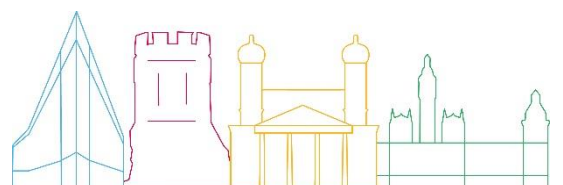




ARCH D3.3 City baseline report - Camerino

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1. City profile

The municipality of Camerino (Figure 1) has a total surface area of 128km² with the Old Town accounting for 0.15km². The municipality is located at an altitude of 600m and dominates the surrounding hilly landscape. It includes a hospital and the headquarters of the University of Camerino which are considered important institutions for the interior territory of the Marche Region between the Apennines (Italian mountains) and the coastal areas near the Adriatic Sea.

After a major earthquake occurred in Central-Italy Earthquake in 2016, the entire population of Camerino's Old Town was temporarily displaced as a consequence of housing and other property lost or rendered uninhabitable. Some people were relocated to housing in other towns with national funds allocated to support the payment of residential rent. Others were temporarily re-housed in pre-cast buildings located in emergency reception areas.

The Old Town is the focus for the ARCH project. This area is situated at the top of a hilly ridge and enclosed within the city's medieval defensive walls. The Old Town of Camerino contains a very large number of historic buildings, churches and artworks, with considerable artistic, architectural and historical value, which could benefit from methods and tools to improve their management and preservation. Thus, the overall aim for the ARCH project is to mitigate the impact of natural hazards on the Old Town by developing knowledge and tools for monitoring and preserving these significant cultural heritage assets.

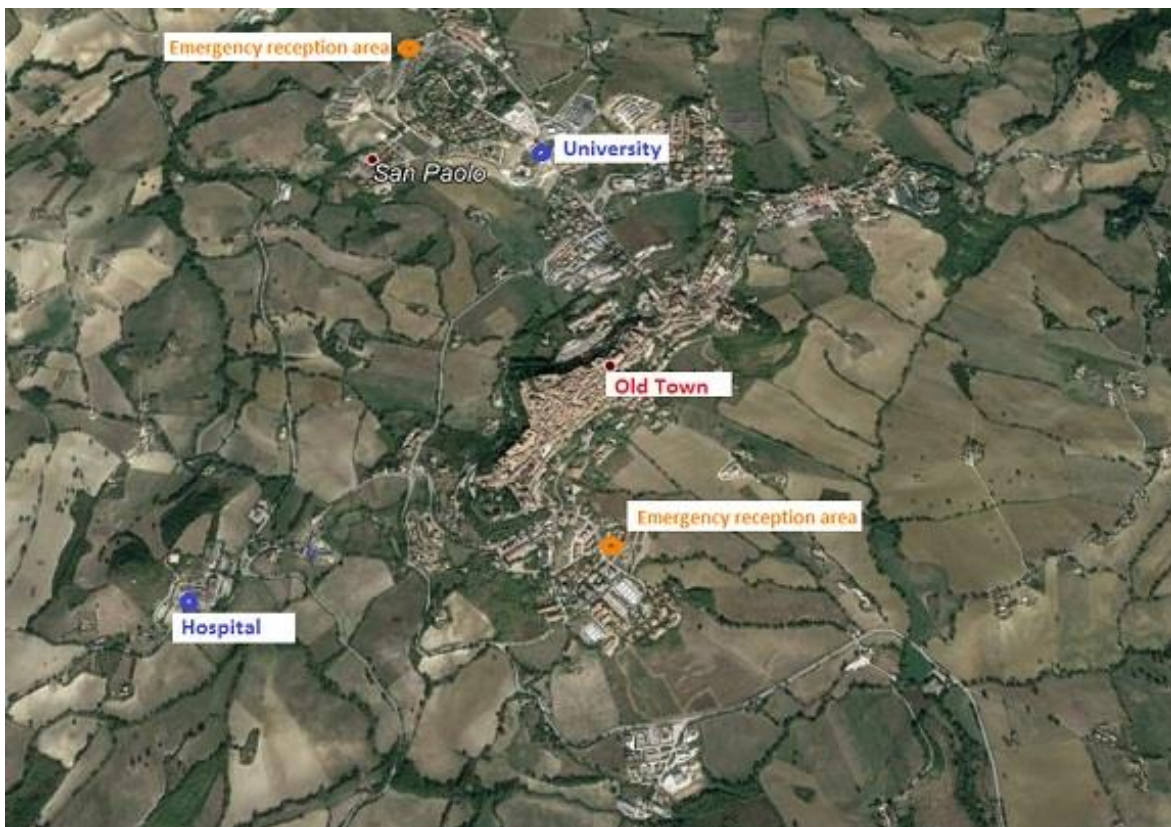


Figure 1. Camerino municipality area [1].

1.1. Demographic features

The population of Camerino's municipality stands at 6,852 (2018) with similar numbers of male and female inhabitants (Table 1). The Old Town had a total of 760 inhabitants up to the last seismic event in 2016. Camerino's population trends are reflected in Table 2. The municipality has noted a population decline, especially after the 2016 earthquake (Figure 2).

Gender	Before Earthquake (September 2016)	After Earthquake (November 2016)	2018
Male	-	-	3,360
Female	-	-	3,492
Total	7,016	6,991	6,852

Table 1. Data of population (Camerino) after the last earthquake of 2016 (2018) [2].

Year	Population
1971	8,499
1981	7,975
1991	7,320
2001	6,858
2011	6,897

Table 2. Demographic development of Camerino from 1971 to 2011 (2018) [2].

The demographic development of the municipality of Camerino was impacted by a depopulation trend, related to a mass relocation process from the internal areas of the Marche Region to coastal areas and to other bigger cities (Figure 3). In general, due to economic and social reasons, the population growth rate can be considered negative for the municipality. In fact, several migrant flows can be identified both for Camerino and the area near the Apennines. The first occurred during the first decades of the twentieth century as a result of economic conditions in the rural areas. The second migration flow happened after the Second

World War; away from the rural areas and towards the valleys, the industrialised areas of the big towns and the coastal areas that offer greater job opportunities and better services.

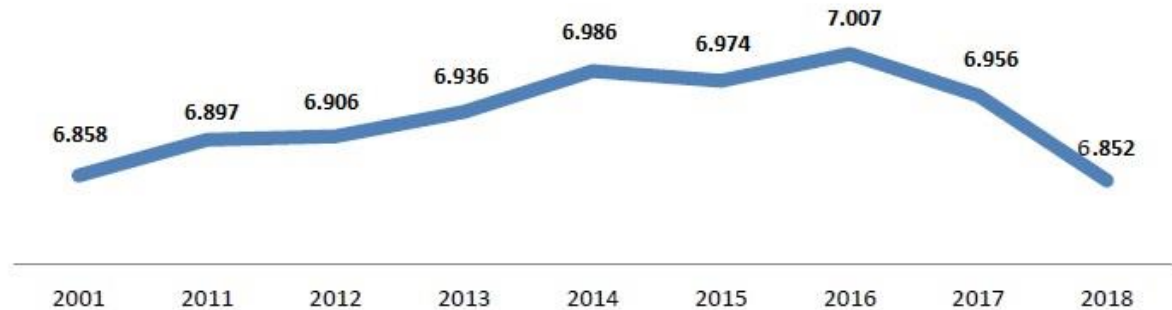


Figure 2. Population trend of Camerino (2001-2018) [3].

These phenomena resulted in a progressive aging of the population; a phenomenon reflected both in Camerino and the Apennine area of the Marche Region. The data concerning population density for the Marche Region (Figure 3) highlights the high density (orange and red colour) for the biggest cities in the coastal areas and for the industrialised zones; low population density characterises the internal zones (pink and yellow colour).

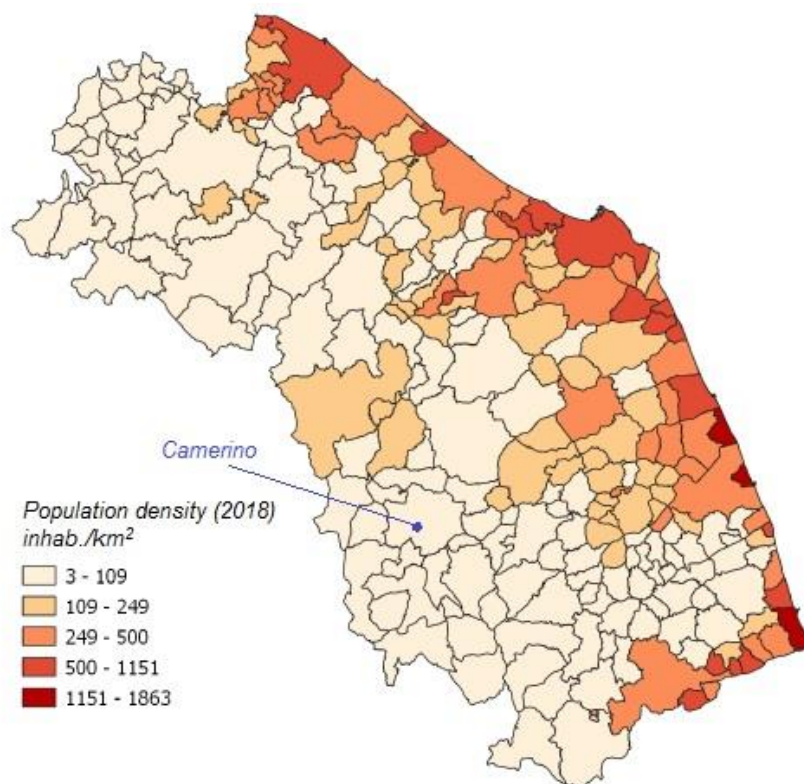


Figure 3. Population density (2018) of Marche Region [4].

After the 2016 Central-Italy earthquake, the entire population of the Old Town was temporarily displaced due to property/housing lost or rendered uninhabitable.

An analysis conducted on 25th September 2019 [5] highlights that a large number of people, approximately equal to 2,242 inhabitants, had obtained funds to support rental payments in temporary residences. As previously mentioned, approximately 1,179 inhabitants were relocated to other towns with national funds to support residential rent, whereas others were temporarily relocated to emergency reception areas. The result has been a low population density in the municipalities inside the earthquake-stricken areas (Figure 4).

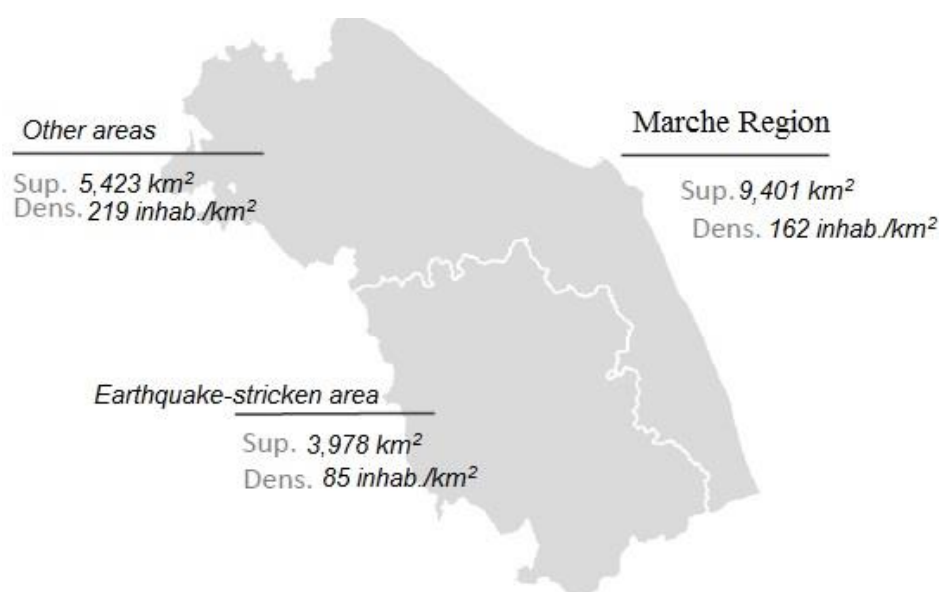


Figure 4. Population density (2018) of Marche Region [3].

The natural growth rate of Camerino's population (Table 3) is negative (-8.10%) and it is lower than the average value for the Marche Region; the internal migration rate is negative (-11.6%) principally due to the economic and social effects of the last earthquake event.

Growth rate	Municipality of Camerino	Marche Region
Natural growth rate (‰)	-8.1	-4.6
Internal migrant rate (‰)	-11.6	-0.1
Foreign migrant rate (‰)	6.8	2.4
Total growth rate (‰)	-15.1	-4.2

Table 3. Population growth rate (2018) of Camerino and of Marche Region [3].

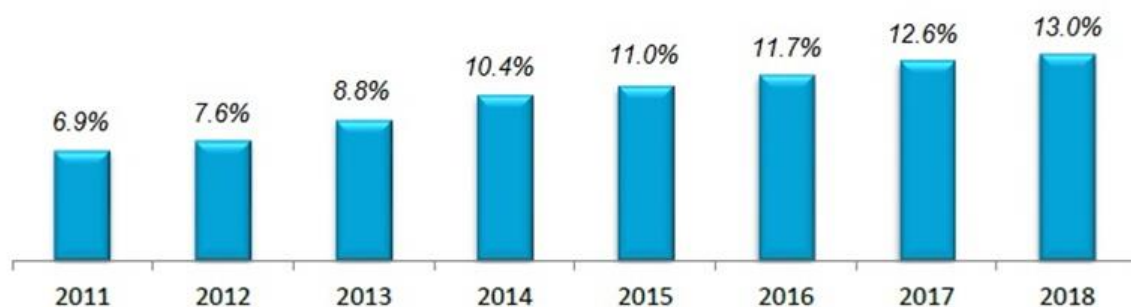


Figure 5. Foreign inhabitants (2018) of Camerino [3].

The collected data (Figure 5) highlights the increment of foreign inhabitants in Camerino who principally come from Europe, Africa and Asia (Table 4). The total growth rate of Camerino's population is negative (Table 3) and it is higher than the average value for the Marche Region.

Approximately, half of the population is in the age range 45-84 with a life expectancy of about 83 years (see Table 5). The percentage of inhabitants in the age range (0-14) is equivalent to 9.7% (Figure 6). The old age indicator is equal to 280.1 (Figure 7); a high value that is similar to other municipalities of the earthquake-stricken areas in the southern part of the Marche Region. Additional data on Camerino's population is shown in Figure 8.

Native land	Municipality of Camerino	Marche Region
Europe	41.1%	53.7%
Africa	24.6%	19.9%
Asia	30.0%	20.9%
America	4.0%	5.5%
Oceania and stateless persons	0.22%	0.04%

Table 4. Native land of foreign inhabitants (2018) of Camerino [3].

Age Range	Number of people	Percentage
0-5	232	3.41 %
6-17	609	8.97%
18-24	358	5.27%
25-34	957	14.10%
35-44	839	12.36%
45-64	1,921	28.31%
65-84	1,526	22.49%
+ 85	342	5.04%

Table 5. Average age distribution, excluding university students (2020) [2].

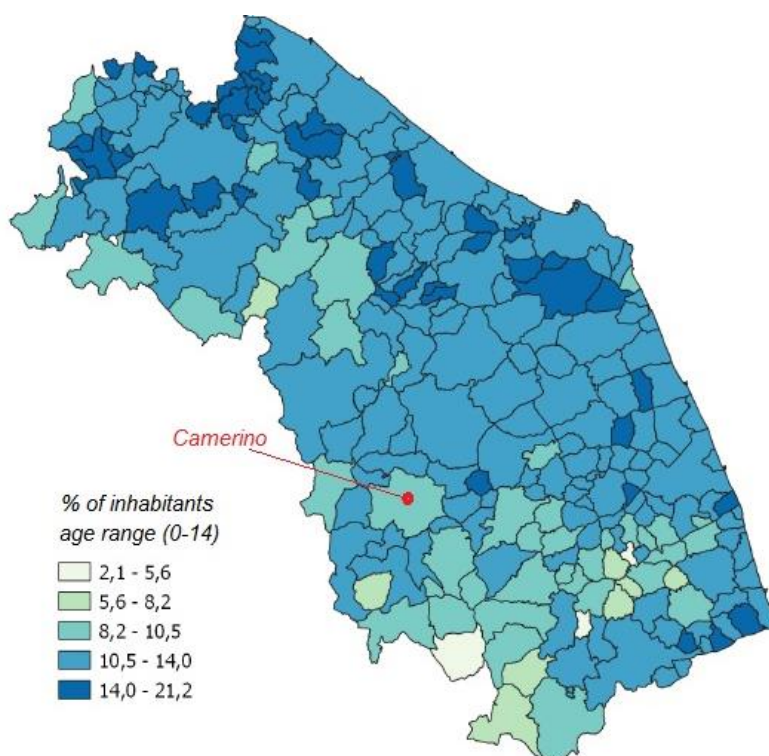


Figure 6. Percentages of inhabitants of Marche Region (2019) for the age range (0-14) [4].

