of artistic inspiration, 2013
- Tomioka Silk Mill and Related Sites, 2014
- Sites of Japan's Meiji Industrial Revolution, 2015
- The Architectural Work of Le Corbusier, 2016
- Sacred Island of Okinoshima and Associated Sites, 2017
- Hidden Christian Sites in the Nagasaki Region, 2018
- Mounded Tombs of Ancient Japan, 2019

Natural (4)

- Yakushima, 1993
- Shirakami-Sanchi, 1993
- Shiretoko, 2005
- Ogasawara Islands , 2011

From © UNESCO World Heritage Centre website

京都市
Kyoto

Kyoto Prefecture

KYOTO

Osaka

Tokyo

1.4   Kyoto and its history

Japan's territory (fig. 12) is known for its prefectures that are 47 and these divisions were introduced by the Meiji governement in 1871. Even if the term **chihō 地方** (region) has only formal character, Japan established eight major regions, respectively: **Hokkaido, Tohoku, Kanto, Chubu, Kansai, Chugoku, Shikoku, Kyushu**[16].

Fig. 14. Japan's territory and its prefectures
Illustrations made by the author.

16. From https://nationsonline.org/oneworld/japan_prefectures.htm

Among these eight regions which offers landscapes, cities, folklore and typical products confirming the variety that characterizes the Japanese archipelago, Kyoto is located in the Kansai region, in the central-western part of the Honshū island.

Its history has begun in 794 A.D., when Emperor Kanmu develops the intention to relocate the capital which, at that time, was Nagaoka-kyo.

The decision to select **Heian-kyō** was adopted because it respected all the factors needed for being an appropriate and harmonious place for a capital, with the idea of Chinese-style state[17].

Before starting to describe the city's land division, it's essential to describe two different phases of spatial planning: the *conceptual* and the *real plans*.

1.4.1 The conceptual plan

As anticipated, the government followed the Chinese model. The system was called '**Ritsuyō**' and saw the Emperor at the top with the institutional bodies administered by a small population of aristocrats. High positions were not available to everyone, in fact this depended by the rank. In essence, unlike in China, rank was a matter of birth and not of merit.

The new capital system required the seat of the statutory government, home and ritual center of the emperor and the civil aristocracy, and the location of numerous official buildings and monuments that facilitated imperial pageantry, bureaucratic administration, and diplomacy. Temples and shrines were not considered. agriculture was forbidden and commercial activity very poor.

The new Heian-kyō was to be the gravitational fulcrum (embodied by the emperor and his palace) in which the most important positions revolved. Everything was to be inclined to a formal code, from how people lived to how they built. The urban planning structure had to be characterised by wide streets and appropriate architectural styles.

However, the complexity of these formal codes, was summarised in a simple and rational **grid**.

The imperial palace was connected by the main street **Suzaku-ōji** (**朱雀大路**) which divided the capital into symmetrical administrative zones, the right (**Ukyō**) and the left (**Sakyō**). Its extension continued for 3.8 km and was bordered by perfectly spaced willows over a width of 85 metres. Its use was reserved exclusively for the emperor and their official members, with an extension from the Palace to the center of the city. Furthermore, the city was further divided by two distinct types of roads: the main called ōji (**大路**) and minor called **koji** (**小路**). Thus, the symbolic feature of this city was its rational system of the grid, which made it symmetrical and geometric[18].

---

17. From: https://www.britannica.com/event/Heian-period

18. Stavros, *Kyoto: An Urban History of Japan's Premodern Capital*, 8.

Daidairi (大内裏, palace in the center) and the cityscape of Heian-kyō (miniature model at the Kyoto City Life-long Learning Center).

The geometric grid drew a huge rectangle, with an area of 4.5 km (from East to West) x 5.2 km (from North to South). In the centre was placed the Daidairi which was the greater palace, surrounded by walls and fragmented by 14 gates (in red).

Regarding the blocks, it's possible to suppose the intention of Japanese people of planning a grid made by perfect blocks, equal to each other. But there is always a plus point. The issue's blocks has its roots in earlier history, dating back to when the Japanese tried to imitate the Chinese model. This was made by marking the side with strings of rope perpendicularly twisted.

Dairi

Suzaku

Through this method the intention was to create perfect blocks. Later, it emerged a problem adding the roads layer because the blocks were no more squared. This natural process of diversification of block sizes, previously conceived as equal measures, created disparities in the land.

The diagrams below shows the differences of the grid form between **Heijō-kyō** (fig. 15) and **Heian-kyō** (fig. 16). The numbers identify widths of blocks and roads in meters, useful to understand the irregular blocks.

Fig. 15. Heijō-Kyō, Nara.
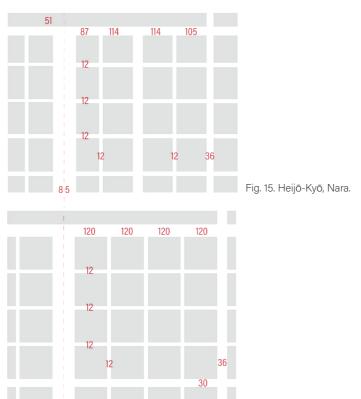
Fig. 16. Heian-Kyō.

Illustrations made by the author.

To ensure that the machi were assigned, in form and proportion, to the right social rank, it was created a hierarchy:
▪ **Lower** rank of the aristocracy (1/4 of machi)
▪ **Middle** rank of the aristocracy (2/4 of machi)
▪ **High** rank of the aristocracy (the whole machi).
Nevertheless, problems arose when it was realized that the size of the blocks was obviously different.
It happened that the highest rank preferred the land along the main roads, but often those lands were smaller than those of their social inferiors. As a result, due to these social disparities, the planners have rethought the strategy, starting from the size of machi and not from the grid system. Thus, they set a specific area of machi, respectively 40 jō to a side, a length of about 120 meters. The result was that each block was a perfect square with an area of 14,400 sqm (fig. 15). Consequently the streets came later, after the arrangement of the machi, which differed in width. At the end, the aristocrats took possession of large blocks, which could have differences in size (from 1/4 to the whole machi); while for the lower ranking residents the machi units were 450 sqm and for this were renamed *henushi* [19].

▪ **3rd rank and higher** : 1 machi (14,400 sqm)
▪ **4-5th rank** : 1/2 machi (7,200 sqm)
▪ **6th rank and lower** : 1/4 machi (3,600 sqm)
▪ **commoner** : 1 henoushi (450 sqm)

19. Stavros, *Kyoto: An Urban History of Japan's Premodern Capital*, 13.

1.4.2 The reality plan

Some time later, urban phenomena emerged and changed the aspect desired by the capital.

The intention is not to deny what was previously said, but to deal with some perplexities regarding history. Excluding the Daidairi, according to the original grid plan, Heiyan-Kyō planned to possess 1,136 machi. But, by looking at historical documents in 819, it possible to discern the presence of a large number of desert land. Rather than leave these fallow lands, authorities offered them to people who created agricultural lands within city limits. As mentioned at the beginning, agriculture was forbidden and this created a series of violations of formal codes. However, it emerged that the lands of the west were marshy and prone to flooding and this created an exodus of people from Ukyō to Sakyō. This migration naturally converted the lands from residential to farmlands. In addition, the excavations conducted revealed the lack of roads and blocks planned by the urban grid (with the exception of the main Suzaku). Finally, the blocks were not equal as planned because ordinary residents didn't agree with the central planning system. Indeed, they adapted the urban landscape to their needs subdividing the machi with internal streets to have an access to the surrounding roads. This changed the machi's appearance (they became longer). These new social units were called chō and the medieval era bears witness to this. For the commoners, the streets play a major role in allowing for more commercial activity.

This changed the machi's appearance (they became longer). These new social units were called chō and the medieval era bears witness to this. For the commoners, the streets play a major role in allowing for more commercial activity.

As a result of these changes, the streets were the glue that joined the houses which now faced each other[20].

---

20. Stavros, *Kyoto: An Urban History of Japan's Premodern Capital*, 31-32.
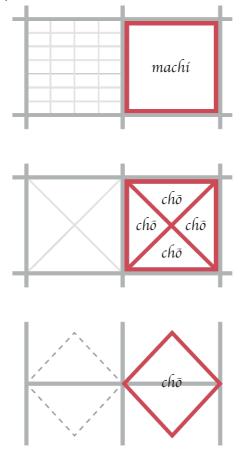
Fig. 17. From machi to cho. Representational diagrams of the block's evolution. Illustration made by the author.

Following this pattern, the medieval era saw the evolution of several neighbourhoods that still exist today as historical witnesses.

The medieval era (中世) settled as a pre-modern period and urban development continued to support the legitimacy of the Emperor and the State. This epoch is divided into three different periods and saw urban development that reflected the rejection of the earlier classical model, discussed above.

M	1185 - 1333	Kamakura period
E		
D		
I	1333 -1568	Muromachi period
E		
V		
A		
L	● 1568 - 1600	Azuchi – Momoyama period
E		
R		
A		

The **Azuchi–Momoyama period** takes the name from Azuchi Castle, which was built by Oda Nobunaga. The prospects designated for this period had a flourishing desire to rebirth Japan and Nobunaga chose the site, on the shores of Lake Biwa, where he installed his new palace.
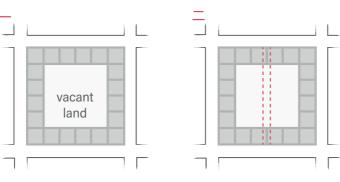
Despite his leadership's apparent success in unifying Japan, he was killed by Akechi Mitsuhide, one of his officers during an attack on his camp. Subsequently Toyotomi Hideyoshi, which was one of his top generals, revenged his death by suppressing the revolt of Akechi, and became the successor of Nobunaga[21]. The Azuchi Palace on the hill (fig. 18) was burnt down, never restored.

Instead, Momoyama takes the name from Fushimi Castle, also known as Momoyama Castle, built by Hideyoshi. After Nobunaga's death, Hideyoshi achieved his goal of unifying Japan but not only.

He succeeded in being a leader, both socially and in terms of urban planning.

Fig. 18. A drawing of Azuchi Castle.
Source of public domain.

21. Takayanagi, *The Glory that was Azuchi*, 515-524.
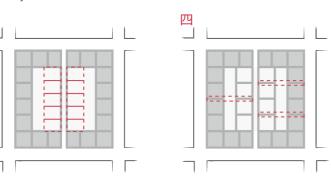
Indeed, he made a survey on the land and introduced new legislation in order to improve the use of the vacant land located in the centre of the city blocks. In the middle of this land he placed small roads called Roji (fig. 19). Today roji are the alleyways that characterize Kyoto[22].

Along this way, the Medieval Kyoto has an urban development pattern of two distinct areas: **Kamigyō-ku** (上京区) and **Shimogyō-ku** (下京区). The two areas are poles apart, both in terms of geography and urban development (fig. 20).

一

vacant land

In the previous plan all buildings had to face the street, thus were naturally created free land courts.

二

Therefore, new plan called for new roads to pass through, in order to inhibit the vacant land.

三

Rather than roads, were placed new buildings, in order to meet the demands of the people.

四

Finally, in order to better connect the whole, were created the above-mentioned roji.
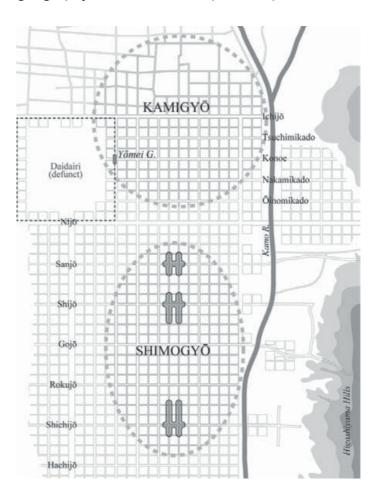
Fig. 19. Illustrations made by the author.

22. Redesigning of Kyoto conducted by Toyotomi Hideyoshi. From http://www.hachise.com/kyomachiya/histories/histories.html

Fig. 20. From Stavros, *Kyoto: An Urban History of Japan's Premodern Capital*, 50.

The southern district of **Shimogyō** was considered as the 'lower capital', its development was focused on the oriental market and the land was filled with stalls and laboratories bordering the streets.
This dynamic was quite popular.

Kamigyō reincarnated aristocracy, nothing compared to the commercial areas. Indeed, its area had a greater development due to the concentration of palaces of the aristocracy and emperors of the past. Located in the Northeast of the capital, Kamigyo is close to the defunt Imperial Palace of Daidairi and perhaps this is also why it had a greater development, due to the lords who had to reside near the area.
In this regard, this period saw the beginnings of a new type of multi-purpose buildings where the central part was used as homes, while the back parts (which mainly faced the inner courtyard) were generally used for storage: the *machiya* house.

What is perplexing is that today the greatest concentration of these houses is in the northern quarter, the one considered elitist.
Although the machiya reflected commercial needs, the greatest concentration was in the north-eastern district[23].
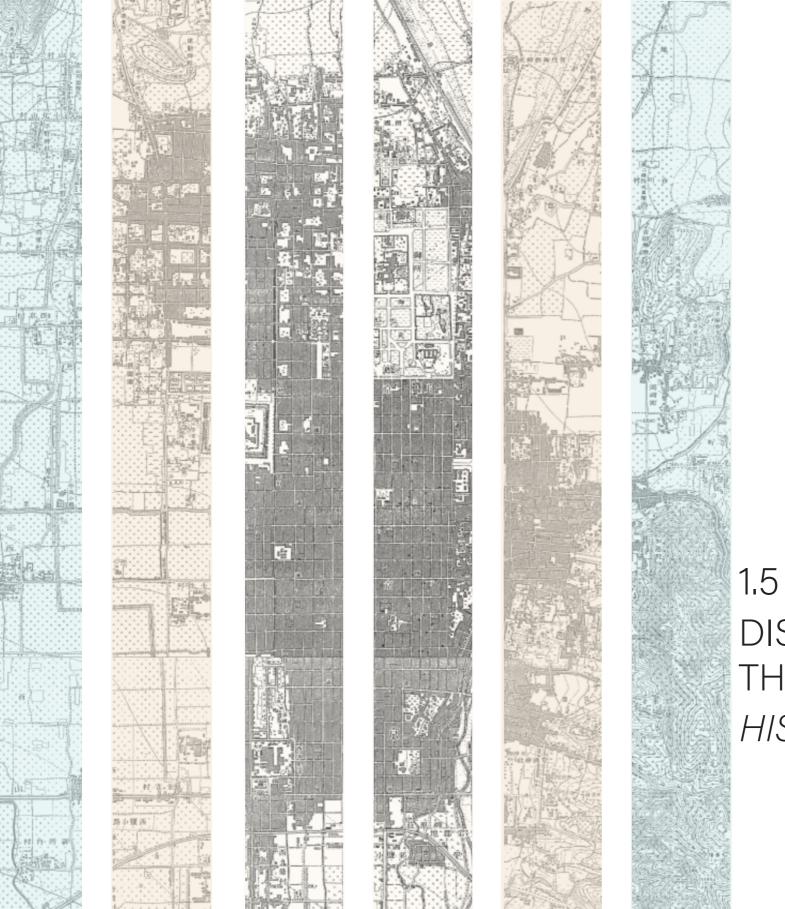
From here a number of curiosities unfold, leading to an in-depth examination of how the urban planning of the city of Kyoto has developed and how these houses have taken over the surrounding neighbourhoods even if they are mainly inhabited by merchants.

The historical itinerary has been useful to contextualise the main eras that are fundamental to this study in order to articulate the discourse regarding urban development.
Consequently, the historical maps available in the digital archives are reported in order to observe what were the changes that shaped the land and, as a result, the birth of the so-called kyo-machiya.

Their preservation still makes it possible to study what changes have taken place in the past.
For last, it allows to learn more about how they were conceived architecturally and materially and what different phenomena they have to deal with.

---

23. Stavros, *Kyoto: An Urban History of Japan's Premodern Capital*, 44-45.

1.5

DISCLOSING
THE
HISTORICAL
MAPS
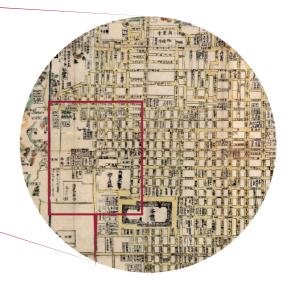
Through overlapping historical maps made available by different archives, respectively:
▪ *Digital Archive Ritsumeikan University*
▪ *Bibliothèque Nationale de France - Gallica*
▪ *LUNA - Japanese Historical Maps*
it will be possible to perceive the changes previously mentioned, showing that the expansion of the land was an evolving process and the key to the development of Heian-kyō.

Dating from 1687, this colourful map illustrates the old Heian-kyo when it was still the capital.
The road axes (in yellow) are crossed in a perpendicular pattern and circumscribe the lands.

Focus on the old Daidairi. It was burned many times and reconstructed until 1227, until it was definitively destroyed by fire (fig. 18). In 1334, Emperor Go-Daigo issued an edict to rebuild it but there were no resources to support the project.

Fig. 21. Hayashi, Yoshinaga, 1687, Shinsen zoho Kyo oezu. [between 1734 and 1739], Series No 2, Kyoto (Japan), Kyo : Hayashi-shi Yoshinaga.
From LUNA - Japanese Historical Maps.

However, before proceeding and studying the other maps, it's useful to understand the Daidairi structure and its relationship with the urban plan (fig. 22).

In 794 one of the first and most important structures created was undoubtedly the Imperial Palace (fig. 23). The palace was located at the Northern centre of the rectangular Heian-kyō, facing south. The main entrance to the palace was the gate Suzakumon, which formed the northern terminus of the great Suzaku Avenue (the main street in red).
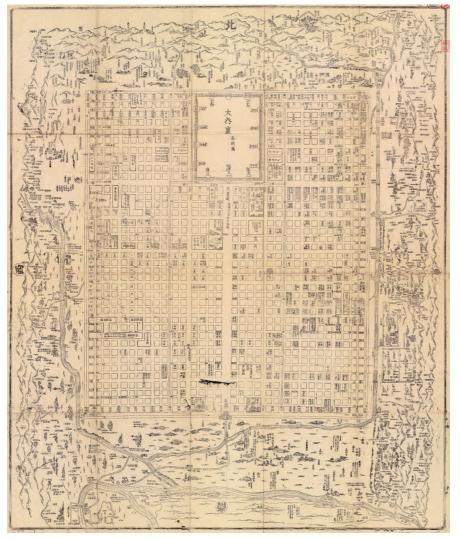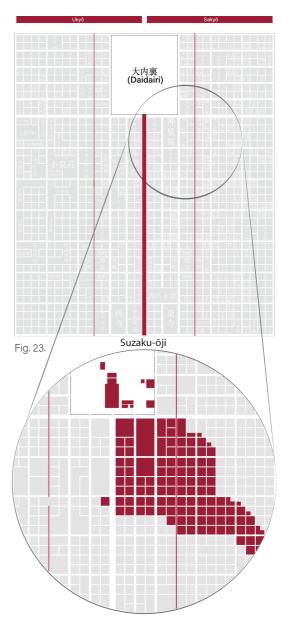
Fig. 22. Ogawa, Tazaemon, 1800, Kyo mizu Karaku okozu, Kyoto (Japan), Ogawa Tazaemon.
From LUNA - Japanese Historical Maps.
Fig. 18. Focus on the damaged areas by the Angen Great Fire.
Illustration made by the author.

Fig. 23.

Suzaku-ōji

As history evolves, the maps follow suit. The division of land and the road layer became clearer and more visible (fig. 24). Indeed, the main street of Suzaku can be easily identified (north-west in yellow). Both in the previous map and in this one below, the Nijō Castle is visible (circled in red), close to the old Daidairi area. Nijō Castle (二条城) was built around the 1601 and completed in 1626 (fig. 25). This fortress served as home to the shōgun for 270 years (until the Meiji Revolution, when the Tokugawa era ended-1867).
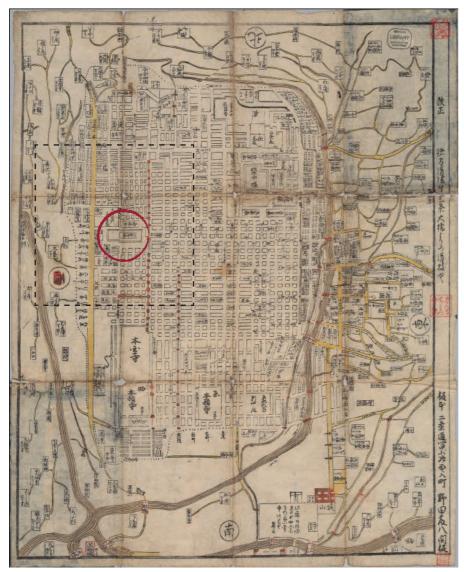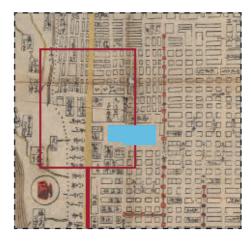
Fig. 24. N. Tohachi, 1763, Horeki kaisei Kyo ezu michinori tsuki : zen, Kyoto (Japan), [Kyoto] : Noda Tohachi. From LUNA - Japanese Historical Maps.

Focus on the old Daidairi area (in red) and on the Nijō Castle (in blue) that still exist today and it's one of the seventeen Historic Monuments of Ancient Kyoto, designated by UNESCO and added to the World Heritage Site.

Fig. 25. Nijō Castle.
From https://www.giapponeinpillole.com/blog/il-castello-nijo

Therefore, the medieval era played the decisive role in the division of land, which can be clearly displayed on the first map. Moreover, it's evident that the lands had a different size from the beginning, both because the hierarchy of the ranks demanded it and because the addiction of roads layer could not accommodate it. The second map emphasises the location of Nijō Castle and the new position of the Emperial Palace (Daidairi), moved and reconstructed permanently in the North east in 1855.
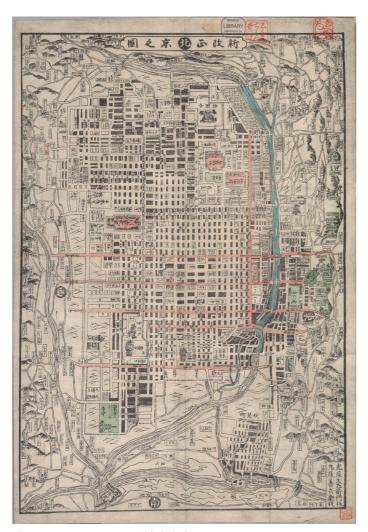
Fig. 26. T. Kyuzaemon, 1831, Shin kaisei Kyo no zu, Kyoto, Toraya, Kyuzaemon. From LUNA - Japanese Historical Maps.
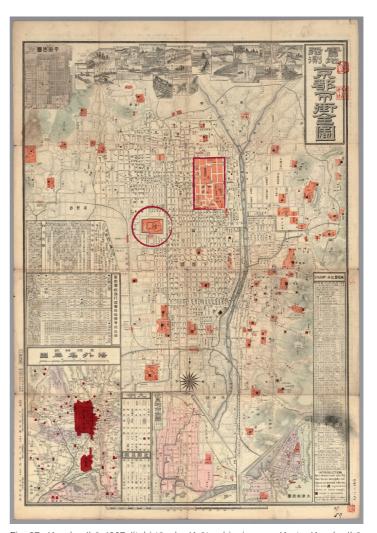
Fig. 27. Kusaka, Ihē, 1907, Jitchi tōsoku Kyōto shigai zenzu, Kyoto, Kusaka Ihē. From LUNA - Japanese Historical Maps.

