Climate Change and Urban Tourism: Preservation Strategies and Destination Management Policies in Coastal Cities. The Case of Venice

Nina Balan
nbalan1@uno.edu

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Climate Change and Urban Tourism: Preservation Strategies and Destination Management Policies in Coastal Cities. The Case of Venice

A Dissertation

Submitted to the Graduate Faculty of the University of New Orleans in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Urban Studies

by

Nina Balan

B.A. Università Cattolica del Sacro Cuore, Brescia, 2013
M.S. University of New Orleans, 2016

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To my loving mother, without whom my dreams of pursuing a Ph.D. would have never come true. Thank you for instilling in me discipline, courage, and determination.
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Abstract

Climate change is an influencing phenomenon in the present global perspective, having a wide range of impacts at different levels within society and the global tourism industry. Climate change has progressively affected coastal areas more vulnerable to intense hydrodynamic and atmospheric events due to their proximity to water. The primary process to be held responsible is eustatic sea-level rise due to anthropogenic (human-induced) and morphological (natural) factors over time. While the exact magnitude of global sea-level rise and regional variability remains uncertain, sea-level rise is considered one of the most certain consequences of anthropogenic climate change in the coastal regions that rely on tourism activities. Tourism has a more significant environmental impact on coastal areas than non-coastal areas due to its proximity to water and cruise line activities. This research presents a case study on Venice. In this emblematic iconic city, the two most pressing issues are flooding due to sea-level rise and locals fleeing the city due to the overtourism phenomena. The research uses a mixed methods approach to examine changes adopted to manage climate change stressors and overtourism activities in Venice to ensure the city’s habitability by 2100. The research uses the conceptual framework between environmental impact and urban tourism as a reference and develops a framework that includes socio-cultural and economic impacts at the destination level. In addition to its proximity to water, Venice is characterized by a strong economic dependence on the tourism and hospitality industry, leading the research to examine how the industry (alongside climate patterns) affects a UNESCO world heritage site’s historical heritage and cultural preservation over the past 20 years, and what actions are required to protect Venice in the future.

This study contributes to the tourism and climate change body of knowledge by advancing a further step toward understanding experts’ and tourism stakeholders’ responses to the
safeguarding of Venice in a scenario in which a destination’s most appealing, cultural, historical, and natural resources are impacted by climate change.

Keywords: Climate change, Venice, coastal cities, adaptive management, sustainable tourism
Chapter 1: Introduction

Climate change is recognized as a fundamental challenge for cities in the coming decades. It will potentially affect large groups of businesses and residents in what some call “this century of urbanization” (Reckien et al., 2017, p. 159). Carmin et al. (2012, p. 18) observe that cities “are experiencing new weather and climate patterns that are being attributed to global climate change throughout the world.” Some of the most vulnerable areas worldwide have already started experiencing the consequences of climate change, with action to deal with it long overdue (Atzori et al., 2018). Approximately 41% of the global population lives within 70 miles of a coast, 38.7% of which are in hurricane basins, while about 40% of the people in the United States alone live on the coast (Lindsey, 2021).

The effects of climate change on coastal areas generate severe consequences for the tourism industry. Therefore, there is growing interest in adaption strategies. Tourism is a “climate-sensitive human activity with a vulnerability to climate change that is generally greater in coastal and riverine areas” (Wilbanks et al., 2007, p. 359). The threshold between climate and tourism is multifaceted and complex. Climate represents both a vital resource to be exploited and an important limiting factor that poses risks to be managed by the tourism industry and tourists alike (Scott & Lemieux, 2010). A recent study conducted by Arbulú et al. (2021) looked at how crises affect various sectors. The findings showed that crises asymmetrically hit different industries, with the tourism industry (transportation and hospitality in particular) being one of the most affected (Arbulú et al., 2021).

The literature has acknowledged that urban areas will need to mitigate and adapt to the impacts of global warming and cope with increased incidence of heatwaves, water shortages, storm surges, and natural disasters, which, in turn, can impact urban infrastructure, stress services, and
prevent the adequate usage of the built environment (Satterthwaite et al., 2007). Human impact, particularly in densely populated areas, has put increased pressure on the natural environment, which has escalated climate change and, in turn, altered coastlines and coastal cities’ future viability.

Founded in the 5th century, Venice, Italy (Figures 1 & 2), is a major seaport, and capital of both the province of Venice and the region of Veneto, northern Italy. Also known as the queen of Adriatic, the city was once the center of a maritime republic. It was the greatest seaport in late medieval Europe and the continent’s commercial and cultural link to Asia. Venice is unique environmentally, architecturally, and historically, and in its days as a republic the city was styled *la Serenissima* (the most serene or sublime). It remains a major Italian port in the northern Adriatic Sea and is one of the world’s oldest tourist and cultural centers (Cessi et al., 2020). The *centro storico* or historic center of Venice is connected to the mainland suburb of Mestre by the *Ponte della Libertà*, a long causeway that was built early in the 19th Century.

The Comune di Venezia is comprised of six municipalities and three primary components: the *città storica* (historic center), the *estuario* (estuary) and the *terraferma* (mainland). The name Venice is often used to refer specifically to the *città storica* and the Comune as a whole. For the purposes of this research Venice will be taken to mean the historic center.

Venice is standing in the lagoon waters where it is exposed to tides and storms and is particularly vulnerable to rising sea levels (Dolan & Goodell, 1986). Land subsidence (human-induced subsidence, eustasy, and morphological changes in the Lagoon) and SLR are jointly responsible for higher water levels that have caused increasingly frequent flooding.
Acqua alta means high water in Italian, and the phrase is what Venetians use to describe high tides that flood the city. In the last century, the frequency and intensity of acqua alta have increased. On November 4 of 1966, Venice experienced the worst flooding on record, with the city covered in 76.4 inches of water. On November 12 of 2019, flooding submerged Venice in 74.4 inches of water. From 2000 to 2020, more than half of the city flooded a total of twelve times, compared to just once between 1872 and 1950 (Masters, 2019). As ocean levels rise and Venice sinks due to plate tectonics, acqua alta becomes a more significant threat to this idyllic Italian city (Nelson, 2021). According to previous studies (Gatto & Carbognin 1981; Carbognin et al., 1995, 2004, 2010; Tosi et al., 2002; Brambati et al., 2003), the historical center of Venice has sunk about 23–25 cm relative to the mean sea level over the past one hundred years. Twelve cm was lost due to land subsidence, both natural (3 cm) and human-induced (9 cm due to groundwater extraction); 11–13 cm was lost because of global eustatic processes. Since groundwater exploitation has been regulated by law in the 1970s, land subsidence in the city of Venice and most of its surrounding areas has decreased to natural rate (Munaretto et al., 2012).
There is a need to enhance practical research regarding the vulnerability and impacts of climate on tourism, as tourism is one of the most important economic activities in Venice, Italy. Venice has been – and still is – considered a tourism destination par excellence (Cosgrove, 2003; Quinn, 2007). The island city has faced two significant challenges: flooding and mass tourism. On the one hand, the city is flooding due to sea-level rise and subsidence. The occurrence of high water poses a significant threat to the protection and integrity of Venice Lagoon and historic settlements. Research predicts that the frequency of *acqua alta* will increase from today 4 times per year to a range between 20 and 250 times per year (Carbognin, et al., 2010). Increase in the frequency of precipitation and annual flooding due to global warming and sea level rise puts the Lagoon’s ecology at risk.

On the other hand, the city is in danger of sinking in the wake of mass tourism (Settis, 2016). In 2020, the historic city of Venice received a considerably smaller number of tourists due to the coronavirus (COVID-19) pandemic. In 2020, Venice recorded approximately 1.34 million arrivals, while in comparison, in 2019, approximately 5.5 million tourists visited Venice (Statista, 2020). To this number, one must add day-trippers: people visiting Venice without an overnight stay. Day-trippers are not statistically represented but have a high-impact tourism presence (Van der Borg, 1966; Russo, 2002; Mencini, 2011). Growing mass tourism and the adverse effects of these dynamics on the residential population have been variously analyzed in the literature by framing them as overtourism impacts (Bertocchi & Ferri, 2021) or as touristification and gentrification displacement (Cocola-Gant, 2018).