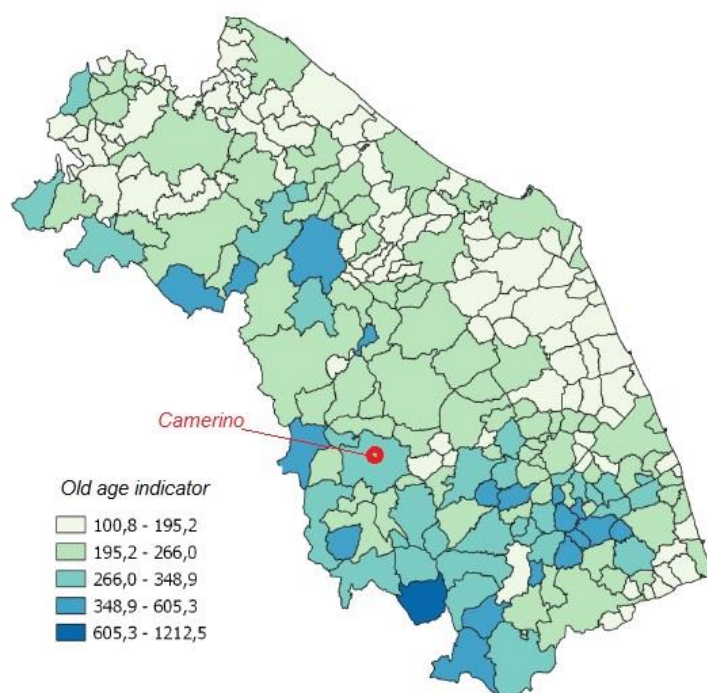


Figure 7. Old age indicators of Marche Region (2019). This indicator is equal to the number of inhabitants with age higher than 65 years respect to 100 inhabitants of age lower than 14 years [4].

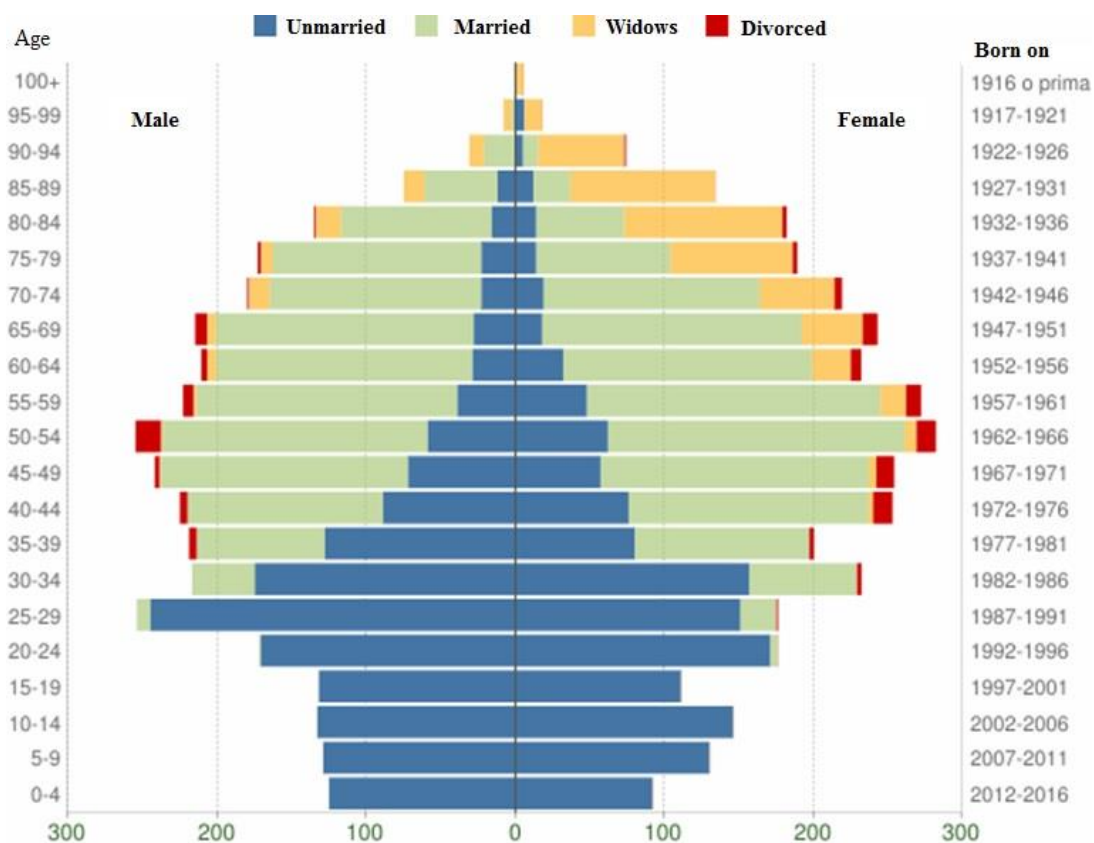


Figure 8. Population of Camerino (2016) divided for age, male and female, unmarried, married, widows and divorced [6].

1.2. Economic features

Figures 9 and 10 below show the development of enterprises and the corresponding sectors in Camerino. The number of enterprises reflected a light decrease since 2010 (Figure 9) both due to the international financial crisis (2008) and to local reasons. Small companies, often family-run, are responsible for most commercial activity in Camerino. Following the 2016 seismic event, several stores located in the Old Town closed and were relocated to new sites financed by national funds. According to statistics, the most prevalent service sectors in Camerino's municipality in 2018 were agriculture and silviculture, followed by commerce, construction, and lodging and food services (Figure 10). The size of the rural area is a significant determinant of the rate of activities in agriculture and forestry. The increment of the average age of the farmers employed in this sector is due to both demographic and cultural reasons. The economic vitality of the urban area is closely linked to the University: the presence of numerous students is very important for local economic activities. Tourism is a developing sector that is focused both on cultural heritage from the Renaissance period, and on the preservation of the natural landscape. The industrial sector, comprising only a few small companies, is very modest. On the other hand, the number of handcraft enterprises (manufacturing activities in Figure 10) is relevant. The distribution of Camerino's enterprises has a similar trend to those of other earthquake-stricken areas in the region (Figure 11).

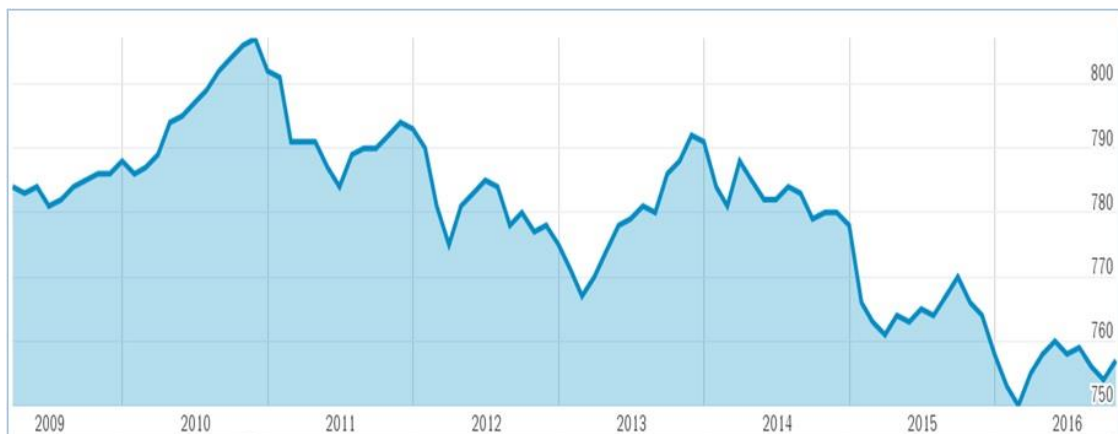


Figure 9. Number of enterprises from 2009 to 2016 for the municipality of Camerino [7].

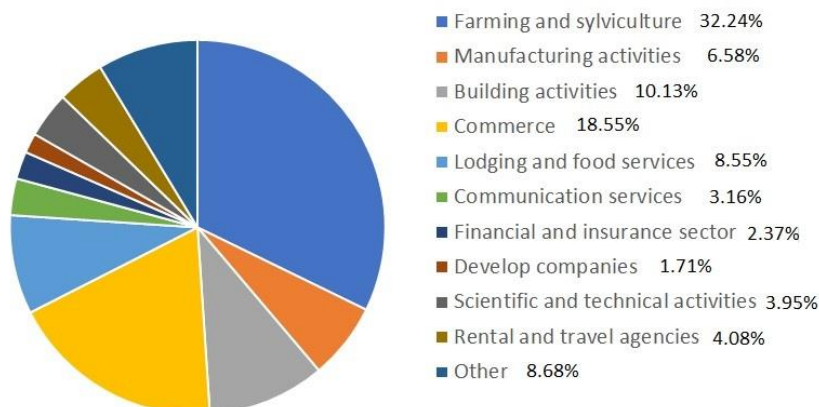


Figure 10. Distribution of Camerino's enterprises (2018) [3].

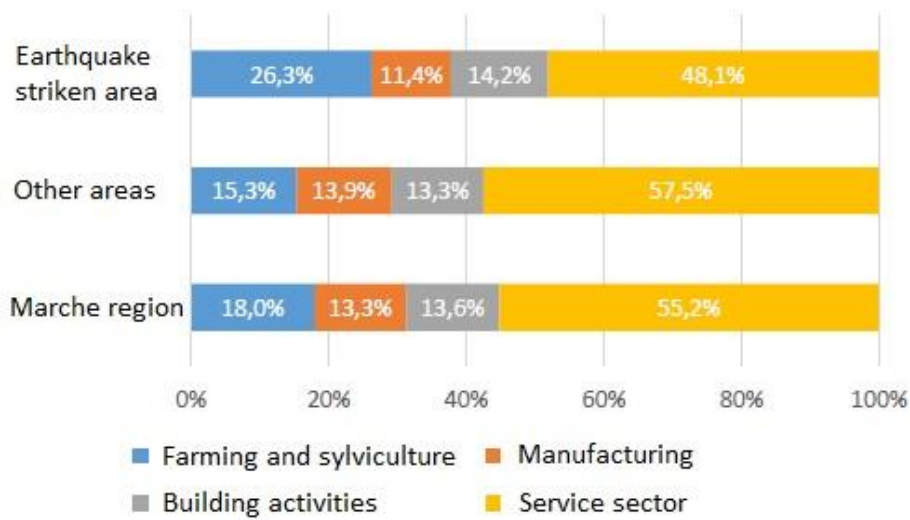


Figure 11. Distribution of enterprises of the Marche Region (2018) [3].

After the decrease in the number of enterprises due to the 2016 earthquake, the growth rate (Figure 12) displays substantial equilibrium for the year 2018. Commercial and manufacturing centres have been built with national financial funds in order to allow the relocation of some activities. The taxable income of Camerino (Table 6) includes activities related to the tertiary sector, as a direct result of the presence of the local University which is important for a small municipality like Camerino.

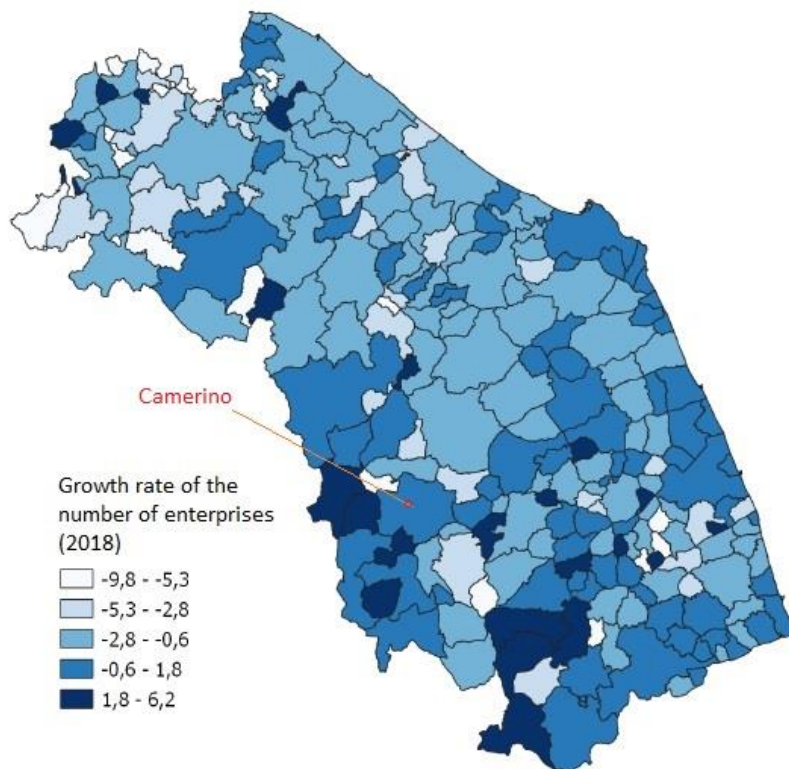


Figure 12. Growth rate (%) concerning the number of enterprises for the Marche Region (2018) [4].

Taxable income for contributor	Taxable income for inhabitants
21,502 €	14,621 €

Table 6. Taxable income (2017) for the municipality of Camerino [3].

1.3. Vulnerabilities and risks

The municipality of Camerino identifies the elderly as the most socially vulnerable population group (adults over 65). Prior to the Central-Italy earthquake of 2016, many such elderly people lived in Camerino's historical centre, and were hence part of the relocation to temporary housing or to other towns mentioned earlier. Older adults may be most vulnerable to natural disasters and emergency events, such as the 2016 Central-Italy earthquake. Since then, the municipality of Camerino has supported initiatives to improve the psychological health of inhabitants, especially for younger persons. Furthermore, the local University has provided funds to support students through online courses. There is not a significant number of homeless people due to the limited parameters of the urban area; furthermore, access to the Old Town has been prohibited since the last earthquake. Inhabitants with economic difficulties are supported by municipal and ecclesiastical institutions, while families and small companies that were relocated after the 2016 seismic events are supported by national funds (as mentioned earlier). However, a spatial mapping/analysis of vulnerable population groups/areas in the municipality currently does not exist.

In terms of the built fabric of Camerino, many buildings located in Camerino's historic centre pre-date 1974 (Table 7) when seismic standards became obligatory. The time needed to complete the post-earthquake rebuilding process will influence the future possibility of people returning to Camerino's urban area. This issue will also influence the social and economic profile of Camerino in coming years.

In response to the risk of seismic activity, the municipality of Camerino has mapped the following:

- Emergency response procedures and responsibilities in the city;
- Preliminary cultural heritage protection strategies and key legislation.

Additional mapping activities that could be useful to the municipality in building its resilience include the mapping of:

- a) existing cultural heritage protection measures, strategies and key legislation in the city;
- b) existing databases on natural risk information for the city; and
- c) decision-making structures in the city regarding cultural heritage protection.

Construction age	% of residential buildings
< 1918	43.0%
1919-1945	13.4%
1946-1960	6.2%
1961-1970	6.7%
1971-1980	9.2%
1981-1990	6.5%
1991-2000	7.6%
2001-2005	3.7%
> 2006	3.7%

Table 7. Construction age of residential building (2011) of Camerino [3].

2. Target historic areas identified for ARCH

2.1. Overview

The municipality of Camerino's territory (Province of Macerata, Marche Region, Italy) is centrally located between the rivers Potenza and Chienti (Figure 13). The territory of Camerino is characterised by large areas with high naturalistic and environmental value.

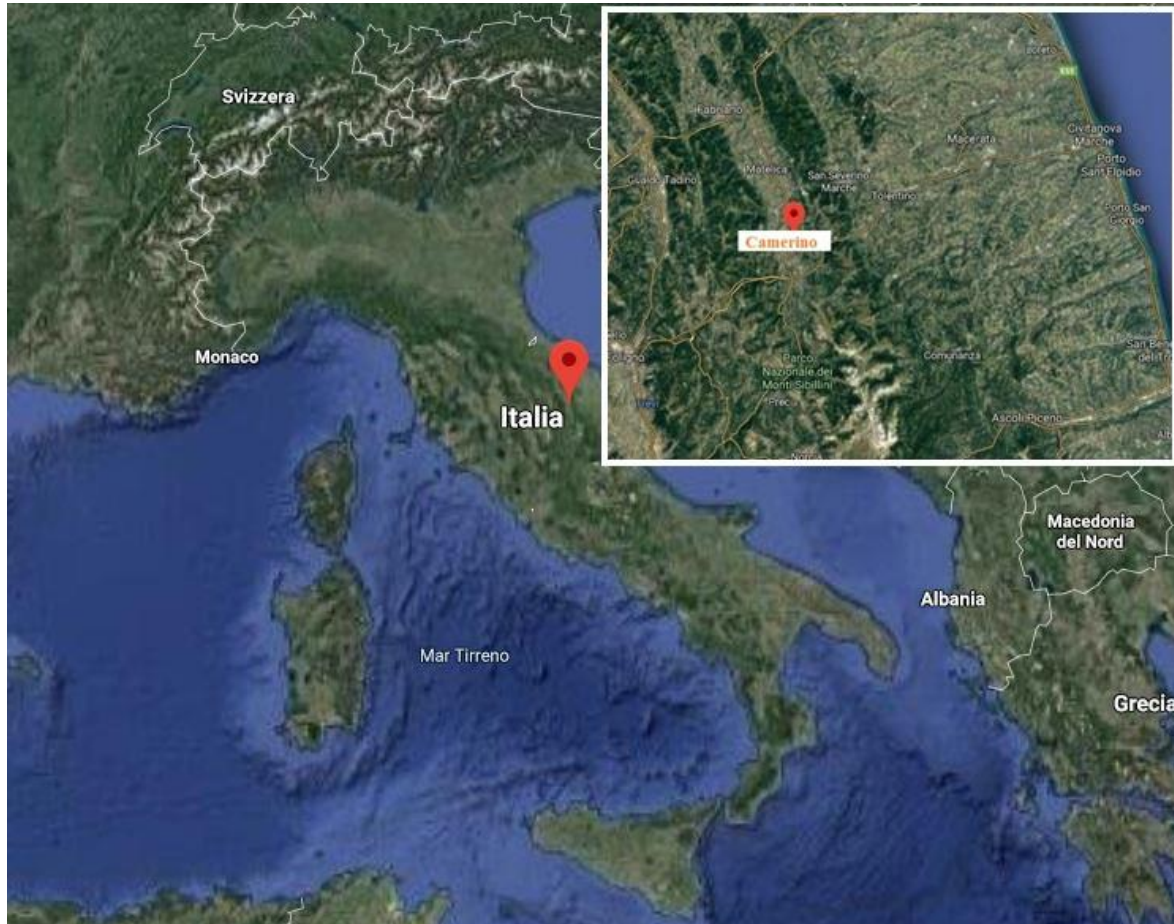


Figure 13. Camerino's geographic location [1].