SUPERIMPOSING THE OLD GRID OF HEIAN-KYO OVER NEW KYOTO

To illustrate this, superimposing the old planned grid on Kyoto reveals that they are far from each other. Zooming in, the "grey cloud" shows the densification of the lands and emphasises the eastern part which was visibly more developed than the western part (related to the fact that in the west the land was more marshy and prone to flooding, so less workable and less suitable for building).
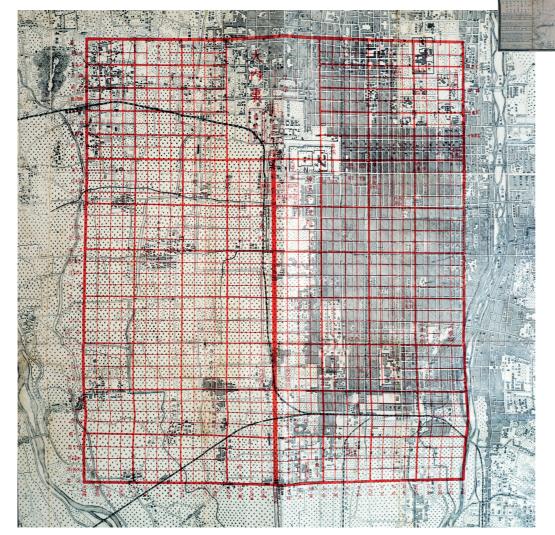
Fig. 28. H. Kenjiro and M. Shousuke 1903, Grid of Heian-kyo superimposed in red over Kyoto City as of 1903.
From https://crafttabby.com/explore/heiankyo-superimposed-map

Finally, are shown a series of maps (from **Digital Archive of Ritsumei**) dating from the Meiji Era until the end of the Second World War, when restarts the modernization process. The layer superimposed on each map is intended to show the evolution of the urbanization process.

1829
25 ys
Meiji
era

1912
1 y
Taisho
era

1922
11 ys
Taisho
era

1953
Showa
era

1.6   Introducing Kyo-Machiya type as witnesses
of the past

The information provided so far has been useful in contextualising the history and evolution of urban planning regarding the pre-war and post-war periods. In fact, through the historical maps it has been possible to notice how the built-up area has densified towards the north-eastern part.

Medieval Kyoto changes the different perspectives and this is also reflected in the town planning.
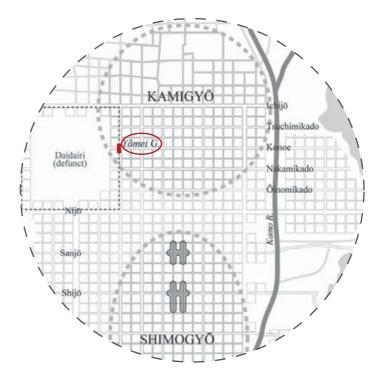
The hierarchy established the subdivision of the land and with it came the different dwelling houses: the **Kyo-Machiya**. The concentration of these traditional houses was greater in the city of Kyoto and even today it is possible to see a densification in the district of Kamigyo-Ku. While the first was considered as the élite part, because it was close to the Imperial Palace and home to the aristocracy, the second, located in the southern part, retained the identity of the lively merchant population.

Before analysing the richness that this district has to offer, it is important to understand why Kimogyo tends to be more aristocratic than popular.

There could be many reasons for this and there are no sources that specifically analyse them.

First of all is probably related with the position, in fact the district is very close to the Imperial Palace. In addiction, it could be a consequence of the possibility of the land, because already in the past there was an exodus of people due to the terrain conditions, marshy and wet[24].

Despite these facts, it seems that the élite people didn't give so much importance to this factor. Indeed, the proximity to the Kamo River meant that there was a constant risk of flooding and this always caused a constant widespread damage. Thus, *what could be the most plausible explanation of this development? Why the northern part was more suitable for housing aristocrats?*

Fig. 29. Focus on Kamigyo and Shimogyo.
From Stavros, *Kyoto: An Urban History of Japan's Premodern Capital*, 50.

24. Stavros, *Kyoto: An Urban History of Japan's Premodern Capital*, 48-49.

The reason why the east side of the Daidairi was more favoured was related to a factor of "convenience". Specifically, during the Heian period, those who worked in the palace couldn't live there. Thus, for convenience, they preferred to live nearby. Since the Suzaku-oji was the central door of the palace but could only be used for formal occasions, officials used the Yomei door (fig. 27) at the side of the palace. Finally, this could be read as a key of why the élite were denser in the northern part.

The study of this district is aimed to identify the Kyo-Machiya, the traditional wooden houses which are the face of Kyoto's history.

Most of the machiya were built from the end of the Edo period to the Meiji period.

Machiya are closely linked to craftsmen and merchants and were considered multifunctional because they served as both a residence and a place of work.

Thus, another question arises, if Kamigyo is considered an aristocratic district, how did these houses of popular image settle there? It seems contradictory but there is an answer.

It is natural to presume that Shimogyo, considered the lower capital, saw the densification of these houses very quickly, as the district was home to all workers of the lower classes.

However, considering the size of the aristocratic houses, it is possible to imagine the demand for staff to manage economic as well as domestic affairs. Consequently, these houses were created in the neighbourhood, which in documents appear as blocks of warehouses (mikuramachi), as a dwellings of households staff members in which appears storehouses, kitchens and other mansions in a separate area[25].

Originally, the capital plan made no provision for trading activities but since the central power was not so strong, this prohibition was commonly ignored. The Kyo Machiya became a reflection of the dynamism of the common people and were set up shops, stalls, workshops, warehouses and others. The wider streets were the ideal places to open shops and workshops because the land was wider and more regular, and gradually the commoners occupied small plots inside the formal blocks (machi). This transition is clearly visible in the medieval period, not only in the "appropriation" of pieces of land but also in the style of the houses. Since they were multifunctional, their appearance also reflected this plurality of styles, with an excess of decoration and ornamentation and bright colours.

As proof of this there is not much graphic documentation. Therefore, it will be shown drawings which can give an idea of what they were the machiya compared to that of the Edo and Meiji eras.

25. Shively and McCulloug, "The Cambridge History of Japan".

1.6.1
TYPICAL
KYO-MACHIYA
DURING THE
*MEDIEVAL
ERA*
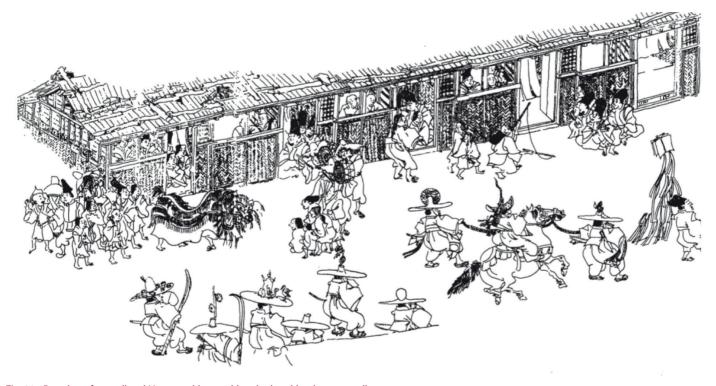
Fig. 30. *Drawing of a medieval Kyoto and its machiya depicted in picture-scrolls.*
From Morris, *Kyo-Machiya: Tracing the Development of the Traditional Town Houses of Kyoto Through the Medieval Centuries, Vernacular Architecture,* 1-23.
https://doi.org/10.1179/174962906X158219
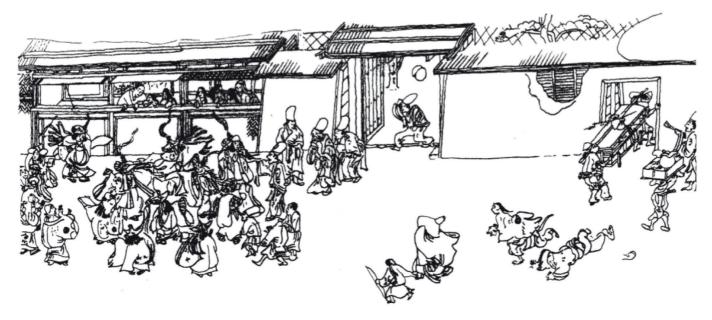
Fig. 31. *Drawing of the street frontage of an élite residence with festival-viewing stand.*
Ibidem.
https://doi.org/10.1179/174962906X158219

Fig. 32. *Kyoto with the bridge over the Kamo River. On the right a machiya with an open shop front.*
Ibidem.
https://doi.org/10.1179/174962906X158219
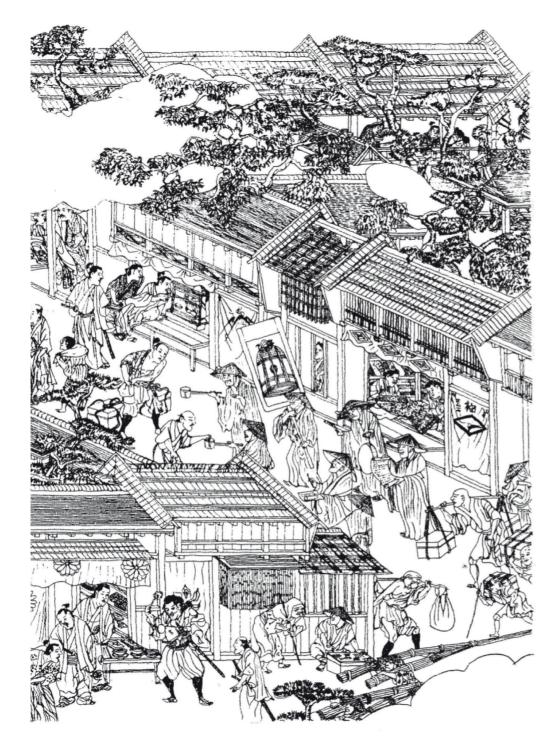
Fig. 33. *A typical machiya of the Momoyama Period.*
From Morris, *Kyo-Machiya: Tracing the Development of the Traditional Town Houses of Kyoto Through the Medieval Centuries, Vernacular Architecture,* 1-23.
https://doi.org/10.1179/174962906X158219

Fig. 34. *The street front of a nineteenth-century machiya.*
Ibidem.
https://doi.org/10.1179/174962906X158219
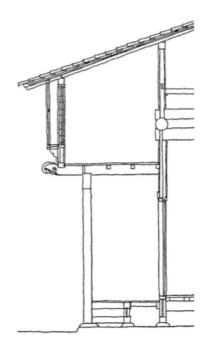
Fig. 35. *Section of the front portion of the Sanayama House, Nagano Prefecture (1766).*
Ibidem.
https://doi.org/10.1179/174962906X158219
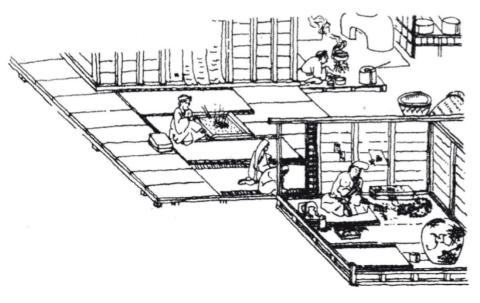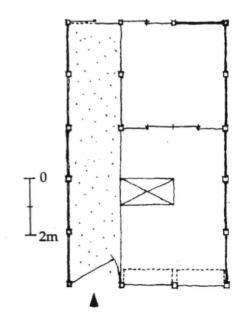
Fig. 36. *A fragment showing the interior of a medieval artisan's dwelling.*
Ibidem.
https://doi.org/10.1179/174962906X158219

Through the transition to the modern era, aesthetic also undergoes changes. However, the aesthetic sensibility changes also because of a series of accidental events that occur, such as fires (more in chapter 3).

For Kyoto, the threat of fire was nothing new. Even before the advent of the modern era, the city had already suffered several attacks, mainly aimed at the Imperial Palace. Thus, they were isolated incidents that did not damage the surrounding areas.

The first real fire on the list of damaging events for the city of Kyoto occurred in 1620. Indeed, on the 2nd of April a fire broke out in the city, damaging several areas and, only a few days later, (on the 6th of April) another series of outbreaks broke out. There is little evidence of these two events, only that they certainly caused damage to houses[26].

Thus, *when does the need arise to think of new solutions that fit into existing houses to mitigate this kind of threat?*

This decision was triggered by a disastrous event occured in 1673. It's not a coincidence that, in the following year, there was the invention of a new type of roof tile, lighter than the previous ones, able to reduce fires and also to align the urban landscape, since it was a choice shared by most of the inhabitants (fig. 37-38).

From **Hongawara-buki (本瓦葺)** roof tiles:

to **Sangawara-buki (桟瓦)** roof tiles:

---

26. Shively and McCulloug, "The Cambridge History of Japan".

Fig. 37. Round and square tiles are laid down alternately.
Fig. 38. Lighter form of roof tile because is square but undulates from concave to convex.

END OF CHAPTER CONCERNS

Despite this significant danger, Japan has always placed great trust in wood. But, what keeps this people tied to the wood is not only about the connection with the nature, and it is necessary to be aware of other factors by studying them.

Along this line, a number of questions arose and led me to necessarily investigate through the readings of books, documents, papers, thesis, japanese articles, *why*, despite the constant danger of fire, *these people persisted in resisting it, finding solutions rather than replacing the wood material?* The answer is not immediate, I needed a lot of time to process it, or rather, to interpret it on my own way.

Taking a closer look at this country, it becomes clear that the threats are not just fires. Indeed, it is common to hear how the Japanese territory is "favourable" to earthquakes, tsunamis and all those terrifying natural phenomena that threaten both the built environment and people's lives. And, despite the spontaneous thought, wood has an excellent response to earthquakes. Indeed, it is one of the most advanced materials in this field.

But, that wasn't enough for me.

This is because recognising wood as a sustainable material and as a good performer against large-scale phenomena is a current theme, dated to the modern days.

In pre-modern history, concerns about earthquakes and fires never played a major role in building until natural events started destroying pieces of cities. Japan uses this material since ancient history and even during the rise of the modern era, many efforts have been made to try to prevent this construction practice from disappearing.
Thus, I stopped there and I further researched why wood has always been a trademark of this country. Besides understanding the potential that Japanese people understood before Westerners, I wanted to translate everything with key words that could explain why, in its essentiality and purity, wood is a fundamental material in Japanese building practice.

What factors have most influenced the use of this material in the past, leaving aside for a moment the issue of earthquakes and sustainability?
The second chapter will aim to explain the following points in more detail.

Nature   *Resistance*   *Climate*
(related to the place)

WOOD

Reversibility
(construction techniques)   *Availability*
(in terms of resources)

2. Wood as a primary material in Japanese culture and a conservation approach to manufacturing techniques

Shinto priests during a ceremony.

2.1. Wooden profile and its reversible solutions

The idea of Japan without its wooden houses, although open to the modern era, would be like erasing centuries of history. For this reason, wood use is one of the distinguish features of Japanese architecture. Its use dates back to antiquity and derives from its territory which has always been recognised as seismic. Consequently, it was not possible to build buildings out of stone, so wood was preferred[27]. However, Japan leveraged the qualities of this material to turn resilient houses against calamitous events.

For the purpose of understand why the wood became the predominant construction material in Japan, it's necessary to go deeper into the keywords mentioned above to understand the potential that links this country to the wood.

27. Gryko, *"MANUFACTURING THE WOODEN CITY: A study into the development of wood construction in Japan"*, 44.

2.1.1 The joining method

As a matter of facts, there is no real historical period in which this material can be included but it can be stated that the Japanese handcrafts was established when the first civilization settled on the Japanese archipelago.

Traditionally, the purpose of handcrafts was to create objects more for usefulness than aesthetics. They have chosen not to overwork the wood in order to enhance its natural beauty and it's rare for wood to be painted, as it is preferred to leave it natural to enhance its grain. In addition, always to respect this material, they refused from using nails and this is mostly visible on their shrines and temples[28].

Indeed, the decision to reduce the use of metal components is due to the fact that the Japanese aimed for a pure structure. Therefore, they designed a system of joining beams and uprights that would make the frame rigid but at the same time flexible when lateral forces arrived. This system of knots that interlock the structural elements at right angles provides not only stability and safety against the arrival of unexpected horizontal shakes, but also allows the technique of assembly and disassembly of the structure in a very simple way, without causing damage of any kind.

This system use the so-called **tokyō** (斗栱) **technique**, which involves interlocking the elements as if they were puzzle pieces (fig. 39).

Tokyō (also called kumimono (組物) or masugumi (斗組)) is a system of supporting blocks (斗 or 大斗, masu or daito) and brackets supporting the eaves of a Japanese building, usually part of a Buddhist temple or Shinto shrine[29]. The number of brackets and support blocks is related to the projection of the eaves, in fact the number can be from one (system called *hitotesaki*) to six (as in the photo to the left), depending on how far the eaves grow.

The jointing method is one of the key concepts that has always distinguished the Japanese built environment, because it allows the structure to be *reversible*, rigid, safe and flexible, and permits the replacement of individual elements if they need to be repaired or restored[30].

Fig. 39. The Foguang Buddhist Temple of Wutai, in Shanxi.
28. Hugh Miller, "*Japanese Wood Craftsmanship*", April 2016.
https://www.hughmillerfurniture.co.uk/blog/japanese-wood-craftsmanship/

29. From
https://www.mvorganizing.org/how-were-traditional-japanese-houses-built/
30. Stavros, *Kyoto: An Urban History of Japan's Premodern Capital*, 43.

Fig. 40. *An old photo of Japanese carpentry working on wooden pieces.*
From Cosmic Polymath.

Fig. 41. *A modern-day craftsman at work in the workshop in Uji, just outside Kyoto.*
From ANA - Inspiration of JAPAN.

2.1.2   The importance of the frame structure

The connection between the small pieces of wood coherently fitted together provides an overall view of a frame structure which, although light, responds optimally to the needs of the country of Japan.

The frame structure has been used since the earliest constructions, so much so that it is found in dwellings dating back to the Edo period (more on this later).
The reason for the perseverance in building using this technique lies in the confidence that comes from how these structures have responded over time even to phenomena of a variable nature. In addition to having a devotion to the wooden material because it is connected to the concept of nature, because it is pure in its simplicity and easily available as a resource.

Thus, despite Western influences, the Japanese country has been increasingly oriented towards the use of a structure composed of pillars and transverse beams. Basically, the construction methods known today, which are inherited from the past and still used today in the construction of most traditional style houses, are two[31]:

- *Traditional construction method*
- *Conventional construction method*
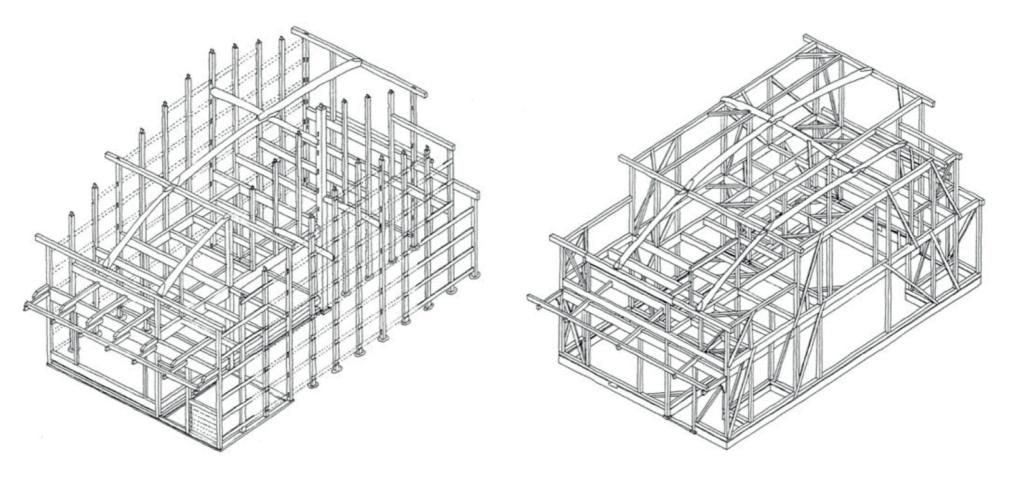
Looking at the two structures (next page, fig. 40-41) the difference is not so sudden at a glance, the whole thing lies in the detail and also in the possibilities that the conventional method exploits according to what are the possibilities that the new construction methods allow.

The traditional wooden houses, which will be analysed more specifically in the following chapters, refer to the *traditional method*, which differs from the conventional one due to the non-use of metal components (as seen in pagodas). Indeed, it has been said that the traditional method is based on the interlocking of pieces of wood that allow flexibility to the structure and at the same time rigidity is optimal in the replacement of pieces that have been damaged over time. In addition, the building is placed on a base of stones placed on the ground and there are not diagonal braces between pillars and beams.

The *conventional method* is apparently similar to the traditional one but was developed to be in compliance with the Construction Standards Act of 1950. The base uses concrete instead of stone and the structure is fixed with bolts. In addition, there is the use of diagonals to enable bracing and the pillars and beams are connected by metal plates. The integration of these components ensures a stronger and more rigid structure[32].

---

31. Van Thoor and Stroux , *"Heritage, History and Design Between East and West"*, 45-46.

32. Ibidem.

Fig. 42. Traditional construction method

Fig. 43. Conventional construction method

From Van Thoor and Stroux , "*Heritage, History and Design Between East and West*", 46.

2.2. A symbiotic relationship between
Japan and *Shizen*

For the Japanese, *shizen* is the word that refers to nature, as an entity, something spiritual. As a result of this intimate contact with nature, currents of thought have developed, based on the concept of nature, such as Shintoism. This reference is meant to clarify the devotion to nature, considered as something beyond what is usually intended. Indeed, this attitude has been reflected in other aspects, including the use of the resources that nature offers so generously.

The development of an architectural style focusing on wood is due to a number of factors, both logistical and environmental culminating in the inborn respect that Japanese people feel towards nature.