Not only Venice is facing these challenges. Touristification and commodification of housing are virulent contemporary phenomena in many cities (Russo & Scarnato, 2018; Russo, 2002; Van der Borg, 1996). However, as an island-based heritage city, Venice is being markedly
reshaped by mass tourism in the form of day tourists from cruise ships, bus tours, and those who enter the city from the surrounding region (Casagrande, 2015; Bertocchi & Visentin, 2019).

This research will analyze climate threats affecting the tourism industry in Venice and determine gaps in adaptation and mitigation policies. A mixed-methods approach including census data to analyze tourism trends such as out-migration, alongside pioneering research on the climate crisis in urban cities will be used for the study. This analysis will be used to identify existing challenges and adaptation measures between the years 2000-2019. To address missing data, the researcher will collect qualitative data involving a survey where experts and key informants in the tourism field from local (Venetian), regional (Veneto Region) and international (European Union) levels are invited to understand current predictions and future expectations for long-term policy frameworks. In their study, Deery et al. (2012) argues that most of the studies analyzing tourism’s impact derives from quantitative methods, therefore, a mixed methodology approach offers new angles of analysis.

The introduction chapter is divided into nine sections. The first section presents the problem statement. The second section is the theoretical framework (including the concept of sustainable tourism, the economic, socio-cultural, and environmental aspect of tourism). The third section describes the evolution of the climate change. The fourth section outlines the rationale of conducting this study. The fifth section presents the purpose of the study, followed by the conceptual framework, research question (seventh section). The eighth section talks about the data collection and finally the significance of the research (ninth section).
1.1 Problem Statement

Sinking cities are urban areas at risk of disappearing due to rising sea levels and subsidence. Since 1880, the global sea level has been increased by about 8 to 9 inches, and by the end of this century, the sea level is expected to rise by at least a foot above what it was in 2000 (Lindsey, 2021). In addition to changes in sea level, densely populated cities have created land subsidence, which occurs when large amounts of groundwater have been removed from the earth, weakening the stability of the ground. The two issues have caused significant cities worldwide to sink, as the grounds supporting them collapse from subsidence and oceans creep further inland with rising sea levels. The impacts of rising sea levels on coastal areas lead to high water tables that can negatively affect the stability of foundations of coastal infrastructure (Scott et al., 2012a).

Venice has long faced the pressures of rising sea levels and unsustainable tourism levels met by insufficient storm infrastructure. On its busiest days, Venice and the mainland attracts approximately 20 million visitors each year in a city with only about 258,600 residents (World Population Review, 2020; Città di Venezia, 2020) Higher tides, known as acqua alta, caused by climate change have made Venice even more susceptible to flooding than ever before (Gugliuzzo, 2017). Since the construction of the industrial settlement of Marghera in 1917, the population of the Venetian mainland has grown steadily, while the population of the historic center (hereafter: HC) shrunk to less than a third compared to the post-war period (Salerno & Russo, 2020). Since the 1960s, the process of depopulation has been tagged in Venetian chronicles as ‘the exodus’ (Zanardi, 2020), one of the key issues of the so-called ‘Problem of Venice.’ Consequently, the HC has experienced a continuing population fall from ~175,000 in 1951 to 78,000 in 1992; 65,000 in 2000 (Page & Hall, 2007); 53,000 in 2017, to approximately 50,000 today (Molinaroli et.al, 2019).
Venice has battled rising water levels since the fifth century. One result of the sinking is that chemical pollution in the Venetian lagoon has become a much more severe problem for the buildings of Venice. The sinking has resulted in fractures, tilting, damages, and irregular surfaces throughout the city, yielding high flood risk. Additionally, Venice does not have a sewage system, so it depends on the daily tide’s flushing action to dispose of waste, posing health and sanitation concerns. Congestion on the main canals from motorized traffic threatens the environment while contributing to atmospheric and water pollution. During the COVID-19 lockdown, locals in Venice noticed that the water in the city’s canals became much clearer, with small fish visible and swimming around (Guy & Donato, 2020).

Venice’s long history of dealing with water, notably due to surges from the Adriatic Sea and runoff from precipitations, has long been a characteristic of Venetian infrastructure. The city was accessible only by water until a causeway with railways was built in 1846, followed by a road in 1933 connecting the Lagoon to the rest of Italy (Kelman, 2020). In the 1970s and 1980s, there were 50 high tides a year, while in 1996, there were 101 high tides and in 2000 around 80 (Page & Hall, 2007). The most famous flood in 1966 sparked an international outcry that led the Italian government to pass a special law in 1973, officially recognizing that the fate of Venice and the Lagoon needs to be considered as one entity. This legislation aimed to turn back the environmental devastation of the last century. It promised to restore the Lagoon’s physical and ecological integrity by rescuing the salt marshes, ending land reclamation, and curbing pollution (Robbins, 2019). Thus, to prevent damages and losses of a unique monumental and cultural heritage, in 1994, the Italian government approved the construction of a system of 78 mobile barriers *Modulo Sperimentale Elettromeccanico* (MOSE) to prevent the flooding of Venice. MOSE’s construction was initiated in 2003, and successfully tested in October 2020. On October 3, 2020, a historic and
memorable moment for Venice and its inhabitants had occurred. After decades of delays, controversy, and corruption, the city finally trialed its long-awaited flood barriers against the tide. All 78 barriers were fully raised, and while the water level rose to 132 cm (4.3 ft) outside the MOSE, inside the lagoon, it remained at 70 cm (2.3 ft), enough to keep St. Mark’s Square dry (Buckley, 2020).

Venice is a fragile city in a structural sense because the survival of the city built on water requires the preservation of the lagoon that surrounds it, and fragile in its social composition due to the departure of the resident population. Bertocchi & Visentin conducted a study analyzing residents’ social perception of tourism pressure (2019). The findings have identified a list of moving-out stressors associated with the following: number of tourists and overcrowding in the city; lack of service for residents; life being too expensive for residents; lack of jobs (outside the tourism market); the inconvenience of a city that has been turned into a tourism monoculture; personal reasons (non-tourism related), and the possibility to rent out their house due to short-term holiday rentals. In addition to Airbnb, it is relevant to mention the implementation of the regional law n. 33 of 2002 which relaxed rental regulations and stimulated the opening of new tourism facilities connected to the accommodation category called complimentary accommodation facilities such as B&Bs, hostels, and vacation rentals (Bertocchi et al., 2020).

Venice is also fragile because the artistic and cultural heritage requires a tremendous cultural and financial commitment for its preservation throughout the years (Fabbri et al., 2019). Although heritage tourism is considered an attractive market with high growth potential, it is also fraught with challenges. Managers of heritage-tourism destinations need to consider many reasons tourists may have to visit these sites; they also must consider that heritage resources have many different stakeholders, often with conflicting interests. Indeed, heritage resources are public goods,
differentiating them from other tourism sites (Garrod & Fyall, 2000). Yet, heritage sites are also part of the tourism industry, in which marketing and profitability issues need to be considered. When heritage sites become tourism destinations, managers increase pressure to achieve conservationist and commercial goals (Garrod & Fyall, 2000). This conflict of interests often becomes most apparent in interpreting the heritage and issues concerning authenticity (Nuryanti, 1996). Historic settlements and urban areas are seen as assets, readily transformed into products sold to consumers seeking an experience (Orbasli, 2002). Vesey & Dimanche (2003) believe that what tourists witness is a commercial image of the past and its reputation, rather than an accurate portrayal of the destination either in the past or present.