For the purposes of the ARCH project, the city case of Camerino will focus on the entire Old Town (Figure 14). The Old Town is well defined by its physical area; it is situated at the top of a hilly ridge and enclosed within the ancient walls which represent the town's medieval defensive perimeter. The old town of Camerino is a historical urban centre (300 B.C.) that was expanded during the Roman Age. The current road network design is essentially based on the medieval pattern. The urban morphology of the Old Town features a compact and continuous urban context, characterised by a high building density and irregular, jagged road network of medieval origin. The Old Town has a surface area of 150,000 m² and contains a very large number of buildings, churches and monuments, some of them of considerable artistic, architectural and historical value. Figure 15 illustrates the location of key buildings within the

Old Town, among them the Ducal Palace and Santa Maria in Via Church, which are discussed in detail later in this chapter.



Figure 14. Urban centre of Camerino (MC, Italy) [8].

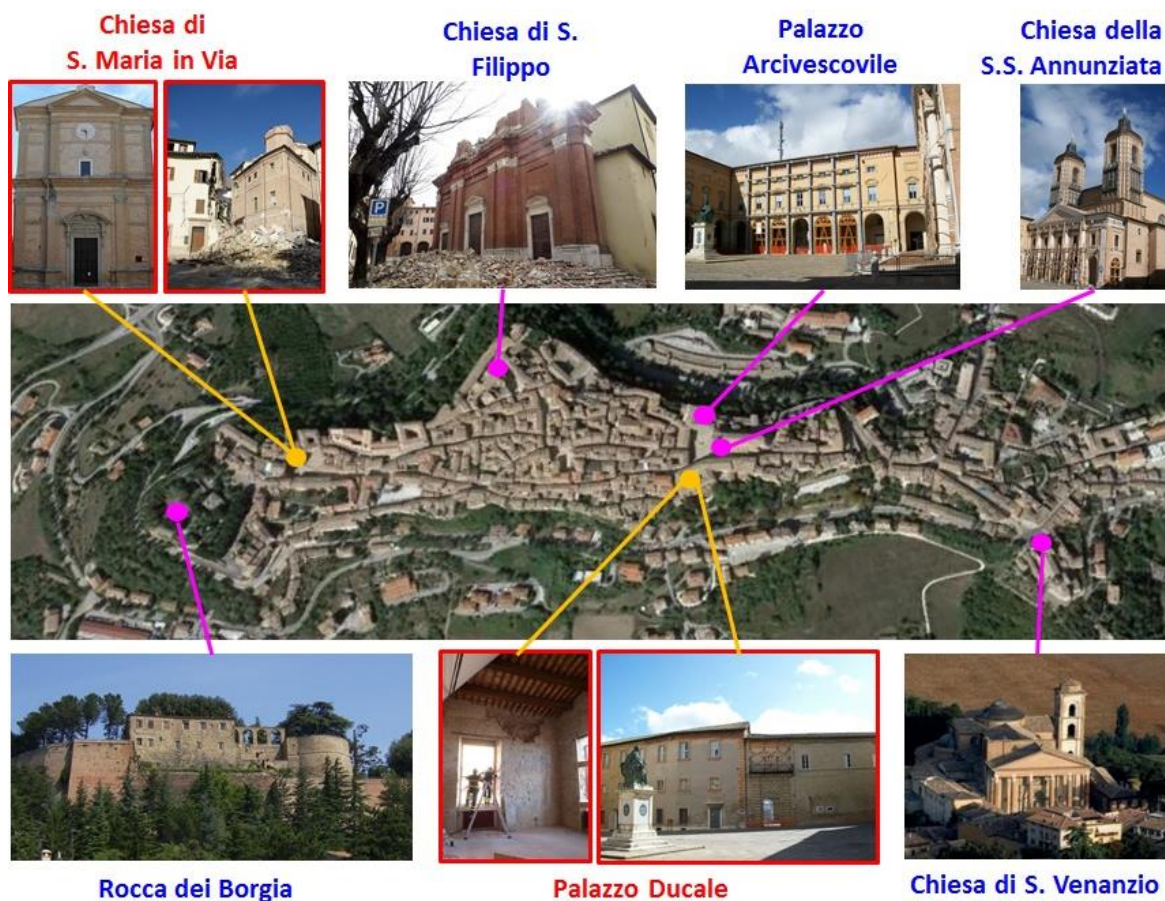


Figure 15. City map of the old town, showing locations of key buildings St. Maria in Via's Church and the Ducal Palace [1, 9, 10, 11].

2.2. Key stakeholders

Local stakeholders relevant to the ARCH project's focus on cultural heritage, disaster risk reduction and climate adaptation have been separately mapped, and more information can be found in related ARCH deliverable D3.2: local partnership and work plan. Table 8 below

presents the different entities involved in the management and maintenance of cultural heritage, as well as civil protection and disaster recovery in the municipality of Camerino.

No.	Institution	Description
1	Civil Protection Office of Camerino (COC) [8]	First authority that organises, under the supervision of the mayor, disaster or emergency response, before the successive and possible interventions of the regional and national civil protection departments. The COC is divided into nine offices that have several supportive tasks: <ul style="list-style-type: none"> a. Technical and planning tasks; b. Health and veterinary assistance; c. Local voluntary organisations; d. Material resources and logistics; e. Main networks (electric, hydric, etc.) and school services; f. Preliminary damage evaluation; g. Operability of the main roads; h. Telecommunication networks; i. Preliminary assistance to population.
2	Civil Protection Office of Marche Region [12]	Authority that organises emergency response at regional level concerning health assistance, material resources and logistics, assistance to the population, etc.
3	Episcopate (diocese) of Camerino [13]	Manages local churches, some artwork museums and local refuges.
4	Superintendence of Architectural and Landscape Heritage of Marche Region [14]	Manages, at regional level, architectural heritage, museums and natural reserves. This authority approves private and public activities that involve cultural heritage.
5	Office for Reconstruction [15]	Manages, at regional level, urban planning and related financing, and authorises technical design and funds for the reconstruction of private and public buildings (as for the last earthquake).
6	Ministry of Cultural Heritage and Activities, and Tourism (MIBACT) [16]	Coordinates the activities of the regional secretariats that supervise the management of cultural heritage. The MIBACT regulates the management of architectural heritage, museums, landscape preservation, etc.

Table 8. Entities that are involved in the management and maintenance of cultural heritage.

Two buildings have been selected as case studies for the ARCH project due to their historical and representative values: the Ducal Palace and Santa Maria in via Church. These are described next.

2.2.1. Ducal Palace

The Ducal Palace (Figure 16) is an example of the evolution of different Italian architectural styles from the 13th to 15th century, and was built in three periods: the Case di Gentile (13th century), the Palazzo di Venanzio (14th to 15th century) and the Case Nove or 'Palazzo di Giulio' (15th century). Camerino's Ducal Palace is among the notable buildings of civil architecture built by the Da Varano family and it is now home to the local University. It has an original section, which was rebuilt in the late fourteenth century, and was extended and completed in the mid-to-late fifteenth century in the Renaissance style. The whole building is centred on a square-portico courtyard (Figure 17) possibly designed by Baccio Pontelli, a Renaissance architect, and can be accessed via several rooms, including the "*Sala degli Stemmi*" a room with coats (Figure 18).



Figure 16. The Ducal Palace [9].



Figure 17. The square-portico courtyard of the Ducal Palace [17].



Figure 18. The “Sala degli Stemmi”, a room with coats inside the Ducal Palace.

With the fall of the duchy (1545), the palace became the seat of the papal governors and, from 1749 onwards, of the University. Some semi-buried tunnels bridge the slope of the hill and emerge onto the main cathedral square. The interior of the Ducal palace is characterised by cellars, dungeons, a monumental spiral staircase, an enormous cistern, rooms dating back to various epochs (some of which are richly frescoed) and a viewing platform. The palace was damaged by the 2016 seismic event (Figure 19).



Figure 19. External (a) and internal (b) damage to and collapse of masonry (Ducal Palace) [9].

2.2.2. Santa Maria in Via Church

The Santa Maria in Via Church (Figure 20) was originally a little chapel, like many others along the pilgrimage's road of Via Romea, offering protection and viaticum to pilgrims who were leaving or passing through. The current church was built between 1639 and 1624 based on a design by Camillo Arcucci da Sigillo, in response to the wish of Cardinal Angelo Giori, secretary of Pope Urbano VIII Barberini. The simple brickwork facade with triangular pediment and two superimposed floors is vertically decorated with pilasters. The perimeter walls of the interior elliptical plant, which draws inspiration from Bernini, are enriched by semi-circular chapels, each of which houses three canvases (17th century). The main altar has the venerated picture of Saint Maria in Via; a canvas in Byzantine style painted on wood from the Umbria and Marche school dating back to the 18th century. Among its most prestigious works, the Church keeps two canvases (vestries) of Valentin de Boulogne who was a 17th century disciple of Caravaggio: they represent Saint Giovanni Battista and Saint Girolamo.

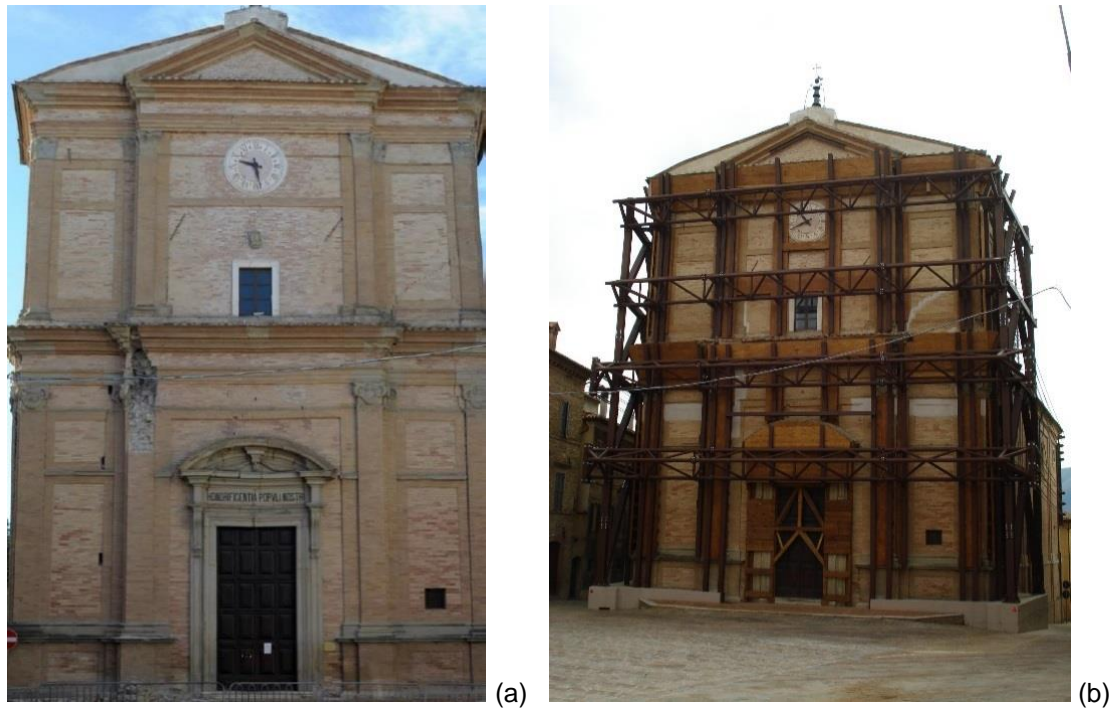


Figure 20. (a) Facade of St. Maria in Via Church and (b) the provisional steel structures that were put up in order to reinforce the remaining structures [9].

An earthquake in 1799 destroyed the brickwork vault, which was then replaced by one made of “camorcanna” (thin vaults usually made by mats of reeds nailed to an upper wooden framework) with historical plasters decorated by Giuseppe Rinaldi. The oratory has preserved a copy of the Sacra Sindone (Holy Shroud) realized in 1658. Due to the earthquake of 1997, the church suffered much damage, among which was the detachment of the facade. After careful restoration works, it was opened again to the public in 2007. The latest earthquake in 2016 resulted in new, severe damage (Figure 21 and Figure 22).



Figure 21. Collapse of the bell-tower of St. Maria in Via Church [9].



Figure 22. Collapse of the roof and of the decorated thin vault of St. Maria in Via Church [9].

2.3. Particular challenges and climatic hazards affecting the sites

Relevant climatic hazards include the impact of snow precipitation in the winter seasons on the effectiveness of the main networks (electricity, communications, etc.). Furthermore, two major earthquakes in a little over two decades (most recently in 2016, as already highlighted, but also earlier in 1997) have highlighted the weakness of the urban area and its valuable cultural heritage to seismic hazards, and related geomorphological hazards (e.g. landslides). In order to address these hazards, the municipality of Camerino has developed a preliminary civil emergency plan [19] that roughly defines the general tasks of officials in emergency events and the main reception areas for citizens. In such circumstances, the role of the mayor, within the municipal territory, is as follows:

- assumes the direction and coordination of the assistance services to the population affected by the emergency;
- organises the necessary interventions immediately communicating them to the President of the Regional Council and to the President of the Province and to the Prefect;
- informs the population on the evolution of ongoing events and on the procedures foreseen in the emergency plan.

Municipal staff of Camerino have improved their knowledge of some natural hazards such as seismic hazards and geomorphological hazards (particularly landslides). As an example, a Seismic Microzonation [28] was carried out in 2018 for the historical centre. Despite this progress, some gaps and challenges remain. For example, the Municipality has the need:

- to develop a database with information about relevant hazards in order to inform civil protection strategies;
- to use a system that helps detect the historical buildings or monuments most exposed to risks;
- to prepare a list of priorities for historical buildings and artwork in order to identify repair strategies.

3. Governance framework for cultural heritage management

3.1. International¹

At the international level, it is possible to consider the policy decisions and the main directives that are adopted by national laws. The Italian laws are promulgated by the Italian Parliament and they are mandatory. Some international commitments recognised by Italian law include:

- Recommendation concerning the Protection, at national level, of the Cultural and Natural Heritage of the General Conference of UNESCO adopted in 1972 and recognised by the Italian Law No. 184 of 6th April 1977;
- Convention for the Protection of the Architectural Heritage of Europe, European Treaty Series (ETS) No.121, Granada, 3rd October 1985, recognized by the Italian Law No. 93 of 15th February 1989.

There are also European Conventions that are references for archaeological heritage and heritage landscapes:

- European Convention on the Protection of the Archaeological Heritage (Revised) ETS No.143 La Valletta, 16th January 1992;
- European Landscape Convention European Treaty Series (ETS) No.176 Florence, 20th October 2000.

Some principles are reported in the following proceedings of international and European conferences:

- Convention on the Protection and Promotion of the Diversity of Cultural Expressions, General Conference of UNESCO, Paris, 2005;
- Recommendation on the historic urban landscape, General Conference of UNESCO, Paris, 2011;
- Davos declaration 2018 - Towards a high-quality Baukultur for Europe, Conference of European Ministers of Culture, Davos, 2018.

Finally, general principles for the conservation of cultural heritage are shown in the following International Charters:

¹ References (See Annex 11.1):

- Italian Law n. 184 of 6th April 1977, Ratifica ed esecuzione della convenzione sulla protezione del patrimonio culturale e naturale mondiale, firmata a Parigi il 23 novembre 1972 (in Italian);
- Italian Law n. 93 of 15th February 1989, Ratifica ed esecuzione della convenzione europea per la salvaguardia del patrimonio architettonico in Europa, firmata a Granada il 3 ottobre 1985 (in Italian).

- European Charter of Architectural Heritage, Amsterdam, 1975;
- Charter for the conservation of historic towns and urban areas, Washington, 1987;
- The Charter of Krakow - Principle for conservation and restoration of built heritage, Krakow, 2000.