From a logistical point of view, it should be noted that Japan has a humid environment and wood compensates this kind of problem. In fact, this material is suited to absorbing moisture during excessively wet seasons and releasing humidity when the air is dry[28]. However, several solutions were adopted to solve the problem of mould growth, but often the humidity levels were very high and remained so for long periods. Nevertheless, in order to solve this problem, the solutions were also conceived in terms of design: raising the floors to prevent direct contact with the marshy ground and leaving the interior spaces as free as possible to allow ventilation. And traditional timber constructions were planned to alleviate the constant worry of deterioration. It's not by chance ancient buildings have limited furniture inside, like temples, shrines, palaces and traditional houses.

On the other hand, in terms of resources, Japan is a land of evergreen forests and has exploited this wealth, making wood the primary material and developing techniques around it.
More than half of Japan's territory is covered by forests, from which most of the timber for construction and beyond is obtained. In this respect, the **Ministry of Agriculture, Forestry and Fisheries** (*MAFF*) is committed to increasing exports of forest products, not only to prefectures but also to other countries. This commitment stems from the need to dispose of mature forest resources, with an emphasis on cyclicity to increase the use of timber.

In addition, in *2016*, 1,055 recreational forests were designated on the website managed by the Forestry Agency, with the intention of promoting the natural landscape, especially for the tourists.
Finally, in *April 2020*, a **Law on the management of Forests** came into effect to ensure the presence of forestry workers who have the skills to manage the forest system, where municipal governments or owners are unable to do so properly[29].

---

33. Gianighian and Paolucci, *Il restauro in Giappone : architetture, città, paesaggi.*

34. From https://www.maff.go.jp

Arashiyama Bamboo Grove in Kyoto.

According to what has been said so far, it's clear that great care taken in the use of this material, because wood is one of the elements embodying the idea of tradition in Japanese culture.

Consequently, in order to keep it at the forefront of events, over the years have been developed several techniques around it to meet the concerns originated from the danger of large-scale phenomena. In addiction, the assembly and disassembly is considered a conservative practice that can also be adopted on historic buildings. Specifically, this technique allows repairing the internal parts of a building, which have been damaged over time, by replacing them with new ones.

However, this conservative approach it's not about preserving the texture material but is related to the knowledge of construction techniques[30]. For instance, while in the West all efforts are employed in preserving the building to keep out the signs of time, in Japan the focus is on skills and the knowledge of of construction techniques.

Restoration is a practice that is certainly used but, since the focus is on the preservation of the *technique* rather than the original material, in Japan conservation could be also expressed through the processes of demolition and reconstruction.

This method is not intended to erase the past, but rather to enhance it, not leaving it to the signs of time.

From a Western perspective, the idea of demolishing historical building in order to rebuild it, is considered almost unbelievable; while in Japan it is an ancient practice.

This approach was already seen in the previous centuries, when the death of an emperor caused the demolition of a palace and its relocation to another area of the capital.

But, considering the efforts made in the past of mantaining the skyline characterised by Pagodas Temples and Shrines (**Law for the Preservation of Ancient Shrines and Temples, 1897**) there are a few perplexing passages because, even in the case of historic buildings, there are differentiations in terms of conservation.

In Italy, it's natural to think of restoring a building before classifying it as unrecoverable and to be demolished, and Japan also uses different techniques for conservation but they differ in some ways. And here another question arises: *what is today's behaviour towards historical sites, temples and shrines?*

---

35.   Niglio, "Sulle tracce del MA: Riflessioni sulla conservazione dell'architettura in Giappone".

2.2.1   Reconstruction and preservation: the case of Ise temple

The following explanation is not intended to suggest the idea that Japanese people have no consideration for restoration. It is necessary to distinguish between restoration and reconstruction.

The most significant case of reconstruction it could be represented by the *Ise Shrine* (Mie prefecture). Japan's Ise Shrine is a huge complex consisting of several shrines and its special feature is that every 20 years the temple is rebuilt. This is because the intention is not to keep the temple undamaged but to pass the construction techniques and the skills to to succeeding generations.

The unusual approach to this Shrine lies in the *Shinto cult*. Shintoism is not really a religion but a philosophy of life, expressed mostly through rituals. In the archaic age, before this philosophy took on "matter", the shintoism was purely symbolic. Everything was directed towards an encounter with *nature.*

On the day of the ritual, a hut was built in a small corner of the earth and the whole place was cordoned off with straw ropes, as if to establish the location of the event. After the celebration, the whole was burnt because it was a temporary dwelling set up for the gods, until they returned to heaven. Then, it became a more concrete practice, on a constructive level[31].

The care in hosting the gods lies in the desire to ensure an adequate accommodation, and here the reason of why it's renewed regularly, because they cannot find a decaying place. Moreover, a fundamental aspect is that the renovation is every twenty years, but the style is never changed.

In the temple area there are two places which are occupied alternately (fig. 42). At this point, while the first is still strong, another one is built on the adjacent site and the first one is demolished. This is done in order to be able to look at the original while working on the other one.
The final ritual is the "**Sengu**" (fig. 43), which allows the body of the God to be transferred to the new temple. Therefore, devotion is more spiritual than material and it is more important to transmit knowledge rather than to keep the original material. In addiction, in order to respect the design and techniques, the sanctuary has its own forest for providing materials and a team of carpenters who are familiar with traditional techniques[32].

The current buildings were built in 2013 (are the sixty-second reconstruction), the next one is planned for 2033.

---

31. Gianighian and Paolucci, *Il restauro in Giappone : architetture, città, paesaggi.*

32. Ibidem.

Fig. 44. *Kuniyoshi, U., 1847- 1852, The Transfer Ceremony at Ise Shrine.*
Source: Honolulu Museum of Art

Fig. 45. *Kodo, Y., 1937, woodblock print representing the "Shikinen Sengu" ceremony.*
From © Miwa Japanese Art 2021

"*The Sengu system plays an important role in preserving and handing down traditional crafts to the next generation, and conveying the roots of Japanese culture*" (Japan For Sustainability, 2013).

However, the Temple of Ise is not part of the UNESCO Heritage because the technique is authentic but the material is not the original one.
The Ise Shrine can be considered an emblematic case because it's about the ceremonial ritual, called **Shikinen Zōtai** in Japanese. In fact, after the modernization of the 19th century, this is the only shrine in which this tradition of Shikinen Zotai continued. The singularity of the sanctuary is reflected in the original design and techniques, while the material texture has no authenticity.

In this respect, there is a question that arises spontaneously, when it becomes clear that the Ise temple is not considered a tangible cultural asset.
In terms of cultural importance, the Ise Temple is placed together with other buildings which are part of the world heritage.
For instance, The Hōryū-ji Temple (fig. 46) and the Ise Temple are considered both important on a religious level or, in the case of Ise, as a philosophy of life. The difference lies in the religion, the first is Buddhist while the second is Shintoist.

Thus, comes to mind: *why, given their equal importance, is one designated as a tangible cultural asset (the first) and the other not?*
The key is still in the subject matter. Both are considered two of the most important cultural monuments in the country, but their designation derives exclusively from the system of conservation in which they are subjected.
The material prevails over the tangible assets, and temple of Ise is linked to the project, to the technique, not to the material.
As already explained, Ise is an exceptional case, where its importance is linked to the significance of traditional ceremonies[33].

Fig. 46. The Hōryū-ji Temple.
From Wikiwand.

---

33. Gianighian and Paolucci, *Il restauro in Giappone : architetture, città, paesaggi.*

END OF CHAPTER REFLECTIONS

However, the case of Ise Temple is not reflected in all types of wooden architecture. Although materially the architecture is not original, but it is considered unique and, even if it does not use the original texture, it retains its importance from a spiritual point of view but above all in terms of the use of traditional techniques.

But, *what is more important? The technique or the original material?* It's necessary to contextualise. The Ise temple is a place of prayer linked to the Shinto cult.
Thus, *what about housing?*

As already explained, the intention is to keep alive the spirit of those who continue to place their trust in craftsmanship and wood as a raw material. And, when talking about craftsmen and merchants, it opens up another direction, the one leading to the so-called wooden houses, the **kyo-machiya**.
Looking at the first chapter, it can be observed that urban densification depended on a number of factors, mainly:

- **decrees made by the different emperors**;
- **stances taken by the lower ranks in opposition to hierarchical decisions considered unbalanced**.

The consequence of those choices and the subsequent contrasts led to the definition of these houses which were immediately labelled as *houses of craftsmen and merchants*. And this was precisely because of the hierarchical difference that was consequently reflected on the landed estate.
Despite the fact that these houses were built on restricted land (which is why they have a narrow and elongated shape), is interesting to note that their densification is greater than people think.
It was also surprising to note that the area with the highest concentration of these houses was the elitist area of Kamigyo-ku.

Today in Kyoto, the kyo-machiya are constantly under observation, to protect the architecture of the past but, above all, because they remain as witnesses of the use of wood and techniques of the past.
The densification of these houses is gradually disappearing, both because they are difficult to maintain in terms of cost and maintenance and because today the choice is oriented towards new generation houses.

The intention of the third chapter is to study the densification of these houses in the Kamigyo district of Kyoto and to note the efforts that the city is taking with the intention of keeping the historical identity alive.

3. MACHI - YA :
from the micro to the macro scale

STATE OF PLAY

Any study that aims to report changes at the urban level must evaluate a study at different scales, from the small scale, to understand the context and changes, to the large scale, to study in detail the physicality and appearance of buildings. Therefore, the objective of the first chapter was to contextualise the era of reference in order to understand what changes had occurred at a territorial level and this in relation to the transition to the modern era, to important decision-making processes and sometimes also due to uncontrollable phenomena.

Then, after having ascertained that wood could be a material exposed to dangers, the interest was focused on understanding why the Japanese, despite several unpleasant episodes, have always tried to keep this traditional material alive.

The intention of this chapter is to visualise the Kyo-machiya in a particular neighbourhood in order to visualise the changes and, if necessary, their causes. Furthermore, taking a different approach to conservation, it will see the effort towards preserving these wooden houses, a symbol of the city of kyoto and its history.

Machiya (町家) in Kyoto.
From: https://www.machiya-kyoto.net/

3.1 Discover Kamigyo and machiyas through Digital Methods

The word *machiya* contains a binomial meaning that explains the influence that this kind of housing had on the urban context.
Specifically, **machi** means *city* while **ya** means *house*[34] and this lays the foundations for a discourse which includes an analysis of Kyoto, the former capital and the city where the densification of these houses is more intense than in other prefectures, and a deeper focus on the architecture of these wooden houses.

The intention to conduct an analysis from a small to a large scale involves the use of QGIS software for the acquisition of geographical data necessary to visualise the attributes required to understand the image of the city of Kyoto.
Specifically, Kamigyo has already largely dominated the scene in the first chapter because it's the area closest to the Imperial palace.
Through the availability of the virtual portal of *Geospatial Information Authority of Japan* it was possible to trace the basic attributes to visualise the shape of the district (fig. 47).

As a first step, it was considered to display on the software four main data sources, respectively:
- **street data**;
- **water data**;
- **prefectures** (*(都道府県 todōfuken)*;
- **building data**.

Kamo River

Imperial Palace

Scale 1: 30000

34. From https://davenoshiten.wordpress.com/2018/10/04/machiya/

Fig. 47. Axonometric scheme made by the author.
Source: **Geospatial Information Authority of Japan website**

The intention of this study is to obtain an estimation about *how many* machiyas have been lost over the years and for *what causes*.

Despite the fact that the site provides the entire map of Japan with its data sources, it's not easy to get hold of those relating to wooden houses.
Thus, unable to come into possession of data to draw a profile of the numbers of machiya today, I took a look back at a study that was carried out on Kamigyo and its surroundings.

The study was carried out in 2009 by survey teams consisting of the Kyoto City Government, Ritsumeikan University, Architects and voluntary citizens. Before this survey, two others were carried out, one between 1995 and 1998 and another between 2003 and 2004. And these two allowed the 2009 survey to continue on the basis of data that had been collected in previous years.

To map the houses, besides being present on site, various tools such as ArcPad, Mobile Gis and PDA were used to obtain the exact spatial info of houses and buildings with their photos[35].

As a support to the survey, the teams had a list of attributes of each house, from its condition to the design of the façade and also if they were vacant or not.
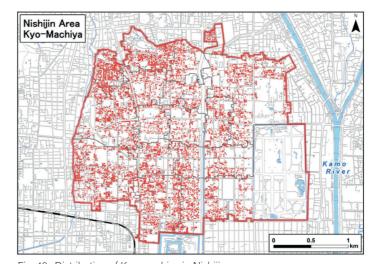
Fig. 48. Distribution of Kyo-machiya in Nishijin area.

The survey covered the area of Nishijin (fig. 48) up to Fushimi and other adjacent areas. But, in our interest, it's reported summarily what was found on Nishijin as it is part of Kamigyo-Ku district.

Comparing the results of this survey with the last one dating back to 2004, a loss of 9.4% of houses (923) due to demolition (fig. 50) was estimated.
Instead of them, were built lower residential buildings, open car parks, open spaces and flats.
Furthermore, despite the large percentage loss, Nishijin had the highest concentration of machiya compared to other areas, respectively:
10.540 machiyas compared to 5.815 Fushimi area.

35. Iizuka, Matsumoto, Seto, Yano,
"GIS-BASED MONITORING SYSTEMS FOR KYO-MACHIYA IN KYOTO CITY".
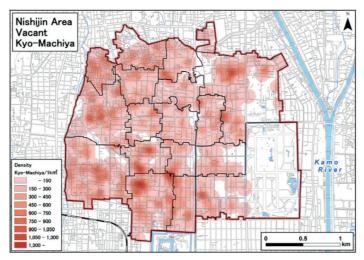
Fig. 49. Density of vacant Kyo-machiya in Nishijin area.
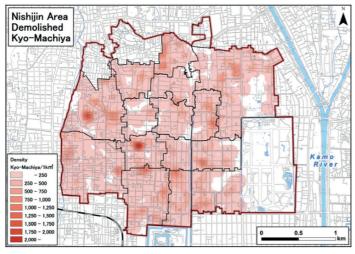
Fig. 50. Density of demolished Kyo-machiya in Nishijin area.

Reflecting on these analyses helps to understand how, despite the efforts made to safeguard this "species", it is more likely to come across a vacant machiya or a new building than a traditional house. Based on these analyses, the different reasons for these losses are hypothesised:

• **ageing buildings**;
• **economic difficulty in supporting maintenance and repair costs**;
• **high seniority rate with the difficulty of passing to the next generation**;
• interest towards investing in new buildings.

Therefore, all these factors caused a division of the population towards the maintenance of these houses and their demolition has certainly altered the historical landscape.

In this vein, it's important to leverage the monitoring of changes through the possibilities offered today by all digital software, which are constantly updated.

These types of studies are not only intended to alert people to the increasing loss but to stimulate policies of change.

Those who are responsible in change management through city planning, with demolition and new construction, must also take into account another important aspect: the preservation of the historic landscape, which has always been a symbolic image of Kyoto City.

3.2 Urban Conservation - Urban Regenaration: towards the Landscape Plan

Prior to the results of the investigation, the Japanese government was already largely aware of the danger that the wooden houses and the identity of the historic landscape were facing.
Indeed, looking back at the Meiji era, the modernization process triggered a series of causes that had also a negative influence.
The expansion of industry led to an increase in the level of environmental pollution that damaged the natural landscape, while the arrival of new materials clearly threatened the permanence of historical assets.

In this respect, what about the reactions from the local community and the government: *have they succumbed to the signs of time or are they still trying to resist the increasing loss?*

Even if the modern age was trying to replace the historical scenario, this dynamic triggered a commitment among systems to launch policies that looked at the protection and conservation of historical heritage, also intended as landscape.

This issue is not new in this paper, already the first chapter made a mention of the Laws, those who were passed to protect the urban and historical context. Indeed, the first law that also looked at urban planning was enacted in *1919* with the intention of preserving places of scenic beauty.

Thus, in that year the **City Planning Act** and the **Building Act** established a legal basis for spatial planning and regulated the construction of new buildings.
Naturally, this renewal process of spatial planning led to various reactions because the intent of this new way of planning meant *change* and with it the probably loss of certain areas considered special.

As a result, in *1930* took place the first designation of landscape zones and from there the process grew towards the protection of historical and environmental landscapes.
This new vision of the whole, as natural landscapes in the surroundings such as mountains but also cultural assets such as temples and shrines, results in a sensitivity towards the environment.
Specifically, it developed an interest that set some constraints on spatial planning:

- restrictions on changing in land use;
- limits on deforestation;
- new buildings with construction limits[36].

The topic of building restrictions is the pivotal point about how the landscape has evolved over the years. Through restrictions, the new buildings must be rigorous in keeping to the construction rules, thus the historical image was preserved.

36. Rotolo, "*The Japanese Way of Urban Planning: the Machizukuri Approach*", https://labgov.city/urban-media-lab/

The years that saw the economic boom were emblematic regarding the desire to keep the historic environment alive. Indeed, this caused a lot of concern regarding the risk of losing the areas of the ancient capitals. For this reason, in *1966*, were designated the ancient capitals according to their natural historical beauty, respectively: *Kyoto, Nara, Kamakura, Tenri, Kasihara, Sakurai, Ikaruga, Asuka, Otsu, Zushi*. This law did not only pay attention to the built environment but also to green areas.
However, the problem was the law's constraint to preserve only the ancient capitals, forgetting all the rest. Thus, in *1975*, there was the law to protect not only the historic buildings but also the landscape around them.

In 2004, was finally passed the Law for the Landscape Conservation which refers to the natural environment as well as rice fields, trees, mountains and everything else that is part of the landscape. Even though it is a law, it is not compulsory for all municipalities but optional. It is up to the prefecture to choose between joining this law or not[37].

Although the name of this law seems to be exclusively aimed at protecting the natural environment, it involves a number of fields that are closely connected to it. Indeed, it restricts both the urban and the rural environment and also places restrictions on the advertising signs.

The objective is to educate people on how to produce good landscape plans. Intervention and modification should not necessarily obscure the natural beauty of the area.
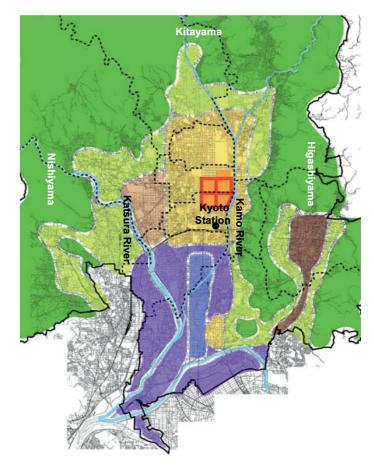
Fig. 51. Landscape Policies suited to Regional Characteristics. Source: Kyoto City Government

---

37. Gianighian and Paolucci, *Il restauro in Giappone : architetture, città, paesaggi.*

3.3 Overview of the Landscape Policy of Kyoto City

As previously mentioned, in 1975 the main capitals were designated as places to be protected, addressing both the built environment and green areas. Following this decision and the development of the 2004 Landscape Law, each prefecture has been able to idealise its areas according to protection and conservation requirements, defining a policy framework in order to control future interventions.

The aim of this paragraph is to set out the guidelines that the city of Kyoto has established regarding the features of its region, with the intention of dealing the loss of wooden houses, controlling the emergence of new buildings and protecting the landscape view.
As the old capital, Kyoto preserves not only the site of the Imperial Palace but a series of historic buildings that together create a sense of history.
While UNESCO ensures the protection of the Heritage, citizens are asked to respect the Political Framework defined by the city following the realisation of the loss of a series of machiyas.
As a city rich in culture and history, Kyoto recognised very early the challenge of urban development. In fact, even before the law of 2004, in 1993 the Kyoto City Development Council established a set of conceptual recommendations that ideally delineated the city into 3 distinct zones[38].

Each region needs different attention, so they have been divided as follows (fig. 52):
▪ the north with the preservation of natural and historical landscape including mountainous areas);
▪ the city centre (regeneration process);
▪ the south (new functions for urban development).
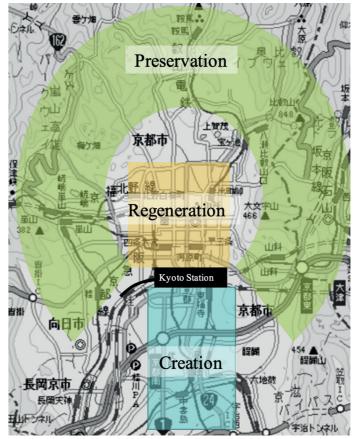
Fig. 52. 1993, New Master Plan of Kyoto City.
Source: Kyoto City Government

38. The World Bank Group (WBG), "Cultural Heritage, Sustainable Tourism and Urban Regeneration: Capturing Lessons and Experience from Japan with a focus on Kyoto".

Despite these efforts, strong economic growth has continued to inhibit the view of the natural landscape and to increase the loss of historic buildings such as the kyo machiya.

Thus, in *2007* Kyoto set out 5 principles (fig. 53) to guide the region in a coexistence of the traditional urban landscape with that of the new built environment, looking to mitigate the existence of both as harmoniously as possible.

Building Height

Establishing the height of new buildings was one of the most important steps, because the development of skyscrapers risked hiding wooden houses and the surrounding landscape from view. In order to create a situation where height levels seem to disappear, six height levels have been defined: from a maximum of 31 metres in the centre to a maximum of 10 metres in the suburbs at the foothills (fig. 54). However, exceptions may be allowed if the new building enhance the urban image[39].

Fig. 53. The five main elements in Landscape Policy of Kyoto City (2007). Diagram made by the author.
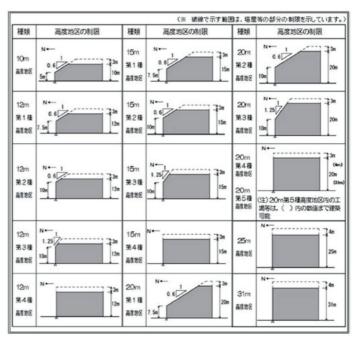
Fig. 54. Building regulations for height control.

39. The World Bank Group (WBG), "Cultural Heritage, Sustainable Tourism and Urban Regeneration: Capturing Lessons and Experience from Japan with a focus on Kyoto".