Tourism is Venice’s most important economic activity. In 2019, Venice generated tourism revenue of 1.5 billion euros (US $1.8 billion), with 30% from day-trippers, but tourism is also a significant source of pollution and a negative influence on the quality of life of Venetian residents (Annuario del Turismo, 2019).

Tourism increases the physical pressures on fragile environments and may be seen as a threat to the social unity of culture and community. But tourism is not just a threat that has to be managed; it also must be viewed as an opportunity to be harnessed. The main reason tourism stakeholders and policymakers appear unprepared to face climate change is the lack of awareness about its impacts on the tourism industry (Cannas, 2017). The future of tourism directly impacts the future of coastal cities. The industry (tourism destination) shares the responsibility to act now and accelerate climate action to cut global tourism emissions by at least a half over the next decade and reach NetZero emissions as soon as possible before 2050 as suggested by Glasgow Declaration on Tourism launched at the UN Climate Change Conference (COP26) in November 2021:
“A just transition to Net Zero before 2050 will only be possible if tourism’s recovery accelerates the adoption of sustainable consumption and production and redefines our future success to consider not only economic value but rather the regeneration of ecosystems, biodiversity and communities” (One Planet Sustainable Tourism Program, 2021, p.1).

1.2 Theoretical Framework

1.2.1 The Concept of Sustainable Tourism

The early tourism literature of the 1950s and 1960s was characterized by a positive and uncritical attitude towards the tourism sector, which was almost universally regarded as an economic savior for a wide variety of communities. The prevalent attitude was that communities should do all they could to attract and promote tourism activity within a minimally constrained free-market environment (Weaver & Lawton 2002). The theory led to anti-management perspectives, which assumed that tourism is a positive force best left to evolve on its own without the involvement of the government. Mings (1969), who advocated a critical supplementary role for tourism in the economic development of the Caribbean, has missed identifying any negative impacts of tourism. It was not until the 1980s that efforts were made to identify modes of tourism that would, in theory, be more positive for host communities, such as alternative tourism and eco-tourism (Weaver & Lawton 2002). The shift in theory determined by Kuhn (1962) responds to the current tourism crisis and has gradually become the dominant theory in literature. In the 21st century, sustainability is in the news every day. That’s because the term sustainability has become one of the most used buzzwords in contemporary society as the world copes with climate change, biodiversity loss, conflict, and resource scarcity. The sustainability concept emerged mainly as an ecological construct. It is often used interchangeably with sustainable development to reflect a more human-centered approach to development within the parameters of the social, economic, and
environmental global context. The most widely accepted definition of sustainable development is that cited in the Our Common Future, also known as Brundtland Report: “Development that meets the needs of the present without compromising the needs of future generations” (WCED, 1987 p. 43). Butler (1993) prefers the term sustainable tourism development since the term sustainable tourism could imply the wellbeing of the tourism sector itself (Weaver & Lawton, 2002).

Sustainability is the biggest single issue facing the tourism sector globally. It is an all-embracing umbrella term used to describe the concepts that now affects all aspects of human activity, given the concerns over the long-term future of the planet’s resources and ability to support the actions of a rapidly expanding population. Tourism is key to global sustainability because of the increased level of domestic and international travelers. The increasing consumption of travel and tourism-related services has brought the inevitable rise in the negative impacts of tourism. Sustainability is the focal point for understanding the interconnections between the visitor, the tourism sector, and resources to develop policies and plans to reduce the negative impact of tourism activity and increase the range of positive effects (UNWTO, 2011).

According to United Nations World Tourism Organization (UNWTO, 2011), the evolution of sustainability has evolved since the 1960s from a focus on the destructive impacts of tourism on the environment to a recognition that the tourism-environmental relationship is symbiotic and based on mutual dependence. The physical environment-tourism relationship has further evolved since the 1980s to a more sophisticated understanding of the mutual interdependencies between the different stakeholders involved in tourism (i.e., the community, the resource-base, the tourism sector, the public sector, and other relevant parties). The emergence of this sustainability focus has also seen continued development and refinement through the 1990s and into the new millennium incorporating green economy and green sustainability (UNWTO, 2011).
Klein (2011) states that sustainable tourism maintains the environmental, social governance (ESG) approach, and companies participating in the industry are expected to do what is morally and ethically correct from the perspective of clients and communities. Therefore, according to the Industrial Ecology theory\(^1\), responsible tourism seeks, among other aspects, to minimize negative economic, environmental, and social impacts (Boss et al., 1993).

The challenges of implementing sustainability principles in practice relate to the concept's broad and widely interpreted nature. In general, it is accepted that sustainability respects three fundamental aspects - protection of the environment, economic development, and social equity, including protecting the viability of these principles for future generations (Kuhlman & Farrington, 2010). According to Kuhlman and Farrington (2010), sustainability can be defined as the maintenance of well-being for an extended period, thinking about an indefinite period. This largely covers the environmental dimension of the triple bottom line, but environment and sustainability are not synonymous. On the one hand, some forms of environmental degradation are reversed relatively quickly and are highly harmful in the present. For example, many forms of air and water pollution caused by cruise tourism are predominantly in the coastal regions. In absolute terms, Spain, Italy, and Greece, closely followed by France and Norway, are the European countries most exposed to sulphur oxide SOX air pollution from cruise vessels. At the same time, Barcelona, Palma de Mallorca, and Venice are the most impacted European port cities, followed by Civitavecchia (Rome) and Southampton (Abbasov et al., 2019). These countries are exposed because they are major tourist destinations and have less stringent marine sulphur fuel standards,

\(^1\) The Industrial Ecology theory is a synthesis of assumptions, concepts, and propositions of ecology in various disciplines and the general theory of the system that refers to the “creation, use, and management of resources for adaptation, human development, and sustainability of environments” (Ruiz-Guerra et al., 2019).
allowing cruise ships to burn the dirtiest, most sulfurous fuel all along their coastlines (Abbasov et al., 2019).

As a result of cumulative scientific evidence, the 1980’s saw an increased awareness of the impact of ship emissions on the environment and public health. This prompted the International Maritime Organization\(^2\) (IMO) to develop and establish new international policy on the prevention of air pollution from ships. At the International Conference of Parties to the MARPOL Convention, held in London from 15 to 26 September 1997, MARPOL Convention was amended with the Protocol of 1997 and a new Annex VI, Regulations for the Prevention of Air Pollution from Ships, was introduced (Čampara et al., 2018). The MARPOL convention with 1997 Protocol amendments included a new Annex VI which for the first time regulates harmful compounds, namely nitrogen (NO\(_x\)) and sulphur oxides (SO\(_x\)), particulate matter and carbon dioxide (CO\(_2\)) emitted from ships on international voyages. The Annex VI regulations present a challenge and obligation to stakeholders in the shipping industry, as these regulations have necessitated the development of cleaner marine diesel engines and additional innovative technological solutions. A number of recent studies also estimated that international shipping accounts for 14-31\%, 4-10\% and 2-3\% of the total worldwide global emissions of NO\(_x\), SO\(_x\), and CO\(_2\), respectively. These estimates consider emissions increasing by a factor of four as the number of ships might triple by 2050 (Čampara et al, 2018). However, these figures depend on future economic growth and energy developments.

\(^2\) The International Maritime Organization (IMO) is a specialized organization of the United Nations based in London, which was initially founded with the purpose of promoting maritime safety. It currently has 173 Member States and three Associate Members representing 99.31\% of the world's merchant shipping tonnage. It was adopted by the United Nations conference in Geneva in 1948 and came into force in 1958 when it was ratified by 21 states.
The United Nations World Tourism Organization (UNWTO) declared 2017 a watershed moment with its official International Year of Sustainable Tourism for Development which proposed making tourism a catalyst for positive change (UNWTO, 2017). This declaration positions tourism as a tool to advance the universal 2030 Agenda for Sustainable Development, including the 17 Sustainable Development Goals (SDGs) 2015–2030 and 169 targets (SDG, 2019).