3.2. National²

The *Ministry for Cultural Heritage and Activities, and Tourism* (MIBACT) regulates the management of archaeological and architectural heritage, museums, landscape preservation, etc. Different levels of government (state, regions and municipalities) share responsibilities for cultural heritage, according to the Italian Constitution. Cultural heritage preservation is listed among the cultural responsibilities to be retained by the state, with a few exceptions listed in article 5 of the Cultural Heritage and Landscape Code (Legislative Decree No. 42, issued 22nd January 2004, modified by Legislative Decree No. 62 of 26th March 2008). According to the Cultural Heritage and Landscape Code, MIBACT developed a specific directive in order to manage the protection and safeguarding of cultural heritage in case of disasters. Regions, municipalities and local authorities shall cooperate with the ministry in performing its protection tasks. The ministry has a superintendent role and ensures through its peripheral offices the proper surveillance and inspection of national cultural heritage. The system for landscape protection has been balanced by giving responsibility back to the state, in cooperation with regional authorities, by the Legislative Decree No. 63 of 26th March 2008. Furthermore, there are voluntary technical standards for the management of cultural heritage that are promulgated by UNI (Ente italiano di Normazione) [18]. These apply, for example, to chemical, physical and mechanical analyses of cultural heritage materials, to defining preservation and restoration methods for architectural heritage and artworks, and managing the cultural heritage and recovery area for artworks.

3.3. Regional³

The Council of the Marche Region developed the regional law no. 4 of 09th February 2010 for the preservation of the regional cultural heritage. This law has the objective of regulating cultural heritage assets and related activities according to the articles no. 117 and no. 118 of the Italian Constitution and in compliance with the legislative decree no. 42 of 22nd January, 2004. With this law, the Marche Region has the task of carrying out actions to protect cultural heritage in accordance with the Cultural Heritage and Landscape Code (see Section 3.2), and

² References (see Annex 11.1):

- Legislative Decree n. 42 of 22nd January, 2004, Cultural Heritage and Landscape Code (in Italian).
- Legislative Decree n. 62 of 26th March 2006, Changes on Legislative Decree n. 42/2004 concerning Cultural Heritage (in Italian).
- Legislative Decree n. 63 of 26th March 2006, Changes on Legislative Decree n. 42/2004 concerning Landscape (in Italian).

³ References (see Annex 11.1):

- Regional Law n. 4 of 09th February, 2010, Laws concerning cultural heritage and activities (in Italian).

to support and promote the conservation of cultural heritage by restoration, prevention and recovery actions. The superintendence of architectural and landscape heritage of the Marche Region manages, at regional level, architectural heritage and museums, and it approves private and public activities that involve cultural heritage according to national and regional laws. The seismic design of any refurbishment of architectural heritage damaged by the last earthquake in 2016 needs to be approved by the regional office for reconstruction [15]. For religious buildings, the regional episcopate is also involved in management [13].

3.4. Local

Camerino's council has the responsibility for planning, managing and conducting the ordinary maintenance of historical buildings and cultural heritage landscapes. Camerino's municipality has no specific plan, programmes or guidelines for disaster risk management of cultural heritage in spite of the various local museums, historical palaces and churches in its inner urban area. Post-disaster management is mainly entrusted to the Civil Protection Office of the Camerino (COC) [19].

At present, the municipality of Camerino lacks a system that identifies the historical buildings or monuments most exposed to risks. Such a system could help to prioritise historical buildings and artworks in order to define preservation and intervention strategies and implement them where most needed.

4. Governance framework for disaster risk reduction

4.1. International⁴

The *Italian Civil Protection Office* works together with the *European Civil Protection Mechanism through the Emergency Response Coordination Centre* (ECCR) that coordinates the delivery of assistance to stricken countries, such as civil protection teams and specialised equipment. The guidelines coming from these activities may be accepted also by the national and local civil protection authorities. The *United Nations Office for Disaster Risk Reduction* (UNDRR) [20] supports coordination mechanisms like the National Platforms for Disaster Risk Reduction and other institutions (e.g. governments, science and technology, civil society). UNDRR [20] supports the implementation of the *Sendai Framework for Disaster Risk Reduction 2015-2030*. The *Sendai Framework* [21] is a tool adopted in order to manage the transition from “disaster management” to “disaster risk management”. The UNDRR [22] and the *Directorate-General for European Civil Protection and Humanitarian Aid Operations* (DG ECHO) [23] define criteria for the disaster management. The DG ECHO is composed of two units: the first has the task of emergency and disaster response based on international collaborations between member states; the second unit develops frameworks in order to prevent disasters and emergency situations (e.g. training courses, exchange of knowledge and expertise, the development of new training solutions, the management of prevention projects, the coordination of public information activities and the financial planning for the two units). This system facilitates cooperation between the European member states and all the activities are based on the principle of subsidiarity, i.e. several actions are undertaken through the supervision of the member state interested by natural disasters.

4.2. National⁵

The *Italian Civil Protection Office* [24] is an agency of the Presidency of the Council of Ministers. The office coordinates responses to natural disasters, drafts legislation on risk

⁴ References (see Annex 11.2):

- Decision 1313/2013/EU of the European Parliament and of the Council on a Union Civil Protection Mechanism;
- Decision (EU) 2019/420 of the European Parliament and of the Council of 13 March 2019 amending Decision 1313/2013/EU on a Union Civil Protection Mechanism.

⁵ References (see Annex 11.2):

- Decreto Legislativo n.1 del 02/01/2018 (Italian National Law): Codice della protezione civile (in Italian);
- D.P.C.M. 09/08/2016 (Decree of the President of the Council of Minister): organizzazione del Dipartimento della Protezione Civile (in Italian);
- Decreto del Segretario Generale della Presidenza del Consiglio dei Ministri del 10/08/2016 (Decree of the General Secretary of the Presidency of the Council of Ministers): organizzazione interna del Dipartimento della Protezione Civile (in Italian);
- D.P.C.M. 20/02/2012 (Decree of the President of the Council of Minister): componenti del comitato paritetico (in Italian);
- D.P.C.M. 21/11/2006 (Decree of the President of the Council of Minister): Costituzione e modalita' di funzionamento del Comitato operativo della protezione civile (in Italian);
- Legge n. 286 del 27/12/2002 (Italian National Law), Conversione in legge, con modificazioni, del D.L. 4 novembre 2002, n. 245, recante interventi urgenti a favore delle popolazioni colpite dalle calamità naturali nelle regioni Molise e Sicilia, nonché ulteriori disposizioni in materia di protezione civile (in Italian)

prevention and promotes training projects. The latest modification to the internal organisation of the Civil Protection Office occurred with the Decree of the President of the Council of Ministers of August 9, 2016. The functions and services of the offices according to the current organisational chart (see Figure 23 below) have been assigned by Decree of the General Secretary of the Presidency of the Council of Ministers of August 10, 2016. The Office of the Operational Director is divided into different departments: Emergency Planning and Drills, Operational Support in Emergency, Italia Situation Room and Operations Centre for Maritime Emergencies (COEMM), Joint Air Operations Centre (COAU) and Mobility and Essential Services. In particular, the COEMM elaborates models and procedures for the National Civil Protection Service, shares information on emergency situations, evaluates the situation post-disaster, and supports in case of the declaration of a state of emergency. The COEMM department also has the task of coordinating first response activities after disasters, catastrophes or other events which, due to their intensity and extent, must be handled with immediate intervention and with special capacities and means.

With the declaration of a state of national emergency by the Council of Ministers, the Head of the Office of Civil Protection decides on the first intervention activities to implement (see Figure 23). The National Civil Protection Office consists of: State administrations, Provincial councils, Municipalities and local authorities for the management of the mountain areas. Its operating structures include: scientific research groups (including I.N.G.V. and other research institutes), technical services, voluntary organisations, the Italian Fire Brigade, the Armed Forces, the Police Force, the National Forestry Commission, the Italian Red Cross, the structures of the Italian Health Service and the National Mountain Rescue and Speleological Corps (C.N.S.A.S.). In ordinary situations, the operative structures with the departments perform the monitoring, forecasting and risk prevention activities as well as the operative interventions, each with its own specific technical skills. In situations of national emergency or when natural calamities occur, after the declaration of the state of emergency by the Council of Ministers, the Prime Minister may avail of delegated commissioners and operative structures for the necessary interventions. The management of the operative structures is assigned to the Head of the Civil Protection Office.

Furthermore, there are national technical standards for buildings and infrastructures also in order to assess vulnerability and to reduce seismic risks [25].

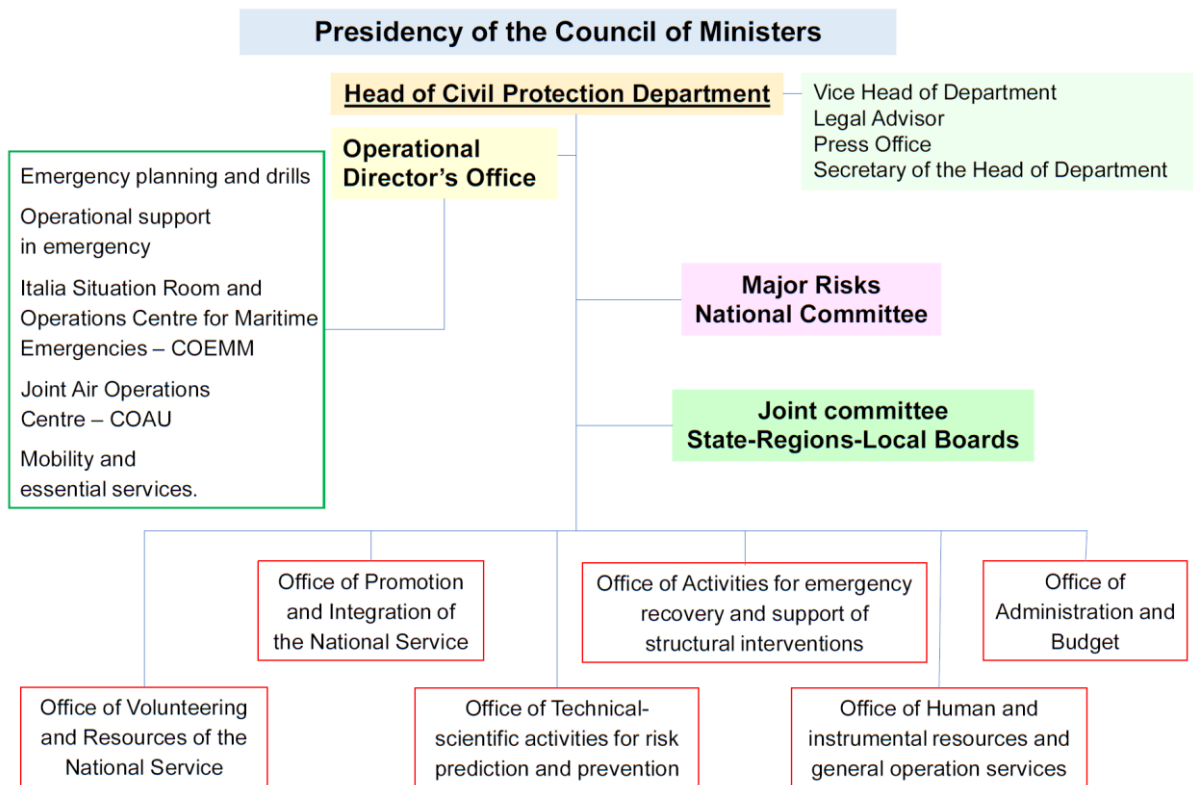


Figure 23. Organisational chart of the Civil Protection Office.

4.3. Regional⁶

The Civil Protection Office of the Marche Region is influenced by some laws, such as the regional law no. 32/2001 that defines both the tasks of the local authorities and the operative procedures for emergency management. The main tasks of the Civil Protection Office of the Marche Region concern programming of civil protection activities, risk prevention and rescue. Regional skills, concerning local security, are entrusted to the civil protection system. When emergencies occur, the Civil Protection Office of the Marche Region defines the tasks of the local authorities and coordinates their activities. The Civil Protection Office of the Marche Region has three main boards: Multi-risks Office, Regional Operative Office (SOUP) and the Emergency Service Centre (CAPI) (see Figure 24 for organisational structure).

4.3.1. Multi-risks Office

This Office contributes to ensuring the management of the national alert system for weather, hydrogeological and hydraulic risk. Its main task is to support the decisions of civil protection

⁶ References (see Annex 11.2):

- Legge Regionale n. 32 del 11/12/2001, Sistema regionale di protezione civile, B.U.R. n. 146 del 20/12/2001, (in Italian).
- Legge Regionale n. 13 del 03/04/2015, Disposizioni per il riordino delle funzioni amministrative esercitate dalle Province, B.U.R. n. 33 del 16/04/2015, (in Italian).
- Decreto del Presidente della Giunta Regionale n° 41 del 01/02/2005, (in Italian).

authorities. The primary functions of the Office are the monitoring and surveillance of events, as well as weather-hydrogeological-hydraulic risk assessment.

The monitoring activities of the Office are based on local and national networks, such as the seismic events recorded by the monitoring network of the National Institute of Geophysics and Volcanology (INGV).

4.3.2. Regional Operative Office (SOUP)

The Regional Operative Office (SOUP) consists of officials from the Civil Protection Department, Fire-Department, State Forestry Commission, Italian Red Cross, and the National Health Service. The SOUP holds networks for the remote control of the area (hydrology, seismic) and databases necessary for the management of civil protection emergencies.

4.3.3. Emergency Service Centre (CAPI)

The Emergency Service Centre (CAPI) of the Marche Region is a permanent operating structure that has warehouses for the storage of emergency supplies to be used when calamitous events occur. The main aims of the centre are the acquisition, storage, and protection of supplies and equipment for civil protection.



Figure 24. Organisational chart of the Civil Protection Department at regional level.

Furthermore, the Prefect of Macerata (the province that includes Camerino municipality) has civil protection tasks within the provincial territory. When a calamity occurs, the Prefect – together with different authorities of the Civil Protection Department – guarantees first aid services and emergency management also by firefighters and law enforcement. If the emergency is more complex, a Coordination Centre (CCS) is activated at the Prefecture; this centre is a temporary structure for the duration of the emergency, and aims to coordinate and connect the measures that are adopted by different local authorities. Finally, the Prefect prepares emergency plans for factories susceptible to high risk levels.

In the Marche Region there are eight local authorities for the management of the mountain areas. These are institutions made up of some municipalities that share funds for guaranteeing the main social and economic services to the population, managing land use zoning and planning, and preserving landscapes and ecosystems (see Figure 25).

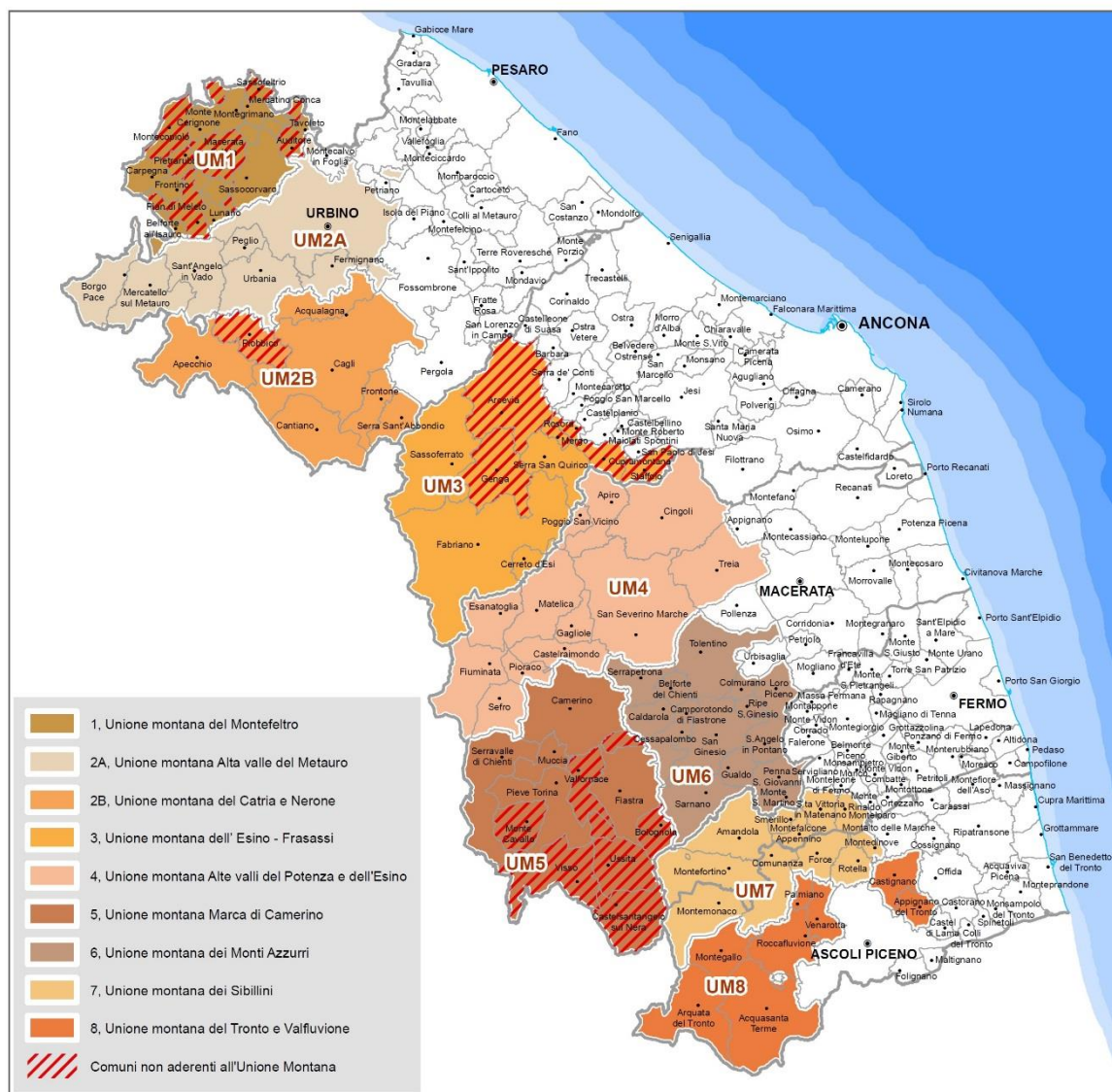


Figure 25. Local authorities for the management of the mountain areas (Marche Region) [26].