..from the former to the present

Before the 2007 Landscape Policy

After the 2007 Landscape Policy
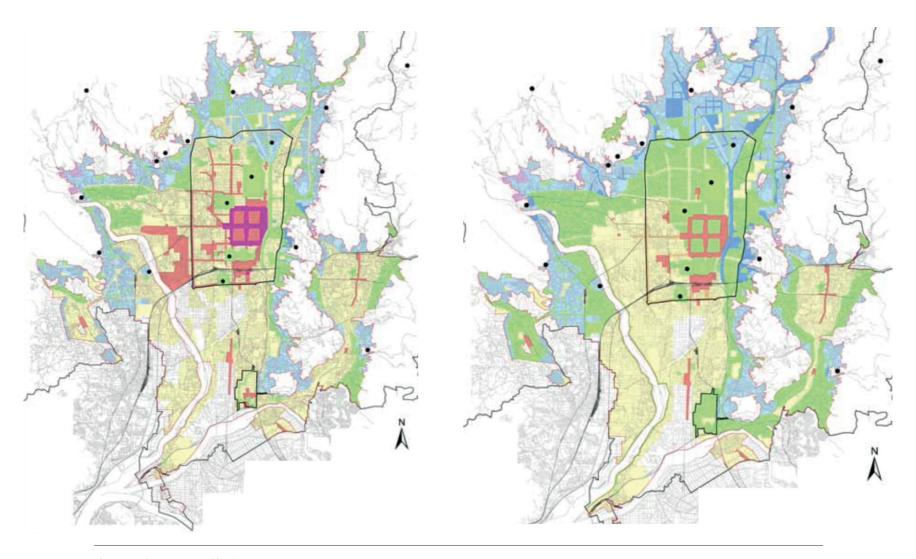
Fig. 55-56. Source: Kyoto City Government

Building Design

The design of the building is also important, it must fit well within the existing. Therefore, the Kyoto Council has delineated specific design codes for each district.

Every district is different and has its own identity, so the design standards change with it (fig. 58-59). Standards include the colour of roofs and external walls, the material of internal walls, balconies and property boundaries[40].

In addition, codes make available different solutions for parking a car inside or in front of a building (fig. 57).

Fig. 58. Aesthetic of historical district.
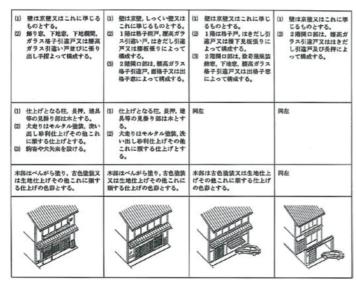
Fig. 57. Building regulations for height control.
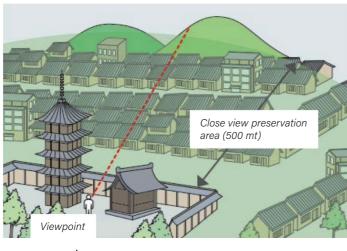
Fig. 59. Aesthetic of roadside.

---

40. Van Thoor and Stroux , "*Heritage, History and Design Between East and West*", 36.

Protection of Natural Vistas

This principle can be considered as a reinforcing of the first and the second because it unites the both. Practically, the committee selected 38 places to protect views, either of landscapes or temples.

Thus, they studied the *perspective landscape* and the subsequent diagrams (fig. 60) are designed to explain what the viewer's point and the surroundings.

Close view preservation area (500 mt)

Viewpoint
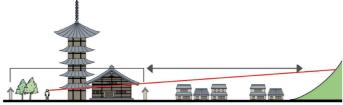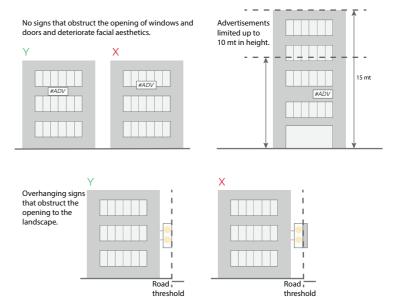
Fig. 60. The observer's perspective from his point of observation towards the landscape surroundings.

Advertising Policy

Principle that turns the attention towards the activities which animate the city. With the outdoor advertisements the scenery can be decorated or it can be also deteriorated it, if done in the wrong way (fig. 61).

Outdoor Advertisement Restrictions

- *Restrictions on placement of the sign, size and colour;*
- *No roof signs because it deforms the skyline;*
- *No signs with flashing lights;*
- *No side signs projecting onto roads near main streets.*

No signs that obstruct the opening of windows and doors and deteriorate facial aesthetics.

Y   X

#ADV   #ADV

Advertisements limited up to 10 mt in height.

#ADV

15 mt

Y   X

Overhanging signs that obstruct the opening to the landscape.

Road threshold   Road threshold

Fig. 61. Schemes on outdoor advertisement restrictions. Diagrams made by the author.

Historical Townscape

Machiya had and still have great importance in the definition of the Landscape Plan because they're considered the key element of the built environment, which embellish the historical atmosphere of Kyoto.

For this purpose, already in the past, was born a group of researchers and architects with the intention of understanding the reasons of why kyo-machiya, with increasing development, were disappearing. Even today, many efforts are still made to keep them alive, but there are many points that play against them and need to be evaluated.

In the whole of this survey, I would like to focus on the reaction of those who inhabit this place. Although conscious of living in a historical place like Kyoto, there have been a several factors which have divided public opinion on the desire to protect these wooden buildings.

This concern about them also derives from another factor, of essential importance: *the machiya are not recognised as an Important Cultural Asset protected by the government* but only designated as cultural assets in the urban area of Kyoto.

Even if it is surprising, the decision to not add them as a cultural asset to be protected by the government is closely related to the right that has the owner of the wooden house.

And here lies the main reason for the loss of machiya houses: the citizens are conscious of the right to be able to sell the land and rebuild on it.

Thus, what is the approach, *revitalisation in order to preserve the identity or demolition to build the new?*

In this regard, the city has understood the difficulties in keeping these structures economically alive (i.e. carpentry costs to renew the original material) and it encourages people through subsidy costs to renovate and mantain these houses.

The support system includes:

- provision of expert consultants for earthquake-resistant design;
- provision of consultants for reconstruction and renovation;
- provision of grants for earthquake-resistant design;
- loans for reconstruction[41].

---

41. The World Bank Group (WBG), "Cultural Heritage, Sustainable Tourism and Urban Regeneration: Capturing Lessons and Experience from Japan with a focus on Kyoto".

3.4   How they look today: machiya features

Before proceeding to analyse what machiya looks like today, it is important to clarify one aspect concerning the renovation of machiya.
As traditional houses, the original wood must be subjected to sophisticated carpentry processes, so the costs were unsustainable. Thus, it renounced the preservation of the traditional style through the use of traditional material.

Essentially, Kyoto has its own rules on conservation rituals (i.e. Ise temple) but also on restoration interventions. Indeed, if in the West it is culturally required to show the difference between the original material and the new replacement, in Japan the concept is different. The approach to restoration is in contrast to the occidental one because the replacement of damaged parts does not distinguish the original part from the new one. However, if this may perplex a westerner (**Venice Charter, article 12**[(42)]), in Kyoto it is a common practice in an attempt to keep the traditional style alive.

In recent years, Kyoto has seen the birth of several groups with the intention of preserving the existence of machiya, such as: *Machiya Machizukuri Foundation.* This foundation was set up in 2005 by a benefactor from Tokyo. The group works with individual machiya owners to restore their buildings and designate them as "structures of scenic importance".[(43)]

Despite all these efforts, the constraints involved in renovating and maintaining such houses are increasingly debilitating. In effect, most of Kyoto's inhabitants prefer modern houses because they are more advanced in terms of performance, while machiya are considered obsolete and outdated. In addiction, the inheritance of machiya is a problem, both because people do not want to inherit it and because the sale of the land is easier.

As a matter of fact, reading and reading various documents, it seemed to me repetitive to find negative meanings in relation to the protection and survival of machiya. There are a lot of aspects that push the owners to give up the idea of allowing these wooden houses to survive, new construction methods give the impression of being more efficient. Therefore: *why the continuous attempt to keep alive machiya houses that have to be sustained financially for renovations, do not have the original material in replacements and are highly prone to fire and earthquakes?* The answer is connected with the Ise temple and its practice. For the Japanese people, it is not important to maintain the original textures but to maintain and pass on, from generation to generation, *traditional techniques*. And the replacement of parts in the structure reinforces the memory of the technique. Only by handing down traditional techniques the style can be considered authentic.

---

42. The Venice Charter for the Conservation and Restoration of Monuments and Sites is a set of guidelines, drawn up in 1964 by a group of conservation professionals in Venice, that provides an international framework for the conservation and restoration of historic buildings.
Erdem, "The Venice Charter under Review".

43. Source: https://www.machiya-kyoto.net/

Living in a Japanese house means living in an essential place, devoid of excess, giving less importance to ornament or decorations. The lifestyle is reflected in every part of the house, from the use of materials, to the design of the structure, to the layout of the rooms, to the furnishings.

As mentioned several times, the suffix *kyo* is an addition to highlight the prevalence of these residences in Kyoto area[44], the city in which most of them have been preserved. The majority were built between the end of the Edo period and the Meiji period. The distinctive narrow and elongated shape is the result of the modelling of the spatial configuration of the land, which evolved and changed over the course of different eras. They usually have one to three floors and face the street. In the past, there were basically three typologies:
- commercial space on the street front and living space at the back;
- two-floor dwelling;
- textile activity with the working space in the back.
Even if they were originally built to house ordinary people, such as craftsmen and tradesmen, to carry out their work, today the machiyas are a source of attraction for many tourists. It has also attracted the attention of renowned architects who have travelled to the region to study these houses in person and literally live in them to understand what makes them unique.

"In the complete silence that reigned I became aware of clearly defined parallel lines made by sliding-doors, surfaces of plastered wall, which are void of paint or whitewash , of cedar woodwork entirely unornamented. There were nothing oppressive about ceiling whose light boards and laths merely served, together with the delicate wooden framework, to define the room-space. The large alcove, or tokonoma, dominated an otherwise neutral room by the integrity of its artistic spirit. The room was empty; the straw mats alone - there were but six - gave a sense of content. These mats have a subtle quality of naturalness, a something that is neither soft, not yet elastic, much less hard. They supply the essential functions fulfilled by furniture the world over, and actually replace chairs and armchairs, sofas and bedsteads, and to a large extent even tables. At last I was ready, extinguished my lantern and lay down. There we were, lyng inside a paper lantern - for such the room seemed, filled as it was with moonlight, strangely soft and smooth". [45]

Among the architects attracted by the machiya's uniqueness there is also Bruno Taut who, in "*Houses and People of Japan*", dwells on certain aspects that characterise the minimalist style of the Traditional Japanese House. Taut writes about his and his wife's experiences during a stay in a traditional house and then spent three years (1933-36) in Japan where he has the opportunity to study their architecture and culture in depth, to appreciate them and even to change his opinion.

---

44. Izumida, "Machiya: A Typology of Japanese Townhouses".

45. Taut, *Houses and People of Japan*.
Taut was a pioneer architect of the modern movement of Expressionism, and in 1918, he confounded the Novembergruppe, widely and popularly known as "*Chain of Crystal*", which included prominent and influential architects such as H. Finsterlin, W. Gropius and Hans and Wassili Luckhardt among many others.

Taut's reference is intended to focus attention on the elements that characterise these traditional houses, because the elements inside the house awaken the visitor's curiosity to understand where the different from what we know lies. And it is thanks to the desire to discover the unusual that these houses are able to survive, as well as the fact that in this way Kyoto maintains its unique atmosphere.

In the previous chapter, the topic of land division was developed, a decision which shaped the so-called machiya houses. Indeed, **machi** comes from the division of the land, and means *city*, while the ending **ya** means *house*. The suffix Kyo is an addition to highlight the prevalence of these residences in Kyoto area[46].

Machiya evolution is closely linked to the historical period, developments of events and decisions. The construction period of these houses is between the end of Edo period and the Meiji era but, most of those we can still admire today, were conceived during the Meiji period, when Japan was opening up to the modernization process.

When discussing machiya, there are several elements that can jump into the imagination, and the predominance of wood is definitely the major player. The decision to use wood is clearly related climate, resources and its excellent response to earthquakes in terms of design. In addiction, in old Japanese houses, the wood was not coated with varnish or other coatings, to enhance the natural beauty of its grain.

Kōshi (格子) grilles

Thin, evenly spaced pieces of wood usually made of wood or bamboo.

On the ground floor machiya have protection systems known as "koshi" which are installed above the doors and windows of the machiya, creating a distinguishable façade.

46. Izumida, "Machiya: A Typology of Japanese Townhouses".

Restored façade of a machiya with the ground floor characterised by the entrance and windows covered by the koshi system.

The grill allows light to filter into the house in a gentle way, prevents crime and increases the level of privacy because if you are walking you cannot see inside the house, while from the inside you can see out. On the side, three types of grilles with a design that differs depending on the activity.

Talking about elements that characterise the external façade, in addition to the grid we identify another series of elements that can be seen as distinctive for the particular type of house.
Primarily, the characteristic feature of machiya is its elongated shape, which follows the edge of the land and faces the street.
As learned from history, the division of land was a fact determined by the hierarchy. In this respect, the rank level played the greatest role in the allocation of land. Indeed, the size of the plots was directly related to the wealth of the people, by possessions and this caused a multitude of rebellions. As a result, many people resisted these standards and took over parts of the land to set up their commercial activities. Therefore, machiya are associated to merchants and craftsmen, who used them both as residences and as places of work. Moreover, even if the inhabitants were rich, their facades are conceived in a simple way, because a law in Japan prohibits any form of ostentation and prosperity[47].

糸屋 格子

麩屋 格子

酒屋 格子

47. Izumida, "Machiya: A Typology of Japanese Townhouses".
Fig. 62. Drawings made by the author.
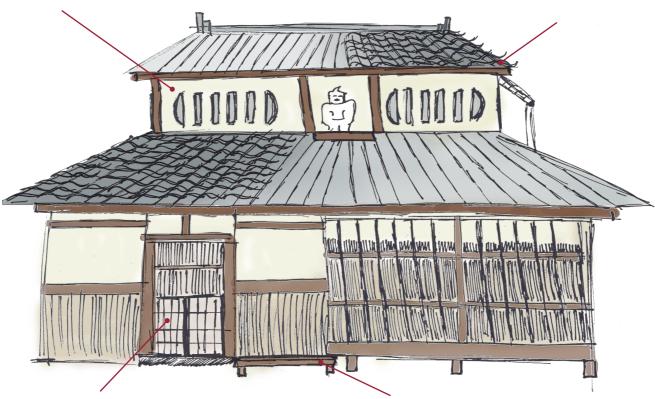
OUTSIDE THE KYO-MACHIYA - 京町家の外

Mushikago-mado windows (虫籠窓)
literally "insect cage window" and usually placed along the façade of the second floor. Made of clay, allows ventilation, lighting and fire protection.

Sangawara-buki (桟瓦葺)
Eaves extending towards the street front. Roof composed of a fireproof tile system. The lower ends of the tiles are aligned as if they were cut.

Pedestrian door ō-do (大戸)
consists of two doors: the larger one is used for the passage of objects and their transport inside, while the smaller one is used for normal entry and exit.

Thud stool (スッドスツール)
is normally placed under the eaves to have a break and be protected, or as a retail display stand.

Typical façade of a machiya with its characteristic elements.
Fig. 63. Drawing made by the author.

INSIDE THE KYO-MACHIYA - 京町家の中

Foremost, machiya are classified into three types:
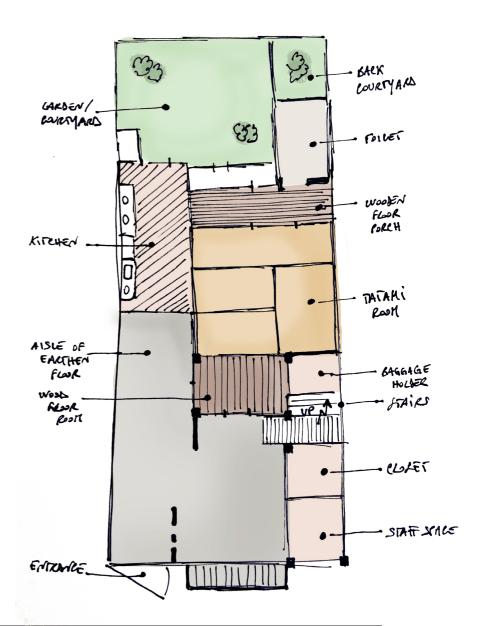
▪ the first gave priority to the shop facing the street, while the part behind was used for residential purposes;
▪ the second type was for residential use only, developed on two floors;
▪ the third hosted weaving activities on the front side, while the back was used as a workspace.

In addition, a machiya could rise up to three storeys above ground (including the ground floor).
The internal machiya's layout is literally called "eel beds" because the façade is narrow, while the interior is long and deep, like a corridor[48].
The special feature is not, as mentioned at the beginning, in the opulence but in the simplicity of the furnishings, which are enriched by the skilful use of materials (wood and organic materials are definitely predominant). As shown in the plant on the side, the spaces are separated from each other but allow a dialogue through the use of sliding doors that provide privacy and at the same time an open environment.

But what attracts most tourists, who have the desire to stay in a real machiya, (so much so that it attracted the architect taut as well) are the different elements that make up the Japanese spaces, from the interior to the private garden.

LAYOUT OF 1TH FLOOR

48. Source: http://kyomiyabi.com/en/room.php
Fig. 64. Drawing made by the author.
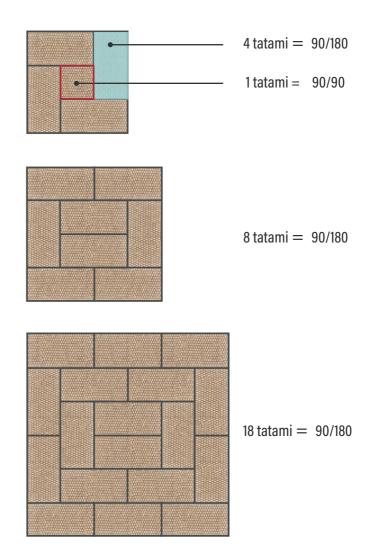
Tatami 畳

Literally *folded* and *stacked*, Tatami is a traditional Japanese floor made of modular rectangular panels, assembled with a frame of wood or other materials and covered with woven and pressed straw. It is considered the fulcrum of the entire house, in fact around it the dimensions and shapes develop, with the exception of secondary rooms (entrance hall, kitchen, bathroom).
Its standard measures are approximately 180 by 90 cm (6 by 3 feet) and is about 5 cm (2 inches) thick[49].

On the side, the picture shows how the edges are perfectly squared and this is to avoid the presence of gaps, because the tatami is treated as dowel, which fit together perfectly, without the use of adhesives. In terms of composition, the base of the tatami is the *tatamidoko* (畳床), a panel of plywood or chipboard then covered with a mat called *tatamiomote* (畳表). Finally, the sides are framed with a linen or cotton cloth which is the *tatamiberi* (畳縁).

Something curious was that before the end of the shogunate, the linen-edged sides took on different colours according to caste indication: multicoloured for nobles and daimyō, monochrome if there were common people.

4 tatami = 90/180

1 tatami = 90/90

8 tatami = 90/180

18 tatami = 90/180

49. Source: https://www.britannica.com/technology/tatami

Fig. 65. Examples of tatami patterns.
Illustration made by the author.

A typical example of a tatami floor with sliding doors opening to the private garden.

4. Natural Hazard's phenomenon against the wooden buildings

4.1 Defining the major threats that shaped the cities of Japan

The Japanese archipelago places great importance on nature, so much so that in its construction it has become one of the fundamental principles, using natural materials and paying attention to the protection of the landscape, as will be discussed below.

Nevertheless, this has not prevented exposure to uncontrollable natural phenomena which have visibly marked this country throughout history. It is not only fires that threaten this country. Following a series of studies which have established that its exposure to this phenomenon is due to its geological position, it has become almost "natural" to associate the phenomenon of earthquakes or tsunamis to Japan.

4.1.1 Earthquakes

Japan has always been prone to earthquakes because it is closely linked to the fact that the archipelago serves as the meeting point of three tectonic plates, respectively: Philippine, Euro-Asian, and Pacific (fig. 66). In addition, the Kanto region is located above the convergence point of three plates. As these plates move and slide over each other, they release enough energy to trigger a violent seismic wave[50].
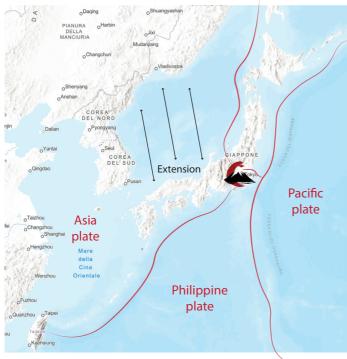
Fig. 66. Map illustrating Mount Fuji standing on the fault that meets the three plates mentioned above.
Maps from: https://arcgisss.maps.arcgis.com

Major earthquakes occured in Japan	Intensity
▪ 1923 - Kanto Earthquake	6 JMA
▪ 1941 - Fukui Earthquake	7 JMA
▪ 1964 - Niigata Eartquake	5 JMA
▪ 1968 - Tokachi-Oki Earthquake	5 JMA
▪ 1978 - Miyagiken-Oki Earthquake	5 JMA
▪ 1983 - Nihonkai-Chubu Earthquake	5 JMA
▪ 1995 - Kobe Earthquake	7 JMA
▪ 2011 - Tohoku Earthquake and Tsunami	9 JMA

Overall, earthquakes with a magnitude of more than six had a significant impact, destroying parts of cities and leaving numerous victims. Among those mentioned, the most significant was the *Kanto earthquake* which is so called because it struck the Kanto region and destroyed most of the cities of Tokyo and Yokohama, generating several fires in the cities and with a count of over 140,000 deaths. In addition, the earthquake also generated a tsunami wave of 12 metres in height that occurred in Sagami Bay. The *Kobe earthquake* left a huge footprint on the landscape, with the pillars of the Akashi Kaikyō bridge shifting by almost a metre. There were also numerous casualties and disasters. The last one in 2011 is known as the *triple catastrophe*, because after the earthquake and the tsunami, with a wave of 23 metres, there was also the Fukushima disaster[51].

---

50. Okubo, "Traditional wisdom for disaster mitigation in history of Japanese Architectures and historic cities."

51. The earthquake and tsunami.
From:
https://www.britannica.com/event/Japan-earthquake-and-tsunami-of-2011
(Accessed July 21, 2021).

1923, Kanto Earthquake

1995, Kobe Earthquake

2011, Tohoku Earthquake and Tsunami

4.1.2 Fires

Japan was no stranger to fires. Indeed, even before the advent of the modern era, Kyoto has already suffered several attacks, mainly aimed at the Imperial Palace. However, this has stimulated the demand to protect the wood material by integrating new systemic solutions with the intention of preventing from spreading (chapter one, fig. x).

The issue of fires involves a number of aspects, such as earthquakes, and the difference lies in the possibility of controlling them through various safety measures.