The primary remit of sustainable tourism is to strike a balance between the host, the visitors, and the environment. The VICE model (as outlined by the English Tourist Board and Tourism Management Institute in their Destination Management Handbook, 2003) accommodates these requirements and gives destination planners, and managers a framework to ensure sustainable actions. The VICE model, illustrated in Figure 3, presents destination management as the interactions between the visitors, the industry that serves them, the community that hosts them, and the environment where this interaction occurs.

![Figure 3: The VICE Model.](image)
Source: Adapted from English Tourist Board and Tourism Management Institute (2003)
According to this model, it is the role of destination managers to work through partnerships and a joint destination management plan to 1) welcome, involve, and satisfy visitors, 2) achieve a profitable and prosperous industry, 3) engage and benefit host communities, 4) protect and enhance the local environment and culture (UNWTO, 2011, p.42).

The green economy is a new concept and pathway to sustainable tourism. A move towards the green economy refers to the process of reconfiguring businesses and infrastructure to deliver better returns on natural, human, and economic capital investment while at the same time reducing greenhouse gas emissions, extracting, and using fewer natural resources, creating less waste, and reducing social disparities.

Tourism is rapidly becoming one of the most critical economic growth sectors in the world. Global tourism has experienced steady growth for over six decades, culminating in an estimated 1.5 billion international arrivals in 2019, representing an increase of 3.8% year-on-year and well ahead of previous long-term forecasts. This strong growth is expected to continue, with arrivals in emerging markets projected to grow at double the rate of advanced tourism economies (OECD, 2020). Demonstrating a similar pattern, global expenditures on travel more than tripled between 2000 and 2018, rising from USD 495 billion to USD 1.5 trillion and accounting for 7% of global exports in goods and services (UNWTO, 2019).

The significant growth in global tourism has significantly benefitted from the rise of globalization and technological advances that have led to cheaper airfares, making it easier for people to plan and book their travel and share their experiences with friends in real-time. While growth is projected to continue, changing demographics, improved connectivity for destinations, technological innovations, and increased recognition of the need for more sustainable and inclusive growth are likely to dramatically transform the face of tourism by 2040, representing a range of
opportunities and challenges for destinations (OECD, 2018). Albeit temporary, global and regional slowdowns due to 9/11, the SARS epidemic, COVID-19, and hurricane disasters, the underlying structural trend of growth is expected to continue. While tourism is often seen as a welcome source of economic development, “conventional” mass tourism is associated with numerous adverse effects, such as destroying ecological systems and losing cultural heritage. In response to these concerns, a term that surfaced in recent years is sustainable tourism or eco-tourism. Countries and (transnational) corporations alike advertise with these new terms as a means to differentiate themselves and convey an ethically sound message to the morally conscious tourist (Lansing & De Vries, 2007). One way to spot the real eco-tourism from buzzwords is to demand certification. Certification is a way to avoid greenwashing, the practice of promoting something as eco-tourism while behaving in an environmentally irresponsible way (Higgins, 2006).

Sustainable tourism should not be considered a special form of tourism, but rather, all forms of tourism should strive to be more sustainable. Long-term sustainability requires a suitable balance to be struck between the economic, socio-cultural, and environmental aspects of tourism development. It requires the informed participation of all relevant stakeholders, as well as strong political leadership to ensure wide participation and consensus building. Achieving sustainable tourism is an ongoing process that requires constant monitoring of impacts (economic, socio-cultural, and environmental) to capitalize on opportunities and respond to challenges as they arise, and inform future policy responses (OECD, 2018; UNEP and UNWTO, 2005 and 2012).

1.2.2 Economic Aspect of Tourism

In the second part of the 20th century, tourism has become one of the largest and most rapidly growing sectors in the world economy (Eadington & Redman, 1991). One of the main reasons governments support and promote tourism throughout the world is that it positively
impacts economic growth and development. Tourism generates employment and income, leading to a positive tourism balance of payments, stimulating the supplying sectors of tourism, and leading to a generally increased level of economic activity in the country (Ivanov & Webster, 2007), thus impacting the gross domestic product (GDP). However, tourism does not have a unique base as an industry but encompasses widely disparate firms and organizations from many industries that serve customers with various incomes, tastes, and objectives. The consumers, the supplies, and the government agencies are the major actors and elementals that shape the tourism industry. Many regions and countries have realized that tourism has become a dominant sector, often replacing extractive, manufacturing, agricultural, or distribution-based activities as a major source of job creation and revenue generation (Eadington & Redman, 1991). Economics can bring clear and organized thinking into areas of substantial importance, and controversy; and, in this manner, put into proper perspective the implications of choosing alternative courses of action.

Tourism has a variety of economic impacts. Tourists contribute to sales, profits, jobs, tax revenues, and income in an area. The most direct effects occur within the primary tourism sectors -- lodging, restaurants, transportation, amusements, and retail trade. Through secondary effects, tourism affects most sectors of the economy. Economic impact analysis of tourism activity focuses typically on sales, income, and employment changes in a region resulting from tourism activity (Stynes, 1997).

One of the main economic concerns with tourism development is the leakage effect, which prevents host countries or communities from holding and retaining the gains from tourism. Mowforth and Munt (2003) define leakage as consisting of three elements: (1) leakage refers to the purchase of imported goods and services by tourists; (2) leakage covers the imports of goods
and services by hotels and other tourism establishments; (3) leakage refers to the repatriation of
profits by foreign owners of hotels and other services (Mowforth & Munt, 2003).

1.2.3 Socio-Cultural Aspect of Tourism

Following the Second World War with economies as its primary rationale, the community
approach to tourism has been shown to empower communities and give them opportunities to
break free from the destructive influences of mass tourism (Sharma, 2004). Community-based
tourism is a more sustainable form of development than conventional mass tourism because it
allows host communities to break away from the hegemonic grasp of tour operators and the
oligopoly of wealthy elites at the national level. According to Fitton and Price (1996, p. 173),
community tourism is about grassroots empowerment as it seeks to develop the industry in
harmony with the “needs and aspirations of host communities in a way that is acceptable to them,
sustains their economies, rather than the economies of others, and is not detrimental to their culture,
traditions or, indeed their day-to-day convenience.” Overall, a better attitude towards tourism
among destination residents will result if the community participates in decision-making. The
industry will be more successful if residents have a meaningful voice in the organization and
administration of destination tourism management. Gunn believes that tourism development “will
bear little fruit unless those most affected are involved from the start” (2014, p.111).

Similarly, Murphy argues that tourism “relies on the goodwill and cooperation of local
people because they are part of its product (1985, p.153).” In cultural terms, locals’ contribution
is vital as residents tend to do it in a way that is in harmony with cultural traditions.

Local participation is also an instrument in keeping the most sacred spaces and ceremonies
from being defiled by the tourist gaze (Sharma, 2004). However, to achieve holistic growth and
sustainability, various actors at all levels, from municipality level participants and grassroots to
government and NGO organizations, should get involved (Murphy, 1985; 1988; Scheyvens, 1999; Tosun, 2000).

More recently, research shows that socio-cultural tourism is tied with heritage tourism. Heritage tourism products encompass authentic local culture, history, and natural sites (Breen, 2007). The development of heritage tourism would be vital to enliven the socio-cultural improvement of tourist destinations (Richards, 2001). From a practical point of view, stakeholders in tourism should focus on heritage tourism (Jaafar et al., 2015; Jimura, 2011). Therefore, tours operators, travel agents, tour guides, governmental, local authorities, and NGOs working on conserving heritage should work in cohabitation, allowing for sustainable tourism development (Koteer, 2011).