4.4. Local⁷

The *Civil Protection Office of Camerino (COC)* is the first authority that organises the response to a disaster or to an emergency, before successive possible interventions of regional and

⁷ References (see Annex 11.2):

- Civil protection plan, approved by council's deliberation n. 61 of 22nd December, 2008, according to Italian Law n. 225 of 24th February, 1992.

national civil protection departments. When an emergency occurs, the COC activates the different support operation structures. The mayor is the head of COC within the municipality.

4.5. Gaps and needs

Considering the objectives of the ARCH project, it would be essential to conduct new geological and geomorphological surveys in order to more accurately identify hazard scenarios. The same data would then be indispensable for the construction of a “geological model” of extreme detail, functional also for future studies on local seismic response and in order to define a risk map for the historical urban area. The municipality has the need to develop a database with this information for its civil protection strategies.

5. Governance framework for climate change adaptation

5.1. International

At the international level, it is possible to highlight some fundamental strategies and visions, which helped drive climate action. These documents are accepted and recognised by Italy, as a member of the United Nations (U.N.) and the European Community. They affect the national level and should be taken into account in local actions as well. Two international levels can be defined: a global level with the Kyoto Protocol and its successive processes and meetings and a European level with some fundamental directives: EU Directive 2003/87, EU Directive 2012/27, EU Directive 2018/844 and more specific regulations provided by the European Energy Agency like documents relevant to environmental policy in Europe which set out the environmental objectives, targets and reporting obligations with data and indicators. Of particular relevance is the EU Adaptation Strategy (2013). The evaluation package comprises a report on the implementation of the EU Strategy on adaptation to climate change COM (2018)738, the Evaluation of the EU Strategy on adaptation to climate change SWD (2018)461, and the Adaptation preparedness scoreboard Country fiches SWD (2018)460. The evaluation found that the EU Adaptation Strategy has been a reference point to prepare Europe for the climate impacts to come, at all levels. It emphasised that EU policy must seek to create synergies between climate change adaptation, disaster risk reduction efforts and sustainable development to avoid future damage and provide for long-term economic and social welfare in Europe and in partner countries.

5.2. National

In Italy, the protection of the environment, ecosystems and cultural resources is under the exclusive competency of the central government. The *Ministry for Environment, Landscape and Sea* (IMELS) carries out activities on climate change at the national and international level.

The Italian governance framework for adaptation to climate change can be considered as very fragmented with several laws and regulations in which actions, strategies and regulations have been partially provided for different aspects (mobility and transportation, energy use, energy production, waste management, marine cost management, greenhouse gas emissions, etc.) and in different ways without an overall and comprehensive vision. Specifically related to climate change are the Legislative Decree 216/2006 and the National Adaptation Strategy (NAS).

The NAS from 2014 includes the following:

- The state of scientific knowledge on impacts, vulnerability and adaptation to climate change in Italy;
- Analysis of the EU and national legislation relevant to impacts, vulnerability and adaptation to climate change;

- Elements for a National Strategy for Adaptation to Climate Change.

The NAS is a tool for encouraging adaptation actions in planning activities at national, regional and local levels. After approval from the "State-Regions Unified Conference" on 30th October 2014, the NAS was finally adopted in June 2015 by a Directorial Decree of the Climate and Energy General Directorate, establishing specific objectives to be reached by 31st December 2016.

Based on the NAS, the Ministry of Environment started in 2017 to provide an Italian National Adaptation Plan for Climate Change (NAP). The Directorate General for Climate and Energy of IMELS is currently working on the implementation of the NAS through the NAP, developed with the support of the *Euro-Mediterranean Centre on Climate Change* (CMCC). The NAP was drafted in December 2016. During 2017 and the first half of 2018, IMELS carried out a check on the draft NAP by a consultative process involving national, regional and local authorities, universities, research centers and other stakeholders. The approval of the NAP is occurring through an Agreement with the State-Regions Conference. The NAP provides some preliminary institutional guidelines [27] to national and local authorities for the elaboration of regional strategies or plans and for the integration of climate change adaptation within spatial and sectorial planning.

5.3. Regional

For the Marche Region, it is possible to cite two guidelines related to the management of and adaptation to climatic changes: the Regional *Environmental and Energy Plan* from 2016 and the *Regional Plan for Climate* from 2007. The *Regional Environmental Energy Plan* identifies the guidelines for environmental energy policy in the regional territory:

- to respect the "burden sharing" legislation (Ministerial Decree 15th March 2012 and Ministerial Decree 11th May 2015)⁸;
- to respect the "ex ante conditionality" for the use of the structural funds - energy sector, as established by the regional operative program (POR)⁹ and the Rural Development Plan (RDP) 2014-2020.

The *Regional Plan for Climate*, made in 2007 but still in draft, intends to systemise and make more effective the climate change mitigation policies. Targets of the plan are:

- energy efficiency to direct the construction market towards the design and construction of zero-emission buildings and favours the use of cogeneration and smart systems in the industrial, civil and tertiary sector;

⁸ These laws implemented the legislation of the European Strategy 20.20.20 on climate and energy and Legislative Decree 28/2011 on the promotion of the use of the energy from renewable sources.

⁹ <http://www.regione.marche.it/Entra-in-Regione/Fondi-Europei/FESR/Programma-Operativo-Por-FESR>

- renewable sources to improve the biofuels, micro-wind and geothermal sectors applied to the civil sector and the recovery of energy contained in the organic waste fraction biogas;
- sustainable mobility and urban development to reduce the need for travel by private transport and favours the transition from the use of private transport to public transport by supporting mobility plans, surface metros and carpooling;
- efficient use of resources to minimize the consumption of resources and energy per unit of product and service, supporting Life Cycle Analysis (LCA), green public procurement, separate waste collection at home and a green tax reform;
- other measures to increase the knowledge culture and awareness of the importance of individual political choices and behaviours in facing the climate challenge.

5.4. Local

At the local level, there are no direct laws or regulations for climate change adaptation. The municipality of Camerino has no specific department dedicated to climate change adaption and related aspects. The *Office for Environment and Public Works* can be considered as the local public service most suited to manage possible activities about climate change adaptation. Considering the local land use policy and the management of natural areas as part of the governance for climate change adaptation, it is possible to cite the Forest Fire Emergency Plan (2018) through which the municipality of Camerino plans and manages risks from forest fires. It is a local program for protecting the integrity of life, property, settlements and the environment from damage or from dangers resulting from natural disasters, catastrophes and other events. The mayor and the city council are able to propose, draft and enforce possible actions and plans within the municipality's territory, as long as they do not contradict regional and national plans and laws.

5.5. Gaps and needs

There are no specific studies, surveys, or risks and vulnerability assessments related to climate change impacts for the territorial area of the municipality of Camerino. Existing records about the status and condition of cultural heritage assets, such as historical buildings, monuments, landscapes, ecosystems and environment have to date not considered the impacts and effects of climate change. Reasons for the lack of assessments on climate change impacts could be economic as well as the (possibly related) absence of effective monitoring systems.

6. Expected impacts of climate change-related and natural hazards

The purpose of this section is to report and review the preliminary collection of relevant information about hazards, exposed elements, as well as impacts provided by the municipality of Camerino in collaboration with the University of Camerino as their local research partner, in order to offer an initial overview of the risks that might affect the selected historic areas and their communities. It should be noted that the content in this section is not exhaustive, but rather should be understood as a departure point to serve as a basis for future work.

This section is structured as follows: a description of the methodology is provided, followed by a Risk Profile Table, outlining hazards, exposed elements, impacts, and corresponding resilience-building measures already planned or implemented to date. Next follows a review, interpretation, and validation of the information provided in the Risk Profile Table. Finally, an outlook is provided concerning further risk analysis work in the context of the ARCH project.

6.1. Methodology

In order to elicit relevant information for risk analyses from the municipality of Camerino, ENEA, Fraunhofer, ICLEI, and TecNALIA developed a Risk Profile Table template (see Section 6.2) based on the central risk components identified in the 5th Assessment Report of the Intergovernmental Panel on Climate Change: hazards, exposed elements, impacts (physical, societal, functional, economic, and intangible), as well as corresponding resilience-building measures already planned or implemented to date.

This template was filled out by the Camerino city partners and it provides a starting point from which to conduct more detailed risk analyses. Furthermore, it allows to provide a useful starting point for the data, models, methods, and tools to be developed during the ARCH project. The information provided in the Risk Profile Table was reviewed and harmonised by ENEA in order to provide a comparable description across all city cases and ensure relevance to (and validity for) similar on-going and/or future initiatives¹⁰ and projects in the field of disaster risk reduction, climate change adaptation, and cultural heritage preservation.

The following standards, reference material, and tools were identified as most suitable for this exercise:

- The City Climate Hazard Taxonomy¹¹ for classification of hazards;
- The UNDRR QRE Tool¹² and ISO standard 37120¹³ for the classification of exposed elements and impacts;

¹¹ <https://www.c40.org/researches/city-climate-hazard-taxonomy>

¹² <https://www.unisdr.org/campaign/resilientcities/toolkit/article/quick-risk-estimation-qre>

¹³ <https://www.iso.org/standard/68498.html>

- The ICOMOS CCHWG¹⁴ classification and INSPIRE¹⁵ directive for the classification of heritage assets.

Based on the harmonised information, initial proposals for risk analysis focus actions (e.g. which methods and tools to apply for which part/issue of a historic area) were formulated by ENEA. The initial proposals will be further defined during the co-creation process and in exchange with the relevant local stakeholders.

¹⁴ https://adobeindd.com/view/publications/a9a551e3-3b23-4127-99fd-a7a80d91a29e/g18m/publication-web-resources/pdf/CCHWG_final_print.pdf

¹⁵ INSPIRE, Infrastructure for Spatial Information in Europe D2.8.III.2 Data Specification on Buildings – Technical Guidelines (5.3.1.1.4. Classification of buildings, pages 43-45).

6.2. Risk Profile Table for Camerino

Heritage site (historic area)	Hazard ¹⁶	Exposed element ¹⁷	Impacts					Corresponding resilience- building measure undertaken	Notes/Evidence
			Physical	Societal	Functional	Economic	Intangible		
Old town (Camerino)	Seismic hazards	<p>Cultural heritage (churches, historical buildings, palaces etc.).</p> <p>Intangible cultural heritage.</p> <p>Private and public buildings.</p> <p>People.</p> <p>Transportation systems (road and railroad networks).</p> <p>Infrastructure systems (electrical, gas, and waterworks networks etc.).</p> <p>Natural environment (groundwater level and earthquake-induced landslides).</p>	<p>Damage to cultural heritage assets (churches, historical buildings, palaces etc.) and private buildings.</p> <p>Damage to transportation systems (road and railroad networks).</p> <p>Damage to infrastructure systems (electrical, gas, and waterworks networks etc.).</p> <p>Degradation of natural environment.</p>	<p>Injury and death.</p> <p>Possible effects on mental health (depression due to lifestyle modification).</p> <p>Loss of personal effects.</p> <p>Loss of access to key services.</p>	<p>Functionality loss of transportation systems (road and railroad networks).</p> <p>Functionality loss of infrastructure systems (electrical, gas, and waterworks networks etc.).</p> <p>Reduced functionality of school and other public services.</p>	<p>Loss of tourism revenue due to service disruptions.</p> <p>Interruption of commerce and tertiary sector.</p>	<p>Loss of cultural and artistic values and traditions (also related to loss of artworks and cultural heritage).</p>	<p>Civil emergency management plan (G).</p> <p>Seismic Microzonation (S).</p> <p>Funding for retrofit and seismic upgrade of buildings (G).</p>	[19], [28], [29]
Old town (Camerino)	Geomorphological hazards	Natural environment.	Loss of natural environment.	Loss of access to key services.	Damage to ecosystems.	Loss of tourism revenue due to	Damage or loss of area with cultural value	Land use zoning plan (S).	[30], [31]

¹⁶ Note: the UN Office for Disaster Risk Reduction (UNDRR)'s Resilience Scorecard defines 'hazard' as 'a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation'. Of these, the ARCH project is addressing natural and climatic hazards.

¹⁷ Note: the UN Office for Disaster Risk Reduction's Resilience Scorecard defines 'exposure' as 'the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas'.

Heritage site (historic area)	Hazard ¹⁶	Exposed element ¹⁷	Impacts					Corresponding resilience- building measure undertaken	Notes/Evidence
			Physical	Societal	Functional	Economic	Intangible		
		<p>Cultural heritage (churches, historical buildings, palaces etc.).</p> <p>Intangible cultural heritage.</p> <p>Private buildings.</p> <p>People.</p> <p>Transportation systems (road and railroad networks).</p> <p>Infrastructure systems (electrical, gas, and waterworks networks etc.).</p>	<p>Damage to cultural heritage (churches, historical buildings, palaces etc.) and private buildings.</p> <p>Transportation systems (road and railroad networks).</p> <p>Infrastructure systems (electrical, gas, and waterworks networks etc.).</p>		<p>Functionality loss of transportation systems (road and railroad networks).</p> <p>Functionality loss of infrastructure systems (electrical, gas, and waterworks networks etc.).</p> <p>Damage and flooding of sewerage systems.</p>	decrease in visitors.	<p>(also related to loss of artworks and cultural heritage).</p> <p>Damage to natural environment.</p>	<p>Geological map at regional level (S).</p> <p>Protective infrastructure in place for landslides that are well maintained and monitored (S).</p>	
Old town (Camerino)	Heavy snowfalls	<p>Cultural heritage (churches, historical buildings, palaces etc.).</p> <p>Infrastructure systems (electrical, gas, and waterworks networks etc.).</p>	<p>Damage to cultural heritage (churches, historical buildings, palaces etc.) and private buildings.</p> <p>Infrastructure systems (electrical, gas, and waterworks networks etc.).</p> <p>Damage to public green areas (breaking old trees).</p>	Loss of access to key services.	<p>Reduction functionality of transportation systems (road and railroad networks).</p> <p>Reduction functionality of infrastructure systems (electrical, gas, and waterworks networks etc.).</p>	Loss of tourism revenue due to service disruption.	Loss of cultural and artistic values (also related to loss of artworks and cultural heritage).	Civil emergency management plan (G).	[19]

6.3. Preliminary classification of hazards, exposed elements and impacts

The purpose of this section is to review, interpret, validate, and harmonise the information provided in the Risk Profile Table (part 6.2) as a sound basis for the project to address Camerino's risks to cultural heritage induced by climate change and other hazards. This preliminary analysis covers:

- a) hazards;
- b) elements exposed to those hazards; and
- c) main impacts that the identified hazards might cause on the identified exposed elements.

6.3.1. Hazards

The identified hazards for the municipality of Camerino are recorded in Table 9 below and have been identified based on the hazard classification C40 *City Climate Hazard Taxonomy*¹⁸ which is broken down into main hazard types and hazard subtypes. These are also highlighted in the preliminary resilience assessment presented in Section 7 of this report. According to this classification system, two main hazard clusters were identified in Camerino, namely: meteorological and geophysical (Table 9). As far as meteorological events are concerned, heavy snow was identified by the city as one of the main hazards in Camerino. Whereas for geophysical hazards, earthquakes are the main concern, followed by mass movements of different nature, such as landslides and rock falls (see Table 9).

Hazard categories	Hazard types	Hazard sub-type
Meteorological	Extreme precipitation	Heavy rain, heavy snow, monsoon, blizzard, hail
	Storm surges	Convective storms, (Thunderstorm, rainstorm)
Geophysical	Mass movements	Landslide, avalanche, rockfall, subsidence
	Tectonic activity	Earthquakes, <i>earthquake-induced landslides, rockfalls and subsidence</i>

Table 9. Hazard categories, types and sub-types identified for Camerino based on the city Risk Profile Table; in italics earthquake-induced hazard sub-types, not included in the C40 "City Climate Hazard Taxonomy".

¹⁸ <https://www.c40.org/researches/city-climate-hazard-taxonomy>

Mass movements can also be induced by tectonic activity (as also observed in Camerino after the 2016-2017, Central-Italy earthquake sequence) therefore hazard sub-types such as earthquake-induced landslides, rockfalls and subsidence have been included in Table 9.