The reference to the fire of 1864, which triggered the invention of a new type of roof to slow down the combustion process, was just one of many that Kyoto suffered, especially before that. Indeed, Kyoto has recorderd several fires in the past, not always as a result of earthquakes, sometimes linked to domestic problems or triggered by chemical catalytic reactions.

Although different in the way in which they manifest themselves, the phenomena of earthquakes, fires and tsunamis are linked by the common factor of damage. Moreover, they are closely linked by the fact that, after an earthquake or a tsunami, it may happen that a fire breaks out afterwards (see the Great Tsunami of 2011, in which were triggered several fires).

As a matter of facts, the greatest damage was certainly towards the dwellings houses. Indeed, in the case of Kyoto, which is a city with an agglomeration of wooden and historical buildings (and therefore of low safety performance) the fire can spread more easily.

LIST OF FIRES IN KYOTO BEFORE MEIJI ERA

▪ **May 27, 1177 :** this fire, triggered by strong winds, reduced the Imperial Palace to ashes.

▪ **1361 :** the city was subjected to both an earthquake and a subsequent fire.

▪ **April 2/6, 1620 :** more fires in Kyoto.

▪ **1673 and 1675 :** there were a major fires in Kyoto.

▪ **April 28, 1708 :** The Great Hoei fire, identified for the Hoei era (1704–1711).

▪ **August 3, 1730 :** A fire broke out in Muromachi and 3,790 houses were burnt. It broke out not far from the Imperial Palace in the Nishijin neighborhood and for this reason it was called the Great Nishijin fire.

▪ **March 6/8, 1788 :** The Great Tenmei fire was particularly powerful because it burned for around two days until a powerful rainstorm extinguished the embers.

▪ **August 20, 1864 :** The Great Genji fire seems to be a direct consequence of the Kinmon incident.
The kinmon incident was a rebellion against the Tokugawa shogunate which took place near the Imperial Palace of Kyoto[52].

52. From: https://www.wikiwand.com/en/List_of_Kyoto's_fires#/Great_fires (Accessed July 21, 2021).

4.2 Facing the danger: what about citizens

Before reaching a definition of the solutions that have been developed over the years to mitigate the risk of an earthquake or fire, it's necessary to consider the role of the built landscape.
In other words, citizens are not always facilitated by evacuation paths because they may encounter obstacles or slowdowns. This is because, over the years, there have been studies of routes for citizens to save their lives in the event of accidental phenomena, but there are factors that do not systematically favour such aid.

Specifically, looking at a vulnerable location such as Kyoto, which is dense in historic monuments and consequently prone to triggering fast mechanisms such as fires, it's important to consider the behavior of citizens. According to this analysis, the risk of having more victims in an accident depends mainly by two components:
▪ the age of citizens;
▪ the natural emergence of so-called *cul-de-sac*, or dead-end streets, resulting from previous land use and from the construction of houses and monuments in certain parts of the streets.

In historical districts, populated more by the older inhabitants, where the danger of a fire starting like a fuse ready to start a bonfire is very high. Therefore, to ensure that evacuation plans are effective, the seniority of those living in these districts must also be considered, especially in densely populated areas, where the danger is clearly high because denser areas are much more vulnerable to disasters[53].

These two factors are closely connected because cul-de-sac are more concentrated in the historical districts, inhabited by local people, i.e. mostly older people.

4.2.1 Cul-de-sacs: a barriers for evacuation

In order to arrive at how these dead-end streets emerged, for first it's essential to refer to the grid pattern of the past. Even if the grid designed for Kyoto had a considerable size (120m x 120m), not many *open spaces* were included in it (essential for escape routes today).
The widest streets were inevitably those near to the Palace and the Castle, while irregular streets were created with the intention of the locals to better connect the social activities taking place inside the Kyo Machiya. For this reason the spaces for pedestrians were visibly narrower.
In addiction, this is also in line with the fact that, when the Masterplan was drawn, cars did not yet exist. Thus, the size of the streets did not take into account the danger that citizens run today.
Later, when cars also became part of everyday life, the local community became more and more "closed" in the alleys, where they continued to carry out their commercial activities. And, as mentioned earlier, the commoners used the kyo machiya as a workshop that was also used as a dwelling. So the alleys were inevitably full of wooden houses[54].
Unfortunately, negative effects are visible today. Indeed, as a result of decisions taken in the past, Kyoto inhereted cul-de-sac.

---

53. Kameda, Hagiwara, Shimizu, 京都市上京区における, *"Aree vulnerabili ai disastri e la vita degli anziani a Kamigyo Ward"*.
Translated from Japanese to Italian.

54. Yoshi, "*Preserving Alleyways to Increase Walkability of Historical Japanese Cities*".

The narrow width of cul de sacs limits evacuation routes and is extremely dangerous in disaster situations.

In the historical districts of Kyoto, it is common to find narrow alleys due to the scarcity of public squares and therefore less walkable areas for pedestrians. The propensity to work in this context raises several issues related to the fact that expanding the streets would mean tearing down buildings in order to create space for sidewalks or more suitable circulation. But raising monuments or houses to the ground would be equivalent to erasing centuries and centuries of history, especially in Kyoto[55].

To apply this concept in a practical way, let's consider one of the districts of Kyoto known, as well as for its history, especially for the large number of machiya houses: **Kamigyo Ward**.

In Kamigyo district the rate of elderly people is considerable and it is important to consider this because they are even more hindered by these narrow and blind alleys.

The large number of wooden buildings works against this consciousness because the streets are more susceptible to obstruction by collapse or fire.

The Kobe earthquake of 1995 severely damaged this area, with buildings collapsing, fires spreading and evacuation routes blocked due to the spread of fire. And, of course, a lot of lives lost.

In the absence of sources to carry out a personal study, we consider one of the studies carried out with the intention of submitting the data to the government and promulgating the best strategies for developing evacuation plans.

Fig. 67. Distribution of elderly people in Kamigyo district, Kyoto city. From Kameda *et al.*, 京都市上京区における, Aree vulnerabili ai disastri e la vita degli anziani a Kamigyo Ward, Kyoto City.

The map above (fig. 67) was extracted from a document surveying the age of people living in the Kamigyo district. The intention is to study what is the people's behaviour in relation to their lifestyle and thus their age. This kind of sampling is necessary in order to understand where people would be in the misfortune of an earthquake or fire breaking out.

If this factor is added to the natural existence of cul de sacs and alleyways that are not wide enough for evacuation, the probability of posing a risk to the people living there intensifies.

55. Kameda, Hagiwara, Shimizu, 京都市上京区における, "Aree vulnerabili ai disastri e la vita degli anziani a Kamigyo Ward".
Translated from Japanese to Italian.
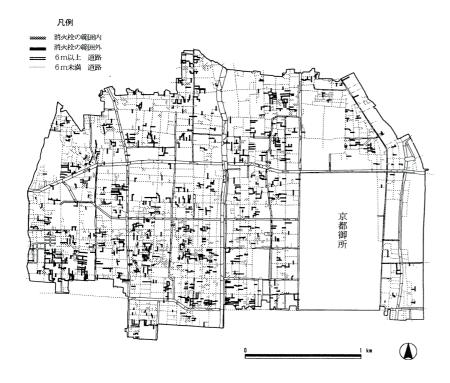
Fig. 68. Distribution of cul-de-sacs facing the difficult to reach the hydrants. From H. Kameda, Y. Hagiwara, Y. Shimizu, 2000, 京都市上京区における, Aree vulnerabili ai disastri e la vita degli anziani a Kamigyo Ward, Kyoto City.

In the following map (fig. 68) the study is different because the intention is to focus on the alleys that run through the neighbourhood. This is to understand which cul de sacs are more compromising than others in the event of having to walk down it.

Obviously, each cul de sac is different. And this depends not only from the width but also from the number of ways of exit. After finding the existence of multiple exit routes, the study continued with the intention of 'cataloguing' the different possible morphologies of a cul de sac, always based on the Kamigyo district[56].

In the event of a fire, it is important to know how many exit routes a cul de sac has, because every cul de sac is different and not all are equally dangerous. And this depends on its morphology, how it develops and therefore on the exit routes it offers. Thus, have been mapped the different shapes of the cul de sacs to make the citizen aware of the possibilities of evacuating the area. This is because if a building collapses during a fire or an earthquake and the citizen is trying to save himself, he needs to know if that is the only way out (and therefore blocked by the collapsed building) or if he is in a position to take another way out.

Clearly, cul de sacs with only one escape route have a higher hazard risk[57].

The table (fig. 69) categorised the different forms of cul de sacs, from simple to more complex, with their associated number of entry (in red) and exit routes (in blue).

No	枝小路の方向図	路線数	入口数	行き止まり数	角数	No	枝小路の連絡図	路線数	入口数	行き止まり数	角数
1		811	1	1	0	12		4	2	2	4
2		171	1	1	1	13		13	2	2	5
3		57	1	1	2	14		10	2	2	6
4		58	1	2	2	15		3	3	1	4
5		33	1	2	2	16		2	2	1	9
6		2	1	2	4	17		4	2	3	6
7		25	1	2	3	18		1	1	3	4
8		6	2	1	2	19		3	1	1	6
9		10	2	1	3	20		1	4	2	11
10		1	1	3	3	21		1	1	5	9
11		1	2	2	4						
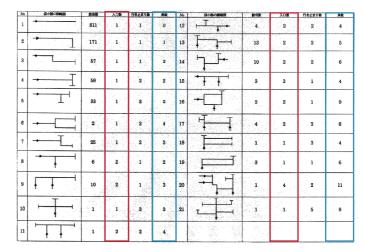
Fig. 69. Distribution of cul-de-sacs facing the difficult to reach the hydrants. From Kameda, Hagiwara, Shimizu, 京都市上京区における, "Aree vulnerabili ai disastri e la vita degli anziani a Kamigyo Ward".

---

56. Kameda, Hagiwara, Shimizu, 京都市上京区における, "Aree vulnerabili ai disastri e la vita degli anziani a Kamigyo Ward".
Translated from Japanese to Italian.

57. Yoshii, "*Preserving Alleyways to Increase Walkability of Historical Japanese Cities*".

Increasing residents' awareness of the danger contributes to the policy of disaster prevention (discussed in the next chapter).

Clarified this kind of policy that should alleviate damage through the knowledge of the place where people live, there is also another factor that takes a necessary part in putting out fires.

Prevention is necessary, both for personal safety and to safeguard heritage. However, when a fire breaks out, it's necessary to take measures and have the tools to stop it. Extinguishing a fire requires the arrival of emergency vehicles and the use of fire-fighting equipment.

Nevertheless, even these have to deal with a number of problems that create several difficulties in arriving at the site. In fact, putting together the various factors discussed above and taking into account that a vehicle has to pass on the road (so it keeps in mind that a cul de sac may be narrower than a 4 m road) the situation becomes more serious. But it is not only width that needs to be considered. Angles also play against the arrival of help or the hydrant tube itself.

The possibility of the hydrant tube (with an average length of 60 metres) reaching the burning building is weighed against the number of corners, as well as any other obstacles. Thus, there may be a problem with the tube not being able to reach its destination due to insufficient coverage of the length of the path[58].

Therefore, the question is: *how to take all these factors into account and prevent lives in danger?*

4.2.2 First signs of consciousness-raising on how to deal with disasters

The studies carried out are demonstrations to bring the government's attention to disaster-vulnerable areas and the risk that citizens run by continuing to live in a city that still contains many Kyo machiya. Moreover, the aim is to facilitate the formulation of risk mitigation policies, considering that each city must be treated individually. As a result, in 2012 was founded the "Disaster Prevention Council" in order to deal this kind of emergences in relation to the danger of escaping in the event of fire or earthquake. Basically, the intention was to:

• identify the most vulnerable areas in order to create and promote the implementation of plans for emergency measures in the event of a disaster;

• protect the safety of citizens;

• promote risk mitigation strategies by taking the various factors resulting from the studies;

• improve disaster preparedness in order to have a more effective response in the recovery phases[59].

Although the above points seem to be addressed individually but they are interconnected. It's essential to consider all of these points because neglecting one of them would distort the objective. Consequently, *how did the Japanese government decide to proceed? And how have policies changed today following other accidents in recent years? Furthermore, are there any strategies to protect wooden buildings which are most at risk?*

58. Yoshi, "*Preserving Alleyways to Increase Walkability of Historical Japanese Cities*".

59. From https://japan.kantei.go.jp/policy/index/bousai/konkyo_e.html (Accessed July 22, 2021).

1923 - **Kanto Earthquake**

1941 - **Fukui Earthquake**

1964 - **Niigata Earthquake**

1919

Urban Building Law
(Enforcement)

▪No seismic requirement

▪ Building permissions by police

1924

Urban Building Law
(Amendment)

▪ First structural calcultion regulation against seismic forces

1950

Building Standard Law
(Replacement of the first)

▪ Minimum standard and uptadet structural calculation

▪ Confirmation by local government

▪ Measures of adjacent road 2.7 mt --> 4 mt

1970-71

Building Standard Law
(Amendment)

▪ Strengthening of RC standards

▪ Introduction of FAR in all areas

1981

Building Standard Law
(Amendment)

New Seismic Code:

▪ Medium-scale earthquake does not cause damages

▪ Large-scale earthquake does not cause collapse

RC = reinforced concrete
FAR = floor area ratio

FOR IMPLEMENTING RESILIENCE

1995 - Kobe Earthquake

2004 - Tohoku Chuetsu Earthquake

2011 - Grand East Earthquake

1995

Seismic Retrofitting Promotion Law (Enforcement)

▪ Measures and guidelines for seismically deficient existing buildings

1998

Building Standard Law (Amendment)

▪ Performance code

▪ Designation of private sector bodies to perform building confirmation and inspection

2000

Building Standard Law (Amendment)

▪ Alternative seismic design method (response and limit deformation)

2006

Building Standard Law/ Seismic Retrofitting Promotion Law (Amendment)

▪ Designation of structural calculation review body; strict review process (large buildings)

▪ Seismic retrofitting promotion plan by local government

2013-2014

Building Standard Law/ Seismic Retrofitting Promotion Law (Amendment)

▪ New regulation for large wooden buildings

▪ Easier oroicess for structural review

▪ Mandatory seismic diagnosis of large public buildings

4.3. Introduction to Building Standard Law for project safety

The parallelism between the seismic events and the changes in the laws is a way to notice how these events triggered a new Japan's approach towards these hazards and how security measures have been implemented over the years. Indeed, the timeline shows all measures concerning seismic design and are aligned following particularly significant magnitude earthquakes.

The way in which these unpleasant phenomena have become an input for developing a seismically way of designing is the result of a close collaboration, begun in 1971, between Japanese Universities and the Government.
Through the use of continuously advancing technologies, they have tried to develop seismic design codes suitable for both reinforced concrete and timber houses. The results of this constant research are reflected in the laws and their continuous amendments and also in the revision of the Building Standard Law (BLS) in 1981. This revision was an almost drastic step because, until then, the design code did not consider the dynamic part of structures[60].
The origin of this concern clearly stems from events prior to this time. Thus, the earthquakes that had the most destructive effects on cities and especially on buildings are mentioned:
- *Niigata Earthquake*, 1964
- *Tokachi-Oki Earthquake*, 1968
- *Los Angeles Earthquake*, 1971.
As a result, the change made to the BLS was a necessity.

The BLS is a seismic design code that looks not only to safeguarding the most at-risk buildings (such as machiya) but at the building as a whole, acting as a guarantor for both categories, i.e. both timber and reinforced concrete buildings[61].
Essentially, in order to properly design an earthquake-responsive building, it is necessary to:
- **determine the seismic load;**
- **develop a structural design to cope with the seismic load determined.**
Nowadays, illustrating these two points is almost a triviality, a normal way of planning in an area like Japan. But, until then, the study of soil had never been taken into consideration. It was the effect that the oscillations had on the structure of the buildings that prompted the development of this study.
Although the standard could be applied to wooden and reinforced concrete buildings, the response range of the individual material must be evaluated. Practically, this refers to the difference between elastic behaviour (the building returns to its initial position) and plastic behaviour (failure of the material and possible collapse of the building).
The challenge in this mission is to ensure that during earthquakes of medium magnitude the building recovers its original condition, while during large earthquakes the structure should not collapse in order to save people's lives. The application of BLS demonstrated great effectiveness during the last earthquake in 1995. The highest percentage of collapsed buildings is found in those built before 1971, while those built or implemented after 1981 had a summarily low percentage of destruction.

---

60. World Bank Group, "Converting Disaster Experience into a Safer Built Environment: The Case of Japan".

61. Ibidem.

However, what has been discussed so far concerned buildings that were constructed after the revision of the BLS. Specifically, our interest is to understand what was the behaviour in the face of wooden houses such as machiya that are considered old because they were built in a conventional and non-engineered way.
The approach was to intervene gradually, involving different parts, in order to save the old wooden houses and not to demolish and then rebuild. The following table (fig. 70) is an adaptation from a sources data taken from KEN-Platz–Nikkei BP website which explains the changes in wooden houses under the BLS.

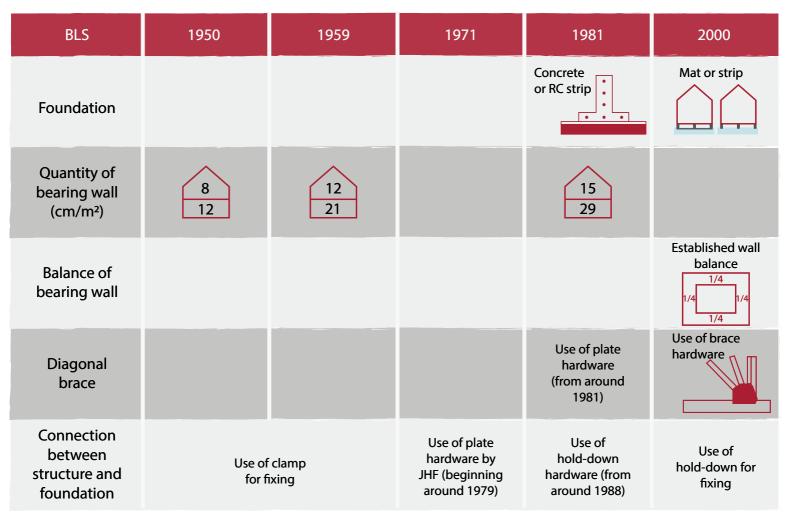| BLS	1950	1959	1971	1981	2000
Foundation				Concrete or RC strip	Mat or strip
Quantity of bearing wall (cm/m²)	8 / 12	12 / 21		15 / 29	
Balance of bearing wall					Established wall balance 1/4 1/4 1/4 1/4
Diagonal brace				Use of plate hardware (from around 1981)	Use of brace hardware
Connection between structure and foundation	Use of clamp for fixing		Use of plate hardware by JHF (beginning around 1979)	Use of hold-down hardware (from around 1988)	Use of hold-down for fixing

Fig. 70. Incremental Improvement of Specifications for Wooden Houses under the Building Standard Law.

However, the revision process is a fundamental issue that must necessarily be carried out with the passage of time and must be updated with technological development. In this respect Japan, in order to ensure a decision-making system balanced and impartial, it also involved the public, local authorities and all those who might have a role to play in changing or issuing new regulations.

The BLS's 2014 process was modified taking all this into account[62].

Stakeholders

- Architects and Contractors

- Bodies for Structural Calculation

- Bodies for Inspection and Confirmation

- Building Officials in local governments

- Internet public comments

- Local governments

- Organizations (design, construction..)

- Private companies, users and experts

- University Professors

Although in this paragraph the discussion of non-engineered houses is about wooden houses like machiya, this category (of non-engineered houses vulnerable to disasters) is very common, even in other countries around the world. Indeed, looking at the Japanese experience and its efforts to implement the safety factor, JICA (Japan International Cooperation Agency) has also offered technical support to other countries, such as Indonesia and El Salvador. This means that the BLS is a design code that can be mirrored to other countries that have not yet developed such knowledge to apply it to similar problems. However, it is important to consider that *each territory is different*. It doesn't matter to use systems more developed than others but it's important to visualize the aspects that characterise each territory. In this regard, fires are not a threat to all types of housing but specifically and primarily to wooden houses.

Chapter three explored the disappearance of houses taking as its main factor the advent of the modern era and the trend towards the new. However, also fire is an aspect that could increase the disappearance of kyo-machiya. Following this, it can be argued that the Landscape policy aims to promote the historical landscape and also the visual protection of the machiya but, looking at the physical danger, *what kind of solution did the Kyoto citizens adopt in order not to be constantly worried about the danger of fires?*

---

62. World Bank Group, "Converting Disaster Experience into a Safer Built Environment: The Case of Japan".

BREAK FOR REFLECTIONS

The assumption of risk is something that requires a long period of maturation. And Japan shows that not all traumatic events end in destruction, history can be reconstructed.

The excursus from the Meiji to the present days has been a fundamental part of understanding how Japan has become aware of its territory and how it has been able to survive. Traumatic events must fortify, and this country has adopted this philosophy of life and reflected it in its dwellings and historic buildings.

Compared to this, my goal was to learn more about *how wooden houses have survived* so far, despite the constant danger of fire exposure.

It is true that this issue has come up several times, mainly considering what has been said so far. Machiya have been the target of several eras, especially with the advent of the modern age, the emergence of new materials and also of earthquakes and fires.

Through the reading of various studies which collected data on the decline of these houses, I found the main points which aim to avoid the extinction of these historic houses. Thus, I will conduct a subsequent reasoning to arrive to an explanation.

It is well known that wood is a material exposed to the danger of fire but when looking at intervention strategies to mitigate this kind of danger there is no real regard. I mean, the strategies adopted for the survival of these buildings are not individually aimed at one situation.

Looking back at the list of fires (pag. x) it is clear that the occurrence of incidents involving fire were much more related to the home or work environment and, with the advent of the Meiji, the frequency gradually decreased thanks to some careful consideration of the dynamics within the domestic environment.

The reason why there is no renunciation of this material is explained in chapter two, it talks about climate, resources, *tradition*. From my point of view, tradition is the concept that has shaped the city of Kyoto. With **modelling** I mean that all the policies for the revision of the building, the laws for the conservation of historic buildings, the respect for the use of wood, find their meeting point in the effort to maintain the typical atmosphere of local architecture. The danger of fire is not reduced by removing the wood. But, in order to keep the local tradition intact, they use the technique of assembly and disassembly. And this, in turn, makes it possible to keep the structures relatively new, to be able to replace damaged parts, to avoid the building being dismantled.

But, there is another aspect to evaluate: the concern shifts to the danger of fires occurring after an earthquake or tsunami. And, as already mentioned, the response from the Japanese government was to set the basis for the Protection of Heritage through Laws and Policies for Risk Mitigation (chapter 5 will give an account of this).