1.2.4 Environmental Aspect of Tourism

Several researchers question the claims of sustainable tourism. One of the aspects on which to doubt the characterization sustainable is the environmental aspect. Set apart from the attempts to combine tourism development with sustainability in host countries or communities, true sustainability will always remain questionable due to the pollution caused by air travel to reach the destination. Reid (2003) and Mowforth and Munt (2003) recognize this paradox in sustainable tourism. In areas where clean drinking water is one of the significant issues faced by residents, advertising with the acres of the azure-colored, ozone-purified, tropical-landscaped pool seems rather dubious. Mowforth and Munt (2003) provide a telling example of InterContinental Hotels Group, whose freshwater luxury swimming pool at its property in Managua, Nicaragua, is replenished regularly, while water conditions in surrounding slums are deplorable. From an economic point of view, sustainable tourism does little to negate the problems associated with
conventional tourism development. Therefore, the terminology sustainable or eco is most of the time used as a buzzword to appeal to the market.

1.3 The Evolution of the Climate Change

The phenomenon of climate change, which includes global warming (induced by the release of excessive greenhouse gasses into the atmosphere) and ozone depletion, among other factors, result in higher sea temperatures and rising sea levels. Initially, climate change was seen as a clear-cut environmental problem. The discovery of increased levels of greenhouse gasses in the atmosphere resulted from data collected from a measuring station established on the Mauna Loa volcano in Hawaii in 1959 to monitor CO₂ and other emissions in the atmosphere (Urry, 2015). The readings showed that CO₂ was not being fully absorbed into the oceans and was inevitably rising, indicating that the earth was irreversibly changed by unprecedented human activities that raised CO₂ levels.

In 1988, NASA climate scientist James Hansen testified before U.S Senate about anthropogenic global warming due to greenhouse gas emissions:

“Number one, the earth is warmer in 1988 than at any time in the history of instrumental measurements. Number two, the global warming is already large enough that we can ascribe with a high degree of confidence a cause-and-effect relationship to the greenhouse effect. And number three, our computer climate simulations indicate that the greenhouse effect is large enough to begin to affect the probability of extreme events such as summer heat waves. ... It is changing our climate now” (Hansen, 1988, p.40).

Shortly after the statement, joint efforts to deny the reality and significance of the phenomenon began, reflected by the formation of the Global Climate Coalition in 1989 – an industry-led group formed to call global warming into questions (Dunlap & McCright, 2015).
Because of the efforts to deny climate change, the Kyoto Protocol was adopted. The Kyoto Protocol was an international treaty which extended the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that (part one) global warming is occurring and (part two) that human-made CO₂ emissions are driving it. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There were 192 parties to the Protocol in 2020. The protocol marked a culmination point of this model – an uneconomically efficient solution to tackle the cleat-cut task of mitigating an environmental pollutant (Hermwille, 2016).

Paul Crutzen (2006) states that a new geological period of human history called the Anthropocene (which is believed to have started in 1950 when the Great Acceleration, a dramatic increase in human activity affecting the planet took off) follows from the Holocene (the current geological epoch), which defines humans' impact on nature. His idea is that the world has entered a new geological era where human activity has become a determining geological force (Crutzen 2006). Later, Rockström et al. (2009) developed the concept of planetary boundaries – a concept involving Earth system processes that contain environmental boundaries, within which safe human development was possible. O’briend and Selboe (2015, p.13) argued: “Climate change is a challenging idea because many societies have traditionally treated climate as an external condition. The climate is now no longer a given background for human activities but instead has become a collectively produced (although variable) and deeply sociopolitical phenomenon (Urry, 2015).”
1.4 The Rationale of Conducting This Study

Climate change and sustainable tourism practices have been the topic of multiple research areas. Tourism is one of the most important economic drivers worldwide and has a complex influence on how climate change evolves and accelerates. This is one sector that can make an impact across the board in how communities advance adaptation practices towards reducing carbon emissions, in juxtaposition with the conservation of culture in vulnerable coastal cities. As such, it is advancing sustainable tourism practices.

The rationale of conducting this research comes from the urgent need to protect a UNESCO world heritage site from disappearing by sinking due to mass tourism and sea-level rise. Repeatedly Venice has been listed among the top cities environmentally, socio-culturally, and economically in danger due to effects of climate change. The urgency for actions and the involvement of leaders in the field is the foundation for this research. The results aim at identifying a way ahead through innovation, forward planning, and better management of the heritage environment for urban coastal cities to reduce environmental, socio-cultural, and economic vulnerability.

Urban cities that are culturally, environmentally, and historically rich gain popularity while risking losing their authenticity, heritage, and environmental protection. In historic cities, tourism is moving from being an add-on economic benefit to playing a significant and sometimes influential role in conservation and economic regeneration on one hand, and an add-on vulnerability causing massive disruption on residents on the other hand. Unless cities have a risk management practice/model/policy in place, vulnerable cities, like Venice, become victims, leading to outmigration of its residents because of unsustainable lifestyle, lack of jobs, mass tourism, and short-term rentals. Historic settlements, architecture, and uniqueness in Venice have
become assets readily transformed into products sold to consumers seeking an experience (Orbasli, 2002) at the cost of residents. As Murphy points out, in many Third World situations, “[tourism] involves a lot of noise and activity, but at the end of the day, locals have surprisingly little to show for it” (1985, p. 97). Recently, tourism has been seen and identified as a threat to urban cities and societies due to its side effects on the environment and the possible spread of diseases and viruses like Covid-19. Because of its powerful influence and worldwide accessibility, tourism can also be a solution to environmental sustainability and an opportunity to pursue. The solution is to allocate equal financial investment in adaption and mitigation, proactive versus reactive response to disasters, and effective communication between planning and marketing and tourism management. Orbasli emphasizes that “visiting historic towns is not about going to a museum or reliving history, and urban conservation is not about preserving the past as an archaeological ruin; it is about enhancing an area which has qualities built upon from the past, as a contemporary living environment” (p.4, 2002). He also adds, “tourism must be made to work for historic towns, enhance rather than destroy, support rather than siphon, and value the depth, the heart, and the spirit of a place. A valued environment in which people want to live and work will also be appreciated by visitors” (Orbasil, 2002).

1.5 Purpose of the Study

How have existing adaptation and mitigation policies (or lack thereof) evolved in Venice regarding increased flooding affecting the tourism industry? How do new mitigation strategies minimize negative impacts on the tourism economy and infrastructure? What practices have been implemented to assist visitors’ flow and control carrying capacity? What role does the tourism industry play in preserving historical heritage and promoting a sustainable lifestyle for the residents in Venice remaining on the island? These questions have long been the center of
attention of Venice's politicians, stakeholders, and environmental planners. Therefore, the purpose is to use a mixed-method approach to investigate:

- Current predictions (recognizing present ongoing chronic vulnerabilities).
- Who oversees managing solutions through policy frameworks and adaptation measures?
- Institutions that possess administrative and technical competence to deal with issues/related to climate change in Venice (among these are Italian governmental agencies at the national, regional, provincial, and municipal levels);
- How these lessons can be applied to long-term planning strategy?