6.3.2. Exposed elements

The elements exposed to the hazards and identified in the Risk Profile Table (part 6.2 above) for Camerino have been reorganised in Table 10 below.

Exposed Element Categories	Exposed Element Types
Natural Environment	Ecosystem
	Agricultural soil
	Natural parks and public green areas
Built Environment	Private and public buildings
	Transportation system
	Further critical infrastructure systems (electrical, gas, and waterworks networks etc.).
Cultural Heritage	Tangible and intangible elements (see Table 11)
Services	Tertiary sector (education and university)
	Agriculture
	Commerce
	Tourism
Human and Social Aspects	External people (e.g. tourists)
	Local people

Table 10. Exposed elements identified in Camerino.

The cultural heritage category subsumes all exposed elements (Table 10) that are in themselves heritage, i.e. exposed elements declared as heritage are only categories as such

and not as any of the other categories. Table 11 reports the exposed elements categorised as cultural heritage. Here, reference has been made to the six categories identified by the *Climate Change and Cultural Heritage Working Group* (CCHWG) in 2019. Thanks to data provided by the *Italian Ministry of Cultural Heritage, Cultural Activities and Tourism* (MIBACT), cultural heritage assets were identified in Camerino for all the six typologies identified by CCHWG¹⁹, as reported in Table 12. However, among the six CCHWG categories the following three are of particular relevance for Camerino: Movable Heritage, Building and Structures, and Cultural Landscapes. For the aforementioned cultural heritage, categories cultural heritage sub-types have been identified to provide a more detailed picture (Table 11).

Exposed Cultural Heritage Categories	Exposed Cultural Heritage Types
Moveable Heritage	Works of monumental sculpture and painting
Archaeological Resources	Archaeological sites
	Archaeological monuments
Buildings and Structures	Architecture: churches, castles, palaces, towers, etc.
	Groups of separate or connected buildings
	Historical nuclei in surrounding villages
Cultural Landscapes	Parks/gardens
Associated and Traditional Communities	Local authorities for the management of the mountain areas and congregations
Intangible Heritage	Oral traditions
	Performing arts
	social practices
	Rituals
	Festive events
	Knowledge and skills to produce traditional crafts

Table 11. Categories and types of the cultural heritage exposed elements identified in Camerino.

¹⁹ https://adobeindd.com/view/publications/a9a551e3-3b23-4127-99fd-a7a80d91a29e/g18m/publication-web-resources/pdf/CCHWG_final_print.pdf

As far as **Movable Heritage** is concerned, there is a strong interest in Camerino to find viable operational procedures and location (depots) to ensure the preservation and security of the works of monumental sculpture and paintings that were dislocated from the damaged churches and palaces in Camerino following the recent seismic events.

As for **Buildings and Structures**, the interest is both in groups of separate or connected buildings as well as in historical nuclei. For groups of separate buildings, the following sub-categories have so far been identified in Camerino: churches, castles, palaces, triumphal arches, masonry bridges, towers and obelisks. For connected buildings, as far as earthquake hazard is concerned, a peculiar analysis (from a strictly technical point of view) needs to be performed. These “building aggregates” are very typical in Italian historical centers. With regard to historical nuclei, in addition to Camerino, small surrounding villages (e.g. Ussita and Visso) will also be investigated.

As concerns **Cultural Landscape**, attention will be placed on natural capital (parks and gardens and on any heritage green and blue infrastructure included there) that go beyond Camerino’s administrative borders and that are governed, as far as their preservation is concerned, by local authorities for the management of the mountain areas.

6.3.3. Impacts

Table 13 reports the different impacts identified in Camerino for the five categories of impacts included in the Risk Profile Table (part 6.2 above) for the different exposed elements categorised according to the classification reported in Table 11 reports in a succinct way.

Exposed Element Categories	Exposed Element Types	Physical	Functional	Societal	Economic	Intangible
Natural Environment	Ecosystem	Damage to ecosystems			Loss of tourism revenue due to decrease in visitors	
	Natural parks and public green areas	Degradation and damage to natural environment				
	Agricultural soil	Damage to old trees				
	Private and public buildings	Damage		Loss of access to residential houses, offices, schools		
	Transportation system	Damage				

Exposed Element Categories	Exposed Element Types	Physical	Functional	Societal	Economic	Intangible
Built environment	Critical infrastructure systems	Damage of sewerage systems		and key services		
Cultural Heritage	Tangible and intangible elements	Damage	Service disruption		Loss of tourism revenue	Loss of cultural values and traditions
Services	Tertiary (education, university)				Loss of revenue	
	Agriculture					
	Commerce					
	Tourism					
Human and Social Aspect	External people (e.g. tourists)					
	Local people	Injury and death		Loss of personal effects		Possible effects on mental health, PTSD ²⁰

Table 12. Physical, Functional, Societal, Economic and Intangible impacts identified for the different exposed elements in Camerino.

Further to the impacts identified by Camerino in the Risk Profile Table (part 6.2 above), it is suggested to consider additional impacts. In particular, and as far as societal impacts are concerned, it would be important to consider all the people directly and indirectly affected by a disaster (e.g. people whose livelihoods and/or family and traditional craft businesses were

²⁰ *Post-traumatic stress disorder (PTSD), e.g. in Camerino due to the experienced trauma, lifestyle modifications, lack of reference points including loss of access to houses, personal effects and religious and cultural heritage buildings.

disrupted or destroyed) as well as long-term effects (e.g. the sudden post-disaster increase in depopulation of the territory already in act since a long time in all the rural territories of central Italy). Furthermore, Camerino's Risk Profile Table currently encompasses only indirect economic losses (i.e. loss of revenue), whereas direct economic losses should also be accounted for (e.g. direct economic losses resulting from damaged or destroyed buildings, cultural heritage and critical infrastructures). Additionally, as far as loss of revenue is concerned, it would be important to further disaggregate them by economic sector, according to the standard classification adopted in Italy (ATECO 2007²¹).

6.3.4. Outlook and implications for the ARCH project

Based on the information provided in the Risk Profile Table (part 6.2 above) and building on the joint meetings between Camerino and the research partners, ARCH's work for the municipality of Camerino is envisaged to be conducted at different levels of analysis (Table 13).

Study Areas/Buildings	Possible Analysis	Possible Tools
District scale - beyond the municipality's borders	<ul style="list-style-type: none"> Impact chain analysis; Thematic maps. 	<ul style="list-style-type: none"> IVAVIA impact chain creator (adapted for ARCH); ARCH DSS (i.e. CIPCast).
Municipality scale - Camerino's old town	Scenario simulations	<ul style="list-style-type: none"> ARCH DSS; Satellite images and and/or survey supported by drones.
Prototypical building scale - identified within Camerino old town	Scenario simulations with dynamic data integration from sensors and satellite images	<ul style="list-style-type: none"> ARCH DSS; Survey supported by drones; Chemical and mechanical characterisation of constructive materials;

²¹ ATECO 2007 classification is the Italian national version of the Nace Rev. 2 (the statistical classification of economic activities in the European community, <https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF>). From 2008, not only the Italian National Institute of Statistics (ISTAT) adopted the so called ATECO 2007, but also multiple institutional governance body (e.g. the Ministry of Economy, business enterprise associations, and internal revenue agencies) .

Study Areas/Buildings	Possible Analysis	Possible Tools
		<ul style="list-style-type: none"> Sensors.
<p>Two buildings of interest (See Section 2):</p> <p>1) Palazzo Ducale;</p> <p>2) Santa Maria in Via Church.</p>	<ul style="list-style-type: none"> 3D building model with identified damage pattern; Dynamic monitoring of damage; Finite element analysis of the buildings to support retrofitting interventions. 	<ul style="list-style-type: none"> Sensors installation of low-cost and traditional structural health monitoring sensors (e.g. MEMS, optic fibre and accelerometers); Chemical and mechanical characterisation of constructive materials; Photogrammetry laser scanner and/or survey supported by drones; 3D models.

Table 13. Possible analysis and possible tools to be implemented for ARCH work in Camerino.

Table 13 provides initial ideas of possible examples for the work that can be undertaken as part of the ARCH project. The proposed content in Table 13 was discussed with the municipality of Camerino and the research partners.

For the different study areas/buildings, identified in Table 13, the idea is to conduct damage and impact assessments, with particular focus on earthquake events and heavy snow falls, both at the “status quo” and after the implementation of resilience strategies that might encompass both physical interventions (such as seismic retrofitting of buildings, critical infrastructure and cultural heritage), as well as strategies to improve the current best practices and frameworks for governance and management.

The idea is to allow the municipality to assess the effectiveness of alternative resilience strategies not only in terms of tangible and measurable costs and benefits (e.g. reduction of physical damage to the built environment, including cultural heritage asset, reduction of physical and social impacts on communities, depopulation of the territory, direct and indirect economic losses), but also in terms of reduction of intangible losses related to the loss of cultural and artistic value and to the loss of social practices such as festive events and the know-how for producing traditional crafts.

7. Preliminary resilience assessment

The following resilience assessment was developed using the preliminary version of the *UNDRR Disaster Resilience Scorecard for Cities*. The preliminary assessment was conducted within the framework of a workshop between the municipality of Camerino, the University of Camerino, ENEA, and Fraunhofer on 9th December 2019. As the original Scorecard is aimed at city-level, not all questions were immediately applicable on the level of historic areas or single heritage assets. Wherever possible, answers were provided for the historic areas under examination (e.g. with regard to hazard scenarios). For all other questions, answers were provided on city-level (e.g. with regard to city masterplans). The results give a first indication of the overall resilience of the city with some – but not exclusive – focus on the historic areas examined by ARCH. In addition, the application of the Scorecard will be used as input for the development of the ARCH Resilience Assessment Framework specifically focused on historic areas. Lastly, the preliminary resilience assessment results presented in the baseline reports should not be employed to develop resilience action plans, as not all necessary stakeholder groups were involved in the assessment process.

7.1. Essential 01: Organise for resilience

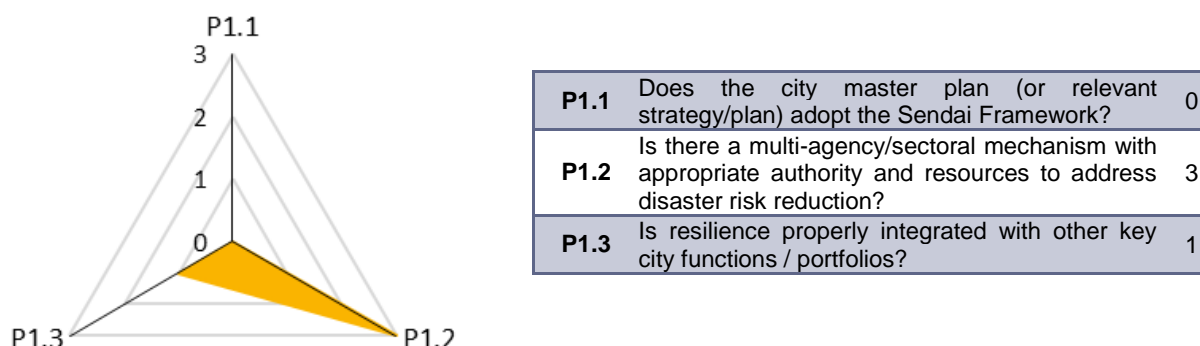


Figure 26. Results Essential 01.

For Essential 01, Camerino achieves an overall resilience score of 4/9, with room for improvements in planning and resilience integration. There exists no city master plan in order to improve resilience, and the *Sendai Framework for Disaster Risk Reduction* is not well known in Camerino (score of 0 for P1.1). Urban planning takes into account the geomorphological features of the municipal area. Camerino's municipality has a preliminary civil emergency plan that roughly defines the general tasks of officials in case of emergency events, and the main reception areas for people. The Civil Protection Office of the Camerino municipality (COC) is the first authority that organizes disaster and emergency response, before the successive and possible interventions of the regional and national civil protection offices. At the same time, the local, regional, and national offices for civil protection are well coordinated and resourced, enabling a multi-agency mechanism for addressing disaster risk reduction to be applied (score of 3 for P1.2). Lastly, disaster resilience is only integrated with key city functions (e.g. planning or community engagement) on an ad hoc basis (score of 1 for P1.3).

7.2. Essential 02: Identify, understand and use current and future risk scenarios

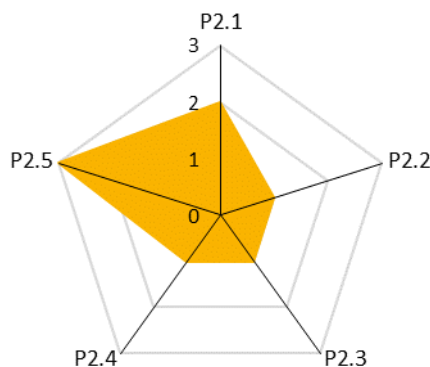


Figure 27. Results Essential 02.

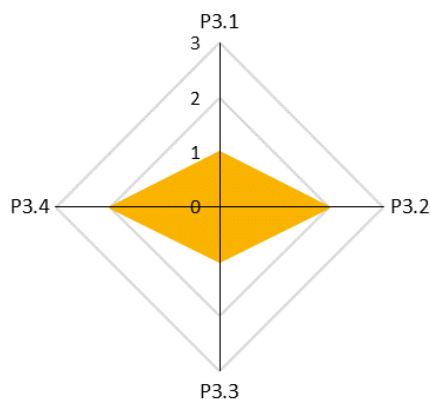
P2.1	Does the city have knowledge of the key hazards that the city faces, and their likelihood of occurrence?	2
P2.2	Is there a shared understanding of risks between the city and various utility providers and other regional and national agencies that have a role in managing infrastructure such as power, water, roads and trains, of the points of stress on the system and city scale risks?	1
P2.3	Are their agreed scenarios setting out city-wide exposure and vulnerability from each hazard, or groups of hazards (see above)?	1
P2.4	Is there a collective understanding of potentially cascading failures between different city and infrastructure systems, under different scenarios?	1
P2.5	Do clear hazard maps and data on risk exist? Are these regularly updated?	3

For Essential 02, Camerino achieves an overall resilience score of 8/15. The municipality understands the main hazards affecting it and there are currently some processes for updating information concerning seismic and landslide hazard maps. Geomorphological features of the municipal area are taken into account in the urban planning choices (land use zoning plan). There are no risk scenarios for the main natural hazards, however some issues are roughly defined in the civil emergency plan (score of 2 for P2.1). At the same time, individual system risks are not shared among utility providers and regional/ national agencies proactively in order to understand cascading effects; these risks are only shared after a hazard occurred as part of post-disaster discussions (score of 1 in P2.2). Hazard scenarios for vulnerability and exposure only exist for some disasters. Specifically, the municipality of Camerino has historical data on earthquakes available, but not enough data for other hazard scenarios (score of 1 for P2.3). As a result from P2.2 and P2.3, there is only a limited understanding of cascading impacts under a limited amount of disaster scenarios (score of 1 for P2.4). However, for most hazards (i.e. earthquakes and hydrogeological risks) there exist regularly updated hazard maps provided by national agencies (score of 3 for P2.5).

7.3. Essential 03: Strengthen financial capacity for resilience

For Essential 03, Camerino achieves an overall resilience score of 5/12. While the municipality employs crowdfunding and participates in national/European (research) projects, not enough information about other funding opportunities is available (score of 1 for P3.1).

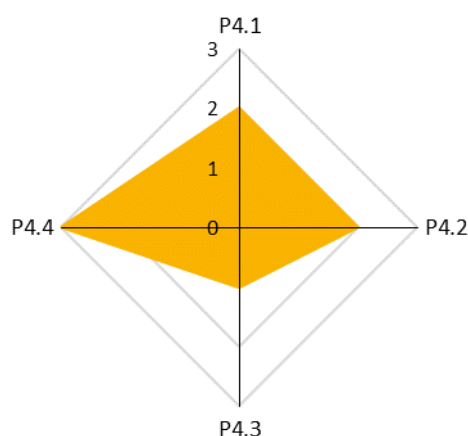
At the same time, the municipality's financial plan allows for DRR activities and the associated budgets are reserved (score of 2 for P3.2). An area where room for improvement exists is insurance coverage, which varies significantly per sector and is not actively promoted by the municipality (score of 1 for P3.4). Whereas public infrastructure is often covered by insurance, cultural heritage assets are not. Lastly, there exists a sufficient number of incentives to support resilience building on national and regional level, with gaps remaining in some sectors (score of 2 for P3.4).



P3.1	The city/ lead agencies understand all sources of funding, and the “resilience dividends”, are well connected, understand all available routes to attract external funding and are actively pursuing funds for major resilience investments.	1
P3.2	Does the city have in place a specific ‘ring fenced’ (protected) budget, the necessary resources and contingency fund arrangements for local disaster risk reduction (mitigation, prevention, response and recovery)?	2
P3.3	What level of insurance cover exists in the city, across all sectors – business and community?	1
P3.4	What incentives exist for different sectors and segments of business and society to support resilience building?	2

Figure 28. Results Essential 03.

7.4. Essential 04: Pursue resilient urban development



P4.1	Is the city appropriately zoned considering, for example, the impact from key risk scenarios on economic activity, agricultural production, and population centres?	2
P4.2	Are approaches promoted through the design and development of new urban development to promote resilience?	2
P4.3	Do building codes or standards exist, and do they address specific known hazards and risks for the city? Are these standards regularly updated?	1
P4.4	Are zoning rules, building codes and standards widely applied, properly enforced and verified?	3

Figure 29. Results Essential 04.