However, protection measures have certainly required a revision of the policy framework and the implementation of safety measures for the evacuation of citizens, but these alone have not increased the safety of living in an area prone to frequent earthquakes.

Starting from this, I would like to emphasise that the desire to keep the historical layout has not excluded the possibility of using new materials.
Despite my willingness to highlight how much Japan is linked to local tradition, it is simultaneously important to know that it is one of the most developed countries in terms of earthquake-resistant construction.

The challenge of living in a harmonious country, where the old and the new coexist, is in the effort to create dynamics capable of dialogue. For instance, the Landscape policy provides for new buildings to be built respecting height levels in order to safeguard the historical image and the surrounding natural environment.
This meeting can be defined such a dichotomy, where the old and the new are two entities which seems to be separate but, in any case, the Japanese always trying to bring together.

Therefore, in order to conclude this chapter, I would like to focus my attention on construction systems, on the skeletons of the buildings and on the use of old and new materials. Whether wood or steel, the Japanese successfully mitigated their existence.

And, fundamentally, the question is still the same:
how Japanese buildings resist cataclysms?

4.4. Materials and methods as risk strategies

Although many natural phenomena have destroyed pieces of cities, heritage and even newly built houses, it can be said that the Japanese, conscious of the fact that the territory was 'suitable' for cataclysms, have always tried to mitigate this danger. Indeed, while disaster prevention and risk mitigation strategies are a current issue, the surviving existence of many traditional buildings suggests that they have used materials and techniques wisely. This is to reveal that the choice of materials plays a fundamental role in the protection of the building, being the skin of the structure, but also the skeleton is responsible for keeping the entire complex standing.

4.4.1. Reducing horizontal shaking

In spite of the concern that wood gives about the danger of fire, in the field of applicability concerning earthquakes this material is extraordinarily elastic. As a confirmation of this, events over the years demonstrated that it is more frequent to encounter the collapse of buildings made of stone or brick than of buildings made of wood or reinforced concrete. The flexibility of wood and its optimal response to horizontal oscillations is well known, while for reinforced concrete buildings this is mitigated by steel reinforcement[63]. However, these buildings cannot be considered indestructible, but the key to their safety lies in ensuring that catastrophes do not lead to other catastrophes, i.e. *avoiding collapse,* an irreversible condition.

In Traditional Japanese Architecture, even before the machiya, Temples and Pagodas can be identified. They can be recognised as architecture of a certain importance because they have resisted all signs of time, even natural disasters, and above all they are proof that wood is a resilient material.
The secret of its remaining young in its antiquity is certainly in the care taken to protect it but, above all, the material is the most important part of this. The wise way in which the elements are interlocked allows the structure to develop in height. Indeed, the particularity resides precisely in the way they develop, the focus is on their height, on their five storeys, and not on their practical usability[64].
Thus, the purpose was to give the temples a powerful architecture, which could look at the surrounding landscape and enrich it in some way.

In the second chapter reference was made to one temple in particular, to compare it with that of Ise, that of Hōryū-ji (*AD 600*). It is important to recognise this temple not only as a Unesco Heritage Site (designated in the World Heritage site in 1993) but also as one of the oldest buildings in existence, being about 1300 years old[65]. Although the case of Hōryū-ji Temple records a fire in 670 which destroyed the site (subsequently rebuilt and enlarged), several structures have survived and are among the oldest existing wooden structures in the world, so much so that they were listed as National Treasures of Japan[66]. Among them, five-storey pagoda is the case study analysed below for understanding its behaviour in earthquakes.

63. Okubo, "Traditional wisdom for disaster mitigation in history of Japanese Architectures and historic cities."

64. Ibidem.
65. From https://www.britannica.com/topic/Horyu-Temple (Accessed July 26, 2021).
66. Ibidem.

There are about two hundred and ten wooden pagodas in Japan and most of them contain within their structure the so-called *tuo* (in Japanese), which means *tower* and refers to the central pillar[56]. However, if initially it was only designed to be a symbolic element, with the passage of time it became clear that the survival of the pagodas was related to its existence. Indeed, this states that although the intention was to protect the height, it was the central pillar that made it possible for the pagodas to survive earthquakes.

Specifically, historical reviews (made since the end of the Meiji era) have established that pagodas built during and before the Edo period were not suppressed by earthquakes. The damage inflicted over the centuries by a series of earthquakes with magnitudes greater than six, did not permanently destroy the structures. Not even with the last Great Earthquake in Hanshin-Awaji[67]. Damage was restricted to inclined structures but never completely collapsed.

The key to their resilience to seismic events is related to the use of the material and the way in which the elements are connected to each other. The use of wood is the fundamental component due to the fact that this material makes the construction flexible and when subjected to a force it can flex and deform, but it is not easy to reach the breaking point. In addition, the elements are connected by joints and notches between the members so if the ground shakes they will rub against each other. In this way the energy dissipates from the base to the top.

Looking at the case of the Five-Story Pagoda at Horyu-ji Temple (fig. 71), here we also find the presence of a distinctive feature, the central pillar, called *shinbashira.*

Fig. 71. The Five-Story Pagoda (Goju-no-tou).
From Wonderland Japan.

---

67. Ooi, "ORIGINALITY OF CENTRAL COLUMN IN JAPANESE PAGODA".

Analysing the elements that shape the structure, the pillar of the pagoda runs from bottom to top, growing upwards. On this column stand five independent structures of different sizes, the largest being the one at the bottom and the narrowest at the top. The decision to restrict the structure as it goes up gives the impression that it is taller.

The floors are bound by pillars and beams which are rarely connected to the central pillar and are part of a single floor, they are not interconnected with the other floors[68]. In practice, around the various studies carried out by researchers such as Muto K. (1963), they introduced the concept of *flexible design* and the Japanese pagodas have a seismic performance resulting from the non-linearity of the rigidity of the previously mentioned elements.

Since the stacking of the structural members is non-linear this in turn gives *rigidity* to the structure and this causes a higher level of response during earthquakes. In fact, the horizontal shocks are denser at the base of the first two levels, while the dissipation of the shaking seems to lose energy as the floors rise[69]. This is basically the concept that is used today by contemporary structures such as skyscrapers.

The next is a diagram (fig. 72) that aims to explain how the pagoda structure stands with the elements not all interconnected between floors, except for the central pillar.
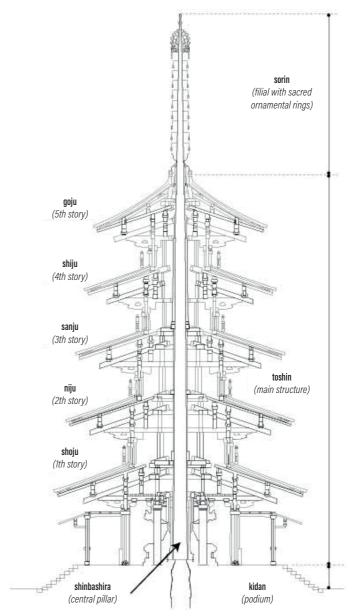
Fig. 72. The Five-Story Pagoda (Goju-no-tou). From Wonderland Japan.

---

68. Okubo, "Traditional wisdom for disaster mitigation in history of Japanese Architectures and historic cities".

69. Hanazato, Minowa, Niitsu, Nitto, Kawai, Maekawa, Morii, "Seismic and Wind Performance of Five-Storied Pagoda of Timber Heritage Structure", 79-95.

▪ There aren't continuous columns between the stories and each of them is piled up;

▪ Restoring force for overturning of each story resists against heave;

▪ Central pillar will not be weighted and control big gap.

Shaking of upper part controls shaking of lower part

Collision of central pillar and each story control the displacement of earthquake

Central pillar stands alone regardless of other structure

originally, the central pillar was buried in the ground, now it is on a base stone in the podium

Fig. 73-74. The Five-Story Pagoda (Goju-no-tou).
Reference from Okubo, "Traditional wisdom for disaster mitigation in history of Japanese Architectures and historic cities".
Diagram made by the author.

EXPLAINING THE STRUCTURE

Large block and bracket arm,
Hōryū-ji.

Flat three block, Great Lecture Hall,
Hōryū-ji.

Two-step complex
Five-story Pagoda, Kaijusenji.

Fig. 75. Complex system of corbel joints, three examples in the structure of pagodas.
From http://architecture.thetowerofdreams.com

As evidence of the fact that modern buildings absorbed traditional techniques, the Tokyo Sky Tree, is based on the structural construction concept of the Hōryū-ji Temple in Kyoto.

The building was designed by the engineering and architectural firm Nikken Sekkei, with the collaboration of Tadao Ando and sculptor Kiichi Sumikawa[70].

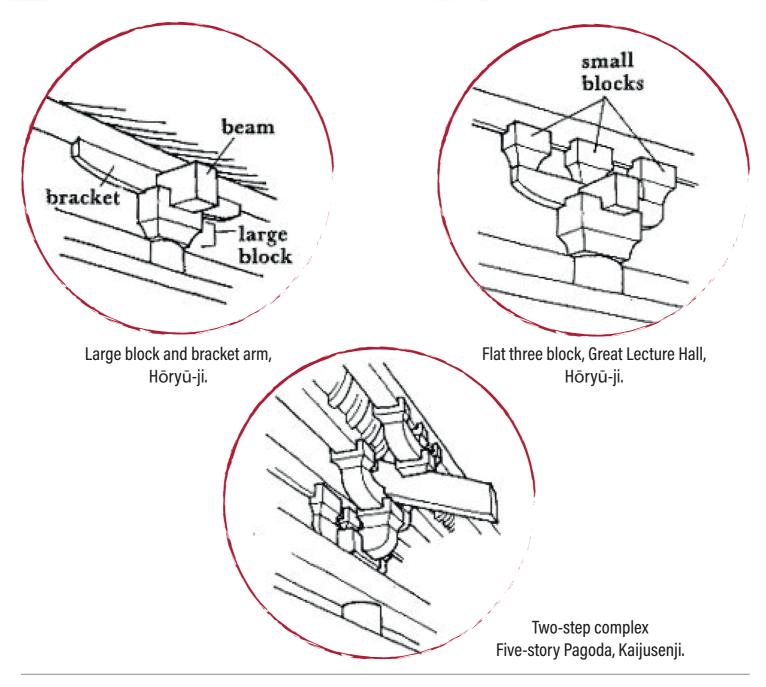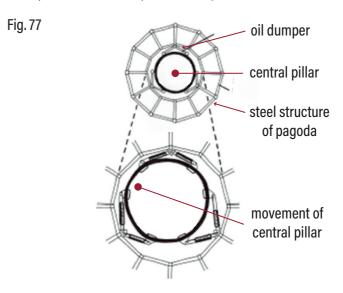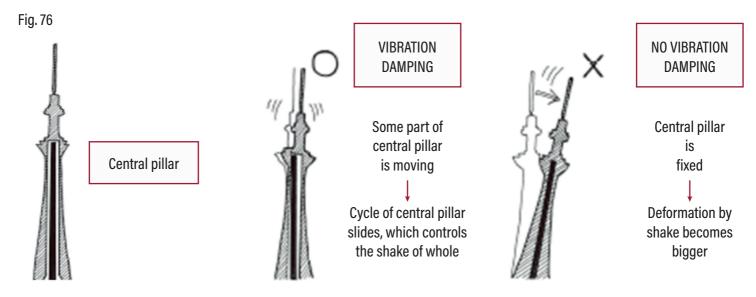The structure is made of steel and reinforced concrete, with a lattice that wraps around the structure. The special feature is that the anti-seismic construction uses the shinbashira as its central element, but here it is built of reinforced concrete and hollowed out inside. The pillar is anchored to the cylindrical structure for the first 125 metres, and when an earthquake occurs the remaining free part is left to oscillate at a different frequency and this brings stability to the structure (fig. 76) .

What is also special is that the pillar is equipped by elements that perform the same function as the oil damper in a car suspension (fig. 77).

Fig. 77

oil dumper

central pillar

steel structure of pagoda

movement of central pillar

Fig. 76

Central pillar

VIBRATION DAMPING

Some part of central pillar is moving

↓

Cycle of central pillar slides, which controls the shake of whole

NO VIBRATION DAMPING

Central pillar is fixed

↓

Deformation by shake becomes bigger

70. From https://www.domusweb.it/it/edifici/tokyo-sky-tree.html (Accessed July 27, 2021).

Fig. 75. Earthquake resistance mechanism applied to a modern tower. Reference from Asahi Shinbun, May 1, 2010.

TOKYO SKY TREE

At a height of 375 mt

Core column

Flexible region: the core column and steel tower are connected with an oil dumper.

At a height of 125 mt

Rigid region: the core column and steel tower are fixed with steel members.

Fig. 78. Structural view of Sky Tree Tower.
Image: Nikkei Sekkei.

Fig. 79. A photo of Sky Tree Tower in Tokyo, Japan.

4.4.2 Reducing fire risk

Looking at wooden houses, the structure is also made of wood and is maintained as such, with the wooden frame as a structure that allows, with its flexibility, to contrast horizontal oscillations.

In addiction, the approach was to integrate an emergency exit door into the structure in the event of an earthquake. The lock system used for these doors (fig. 80), called *kuguri-do no kagi* (exit door locks) is installed in traditional houses such as machiya. These locks cannot be opened from the outside but can be locked and unlocked from the inside and are easily opened during an emergency, such as an earthquake or fire. Being a design used by friction, they will open when the building is violently shaken by an earthquake[71].

Another protective element was the Dozō. The outside of the wooden warehouses were plastered in clay, because it is a non-flammable material. Therefore, if a fire started, the clay did not give the opportunity to spread the flames. In order to protect the clay from the arrival of rain, there was a roof (this for the upper part). For the lower part, wooden panels were attached to the walls which could be removed if they needed to be replaced[72]. This allowed the clay to do its job and at the same time keep the structure ready for maintenance (wooden panels deteriorate with the rains).

And finally, it is essential to remember the technique of interlocking elements that allows damaged pieces to be restored, which was also a factor in saving the structures and explains how they have been preserved over the centuries.

Fig. 80. Renovated Kyo-Machiya House in Kamigyo Ward with a typical Kuguri-do (wicket door), Kyoto.

Fig. 81. A traditional house with particular of clay in the upper part, covered by the roof.

71. Okubo, "Traditional wisdom for disaster mitigation in history of Japanese Architectures and historic cities."

72. Ibidem.

4.4.3 Maps of seismic preparedness

At the beginning of the chapter, attention was also paid to the behaviour of citizens living in an area threatened by earthquakes and fires. In this regard, the study underlined how dangerous cul de sacs can be and how small precautions can save people's lives.
According to the study, the combination of earthquakes and buildings collapsing in an alleyway such as a cul de sac can keep a person from escaping and trapping them.

For years, the Japanese government has worked to make people conscious of the territory in which they live. Since Kyoto is a city with a history, the city's urban plan could not be disrupted. Thus, it created a building code that considered both new construction and traditional buildings, also taking into account natural factors that threaten the safety of buildings and people. But it didn't end there. Indeed, the effort has been to understand *how to communicate* the risk of earthquakes and all the dangers that come with them, such as the outbreak of a fire or the collapse of a building. In this respect, **seismic preparedness maps** were introduced, produced and distributed to each family. It is fundamental to be aware of where one lives. The aim is not only to encourage household preparedness but also to allow the promotion of this approach to other countries at high seismic risk[73]. Thus, the questions are: *what do a Seismic Preparedness Maps look like? And, how are they designed to explain a hazard in the same way but differentiating the risk level?*

The aim is to prepare those who live in the territory at risk, so the key concepts included in the maps give the following explanation:

▪ **a scale of intensity (a datum collected through history with the events that have followed) and consequently the dangers related to them;**
▪ **action plans and evacuation centres available for families.**

However, while in possession of these maps, it is spontaneous to think that earthquake shakes arrive unexpectedly and this can alter a person's state of calm, leading to a state of confusion and agitation. For this reason, the action plans also provide sections that deal with this possibility, noting how important a person's behaviour is in such situations. Accordingly, the *Kyoto Prefecture Earthquake Damage Prediction Inspection Committee* makes available in print and digital format how situations should be faced, taking into account the context in which one is at the time.
In fact, it contextualises the place, illustrating the countermeasures in case of an earthquake in Kyoto: *"If you are at home.."*; *"If you are in a department store.."*; *"If you are driving.."*; *"If there is a danger of a tsunami.."* and so on[74].

In order to make citizens feeling safer, the next page shows some actions that people can follow in case of an earthquake arrives and how to avoid panic and to evacuate in total security.

---

73. World Bank Group, "Converting Disaster Experience into a Safer Built Environment: The Case of Japan".

74. Sources: https://www.pref.kyoto.jp/en/ (Accessed August 2, 2021).

EARTHQUAKE OCCURENCE

- Remain calm and protect yourself
- Fires should be swiftly dealt with
- Open a door or window to preserve an escape route

You will be notified several to tens of seconds before an earthquake with strong shaking will occur via TV, radio, city disaster prevention wireless system or your cellphone.

1-2 minutes

- Check for fire's sources and if it has already breaks out, try to extinguish it
- Check your family's safety
- Wear shoes
- Have your emergency kit prepared on hand

3 minutes

- Check of your neighbours
- Beware of aftershocks

5-10 minutes

- Check information on the radio, TV, smartphone, etc.
- Try not tu use the phone as much as possible
- Prevent fires turning off gas and electrical breakers
- Evacuate if you think your house will collapse

10 minutes - several hours

- Put out fires
- Cooperate with your neighbours
- Conduct rescue activities
- Report to the fire department

Materials Provided by: *Kyoto Prefecture Earthquake Damage Prediction Inspection Committee.*

5. Converting *Natural Disasters* into *Risk-Reduction* Experience

STATE OF PLAY

This final part culminates in a theme that today involves not only Japan as a region in its singularity but brings together communities on a global level.

The fourth chapter focused on how the territory of Japan, specifically looking at Kyoto as a specific model, conforms "to hosting" a series of catastrophic events that periodically put the World's Heritage at risk as well as the safety of those who inhabit the territory. This was the starting point for a series of decisions taken by the Kyoto government's to preparing those living there to cope with these unexpected phenomena (i.e. maps of seismic preparedness).

However, when looking at the phenomenon of natural hazards as a whole and reflecting it on a global level, it is certainly the goal of many countries to mitigate the danger.
In this regard, Japan has been and remains a country that today is seen as an example to follow, especially in terms of Disaster Risk Reduction.

The common goal is to build resilience, to prepare the community for unexpected events but with an awareness of how to deal with them and to reduce the effects.

Therefore, the next scenario will be an involvement of actions carried out, and still in progress, that aim to promote disaster management through the propagation of guiding principles.
Clearly, it must be kept in mind that each territory is different and consequently what connects globally is an ideological concept, where solidarity links the different countries and where the common effort is to prepare their communities to apply the guiding principles. And then, shape them according to the needs of their own country.

Despite the fact that the catastrophic event has a negative connotation, it has successfully connected people and created platforms that, with their good intentions, continue to make huge progress.

All the information that follows was extracted from official documents including the SFDRR 2015-2030, UNISDR 2016-2021, 2009-UNISDR Terminology on Disaster Risk Reduction.

5.1 Promoting Disaster Prevention through Risk Mitigation Policies: the *Sendai Framework*

The common interest of Nations in building strong countries and focusing on *resilience*[75] converge in the **Sendai Framework**.

The *Sendai Framework for Disaster Risk Reduction 2015-2030* was enacted at the Third United Nations World Conference that took place from 14 to 18 March 2015 in Sendai, Japan.
The Sendai is consequent to previous frameworks for action that were also conceived on a global level to propagate policies in reducing the risk of natural disasters. Accordingly:

▪ **Yokohama Strategy for a Safer World:** International Framework for Action for the International Decade for Natural Disaster Reduction of 1994;
▪ **Hyogo Framework for Action (HFA) 2005-2015:** Building the Resilience of Nations and Communities to Disasters.

In essence, the HFA was conceived to give additional stimulus to the Yokohama Strategy, which carried out an Action Plan in 1994 and propagated an International Strategy for Disaster Risk Reduction in 1999.

Therefore, the whole process has a continuity, updating and taking into account changes, even in the face of new disasters, with the incentive of also using the new possibilities offered by the new world.
Thus, the World Conference was an opportunity to renew States' Commitment and reinforce other concepts which, if considered in the right way, can really make the difference (for instance the sustainable development).
In addition, the aim was not only to renew commitment towards this tool but also to confront and find the gaps identified in past frameworks, in order to work on improving them. Naturally, this requires the development of strong partnerships between states and comparison in coordinating these types of strategies. In this regard, a great role is played by the Global Platform for Disaster Risk Reduction and all the similar supranational platforms that have key forums for gathering public opinion.

---

75. Resilience is defined as "*The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions*".
UNISDR, "*2009, UNISDR - Terminology on Disaster Risk Reduction*", Geneva, May 2009.
(http://www.unisdr.org/we/inform/terminology)

5.1.1   Objectives and main guidelines

Along the lines of the previous international guidelines, the SFDRR uses appropriate indicators to evaluate global progress in achieving seven specific objectives.
Below:

a) **Reduce the global death rate related to disasters;**

b) **Reduce the global number of people affected by disasters;**

c) **Reduce the economic loss due to disasters in relation to GDP;**

d) **Reduce damage to critical infrastructure and disruption of essential services, including medical and educational services;**

e) Encourage more countries to participate in risk strategies, both at national and local level;

f) Enhance international cooperation by involving developing countries;

g) **Increase public availability and access to multi-hazard early warning systems, information and risk assessments.**

The first impact is that one of the most significant changes is the adoption of an inclusive approach to all communities, prioritising people's needs. This because the expected result is to prevent new disaster risks and reduce existing ones by means of inclusive measures covering all kinds of fields: economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional.

Thus, only by reducing exposure to danger can vulnerability be reduced and only by increasing preparedness can post-recovery phases be more recurrent.

In addition to the seven objectives listed opposite, the SFDRR includes four priorities for action:

- *Understanding disaster risk;*

- *Strengthening disaster risk governance to manage disaster risk;*

- *Investing in disaster risk reduction for resilience;*

- *Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.*

5.1.2 Priority 1: Understanding disaster risk

In order to enable people to understand the significance of incurring the risk of disasters, it is necessary to raise awareness of the different spheres that can be affected. Therefore, reference is paid to the physical vulnerability of people and goods and the degrees of danger, also taking into account the environment.
Consequently, in order to implement preparedness for a better disaster response, a series of actions are required which, if well executed, can mitigate risk and prevent damage of a high degree.