1.6 Conceptual Framework

In the late 1970s, the Organization for Economic Cooperation and Development (OECD 1980) formulated a four-stage environmental impact sequence that models the environmental impacts associated with tourism (see Figure 4). This research uses the model as a starting point, expanding the existing framework observing environmental, cultural & social, and economic factors that have evolved since the 1980s. The focus is to identify the human-induced/anthropogenic factors, contributing to accelerated climate crises in coastal urban cities.
The OECD report analyzed the environmental impacts of tourism worldwide and the extent and means by which adverse effects can be reduced or prevented (OECD, 1980). The report neglects to address climate policy implementation towards adaptation measures and better destination management from the environmental, socio-cultural, and economic approaches. The environment's quality and safety are essential to tourism activities in coastal areas. The welfare of the receiving and host community is crucial to preserving and perpetuating heritage tourism. The outcomes are often measured through the lenses of economic perspective. Countries measure their prosperities based on the economic flow and advancements. According to the United Nations Environment Program, environmental degradation can be reduced, and sustainability can be achieved by installing environmentally efficient new technology and establishing environmental management schemes, which requires direct investments and climatic, financial assistance at the local, regional, national, and global level (UNEP 2005). In parallel, sustainable development

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**Figure 4: Environmental Impact Sequence in Tourism.**

*Source: Adapted from OECD (1980)*

<table>
<thead>
<tr>
<th>Stage A Stressor Activities</th>
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<tbody>
<tr>
<td>Permanent environment restructuring</td>
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<tr>
<td>Tourist activities</td>
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<tr>
<td>Indirect and induced activities</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage B Environmental Stressor</th>
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</thead>
<tbody>
<tr>
<td>What deliberate changes are made?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage C Environmental Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>How does the environment respond to those changes</td>
</tr>
<tr>
<td>Short term to long term</td>
</tr>
<tr>
<td>Direct to indirect</td>
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<table>
<thead>
<tr>
<th>Human Response to Stage C</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do people react to the environmental responses?</td>
</tr>
<tr>
<td>Short term to long term</td>
</tr>
<tr>
<td>Direct to indirect</td>
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requires better institutional quality and a legal and regulatory framework for effective and efficient tourism management (Mikayilov et al., 2018).

1.7 Research Question

In an effort to understand what deliberate changes are made to manage climate change stressors and over tourism activities in Venice, this research attempted to answer the following research questions:

1. Who currently manages climate change adaptation and high-water predictions in Venice?
2. What sustainable measures have been adopted to stabilize Venice’s future by 2100?
3. What is the prediction of Venice residents’ migration and resettlement?
4. What policy implementation measures have tourism stakeholders adopted to protect Venice? Are these sufficient?

By answering these research questions, this research intends to draw general conclusions about experts’ responses to climate change impacts in low-lying coastal cities, with the focus on Venice, and how these responses could be mitigated by proposing policy adaptation measures at the destination level.

1.8 Data Collection Method

Qualitative data presented in the research was obtained from scientific literature, archive analysis, and interviews. The collected documents included law and policy regulation, action plan documents; assessment and thematic reports; newspaper articles, and notes and transcriptions of surveys. The surveys were collected using a self-administered questionnaire developed using the Qualtrics software. Quantitative data was retrieved from census Annuario del Turismo, City of Venice, and Instituto Nazionale di Statistica (ISTAT).
1.9 Significance of the Research

Tourism is the major contributor to gross domestic product (GDP) and employment in many small islands. Sea-level rise and increased seawater temperature will cause accelerated beach erosion, degradation of coral reefs, and bleaching. In addition, a loss of cultural heritage from inundation and flooding reduces the amenity value for coastal users. Whereas a warmer climate could reduce the number of people visiting small islands in low latitudes, it could reverse the mid- and high-latitude islands. However, water shortages and increased incidence of vector-borne diseases may also deter tourists (Hall, 2011).

The main conceptual issue of coastal tourism which needs to be addressed is the conflict between the benefits the tourism industry brings to the coastal regions at the operational level and its heavy impact on the coastal physical environment in terms of urban design, infrastructure, carrying capacity, pressure on sensitive areas, and pollution from the CO₂ emissions. Tourism has a remarkable impact on coastal regions compared to non-coastal areas due to its proximity to water and cruise line activities. Usually, the development of tourism activities in the coastal areas is based on a process where any planning or/and management decision is taken mainly based on economic criteria. In contrast, the environment is considered only in a sense that can be described as “trying to minimize effects given the available budget” (UNEP, 2018). This process leads to unsustainable development of coastal areas, which negatively impacts the environment and society but, in the long run, is also eroding the economic benefits of tourism since it might diminish the longevity of the tourism activity in the coastal region areas.

This research aims to advance the United Nations 2030 Sustainable Development Goals (SDGs) agenda, precisely goal 13 (climate action), to take urgent action to combat climate change
and its impact. It will also be helpful to make recommendations on future mitigation strategies, long term strategies for policy adoption, and implementation at the local level.

From an economic perspective, the city of Venice benefits from the financial revenue tourism and big shipping companies provide. Still, tourism does affect the infrastructure, causes atmospheric pollution via their engines, and results in water displacement that shakes residential homes’ foundations, increases the risk of accidents, and ultimately commodifies culture. Excessive tourism encourages the exodus of residents by increasing the value of the buildings and making life in town more difficult for the host community. Despite its history of common goods, Venice is becoming a private place, a rival source, which means that the use by some is to the detriment of use by others (Fabbri et al., 2019). In such a case, preserving the city life requires the limitation of using the resources (i.e., taking it out of the market). To develop coastal tourism that will maximize the benefits to tourists and lessen the environmental and socio-cultural impacts for locals, it is vital to ensure that the Venetian culture can endure.

Adaptation is considered the appropriate response to the measures taken to reduce climate change impacts on the tourism industry (Patterson et al., 2006; Becken & Hay, 2012). Becken (2013) states that half of the published papers focus on climate change impacts and adaptation, particularly winter tourism. Regarding the number of studies, less attention has been devoted to coastal tourism (Moreno, 2010).

In the context of the valued coastal environment and dependent socio-economic systems mainly focused on the tourism industry, there is the need to promote such concepts to secure the destinations’ economic, social, and environmental well-being through effective planning, skills development, proper implementations, controlled monitoring, thinking long-term policy frameworks, and lateral vision.
Chapter 2: Literature Review

2.1 Existing Literature

Scott & Lemieux (2010) argues that it is almost impossible to develop an effective climate change adaption strategy without knowledge of past climate and how this baseline is projected to change in the future. The issue of sinking cities and sea-level rise (SLR) has long been featured in climate change research. Increases in SLR can cause flooding, soil erosion, inundation, and wave damage to coastlines, particularly in small island states and countries with low-lying deltas (Layne, 2017), such as the Mediterranean Sea, and the Mississippi delta in the Gulf of Mexico. As low-lying plains, deltas are highly sensitive to changes in sea level. They are subject to climatic impacts from rivers upstream (e.g., freshwater input) and oceans downstream (e.g., sea-level changes, waves), and within the deltas themselves. At the same time, they are affected by human activities such as land-use changes, dam construction, irrigation, mining, extraction of subsurface resources, and urbanization (Nicholls et al., 2007). A study by Cook et al. shows that 97 % or more of actively publishing climate scientists agree climate-warming trends over the past century are extremely likely due to human activities (2016). Most leading scientific organizations have also issued public statements endorsing this position (NASA, 2021).

Anthropogenic pressure, such as inadequate regulation and legislation, which among other things lead to poor coastal development, overfishing, land base pollution, and poor land-use practices (including those of agriculture and sand mining), undermines the integrity of critical marine and coastal ecosystems, which contributes to the weakening of the ecosystem and lessens its ability to cope with the added stresses of climate change (Layne, 2017). Tourism, especially uncontrolled marine and coastal tourism, is one the fastest growing areas that poses threats to many
natural areas worldwide, forcing the local population to compete for the use of critical resources (e.g., clean water, food sources).

There are various steps taken to fight against climate change globally. The most recent initiative, such as the United Nations Framework Convention on Climate Change (UNFCCC), is the 2015 Paris Climate Agreement which recognizes the need to reduce risks and impacts of climate change by different approaches and decreases the global average temperature limit to 1.5°C above pre-industrial levels (UNFCCC, 2015). Tourism is affected by climate change because of the large number of tourism-dependent coastal economies regardless of the increasing human-induced pressures it brings to coastal areas (Hall, 2006; Scott et al., 2012a). The Intergovernmental Panel on Climate Change (IPCC) reported that “the impact of climate change on coasts is exacerbated by increasing human-induced pressures” (Nicholls et al., 2007, p.317), including tourism because of the relative attractiveness of the coast in contemporary society. Rosenzweig et al. (2007, p.111) identified, “as a result of the complex nature of the interactions that exist between tourism, the climate system, the environment, and society, it is difficult to isolate the directly observed impacts of climate change upon tourism activity.”