For Essential 04 Camerino achieves a resilience score of 8/12 with minor room for improvement. The municipality employs a land use zoning plan loosely based on known hazards and risks (score of 2 for P4.1) and promotes resilience in new urban developments (guidance for this can be improved) (score of 2 for P4.2). Regulations exist on national level and have to be implemented on local level but in general there is no clear planning for updating the codes (score of 1 for P4.3). Most importantly, where zoning plans and building codes are available these are enforced, although not always verified (score of 3 in P4.4).

7.5. Essential 05: Safeguard natural buffers to enhance the protective functions offered by natural ecosystems

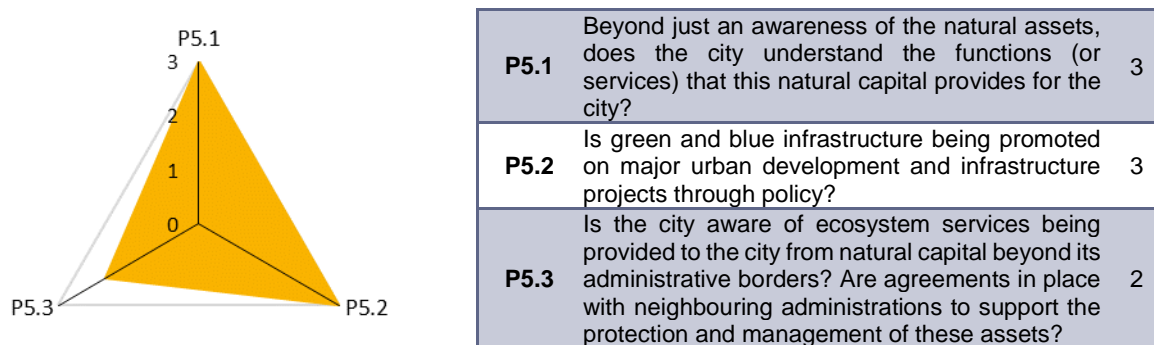


Figure 30. Results Essential 05.

For Essential 05, Camerino achieves a high resilience score of 8/9. Both the municipality and key stakeholders are familiar with the term ecosystem services and understand the economic value of all the functions provided by key local natural assets (score of 3 for P5.1).

In addition, green and blue infrastructure is being promoted in major urban development and infrastructure projects through policy and supporting guidance material (score of 3 for P5.2). Lastly, the municipality is aware of the importance of the functions provided by natural capital beyond its administrative borders and there has been some exchange with neighbouring administrators (score of 2 for P5.3). As an example, the municipality is part of an association of mountain communities²² sharing ecosystem services.

In the Marche Region there are eight local authorities for the management of the mountain areas (see Section 7.3); these are local institutions made up of some municipalities which share financial funds in order to guarantee the essential social and economic services to the population and in order to manage the land use zoning and planning, and to preserve landscapes and ecosystems.

7.6. Essential 06: Strengthen institutional capacity for resilience

For Essential 06 Camerino achieves a resilience score of 5/18 with significant room for improvement. While the municipality can access most of the skills and resources necessary to respond to identified disaster scenarios, gaps still exist. This is especially the case for pre-disaster planning as well as coordination with utility providers (score of 1 for P6.1). Through the dissemination activities of schools and the local university on hazards and risks as well as through civil protection meetings, the municipality is able to reach more than 50% of its

²² The local authorities for the management of the mountain areas were established by D.Lgs 267/2000 and L.R. 35/2013 with the aim of supporting and maintaining partnerships between single local municipalities into a wider governance of internal territories, focused on the protection, conservation and the enhancement of the natural environment. The local authorities for the management of the mountain areas are local entities set up for the enhancement and development of mountain areas and for associated functions and services between municipalities. The municipality of Camerino is part of the "Unione Montana Marca di Camerino" with other neighboring municipalities. The "Unione Montana Marca di Camerino" provides a support to plan and develop green and blue infrastructures, forest management, etc. on and beyond the territory of Camerino.

population with targeted education and awareness raising campaigns (score of 2 for P6.2). However, only some of the municipality's data layers about hazards and risks are shared with other organisations, and the information that is shared requires further interpretation due to the raw format of the data (score of 1 for P6.3).

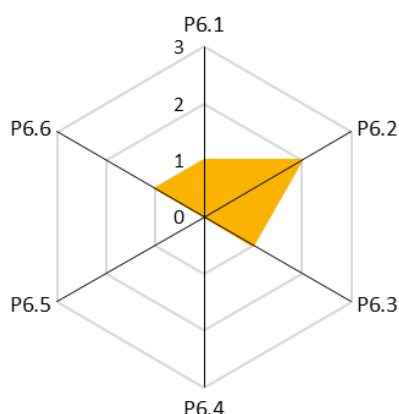


Figure 31. Results Essential 06.

P6.1	Does the city have clear access to all the skills and experience it believes it would need to respond to reduce risks and respond to identified disaster scenarios?	1
P6.2	Does a coordinated public relations and education campaign exist, with structured messaging and channels to ensure hazard, risk and disaster information (that can be understood and used) are properly disseminated to the public?	2
P6.3	Extent to which data on the city's resilience context is shared with other organizations involved with the city's resilience.	1
P6.4	Are there training courses covering risk and resilience issues offered to all sectors of the city including government, business, NGOs and community?	0
P6.5	Are training materials available in the majority of languages in common use in the city?	0
P6.6	Is the city proactively seeking to exchange knowledge and learn from other cities facing similar challenges?	1

While schools and the university disseminate hazard information, there exist no training courses covering risks and resilience issues on the local level, only some civil protection courses on national level exists (score of 0 for P6.4).

Similarly, as no training material exists, it is not translated into other languages. However, if training material would exist, it would be provided in Italian, which is the majority language in Camerino (score of 0 for P6.5). Lastly, knowledge exchange with other municipalities facing similar challenges is limited to local networks and via participation in (research) projects.

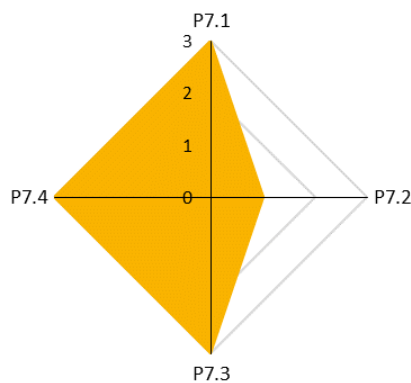
As such, the exchange is more ad hoc than systematic (score of 1 for P6.6). Improving resilience is principally dependent on the availability of financial funds which may be limited for a small town such as Camerino.

7.7. Essential 07: Understand and strengthen societal capacity for resilience

For Essential 07, Camerino achieves a resilience score of 10/12. The municipality actively engages community organizations (e.g. the Concentrico committee – a committee of private citizens) in risk reduction actions and pre-event planning (score of 3 for P7.1).

However, vulnerable population groups do not receive any specific disaster training (score of 1 for P7.2). Of the few businesses in Camerino that employ more than 10 employees – which

are not very many – all have a business continuity plan (score of 3 for P7.3). Lastly, multiple multimedia channels are used for communicating with citizens (score of 3 for P7.4).



P7.1	Are “grassroots” or community organizations participating in risk reduction and post-event response for each neighbourhood in the city?	3
P7.2	Are there regular training programmes provided to the most vulnerable populations in the city?	1
P7.3	What proportion of businesses have a documented business continuity plan that has been reviewed within the last 18 months?	3
P7.4	How effective is the city at citizen engagement and communications in relation to DRR?	3

Figure 32. Results Essential 07.

7.8. Essential 08: Increase infrastructure resilience

For Essential 08, Camerino achieves a resilience score of 16/27. There are no plans or forums to tackle critical infrastructure resilience, as critical infrastructure providers manage these risks on their own (score of 0 for P8.1). For some hazards, such as seismic events and landslides, studies are carried out by the civil protection department or by the Marche Region in order to highlight possible critical issues.

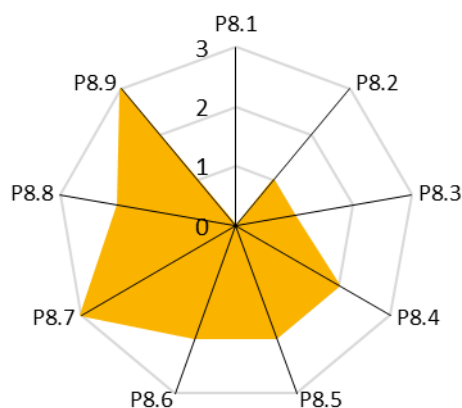


Figure 33. Results Essential 08.

However, the healthcare and education systems of Camerino are well suited to deal with the hazards faced by the municipality as more than 90% of major injuries could be treated within six hours under the “most severe” scenario (score of 3 for P8.7), and no teaching facilities would be at risk under the “most probable” scenario (score of 2 for

P8.1	Is critical infrastructure resilience a city priority, does the city own and implement a critical infrastructure plan or strategy?	0
P8.2	Is existing protective infrastructure well-designed and well-built based on risk information?	1
P8.3	Would a significant loss of service for these two essential services be expected for a significant proportion of the city under the agreed disaster scenarios?	1
P8.4	Would a significant loss of service be expected for a significant proportion of the city in the ‘worst case’ scenario event? In the event of failure would energy infrastructure corridors remain safe (i.e. free from risk of leaks, electrocution hazards etc.)?	2
P8.5	Would a significant loss of service be expected for a significant proportion of the city in the ‘worst case’ scenario event? In the event of failure would transport infrastructure corridors remain safe (i.e. free from risk of flood, shocks etc) and passable?	2
P8.6	Would a significant loss of service be expected for a significant proportion of the city in the ‘worst case’ scenario event?	2
P8.7	Would there be sufficient acute healthcare capabilities to deal with expected major injuries in ‘worst case’ scenario?	3
P8.8	% of education structures at risk of damage from “most probable” and “most severe” scenarios	2
P8.9	Will there be sufficient first responder equipment, with military or civilian back up as required?	3

P8.8). Lastly, first responders in Camerino are well equipped to deal with the “most severe” scenario (score of 3 for P8.9). While there is protective infrastructure in place for landslides that are well maintained and monitored, protective infrastructure for other hazards is missing and the design of existing infrastructure may not be consistent with best practices (score of 1 for P8.2). As for loss of service, there would be some loss of services under the “most severe” scenario (i.e. an earthquake of similar intensity as the ones in 2016) for the energy, transport, and communications systems (scores of 2 for P8.4, P8.5, and P8.6), while some loss of service would be expected for the water system even under the “most probable” scenario (i.e. heavy snowfalls; score of 1 for P8.3).

7.9. Essential 09: Ensure effective disaster response

For Essential 09, Camerino achieves a resilience score of 14/21. The early warning systems can reach more than 75% of the population; however 30% of the population is not reachable, e.g. due to no possession of mobile phone such as is the case for the elderly (score of 2 for P9.1). In addition, Camerino’s municipality has a preliminary civil emergency plan that roughly defines the general tasks of the officials for emergency events and the main reception areas for people (score of 1 for P9.2).

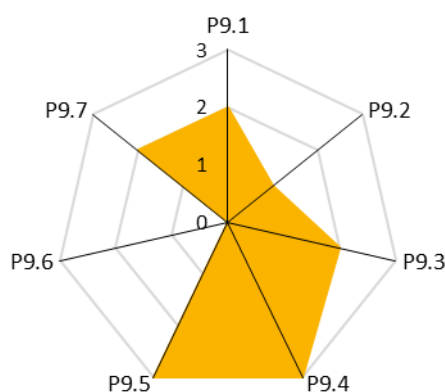


Figure 34. Results Essential 09.

The responsible disaster management authority has enough staff and is able to cover all the neighbourhoods within 24-48 hours in case of an emergency scenario (score of 2 for P9.3). In addition, the equipment and relief supply needs are defined at national level (score of 3 for P9.4) and the necessary supplies of food and basic relief items exceeds estimated needs in the “most severe” scenario (score of 3 for P9.5).

The local civil protection office of Camerino (C.O.C.) is the first authority to organize disaster and emergency response before the successive and possible interventions of the regional and national civil protection departments (score of 3 for P9.6). Lastly, schools, the university and public offices conduct annual drills for disaster response, which are validated by professionals, but are not based on the “most severe” or “most probable” scenario (score of 2 for P9.7).

P9.1	Does the city have a plan or standard operating procedure to act on early warnings and forecasts? What proportion of the population is reachable by early warning system?	2
P9.2	Is there a disaster management / preparedness / emergency response plan outlining city mitigation, preparedness and response to local emergencies?	1
P9.3	Does the responsible disaster management authority have sufficient staffing capacity to support first responder duties in surge event scenario?	2
P9.4	Are equipment and supply needs, as well as the availability of equipment, clearly defined?	3
P9.5	Would the city be able to continue to feed and shelter its population post-event?	3
P9.6	Is there an emergency operations centre, with participation from all agencies, automating standard operating procedures specifically designed to deal with “most probable” and “most severe” scenarios?	0
P9.7	Do practices and drills involve both the public and professionals?	2

7.10. Essential 10: Expedite recovery and build back better

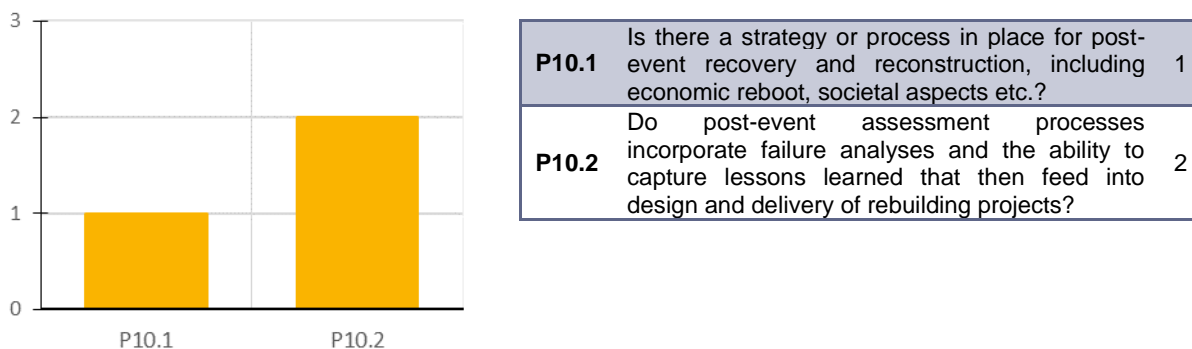


Figure 35. Results Essential 10.

For Essential 10, Camerino achieves a resilience score of 3/6., The current plans for post-event recovery and rebuilding may be improved, especially in terms of economic reboot (score of 1 for P10.1).

The commissioner responsible for rebuilding of the real estate damaged by the last earthquake (2016) issues several ordinances that define criteria for the repair and financing of different types of buildings and of cultural. In terms of lessons learnt, there are clear processes in place to capture lessons from previous difficulties for coping post-event, but the mechanism to transfer these lessons into the design and delivery of rebuilding projects needs improvement. Methods, procedures and funds, which are updated and renewed for each new disaster event, do not always allow for addressing the best and more resilient solutions. (score of 2 for P10.2).

A general issue is the need to combine the preservation of the construction and cultural features of the old town area with the retrofitting works in order to ensure a suitable safety level for the population. Furthermore, there are social and economic issues that have to be tackled in order to avoid the depopulation of the old town.

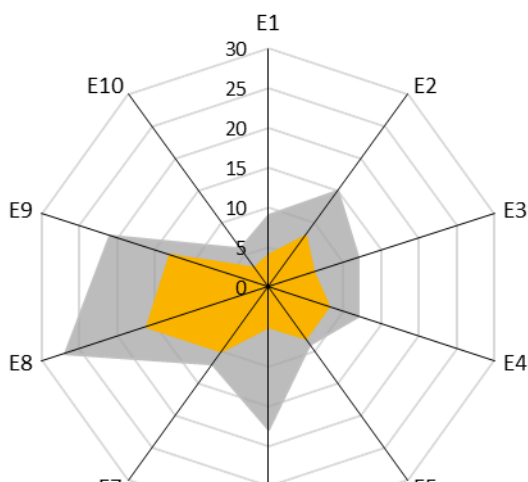


Figure 36. Combined results of Essentials 1 to 10 for Camerino.

7.11. Overall resilience of Camerino

Overall, Camerino achieves a resilience score of 81/141.

The highest scores for resilience were achieved for Essentials 02, 04, 05, 07 and 08 and 09. Camerino offers well established warning systems as well as organisations for risk reduction within the population. The city is a member of a local authority for the management of the mountain areas and it gives great value to its surrounding natural ecosystem and its protection. A zoning plan for hazardous areas and building codes for

urban development exists. The incorporation of these in the development plan of the city will be improved in the next years.

Most room for improvement of the resilience was found in Essential 01, 03, 06, and 10. High quality maps and information about hazards, in particular about earthquakes and geomorphological hazards, are available, but the sharing of these information may be improved and these data are not currently implemented in order to carry out future risk scenarios. The local and regional civil protection offices have defined procedures for post-disaster management. The lack of detailed risk scenarios for emergencies does not currently allow for the development of suitable pre-disaster planning. The critical infrastructure providers do not have a specific agreement with the municipality for resilience improvement, but they support the municipality when disasters occur.