At this point, the analysis and collection of data must be leveraged to be disseminated, monitored and constantly updated. Therefore, it is essential to record and share results at a public level, assessing both the losses resulting from disasters and the impacts at local and national level with respect to all the fields mentioned above.
Consequently, the information must be freely accessible to all and, above all, must be reliable. In addition, virtual platforms allow information to be contextualised at a geo-local level, including geographical information systems (GIS).
This makes it possible to consult data inherent to the own region and to access risk maps, adapted according to the territory and its geological dangerousness.
The possibilities given by technology and the increase of scientific capacities allow to consolidate existing knowledge but above all to apply new methodologies in order to reduce vulnerability and exposure to all types of hazards. It is therefore necessary to promote investment in technology and research in order to fill the gaps inherited from the past.

5.1.3 Priority 2: Strengthening disaster risk governance to manage disaster risk

In order to enable more efficient disaster mitigation and a more advanced prevention system, governance plays a major role.
Improving governance is essential because they are responsible for reviewing national and local laws and consequently have an impact on the public sector's knowledge of risk reduction mechanisms.
The mechanisms that regulate the raising of safety levels are related to urban planning standards, technical norms for construction and environmental and resource management.
In addition, governance needs to stimulate public and institutional debate in order to advance both national and local plans.
Therefore, it is of fundamental importance to assign right roles to the representatives of communities in order to review standards and regulations.

5.1.4 Priority 3: Investing in disaster risk reduction for resilience

Clearly, there is also an investment part to every action, and one predisposition for achieving the objectives is that public and private investments are needed to prevent and reduce the risk of disasters. Investing in resilience means investing in structural and non-structural measures, and consequently their effectiveness is seen as the mortality rate decreases; in addition to the fact that post-disaster recovery is more immediate.

Achieving the objectives requires the allocation of the necessary resources, including financial resources. In addition, everything that is implemented, such as regulations, action plans and risk mitigation strategies, must be protected, thus it is necessary to link them to insurance mechanisms of risk transfer, risk-sharing and risk-retention. In addition, this priority gives space for resilience in every field, including health systems and community inclusion. In this regard, more attention is given to people who are in danger of dying or suffering from particular diseases that put them at risk. Consequently, it is considered necessary to plan for their needs as well, including access to life-saving services before, during and after disasters.
Finally, efforts should be made to strengthen the sustainable management of ecosystems, i.e. to implement strategies for better environmental management of natural resources.

5.1.5 Priority 4: Enhancing disaster preparedness and the use of "Build Back Better" in recovery

Following the inclusive approach, this type of priority also turns its attention to integration and gender equality. This is because the number of people is constantly increasing and consequently there is a necessity to consolidate what has been learned from past events in order to lead everyone to take action in advance of their occurrence and to ensure, if necessary, effective subsequent assistance at all levels. In addition, this type of priority is particularly focused on the recovery phases, demonstrating that if properly planned before the event happens, it is easier to subsequently *rebuild better*.
Therefore, all the measures mentioned earlier also come into play here, because in the end all guidelines need to talk to each other, as well as collaboration between different institutions and stakeholders at all levels. In order to prepare communities to anticipate disasters, exercises such as evacuation drills and training must be instituted. Furthermore, it is necessary to think about the displacement of the population and the availability of shelter, food and other basic necessities.
Recovery and rehabilitation processes must take advantage of the reconstruction phase as an opportunity to implement new techniques such as structural standards and land use planning. Also, integrate a sustainable approach in the reconstruction phase, both in terms of construction, economic and social terms.

5.2 Reinforcing the Resilience through the integration of "*Building Back Better*"

One of the main concepts used today in post-disaster recovery policy is that of Building Black Better (BBB).

The reconstruction phase is a critical post-disaster point. However, thinking about having to rebuild does not necessarily suggest a scenario full of irreversible damage. Indeed, it is through the application of the Sendai principles that disaster impact reduction is attempted, focusing on reducing what may be the damage related to an event. Therefore, even imagining a post-disaster scenario without any kind of damage, simultaneously the rehabilitation and reconstruction phases can be seen as an opportunity to rebuild better, using the appropriate integrations to improve physical, social and economic resilience.

In this respect, the concept of Building Black Better as priority four of the SFDRR states that:

"*the recovery, rehabilitation and reconstruction phase is a critical opportunity to build back better, including through integrating disaster risk reduction into development measures*" (UNISDR 2016).

In essence, the SFDRR gives emphasis to reducing the pre-disaster hazard while looking to the future. Thus, it involves aspects of post-disaster recovery with the intention of accelerating reconstruction, implementing knowledge of building and planning standards, and having communities prepared for a new climate of recovery.

Within the framework of the Risk Reduction Policy, several key principles of the BBB are included, in support and with the intention of adding value to what has already been discussed above.

As a matter of fact, recovery is relevant in itself as a risk reduction concept because by rebuilding better you are giving more security to future generations or at least ensuring a better life quality with a reduction of worries. Consequently, it is important to include the understanding of the principles supporting the BBB in order to achieve the common goal of better recovery, for resilient cities and communities. Respectively:

- *Improvement of Structural Designs;*
- *Land-use Planning;*
- *Social Recovery;*
- *Economic Recovery;*
- *Social Recovery;*
- *Economic Recovery.*

Clearly, as already mentioned, the regulation and role allocation parts are required for achieving the objectives:

- *Stakeholders;*
- *Legislation and Regulation;*
- *Community Consultation;*
- *Monitoring and Evaluation*[76]*.*

---

76. Mannakkara and Dr. Wilkinson , "*Building Back Better in Japan - Lessons from the Indian Ocean Tsunami experience in Sri Lanka*", 25.

Before BBB became the fourth priority within Sendai, there were several events in the past that brought this kind of decision to the present day.

The first hint of this kind of approach to Building Back Better is the guideline "Key Propositions for Building Black Better" that was promoted by the former US President Bill Clinton following the catastrophic tsunami of 2004 (Clinton, 2006).

In 2004 the Indian Ocean tsunami hit and devastated parts of regions such as Indonesia and Sri Lanka. The high number of victims and extensive damage triggered a number of reactions claiming that recovery was one of the most urgent things. At that time there were no specific action plans for the context, so this guidance laid the basis for guiding the roles of local and international governments, with a strong focus on donation policies that were supported by all foreign countries. Later, a great deal of academic research was carried out and consequently modifications to the guidelines were applied. These include the amendments by Erin Joakim (2008) and Sandeeka Mannakkara (2014).

Over time, interest in the BBB has grown and several specific guidance methods have been created as a result, such as those of International Recovery Platform (UNDP), the World Bank, institutions such as the WHO, International Federation of Red Cross and Red Crescent Societies (IFRC) and European Commission[77].

Thus, BBB is now considered a priority in the policy framework for disaster risk reduction. However, although the intention is to achieve herd immunity with respect to adhering to this kind of policy framework, it must be said that each situation is unique. In this regard, Building Black Better lays the foundations of the approach to reconstruction through standardised principles, but it's up to each countries to shape the principles according to their context. In order to make a change, a country has to take a closer look at its own situation, looking at the urban and geological context, at the state of the houses and when they were last renovated, at what materials were used and how cultural heritage is protected. Specifically, each situation must be meticulously assessed and measures appropriately applied. In general, the actions that each country needs to be aware of are listed below:

- *Develop an all-stakeholder, national-level disaster recovery framework* (DRF);
- *Enable and foster pre-disaster recovery planning (PDRP) efforts among all stakeholders*;
- *Institutionalise formal and inclusive processes and systems to effectively assess post-disaster damages and needs to formulate broad recovery strategies*;
- *Institute or strengthen policies, laws and programmes that promote, guide and support 'build back better' in both the public and private sectors, at various levels*[78].   (UNISDR 2017)

---

77. Potutan , "Planning for Disaster Resilience in Japan: Integration of 'Build Back Better", 611-626.

78. Ibidem.

5.3 Japan's experience and its response after the 2011 Great East Earthquake and Tsunami

The data recorded in the aftermath of the Great East Japan Earthquake and Tsunami (GEJE) were the wake-up call that triggered SFDRR's policies, intended to implement the previous DRR guidelines and focusing studies on practical and measurable outcomes with the aspiration of significantly reducing loss of life and building collapse.

The catastrophic event of GEJE took the lives of more than 180,000 people and literally uprooted and destroyed more than 400,000 homes[78].
From here, various points are made directed towards the **inclusion of people, consideration of evacuation policies, the safety of buildings**, and the **importance of recovery as a reflection in the future**.

Since the SFDRR lays the foundations for a global behaviour and for the nations that have decided to adhere to this policy, it is important to say that among the catastrophic events that triggered the need to revise the previous guidelines there are also:
- the 2004 Indian Ocean Tsunami;
- the 2005 Pakistan Earthquake;
- the 2015 Nepal Earthquake;
- the 2013 Typhoon Yolanda.

Thus, the BBB grew along with the course of events, where the primary demands called for the construction of more solid housing able to withstand the force of storms.

In addiction, among the most important requirements already mentioned, it was also necessary the identification of no-build areas to avoid that people would rebuild on high risk areas.

It is true to assert that Japan has always been recognised as one of the most advanced regions from a construction point of view, especially when looking at structures that respond optimally to frequent phenomena such as earthquakes. However, the unexpected tsunami broke a lot of certainties and took a place in history and will be remembered forever as one of the worst catastrophes ever. As a result, the region of Japan has paid more attention to the engineering limitations. Indeed, as policy frameworks moved to improve the risk reduction strategies, Japan embraced the opportunity and leveraged the new procedures to enhance resilience.
Thus, one of Japan's primary actions was to collect the lesson 'inherited' from the catastrophic event and to use this negative experience as an opportunity to filter the appropriate information and turn it into priorities to implement the resilience.
Consequently, a substantial amount of work has been done in updating and implementing the number of offshore units capable of detecting tsunami activity.
However, after the 2016 Fukushima tsunami, there were still limitations in sensor activities and as a

---

78. Maly and Suppasri, "The Sendai Framework for Disaster Risk Reduction at Five: Lessons from the 2011 Great East Japan Earthquake and Tsunami ", 167.

result, the response was to develop a new real-time tsunami observation system called S-net[79]. In this background, the **Japan Meteorological Agency** (JMA) is responsible for issuing tsunami warnings within 3 minutes (JMA, 2019).

Another tool required by Priority 1 is an accurate estimation of data, although this can always have limitations depending on local and national contexts. An accurate estimation of the tsunami's source, its potential behaviour and care in disseminating this knowledge are the basis for risk reduction.

Even if the estimates are accurate, it's natural that there may still be some uncertainties regarding the event that could arrive, but this doesn't mean that monitoring the trend of crustal movements doesn't contribute to making places more safe.

In this regard, in 2015 was established the **Global Tsunami Model** (GTM) which "*aims to assess and provide community-based standards, good practices and guidelines for Probabilistic Tsunami Hazard and Risk Analysis*" (GTM, 2019).

This platform brings together the collective global vision of improving the probabilistic calculation of a tsunami's arrival, sharing methods, tools and everything needed to implement what is already in practice. It is a real step towards the possibilities offered by scientific research combined with major developments in the field of technology.

In addition, the research and efforts employed in the attempt to defend the territory culminate in the updating of Tsunami Risk Maps (and also earthquake) that provide regional areas with data on simulated flow velocities, flood zones, and therefore those most at risk, recurrences and ground elevations.

Nevertheless, most of the tsunami hazard maps produced after the GEJE underestimated many aspects. Consequently, they have been updated to include key elements for the probabilistic tsunami hazard simulation.

In this respect, the knowledge of the metrics of a tsunami are provided by the Probabilistic **Tsunami Hazard Analysis** (PTHA) and among these are distinguished the probability of the intensity of a tsunami, its maximum height, the depth of the inundation and its speed[80].

Thus, the data and the accuracy in obtaining them play a crucial role in safeguarding the safety of communities and risk mitigation policies are constantly being updated to achieve these goals.

However, as mentioned, the priorities to be applied are general and it is up to local governments to adapt them to the country's needs.

In this regard, *what is the Kyoto government's behaviour in trying to safeguard the safety of people against the occurrence of a natural disaster*?

79. Maly and Suppasri, "The Sendai Framework for Disaster Risk Reduction at Five: Lessons from the 2011 Great East Japan Earthquake and Tsunami ", 169.

80. Grezio *et al.*, "Probabilistic Tsunami Hazard Analysis: Multiple Sources and Global Applications ", 1158-1198.
https://doi.org/10.1002/2017RG000579

5.3 The use of Hazard Maps in Kyoto Prefecture

In Japan, Flood Hazard Maps are mainly prepared by the Ministry of Land, Infrastructure, and Transport (MLIT) and Prefectural governments (local municipalities) using inundation information[81]. While the MLIT is responsible for managing the flood maps for the Katsura River, the Kyoto Prefectural Government is responsible for the flood maps for the Kamo River.

The monitoring of occurrences is made available on the region's portals and the sources are accessible to everyone. In addition, hazard maps can be downloaded from National Land Numerical Information Download Service (NLNIDS).

Specifically for Kyoto Prefecture, the government has taken care of the division of the different wards that are part of the city also when issuing the maps. The wards of Kyoto Prefecture and their division are respectively shown in the map opposite (fig. 82), which has been made available to understand the geographical location as well.

The distinction of wards is a core component of risk preparedness maps, especially for those living in a particular part of the city.

For instance, over time it has become apparent that the parts closest to rivers need more meticulous attention. Indeed, population density needs to be lower in housing centres because excessive crowds need to be avoided in order to facilitate evacuation.
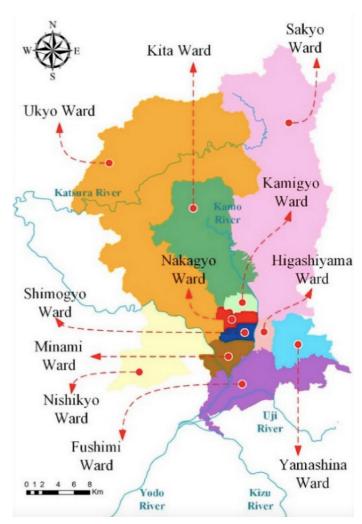

Fig. 82. Kyoto City and its wards.

---

81. Udmale *et al.*, *"Flood Hazard Mapping in Japan"*, 3.

The Kamigyo city section has disaster prevention maps with assumptions and solutions on whether an earthquake or flood is coming. The informations are constantly being updated and the last ones available concerning disaster prevention date back to July 2021.

The Kyoto City Risk Map website provides not only a simulation of a flood caused by an overflowing river but also risk due to excess rainfall occurring once every 1000 years (assuming maximum rainfall).
Therefore, floods can occur in areas that are not designated as flood zones due to overflowing rivers, but as areas at risk due to excess rainfall. The map below shows possible evacuation sites.
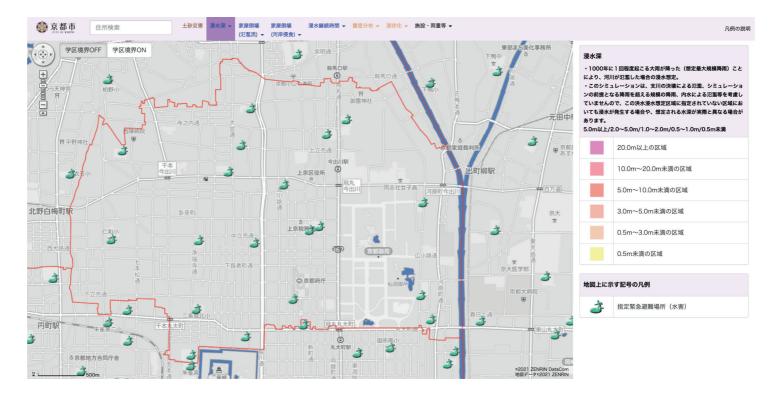

Fig. 83. Map originated from the Kyoto City Official Website.
https://www.bousai.city.kyoto.lg.jp/bousai/hazardmap/index.html?lay=saigai_02
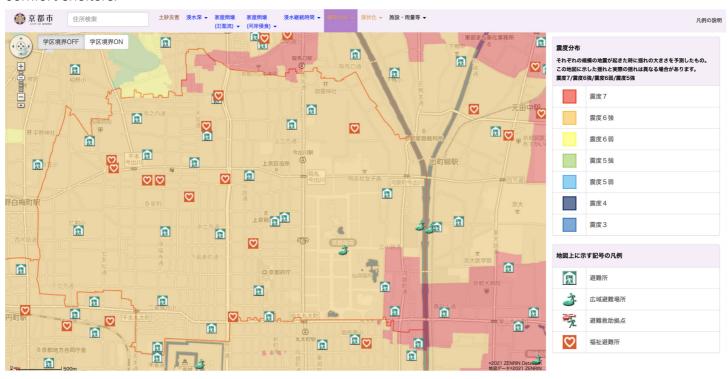
On the other hand, in the event of an earthquake, people gather at a 'local meeting place'.

The local meeting place is intended as a place to evacuate temporarily and see the disaster situation before actually evacuating to an evacuation site planned for an area. For instance: primary schools, parks, shrines, temples, etc.

Also in Kamigyo district, the map below estimates the magnitude of shaking that would occur in the event of an earthquake on each scale. The shaking shown on this map may differ from the real shaking.

The legend shows the different colour bands for the seismic intensity probability distribution.

For last, the map legend shows refuges, wide-area evacuation sites, evacuation and rescue centres and comfort shelters.

Fig. 84. Map originated from the Kyoto City Official Website.
https://www.bousai.city.kyoto.lg.jp/bousai/hazardmap/index.html?lay=saigai_34

In addition to the availability of maps that illustrate in depth the degree of risk in relation to the nature of a disaster, the site provides a number of other programmes to involve citizens.

In order to improve citizens' activity skills, the Kyoto City Disaster Prevention Centre created a "Citizen's Disaster Prevention" programme consisting of half-day simulated experiences.

These experiences are real simulations that test the difficulty of coping with the intensity of strong winds or that realistically reproduce a fire and consequently evacuation behaviour in the middle of a smoke cloud.

In the case of an earthquake, there are simulations of rolling with a seismic intensity from 4 to 7 in magnitude and which prepare for the behaviour required to cope with this event.

Also, there is the one concerning water and the simulations that consist of approaching it in case of flooding.

Finally, with the aim of making citizens more aware and prepared, the city of Kyoto produced a tool to create an action plan for disaster prevention called '*My Timeline*'. In practice, the software takes into account the actions and timelines to be taken in the event of a disaster, which vary depending on where you live and your family structure.

The section allows you to create a smooth evacuation by thinking about your daily preparations and actions in case of a disaster.

As a result, there is a sequence of chronology to follow that distinguishes what to do in the case of both flood damage and the arrival of an earthquake. Both divide the timing of choice into steps where you have to select the map of your district and consequently learn more about the possible damage that may occur.

After that, the next steps ask you to answer questions such as: *where is the building you live in* and *whether the area is particularly marked as at risk with collapse hazards*.

For the earthquake simulation, questions are asked about the seismic intensity, the local meeting place and refuge.

Finally, as already illustrated by the national policy framework, special attention is paid to the situations of people with problems or sensitivities to be taken into account. Therefore, it is necessary to report particular domestic situations in order to take the right precautions and cope with the unexpected event without problems.

The following maps differ from the previous ones because they are downloadable from the website and contain more in-depth information than the ones on the online portal.
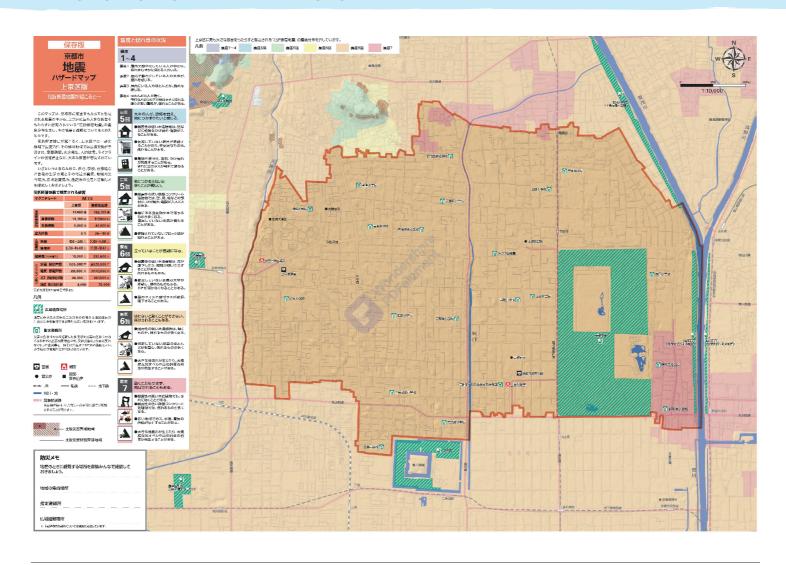
SEISMIC RISK MAP IN KAMIGYO WARD

Fig. 85. Map provided from the Kyoto City Official Website.
https://www.bousai.city.kyoto.lg.jp/cmsfiles/contents/0000000/196/02kamigyojishin.pdf
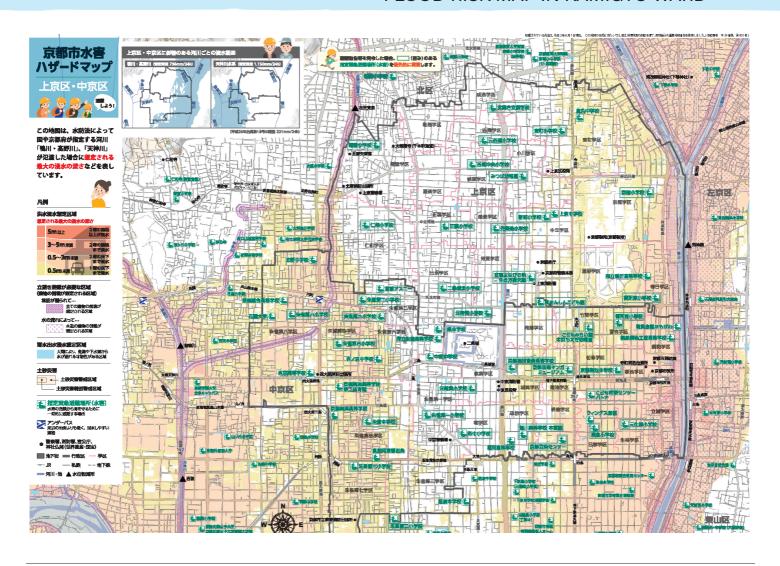
FLOOD RISK MAP IN KAMIGYO WARD

Fig. 86. Map provided from the Kyoto City Official Website.
https://www.bousai.city.kyoto.lg.jp/cmsfiles/contents/0000000/143/02kamigyou_nakagyou.pdf

BREAK FOR REFLECTIONS

The discourse discussed up to now confronts the region's efforts to protect the well-being and safety of its citizens.