The relationship between climate change and tourism has been well documented over the last decade generating debates and discourses (Agnew & Viner, 2001; Lohmann, 2002; Viner, 2006). Smithers predicted that some of the world’s most famous tourist destinations in the Mediterranean could have been closed to visitors by 2020 and beyond because of the worries of climate change (i.e., Punta de Marrozo and the Murcian coastline of Spain, the island of Crete, the Amalfi coast of Italy, and Athens including the Attica region of Greece). Such sentiments have been supported and evaluated by authors such as Becken and Hay (2007), Hall (2013), Jones and Phillips (2017), Ranade (2012), Scott et al. (2012a), Singh (2012), McKercher and Prideaux
(2014), Hall and Gössling (2015) alongside organizations such as United Nations Environmental Program and their current assessments. UNESCO’s evaluation of impacts on world heritage sites has already illustrated and predicted that many of the world’s tourist sites might be under threat from climate change, mainly through rising sea levels, increased flooding risks, and depleted marine and land biodiversity. Such predictions claimed that this could have disastrous effects on over 830 designated UNESCO world heritage sites. These include North America, Northern Europe, the Mediterranean, Caribbean, Indian Ocean, Africa, Asia, and Australasia (Jones & Phillips, 2017).

Tourism is seen as a climate-dependent industry, and because many countries owe their popularity to their pleasant climate, a change can prove debilitating in many ways to the sector (Amelung et al., 2007). The relationship between climate change and tourism has been discussed in earlier literature tracing back to the 1960s. This period has been regarded as a formative phase, which lasted until the late 1970s, as noted by Scott et al. (2005) (cited in Scott et al., 2012a). Early research indicates how climate information became an element in decision-making. This marked the earliest tourism research interest in understanding the importance of weather in decision making and how it affected demand for travel, as indicated by research conducted in the 1960s throughout the late 1970s by Mandauer (1970) (as cited in Scott et al., 2012a, p. 60). Mandauer attempted to establish the Value of weather in that tourists are climate sensitive. He wondered how a destination would be affected by the weather in the tourist place origin (Njoroge, 2015).

The next decade, the 1980s, saw an extremely low publication of research on climate change and tourism. Scott et al. (2005) describe the 1980s as a period of stagnation in tourism climate research attributed to varied reasons ranging from lack of interest among tourism researchers and lack of acknowledgment of anthropogenic cause of climate change.
Later, anthropogenic climate change was acknowledged towards the decade and beginning in the 1990s. The year 2000 and beyond marked the launch of tourism and climate research. Scott et al. (2012a) regard this period as the turning point for tourism and climate research, increasing the volume of publications across the globe. Following this *takeoff*, earlier researchers recognized the need for collaborative research and knowledge dissemination efforts. Due to the importance of this connection, the impacts of climate change and tourism are studied on a global scale (Amelung et al., 2007; Hamilton et al., 2005), country scale (Hamilton & Tol, 2007), and destination scale (Moreno & Amelung, 2009; Scott et al., 2007; Becken, 2005).

Accounting for over 10% of global GDP and supporting more than one in ten jobs worldwide in 2019, the Travel & Tourism sector has been a key global driver of economic prosperity and employment opportunities for decades (WTTC, 2021).

As international economic development progresses, consumer demand for travel has grown much faster than their consumption of other products and services. Global demand for tourism is outstripping the decarbonization of tourism operations, accelerating global carbon emissions. Tourism has been a force for economic growth, and before the recent outbreak of the COVID-19 pandemic, the sector was growing faster than the global economy (Lenzen et al., 2018). The Department of Commerce reported that tourism is the fastest growing industry worldwide. However, due to the COVID-19 outbreak, the World Tourism Organization says that international tourist arrivals worldwide went down by 74%, which translates into a loss of 1 billion international arrivals and about US $1.3 trillion in export revenues from international tourism and over US $2 trillion estimated loss in global GDP, putting 100-200 million tourist jobs at risk (UNWTO, 2021). This is around five times the loss in international tourism receipts recorded in 2009 amid the global economic and financial crisis. Governments recognize that tourism is a
monetary phenomenon and a substantial contributor to countries’ development. Due to its ability to influence public opinion, tourism also involves social, cultural, political, and environmental aspects. As a sector characterized by a set of tourist activities (e.g., walking/biking tours, festivals, concerts), visitors exceeding carrying capacity overlaps with the everyday city’s actions leading to ways of life being ruptured (Visentin & Bertocchi, 2019).

Tung states that Venice is unique among the great historic cities in several ways. First, it is built-in water in the Venetian Lagoon. Its creation required the development of special local technologies to construct buildings and reconcile the human-made settlement with the forces of the surrounding natural environment. Second, Venice is unique for the largest, most complete, and architecturally most significant medieval urban constructions globally, whose history stretches back more than a millennium. “It is more intact than Kyoto or Beijing. It is older than Prague or Cairo (Tung, 2001, p. 319). Third, Venice is unique in that it survives in its geographic context – “is it one of the few medieval urban environments that can be seen in the same setting, and as it once existed in nature” (Tung, 2001, p. 320). Celebrated throughout the world for its beauty, Venice and its Lagoon were added to United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites (WHS) in 1987. The World Heritage List of 2021 comprises 1121 cultural and natural heritage sites across 167 countries, based on their Outstanding Universal Value (OUV) (UNESCO, 2021). According to a study published in 2018 by Nature Communications, climate change is threatening dozens of UNESCO World Heritage Sites found in low-lying coastal areas in the Mediterranean, and Venice is one of the sites where flood risk may increase by 50% and erosion risk by 13% until 2100 (Reimann et al., 2018).
The assault of the sea and the debris of the rivers have always been a threat to the Lagoon. To avoid landfilling in the 15th century, the Dodges (the chief magistrate and leader of the Republic of Venice between 726 and 1797) decided to artificially divert the rivers outside the Lagoon basin, thus allowing Venice to remain an amphibious city (Di Stefano, 2019). One result of the sinking is that chemical pollution in the Venetian Lagoon has become a severe problem for the buildings of Venice. The flooding takes a heavy toll on the city’s art and architecture and leaves Venetians and local stakeholders deep economic losses. Two-thirds of the acqua alta events commonly occur in October through January (Trincardi et al., 2016). World sea level and earth-movement processes contribute to the sinking of land surface with respect to the sea at Venice (Gatto & Carbognin, 1981). Based on the tide-gauge record, there has been a rise in SLR of about 23cm over the last century (Gatto & Carbognin, 1981). It is estimated that 10 cm of this change was due to the pumping of groundwater to run the industrial complex of Porto Marghera in the years between 1930 and 1970 (Carbognin & Tosi, 1995). During the decade 1970-79, this level was exceeded 1013 times (Messina, n.d.). More than 60% of the city is flooded by sea levels of 1.50 meters or greater; this level or higher occurred since 1951, with the highest flood (187 cm) on November 13, 2019 (Di Stefano, 2019).

The tourism industry in Venice is vital to the city’s revenue. However, while tourism costs Venice an estimated 74.4 million euros a year, the tourism industry also generates an estimated 2.3 billion euros in overall revenue for the city’s economy (Blanco et al., 2014, p.35). For this reason, Venice’s problem with tourism is not economic in the short term, but rather it is with the sheer number of visitors in the city, who congest streets and sidewalks, affect resident’s quality of life, crowd markets, and public spaces, increase boat traffic, increase the cost of housing and living, and contribute to the environmental pollution. As a result, residents find it challenging to move
around the city and accomplish their daily tasks or access services. The problematic relationship between tourists and hosts – and the overlap between the two – has been described in literature and mass media as *touristification* (Del Romero, 2018; Mínguez et al., 2019), *tourism gentrification* (Sequera & Nofre, 2018) and more recently, *overtourism* (Mihalic, 2020; Nilsson, 2020; Visentin & Bertocchi, 2019), and generated waves of anti-tourism protests in other popular European cities such Barcelona, Amsterdam, Rome, and Dubrovnik (Butler, 1980; Russo, 2002; Colomb & Novy, 2016; Gerritsma and Vork, 2017), as well as in other parts of the world such as Central America (Cañada, 2010).