Furthermore, there are minor deficits in the Essentials 01, 03, 10. The Municipality of Camerino employs a general land use zoning plan and it has a civil protection plan for population reception and rebuilding after seismic events. Risk scenarios are not available for the main natural hazards, and thus there is no plan for improving resilience. However, regional and national civil protection services do function well. In contrast to the well-insured public infrastructure, there is no dedicated financial support for resilience and investment actions, different from the ordinary maintenance, for heritage sites. The municipality of Camerino, when disasters occur, establishes a local civil protection office. The emergency warning service and support systems offer sufficient functions. Up to now, there are some difficulties in order to learn from previous events due to financial and social reasons and the need to preserve the original construction features of the old town. For new buildings built in the peripheral areas, after the last earthquake, innovative construction techniques are used such as base-isolated buildings.

8. Conclusion

The preliminary analysis of the main hazards, exposed elements and the possible impacts in section 6 allows an initial assessment of the resilience of different features of the municipality of Camerino. This resulted in the identification of preliminary priorities corresponding to the findings of the baseline review and useful for defining the municipality's detailed needs and objectives within the ARCH project. The main aspects for the improvement of Camerino's resilience (chapter 7) were found to be the identification and use of the risk scenarios, and the planning of institutional strategies to improve the resilience of the urban areas as well as the infrastructure.

Generally, maps and information about earthquakes and geomorphological hazards are available, but these are currently not utilised to define future risk scenarios. The local civil protection office has defined procedures for post-disaster management, however, pre-disaster planning is hindered by a lack of detailed risk scenarios for future emergencies. Furthermore, critical infrastructure providers currently have no specific agreement with the municipality for resilience improvement, but rather support the municipality on ad-hoc basis when disasters occur. There are also some difficulties in making use of the lessons learned from previous events due to financial and social reasons. Another challenge derives from the need to preserve the historical construction techniques as well as the cultural features of the Old Town despite the necessity for seismic retrofitting.

Based on this, the specific objectives for the ARCH Project for Camerino include:

- 1) to improve the predictive models and risk assessment methods to lead future actions for current post-earthquake reconstruction, mitigate the effects of future events and enhance the preparedness for natural hazards;
- 2) to increase the knowledge base on the geological-structural setting of the "Camerino hill" and the geomorphological processes, thereby determining the hydrogeological hazard scenarios for the historical centre;
- 3) to increase the knowledge of the vulnerability of historical buildings with reference to construction materials and techniques;
- 4) to monitor cultural heritage of significant value in order to provide alerts and real-time information about damage resultant from natural hazards and degradation due to environmental conditions;
- 5) to develop guidelines for managing and securing artefacts and artwork after seismic events.

It is therefore planned to conduct the analyses of the risks due to natural hazards at different urban scales; from the district scale to that of the case study buildings (the Ducal Palace and Santa Maria in Via's Church). Furthermore, extreme precipitation can influence the risk scenario concerning landslides and service networks (communication, electric, etc.). Thus, enacting measures for increasing urban resilience leads to disaster risk reduction.

These strategies can be supported by the assessment of tangible costs and benefits (e.g. reduction of physical damage to the built environment, direct and indirect economic losses),

and intangible losses related to the loss of cultural and artistic value. The planned activities will also allow the definition of risk scenarios via the use of tools [32] that are able to support the planning of resilience improvement and the identification of emergency strategies for the urban area.

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Additional key documents and laws are described in the Annex (part 11).

10. List of abbreviations

Term	Meaning
CAPI	Emergency Service Centre
CCS	Coordination Centre
CCHWG	Climate Change and Cultural Heritage Working Group
CMCC	Euro Mediterranean Centre on Climate Change
CNSAS	National Mountain Rescue and Speleological Corps
COAU	Joint Air Operations Centre
COEMM	Operations Centre for Maritime Emergencies
COM	European Commission documents
DG ECHO	Directorate-General for European Civil Protection and Humanitarian Aid Operations
DSS	Decision support system
ECCR	Emergency Response Coordination Centre
ETS	European Treaty Series
ICOMOS	International Council on Monuments and Sites
IMELS	Italian Ministry for the Environment, Land and Sea
INGV	National Institute of Geophysics and Volcanology
INSPIRE	Infrastructure for Spatial Information in Europe

IVAVIA	Impact and Vulnerability Analysis of Vital Infrastructures and Built-up Areas
LCA	Life Cycle Analysis
MIBACT	Ministry of Cultural Heritage and Activities, and Tourism
MEMS	Micro Electro-Mechanical Systems
NAP	Italian National Adaptation Plan for Climate Change
NAS	National Adaptation Strategy
POR	Regional operative program
PTSD	Post-traumatic stress disorder
RDP	Rural Development Plan
SOUP	Regional Operative Office
SWD	European commission staff working document
UNDRR	United Nations Office for Disaster Risk Reduction

11. Annex

11.1. Key documents governing cultural heritage management (see Section 3)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Convention for the Safeguarding of the Intangible Cultural Heritage	Agreement	International	Non-binding	United Nations Educational, Scientific and Cultural Organization (UNESCO)	2003	No relevant timelines for the Convention itself have been identified. The created list of intangible heritage elements is annually updated.	Convention: https://ich.unesco.org/en/convention List of Intangible Cultural Heritage: https://ich.unesco.org/en/00011?type=00002#tabs	The Convention established (Article 16) a Representative List of Intangible Cultural Heritage of Humanity.
European Framework for Action on Cultural Heritage	Commission staff working document	International	Non-binding	European Commission	2018	Implementation of the Framework will be monitored by the Cultural Heritage Forum, an informal Commission expert group meeting at least annually since 2019.	https://ec.europa.eu/culture/content/european-framework-action-cultural-heritage_en	Framework of continued action for Europe's cultural heritage based on a holistic, mainstreaming and integrated approach, multi-stakeholder cooperation.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Convention for the Protection of the Architectural Heritage of Europe	Agreement	International	Binding	Council of Europe	1987		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/121	Legally binding instrument which sets the framework for an accurate conservation approach within Europe. Aims to reinforce and promote policies for the conservation and enhancement of Europe's heritage.
European Landscape Convention	Agreement	International	Binding	Council of Europe	2000		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143	Promotes the protection, management and planning of the landscapes and organizes international co-operation on landscape issues.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
European Convention on the Protection of the Archaeological Heritage (Revised)	Agreement	International	Binding	Council of Europe	1995		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143	This revised Convention updates the provisions of a previous Convention adopted by the Council of Europe in 1969. The new text makes the conservation and enhancement of the archaeological heritage one of the goals of urban and regional planning policies.
Italian law no. 184, 6 th April 1977	Law	National (I)	Binding	Italian Parliament	1977		https://www.gazzettaufficiale.it/	Ratification and implementation of the convention on the protection of the world's cultural and natural heritage, Paris, 23 th November 1972.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Italian Law no. 93 of 15 th February 1989	Law	National (I)	Binding	Italian Parliament	1989		https://www.gazzettaufficiale.it/	Ratification and execution of the European Convention for the Protection of the Architectural Heritage in Europe, Granada, 3 rd October 1985.
Legislative Decree no. 42, 22 nd January, 2004	Law	National (I)	Binding	Italian Parliament	2004		https://www.gazzettaufficiale.it/	Legislative Decree no. 42, 22/01/2004 (Cultural Heritage and Landscape Code). The Legislative Decree describes the standards for the cultural heritage i.e. architectural heritage, museums, artwork. Furthermore, this code defines the criteria for the planning of protection, use and the enhancement of the cultural heritage. Standards for the landscape planning are shown.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Legislative Decree no. 62, 26 th March, 2006	Law	National (I)	Binding	Italian Parliament	2006		https://www.gazzettaufficiale.it/	Legislative Decree no. 62, 26/03/2006 (changes on Legislative decree n. 42/2004).
Legislative Decree no. 63, 26 th March, 2006	Law	National (I)	Binding	Italian Parliament	2006		https://www.gazzettaufficiale.it/	Legislative Decree no. 63, 26/03/2006 (changes on Legislative Decree n. 42/2004).
Marche Region Law no. 04, 09/02/2010	Law	Regional	Binding	Regional Council	2010		https://www.consiglio.marche.it/banche_dati_e_documentazione/leggi/	Regional law no. 04, 09/02/2010, Laws on cultural heritage and activities. This law defines the tasks of the Region, of the municipalities and of the local authorities and the types of activities in order to enhance both the cultural heritage and the landscapes.

11.2. Key documents governing disaster risk reduction (see Section 4)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Sendai Framework	Agreement	International	Non-binding	United Nations Office for Disaster Risk Reduction (UNDRR)	2015	Valid until 2030. UNDRR is in charge of follow-up and review of the Sendai Framework by preparing periodic reviews on progress, among other actions.	http://www.unisdr.org/we/inform/publications/43291	Establishment of a global framework for action to prevent new and reduce existing disaster risks, based on 7 targets, 4 priorities for action with supporting rationale and 13 guiding principles.
EU law (Decision 1313/2013/EU)	Law	International (Europe)	Binding	European Parliament	2013		https://eur-lex.europa.eu/homepage.html	Decision No 1313/2013/EU of the European Parliament and of the Council on a Union Civil Protection Mechanism. It defines the activities to assist with the response to immediate adverse consequences of a disaster inside or outside the Union.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
EU law (Decision 420/2019/EU)	Law	International (Europe)	Binding	European Parliament	2019		https://eur-lex.europa.eu/homepage.html	This decision defines an effective and coherent approach to the prevention of and preparedness for disasters and to promote the exchange of best practices within the Union Mechanism.
Directive 2007/60/EU	Guideline	International	Binding	The European Parliament and The Council of The European Union	2007		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32007L0060	The purpose of this Directive is to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community. It should be read together with Act no. 7/2010 Coll. on flood protection,

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Italian law. Legislative Decree no. 1, 02/01/2018)	Law	National (I)	Binding	Italian Parliament	2018		https://www.nor.mattiva.it/	Legislative Decree no.1 02/01/2018: Civil Protection Code (in Italian). This law defines the organisation of the National Civil Protection office and the tasks of the offices at regional and local levels. Furthermore, it defines the tasks of the scientific committee and the planning of the activities to prevent disasters and to manage the rebuilding.
Italian law (Decree of the Prime Minister of 09/08/2016)	Law	National (I)	Binding	Italian Parliament	2016		https://www.gazzettaufficiale.it/	Decree of the Prime Minister D.P.C.M. 09/08/2016: this decree describes the organization of the Civil Protection Office (in Italian).

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Italian law (Decree of the General Secretary of the Presidency of the Council of Ministers, 10/08/2016)	Law	National (I)	Binding	Italian Parliament	2016		http://www.protezionecivile.gov.it	Decree of the General Secretary of the Presidency of the Council of Ministers 10/08/2016: this Decree describes some activities concerning the Civil Protection Office (in Italian)
Italian law (Decree of the Prime Minister of 20/02/2012)	Law	National (I)	Binding	Italian Parliament	2012		https://www.gazzettaufficiale.it/	Decree of the Prime Minister D.P.C.M. 20/02/2012: this Decree describes both the components and the tasks of the committee that supports the civil protection office (in Italian)
Italian law (Decree of the Prime Minister of 21/11/2006)	Law	National (I)	Binding	Italian Parliament	2006		https://www.gazzettaufficiale.it/	Decree of the Prime Minister D.P.C.M. 21/11/2006: this Decree shows the activities and the tasks of the Civil Protection Operational Committee (in Italian)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Italian law no. 286, 27/12/2002	Law	National (I)	Binding	Italian Parliament	2002		https://www.nor.mattiva.it/	Law no. 286 27/12/2002, modification of the Legislative Decree no. 245 04/11/2002, concerning urgent interventions in favour of populations affected by natural disasters in the Molise and Sicily regions, as well as further provisions on civil protection (in Italian).
Marche Region Law no. 32, 11/12/2001	Law	Regional	Binding	Regional Council	2001		https://www.consiglio.marche.it/banche_dati_e_documentazione/leggi/	Regional Law no. 32, 11/12/2001, B.U.R. n. 146 del 20/12/2001, (in Italian). This law defines the tasks of the civil protection offices at regional levels and the organisation of the civil protection authorities.
Marche Region Law no. 13, 03/04/2015	Law	Regional	Binding	Regional Council	2015		https://www.consiglio.marche.it/banche_dati_e_documentazione/leggi/	Regional Law no. 13, 03/04/2015, B.U.R. no. 33 del 16/04/2015, (in Italian). This regional law shows the organization of the administrative functions of the Provinces.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Council's deliberation no. 61, 22/12/2008		Local	Binding	Council of Camerino municipality	2008		https://www.comune.camerino.mc.it/documenti-cms/relazione-piano-di-protezione-civile/	Civil protection plan, approved by council's deliberation n. 61 of 22th Dec., 2008, according to Italian Law n. 225 of 24 th Feb., 1992. The municipal civil protection plan defines the preliminary activities and tasks of the local civil protection office (COC) and the emergency reception areas.

11.3. Key documents governing climate adaptation (see Section 5)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Paris Agreement	Agreement	International	Binding	UNFCCC	2015-2016		https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement	The Paris Agreement builds upon the Convention and for the first time brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.
EU Directive 2018/844		European Community	Binding	European Parliament	2018		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018L0844	Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
EU Directive 2012/27		European Community	Binding	European Parliament	2012		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0027	Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Text with EEA relevance
EU Directive 2003/87		European Community	Binding	European Parliament	2003		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32003L0087	Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC
COM/2018/738 Report on the implementation of the EU adaptation strategy	Report	European Community	No binding	European Commission	2018		https://eur-lex.europa.eu/legal-content/en/txt/?uri=celex%3a52018dc0738	Report from the commission to the European parliament and the council on the implementation of the EU strategy on adaptation to climate change. Impacts of weather and climate extremes

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
EU Climate Change Adaptation Strategy	Strategy	International (Europe)	Non-binding	European Commission	2013	Last evaluated in 2018. Update likely 2021.	https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1	Framework and mechanisms for improving the EU's preparedness for current and future climate impacts.
Evaluation of the EU strategy on adaptation to climate change	Report	European Community	Non-binding	European Commission	2018		https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1	This report examines the process and the results of the evaluation of the strategy COM/2018/738, including the lessons learned from its implementation.
SWD/2018/ 460 Adaptation preparedness scoreboard – Country Fiches	Report	European Community	Non-binding	European Commission	2018		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2018:460:FIN	Commission Staff Working Document/Adaptation preparedness scoreboard Country fiches/Accompanying the document Report from the Commission to the European Parliament and the Council on the implementation of the EU Strategy on adaptation to climate change

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Legislative Decree no. 111/2019	Law	National	Binding	Italian Parliament	2019		https://www.gazzettaufficiale.it/eli/id/2019/10/14/19G00125/sg	This law is aimed primarily at adopting urgent measures for the definition of a national strategic policy to combat climate change and improve air quality. Urgent interventions are also introduced to resolve certain environmental infringement procedures
Legislative Decree no. 216/2006	Law	National	Binding	Ministry for the Environment	2006		https://www.minambiente.it/sites/default/files/archivio/allegati/mission_trading/Dlgs_216-06.pdf	National execution of the EU Directives 2003/87, 2004/101/CE and Kyoto Protocol on greenhouse emissions
National Adaptation Strategy	Strategy	National	No binding	Ministry for the Environment	2014		https://www.minambiente.it/notizie/strategia-nazionale-di-adattamento-ai-cambiamenti-climatici-0	The NAS provides a “State of the art on scientific knowledge of impacts vulnerabilities and adaptation of climate” that illustrate in a depth, for national territory, sectors which are affected on future impact of climate change

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
National Plan on adaptation to climate changes	Plan	National	Non- binding draft	Ministry for the Environment	2017		https://www.minambiente.it/sites/default/files/archivio_immagini/adattamenti_climatici/allegato_2_impatti_e_azioni.pdf	Report on the state of scientific knowledge on impacts, vulnerability and adaptation to climate change in Italy. Analysis of the EU and national legislation relevant to impacts, vulnerability and the 'adaptation to climate change. Elements for a National Strategy for Adaptation to Climate Change
PEAR 2020 Regional, environmental and energy plan	Plan	Regional	Non- binding	Marche Region	2016		https://www.regione.marche.it/Regione-Utile/Energia/Piano-Energetico-Ambientale-Regionale	The Regional Environmental Energy Plan (PEAR) identifies the planning and guidelines for environmental energy policy in the regional territory

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Regional Plan for climate	Plan	Regional	Non- binding draft	Marche Region	2007		http://www.sinanet.isprambiente.it/gelso/banca-dati/regione/regione-marche/schema-di-piano-regionale-per-il-clima-della-regione-marche	The Plan intends to systemise and make climate change mitigation policies more effective
Forest fire emergency plan	Plan	Local	Binding	Municipality of Camerino	2018		https://www.comune.camerino.mc.it/documenti-cms/piano-incendi-boschivi/	Local law to protect the integrity of life, property, settlements and the environment from damages or from dangers deriving from natural disasters, catastrophes and other events