However, the disaster prevention scenario, contemplates that the protection of citizens also depends on the security provided by the place where they live.

Specifically, people must be aware of the safety of their homes because, for example, in the event of an earthquake the houses have to deal with the shaking.

In relation to this, we have discussed in the previous chapters how, contrary to popular belief, wood is a material that reincarnates tradition but at the same time has the flexibility to cope with such unexpected phenomena.

In the case of Kyoto, it is thanks to the natural properties of wood that the historic buildings are still part of the city and part of the world heritage. Clearly, it should be added that most of the buildings and houses inherited from past eras have survived as a result of the care that people took in order to preserve their history. Consequently, following disastrous events such as the GEJE, many buildings did not survive while others required maintenance as well as integration. Instead, for the new buildings, the conventional construction method mentioned above was adopted, which therefore combines a wooden structure with concrete elements.

However, talking about advanced constructions, it has been noted that, despite the fact that people are closely linked to traditional techniques, there is a strong increase in those who decide to live in new generation houses. And this is an unfavourable point for all the houses such as the kyo-machiya, which are becoming fewer in number. Their decrease is not only due to the requirements of choosing to live in a new place but also to the different concerns of keeping the traditional kyo-machiya alive.

In this regard, just look at how many people decide that demolishing the house is more convenient in terms of cost to reuse the land and build a new building there. Or, many people fail in keeping kyo-machiya alive because the cost of maintenance seems to be more expensive than the decision to live in a new house.

Fortunately, in this scenario the preservation of these houses seems to be in the hearts of several people. In this respect, the comparison with the city of today has been important with the purpose of adapting the old houses to the new needs.

For this reason, if on the one hand we have the traditionalists who continue to inhabit these houses, on the other hand we have those who have decided to give them a new life. Thus the concept of refunctionalization is introduced.

The following examples are different machiya cases but with the same intention of keeping them alive.

5.5 A CASE OF PARALLELISM BETWEEN A TRADITIONAL AND REFUNCTIONALIZED MACHIYA IN KYOTO

The parallelism in the choice of keeping traditional houses alive in Kyoto is divided between those who still want to breathe the air of the tradition and those who have decided to give them a new life, trying to keep some elements unchanged. In order to understand which differences are directly reflected on kyo-machiya, the following are two examples of wooden houses located in Kyoto district.

The Tondaya Tea House

Located in Kamigyo Ward, the *Tondaya House* (1885) is an example of a traditional machiya that differs from modern Japanese houses.

Although important because it retains the typical appearance of a traditional house, Tondaya housed the kimono wholesaler handled by the Tanaka family from generation to generation.

Thus, just as designed in the Meiji era, it has a workshop at the front while the living space is located at the back. Obviously, the design is kept simple in its aesthetics, with a tea room and small interior gardens allowing air to circulate, as well as a relationship with the shizen.

For the rest, the machiya has all the elements that characterise it, from the tatami to the typical façade, sliding partitions and so on.

The only difference is that, compared to the rest of the machiya, Tondaya is one of the few that has been registered as a National Cultural Heritage in 1999 and also as a Structure of Landscape Importance in Kyoto in 2007[82].

Machiya Vacation: The Machiya Residence Inn

Located in Shimogyo Ward, on the other hand, there are those who put the effort into renovating machiya to ensure that they could both be adequately accessible and also be integrated with new generation materials. As a refunctionalization process they offer many different solutions, from café bars to airbnb to hotels and so on.

This sector covers a range of machiyas adapted into luxury residences, which in their way of living are always intended to be rented out to offer a local experience. The accommodations of *Machiya Residence Inn* are carefully renovated but with respect in maintaining the historical identity and design of typical Japanese houses, although with an obvious modern twist. Therefore, It will be more difficult to find historical façades like that of Tondaya House. In any case the interior design, despite being renovated with a modern approach, has the intention of making the guest experience a holiday surrounded by the culture of a typical Japanese home[83].

82. From:
https://housingourmatureelders.wordpress.com/2018/04/28/case-study-the-machiya/

83. From: https://www.kyoto-machiya-inn.com/search/

EXTERIOR

Today, the house has become a museum that allows visitors to experience a traditional house. As a result, visitors can choose to dress in typical kimonos, take part in the tea ceremony or have lunch at a traditional bento lunchbox. All of these activities come to life inside the house which, although simple in style, sees the rooms enhanced with decorations dating back more than 100 years.

Compared to the façade of a traditional machiya, this one below has evidently been renovated in recent years, using modern materials and techniques. However, it is possible to notice the effort to keep the dark wood in the façade and the door with the screens. The upper band has not used white plaster but plays on a grey texture that creates some movement to the rigid facade.

The façade of the house reflects the concept of a traditional machiya. The entrance has the large door with typical screens, allowing privacy. The thud stools are placed under the eaves. The roof is composed of sangawara tiles. The only difference is that the windows have been replaced with newer ones because they do not have the "insect cage".

The thud stools have not been placed. The roof is not clearly visible so it is difficult to guess the style of the tiles. The eaves overhang is evidently less prominent than the previous one. The ribbon window is not visible, probably it could be placed on another side of the house. In its place there seems to be an overlook from a small terrace.

Fig. 87. The narrow and traditional façade of Tondaya Tea House, Kyoto.

Fig. 88. The modern façade of Machiya Vacation Rentals, Machiya Residence Inn, Kyoto.

As Tondaya House is now used as a museum, it is not possible to easily get hold of the images.
As the thirteen generations of the Tanaka family are recognised for their manufacturing of kimonos, inside the references are more focused on the textile material and its processing through special tools. Indeed, in many rooms, it is possible to find a collection of traditional kimonos from past eras.

Sumihotaru Oboro is an experience in a traditional machiya through the special use of light.
All the rooms are subjugated by a play of light that recalls the delicate glow of fireflies, creating a contrast between light and shadow that spatially transforms the interior design of the house. The use of warm natural light emphasises the textures of wood and stone, creating a sophisticated living space.

Fig. 89. Selling Kimonos in the storefront area of the Tondaya House.

Fig. 90. Elegant kitchen and dining room with rose gold fittings. Adjacent is a Japanese living room with a wall adorned with silver leaves.
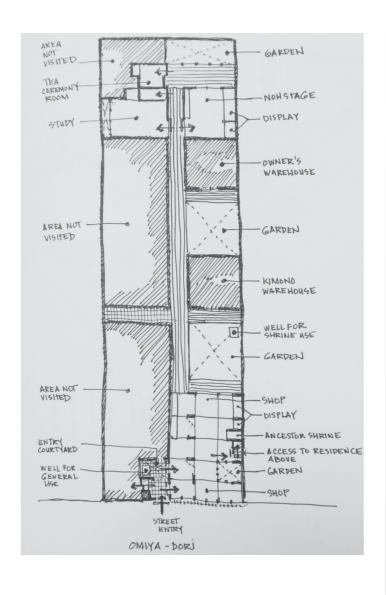
Fig. 91. Inner courtyard of Tondaya House.

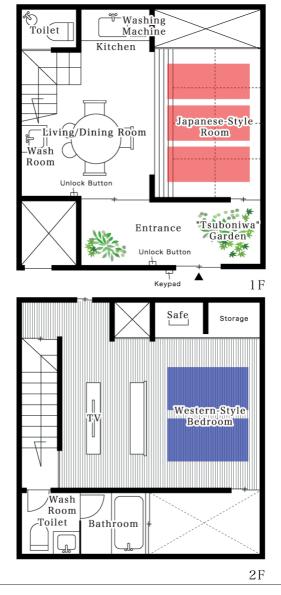Fig. 92. Inner courtyard in a Machiya residence.

Fig. 93. Plan of machiya Tondaya showing the internal division with the shop frontage facing the street and a series of internal courtyards acting as dividers.

Fig. 94. Plan of the machiya residence showing the internal division with the garden at the entrance.
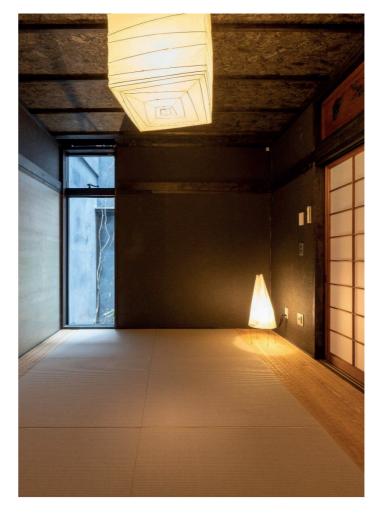
Fig. 95. Interior perspective of entry courtyard at the Tondaya House.

Fig. 96. Interior perspective of the machiya residence showing the decorative detail "ranma" above the entrance and the ceiling wood painted in brilliant black.

CONCLUSIONS

As disaster risk awareness grows, so does awareness of the risks to cultural heritage.

Looking at the damage caused by a series of disasters, there is a realisation of the need to build resilient cities, with a focus on heritage assets in order to protect it. And Japan is one of the countries with the longest experience in this field, with perspectives that have strongly changed not only their lifestyle but also that of other countries that have realised the problem.

Japan's experience has found concrete expression in the actualisation of the Sendai Framework, a tool that outlines priorities for action as guidelines for dealing with future challenges with greater preparedness. The reaction of many countries that have decided to join this political model is a testament of their understanding that building resilience can substantially reduce not only future losses in assets but also in lives.

The historical passages through the different eras are fundamental for understanding how sensitivity to cultural heritage has grown and what efforts have been made to protect it. The attention paid to the evolution of Kyoto's urban history in the Meiji era has allowed to understand that the development of wooden houses has been sequential, as a result of governmental decision-making dynamics and necessity of the people.

Kyoto's identity reflects the image of an historical layout that must not be forgotten. However, this intention to keep culture and tradition alive must coexist with the dynamics of the present. Even with uncomfortable dynamics like those resulting from the threat of natural disasters.

The case of Kamigyo shows how many machiya houses inherited from the past are at risk of being lost, and most are not part of the UNESCO Heritage. For this reason, their survival must be protected at a practical level, through renovation or refunctionalisation, which allow them to take on a new life. It is necessary to make an increasing effort towards the recovery of machiya, otherwise their densification will be increasingly lost over

the course of time. Japanese culture brings together fundamental components for its atmosphere which is so unique and attractive. Traditions, local culture, but above all craft techniques, are fundamental to keeping alive the spirit of typical places like Kyoto and machiya are part of this reality, dressed in the pure material of wood. The machiya must be protected and with them the importance of woodworking techniques must be handed down.

The use of existing research has helped to estimate how many houses have been lost, partly for uncontrollable reasons due to natural disasters, partly because of the carelessness of keeping them alive.
Embracing a political model such as the Sendai Framework it possible to understand how the use of digital tools is essential both to monitor disaster behaviour and to disseminate data to the public, with the intention of making people aware that their behaviour is crucial to their own safety. Thus, the digital method is not only a research tool but also acts as a support to create a useful and accessible result for the public.

In this case, the intention was to connect how the use of digital maps have contributed to comprehend the development of urban history, to identify specifically the machiya, which are today very vulnerable.
Natural factors are certainly a threat that does not make their survival any easier, so it is necessary to monitor them through the possibilities that tools offer.
Awareness of the risk increases the responsibility for heritage protection and disaster preparedness enables post-disaster recovery operations to be reduced.

REFERENCES

Abe, K., "Early Western Architecture in Japan", *Journal of the Society of Architectural Historians* 13, no. 2, (1954): 13–18.

Akagawa, Natsuko, *Heritage Conservation and Japan's Cultural Diplomacy. Heritage, National Identity and National Interest*, Routledge, 2015.

Akimoto, Y.; Ikuyo, K.; Himoto, K.; Hokugo, A.; Sugimoto, R.; Tanaka, T., "Fire Risk Assessment Of Japanese Traditional Wooden District Based On Physics-Based Model For Urban Fire Spread A Study On Effectiveness Of Fire Fighting Activities Of Community Residents In Kyoto Sanneizaka District", *AOFST Symposiums*, 2007.

Asano, Satoshi. "The Conservation of Historic Environments in Japan.", *Built Environment (1978-)* 25, no. 3 (1999): 236-43. Accessed September 8, 2021. http://www.jstor.org/stable/23287816.

Bortolotto, Chiara. "FROM OBJECTS TO PROCESSES: UNESCO'S 'INTANGIBLE CULTURAL HERITAGE.'" *Journal of Museum Ethnography*, no. 19 (2007): 21-33.
Accessed September 8, 2021. http://www.jstor.org/stable/40793837.

Cang V. , "Defining Intangible Cultural Heritage and its Stakeholders: the Case of Japan", *International Journal of Intangible Heritage*, (2007). DOI:10.35638/IJIH.2007..2.004

European Parliament, "Protecting Cultural Heritage from Natural Disasters", Policy Department Structural and Cohesion Policies, 2007.

Esposito F.; Russo M.; Sargolini M.; Sartori L.; *Building Back Better: idee e percorsi per la costruzione di comunità resilienti*, Carocci Editore, 2017.

Fabbricatti, Katia; Boissenin, Lucie and Citoni, Michele . "Heritage Community Resilience: towards new approaches for urban resilience and sustainability." *City, Territory and Architecture* 7, no. 1 (2020).

Geddes, Zuzana; Soz, Salman Anees, *Promoting Disaster Resilient Cultural Heritage*, Washington, DC, © World Bank, 2017.

Gianighian, G.; Paolucci, M. Dario, *Il restauro in Giappone*, Alinea, 2011.

Goldie, George Taubman, "Geographical Ideals", *The Geographical Journal, V*ol. 29, no. 1 (January 1907): 1-14.

Grezio, A.; Babeyko, A.; Baptista, M. A.; Behrens, J.; Costa, A.; Davies, G.,…Thio, H. K., "Probabilistic Tsunami Hazard Analysis: Multiple sources and global applications", *Reviews of Geophysics* 55, (2017): 1158-1198. https://doi.org/10.1002/2017RG000579

Gryko, M., "MANUFACTURING THE WOODEN CITY: A study into the development of wood construction in Japan", Th. diss., University of Tokyo, 2017.

Hanazato, Toshikazu; Chikahiro, Minowa; Yasushi, Niitsu; Kazuhiko, Nitto; Naohito, Kawai; Hideyuki, Maekaw;, and Masayuki, Morii, "Seismic and Wind Performance of Five-Storied Pagoda of Timber Heritage Structure", *Advanced Materials Research* 133–134 (October 2010): 79–95. https://doi.org/10.4028/www.scientific.net/amr.133-134.79.

Harada, T., "Progress toward Development of Fire-Resistant Wooden Structures in Japan", Vol. 55, no. 2, (2009):1-9. Translated from Japanese.

Himoto, Keisuke, "An Analysis of the Post-earthquake Fire Safety of Historic Buildings in Kyoto, Japan", Th. diss., Kyoto University, 2013.

ICOMOS, *The Great East Japan Earthquake. Report on the Damage to the Cultural Heritage*, Japan ICOMOS National Committee, 2012.

Iizuka T.; Matsumoto A.; Seto T.; Yano K., "GIS-BASED MONITORING SYSTEMS FOR KYO-MACHIYA IN KYOTO CITY", 2009.

Iizuka T.; Matsumoto A.; Seto T.; Yano K., "PUBLIC PARTICIPATION GIS OF HISTORICAL LANDSCAPES: A CASE STUDY OF "KYO-MACHIYA COMMUNITY-BUILDING SURVEY IN KYOTO CITY", 2009.

Istituto Giapponese di Cultura, *Il Giappone scopre l'Occidente, Una missione diplomatica 1871-73*, Carte Segrete, 1994.

Izumida, Hideo, "Machiya: A Typology of Japanese Townhouses. 町屋：日本の都市型住居の伝統と保存", *1st TTCL Annual Symposium,* Melaka, 2011.

Kakiuchi, Emiko, "Cultural heritage protection system in Japan: current issues and prospects for the future," *GRIPS Discussion Papers,* 14-10, National Graduate Institute for Policy Studies.

Kobayashi, Masami, "Urban post-earthquake fires in Japan", Th. diss., Kyoto University.

Kunie, Sugio, "Large-scale Disasters on World Heritage and Cultural Heritage in Japan: Significant Impacts and Sustainable Management Cases", (2015). DOI:10.1080/01426397.2015.1057806

Licciardi G., and Amirtahmasebi R., *The Economics of Uniqueness: Investing in Historic City Cores and Cultural Heritage Assets for Sustainable Development*, Washington, DC, © World Bank, 2012.

Maly, E.; Suppasri, A., "The Sendai Framework for Disaster Risk Reduction at Five: Lessons from the 2011 Great East Japan Earthquake and Tsunami", *International Journal of Disaster Risk Science*, Vol. 11, (2020): 167–178. https://doi.org/10.1007/s13753-020-00268-9

Mannakkara, Sandeeka; and Dr. Wilkinson, Suzanne, "Building Back Better in Japan – Lessons from the Indian Ocean Tsunami experience in Sri Lanka", Th. diss., University of Auckland.

Meier, Hans-Rudolf; Petzet, Michael; Will, Thomas, "Cultural Heritage and Natural Disasters. Risk Preparedness and the Limits of Prevention", *International Council on Monuments and Sites*, TUDpress, 2007.

MLIT, "Manual for Economic Evaluation of Flood Control Investment (Draft)," River Bureau, 2005.

Monserrati, Michele, *Searching for Japan: 20th Century Italy's Fascination with Japanese Culture*, Liverpool University Press, 2020.

Morris, Martin, "Kyo-Machiya: Tracing the Development of the Traditional Town Houses of Kyoto Through the Medieval Centuries, Vernacular Architecture", 37, (2006): 1-23. DOI: 10.1179/174962906X158219

Murahashi, Masatake; Tanaka, Yu; Yonemoto, Hiroya; Sonoda, Suguru, "A study on the improvement of densely build-up area with wooden buildings considering front sequence. The case of Kamigyo-ward in Kyoto", *J-Stage*, Vol. 1, (2006):1-6. Translated from Japanese.

Niglio, O., *Sulle tracce del Ma. Riflessioni sulla conservazione dell'architettura in Giappone,* University Press, 2010.

Okubo, Takeyuki, "Traditional wisdom for disaster mitigation in history of Japanese Architectures and historic cities", *Journal of Cultural Heritage* 20, (2016): 715–724.

Ooi, Fumie, "ORIGINALITY OF CENTRAL COLUMN IN JAPANESE PAGODA", *2nd International Conference,* (July 2012): 324-329.

Potutan, Gerald, "Planning for Disaster Resilience in Japan: Integration of 'Build Back Better", *Indian Journal of Public Administration*, Vol. 65, no. 3, (2019): 611-626. https://doi.org/10.1177/0019556119844560

Seto, T; Iizuka, T; Matsumoto, A.; Kirimura, T.; Yano, K.; Nakaya, T.; Isoda, Y.,"Transition of Urban Landscape with Kyo-machiya in Virtual Kyoto", *2nd International Conference od Digital Archives and Digital Humanities Symposium*, Ritsumeikan University, 2010.

Shrestha S.; Shrestha B.; Shakya M.; Maskey PN., "Damage Assessment of Cultural Heritage Structures after the 2015 Gorkha, Nepal, Earthquake: A Case Study of Jagannath Temple", *Earthquake Spectra,* (2017):363-376. DOI:10.1193/121616eqs241m

Shively, D., and McCullough, W. (Eds.), *The Cambridge History of Japan*, Cambridge University Press, 1999.

Stavros, Matthew, *Kyoto: An Urban History of Japan's Premodern Capital,* University of Hawai'i Press, 2014.

Takamitsu, Jimura, 2011, "The impact of world heritage site designation on local communities - A case study of Ogimachi", (2011). DOI:10.1016/j.tourman.2010.02.005

Taut, B., *Houses and People of Japan*, John Gifford Ltd, 1983.

Tseng, Alice Y., *Modern Kyoto: Building for Ceremony and Commemoration, 1868-1940,* Spatial Habitus: Making and Meaning in Asia's Architecture, University of Hawaii Press, 2018.

Udmale, P.; Tachikawa, Y.; Kobayashi, K.; Sayama, T.; "Flood Hazard Mapping in Japan", PhD diss., Universities of Kyoto and Kobe.

UNISDR, *Terminology on Disaster Risk Reduction*, published by the United Nations International Strategy for Disaster Reduction (UNISDR), 2009.

Van Thoor M.T.; Stroux S., "Heritage, History and Design between East and West", Th. diss., TU Delft, 2018.

Wibowo, Arif Sarwo; "Conservation of Wooden Architecture: Willingness, Support and Tradition", *Procedia - Social and Behavioral Sciences 184*, (2015): 388-393.

World Bank Group, "BUILDING REGULATION FOR RESILIENCE. Converting Disaster Experience into a Safer Built Environment: The Case of Japan", World Bank, Tokyo, 2018.

World Bank Group, "Cultural Heritage, Sustainable Tourism and Urban Regeneration: Capturing Lessons and Experience from Japan with a focus on Kyoto", Tokyo Developing Learning Center, 2018.

World Bank Group, "PREPAREDNESS MAP FOR COMMUNITY RESILIENCE: EARTHQUAKES. Experience of Japan", The World Bank, 2016.

Yamasaki, Masafumi, " Control tools for conservation of historic townscape with citizens' strong property right: Experience of Kyoto", *15th ICOMOS General Assembly and International Symposium,* 2005.

Yoshiaki A., "An overview of modern Japanese wood construction-Interaction with tradition", Th. diss., University of Technology of Vienna, 2004.

Yoshii Y., "Preserving Alleyways to Increase Walkability of Historical Japanese Cities", *Procedia - Social and Behavioral Sciences 216*, (2016): 603-609.

https://www.arc.ritsumei.ac.jp/archive01/theater/html/ModernKyoto/

http://www.bousai.go.jp/index-e.html

https://www.city.kyoto.lg.jp/kamigyo/page/0000054496.html

https://crafttabby.com/explore/heiankyo-superimposed-map

http://www.greatkantoearthquake.com/map_archive.html

http://www.hgeo.h.kyoto-u.ac.jp/soramitsu/heijokyo.html

https://housingourmatureelders.wordpress.com/2018/04/28/case-study-the-machiya/

https://iris.wpro.who.int/handle/10665.1/5547

https://www.machiya-kyoto.net/villa-silktree/

https://rinn-kyomachi.com/en/machiya/

http://www.ritsumei.ac.jp/

http://www.ritsumei.ac.jp/research/radiant/eng/kyoto/story9.html/

https://whc.unesco.org/en/list/688/

https://www.undrr.org/implementing-sendai-framework/what-sendai-framework