Tourism and heritage have had an intimate and reciprocal relationship (Graham et al, 2005). Heritage generates tourism, and the latter, in turn, shapes the meanings, uses, and physical characteristics of places of heritage, such as monuments, archaeological sites, and museums, as well as townscapes and landscapes (Egberts & Alvarez, 2018). Previous studies show that heritage has become a commodity, and heritage-making is today a recipe for commoditization, profit-making, and commercialization (Kowalski, 2019). Tourism is said to lead to commoditization (Greenwood, 2012) of areas in the life of a community that, prior to its penetration by tourism, has been within the domain of economic relations regulated by criteria of market exchange. It all started in the 1970s, when tourism showed the first signs of shifting into the mass industry that it has since become—an engine of economic growth, spatial control, and ecological transformation, the profoundly destructive potential of which has only recently appeared in bold relief, in a decade of low-cost flights, single-use plastic, and universal short term rental properties (Kowalski, 2019). Venice is a good example of the perfect operation of the free-market mechanism.

On the one hand, the local administration supports the expansion of upscale accommodation in the HC. On the other hand, it produces a new low-cost accommodation supply
in Mestre (Venice’s mainland suburb). This gives rise to the phenomenon of tourist hospitality throughout the city, with private housing converted to host tourists and short-term rentals (STR’s). The flow of international tourism is both an economic opportunity and a risk for the urban systems consolidated by centuries of growth that have maintained the original character and identity of the communities. According to Fabbri (2019, p.198), there is a risk that communities could become mere tourist containers in this new market of visitors and hyper-commercialization, and the city of Venice makes a case in point.

2.2 Gaps in Literature Review

Research has been focused on the impacts of climate change on tourism (macro-scale), yet less attention was paid to tourism-specific climate change knowledge (micro-scale) (Hall, 2018). Hence, focusing on the case of Venice, there’s an opportunity to understand what adaptation measures can be applied at the micro-scale level. Although coastal regions are highly vulnerable to climate change, there are substantial gaps in knowledge of coastal tourism’s impact in general and specific locations. Exploring the case of Venice, Italy, allows us to investigate a particular site due to its settlement, historical heritage, arts, and culture. Other coastal cities with similar settings and unique characteristics will be utilized as a comparison and examples. A large body of research by social scientists exists on tourism and climate change. Although the implications of climate change on coastal tourism are likely to be profound, fewer researchers have begun to formulate relevant questions, asking (i) “who is responsible for making predictions?”, and (ii) “who is in charge of proposing and implementing mitigation and adaptation strategies?”.

According to United Nations Framework Convention on Climate Change (UNFCCC), adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices,
and structures to moderate potential damages or benefit from opportunities associated with climate change (UNFCCC, 2021) While adaptation means accepting the situation we are in today while focusing on how to reduce the impacts on people, mitigation means efforts to reduce greenhouse gases emissions (Wyatt, 2011) As there is a direct relationship between global average temperatures and the concentration of greenhouse gases in the atmosphere, the key to the climate change problem rests in decreasing the number of emissions released into the atmosphere and in reducing the current concentration of carbon dioxide (CO₂) for example, increasing the area of forests.

The latest evidence shows that current coastal and destination management practices tend to concentrate on immediate short-term solutions and environmental responses, which gives little regard to long-term strategies that address climate change threats to coastal tourism destinations.

**2.3 Research Context-The Case of Venice, Italy**

**2.3.1 How Was Venice Built?**

Venice, the capital of the Veneto region, is acknowledged as one of the world's leading cultural and art cities (Page, 2009). The city we call Venice today was formed by the union of many smaller communities originating as separate units in the 5th century (Distefano, 2014). "Once there was only sea, then lands emerged and formed the Pianura Padana or Po Valley, from the Latin name of the river Po (Padus). The action of rivers combined with that of the sea created the Lagoon" (Distefano, 2014, p.5). At the beginning of the Christian era, the sea level rose and covered part of the Veneto region. Later, it decreased and left a punctuated formation of small islands continuously increased by the rivers that, descending from the Alps, deposited sludge and sediments collected during their slow slide towards the Adriatic Sea. The islets rose at the expense of the sea. Long strips of sand were created by the thrust of the rivers and broken where the mass
of fresh water flowed into the open sea. The Lagoon was then formed by shallow saltwater areas that received fresh water from the many rivers flowing north to south. There are seven main ones: Isonzo, Tagliamento, Livenza, Piave, Brenta, Bacchiglione and Po. Thereafter, the Lagoon lay between the Isonzo and the Po, between Grado (north) and Cavarzere (south). The freshwater mixed with the salt water, which penetrated from the sea through the outlets created by the mouths of rivers. Because of the high tide, twice a day, the seawater penetrated through the gaps between the seashore, giving life to the Lagoon basin. The tide takes six hours to get in and another six hours to get out. So that within 24 hours, there are two high tides and two low tides; the double movement changes the water, thus purifying and ensuring the survival of the Lagoon.

Between A.D. 900 and 1100, as the Venetians were turning from the rivers to the open sea, they founded a cluster of new parishes (each parish was on a separate island) around the marketplace of Rialto and the nearby fortress-palace of the doge who ruled the whole Lagoon (Lane, 1973). According to history, Venice began to rise from the water thanks to courageous men who fled from the barbarian invaders (after the fall of Western Roman Empire), abandoned their homes on the mainland, and took refuge on the scattered islands of the Lagoon. Here the inhabitants built the foundation of their homes first using logs, pallets of wood, or reeds that grow in the Lagoon to make water barriers (Distefano, 2014). The first people who arrived in the Lagoon operated with material transported by the rivers. However, to build sustainable housing, it was necessary to manufacture the soil before manufacturing the housing by depositing the first layers of dry wood to insulate the floor from moisture. The same floor was obtained by spreading a layer of clay flattened, smoothed, and finally cooked, burning woodpiles above it (Distefano, 2014). The whole city is supported by millions of wooden piles, each about 14 cm (5.5 inch) thick and up to 3 meters (10 ft) long. To be more precise: 12,000 tree trunks were used to support the weight of
the Rialto bridge, 100,000 for the campanile on the San Marco square, and more than a million for the Santa Maria della Salute Church (Gugliuzzo, 2017).

Soon the Venetian building became a traditional house form, marked by the construction of two-story houses; the ground floor had clay walls and was used for warehousing and storage, while the upper store housed the family. Due to the increased population, the city had to win land from the Lagoon. The technique was to enclose an area with a palisade sealed with clay, then fill it with soil from the Lagoon, and let it drain and dry out. Finally, the drained soil was raised with additional land to fight the tide.

The Lagoon we see today began to form with the deluges of the 7th century. Over the centuries, due to an unstable situation between the land, water, and marshes over the centuries, an almost continuous Lagoon formed. In the 8th and 9th century, Venice was only an archipelago of small islands separated by one large and many narrow canals. In fact, such an environment was one of the most unsuitable to build a city on. However, it was still subject to the final transformation between the 10th and 12th centuries. Around the 11th century, the Lagoon had as many as six outlets to the sea, while today, they have reduced to three: the mouth of the Port of Chioggia, the mouth of Malamocco, and the mouth of Lido (Figure 4). The never-ending assault of the sea and the debris of the rivers have always been a threat to the Lagoon. Since the 15th century, in order to avoid the land filling in, the Dodges decided to artificially divert the rivers outside the Lagoon basin, thus allowing Venice to remain an amphibious city.

The Lagoon, inhabited by fishermen, salt workers, and gardeners, was populated by refugees. Each small island turned into a village, the autonomous and independent center of one or a few families. The new inhabitants-built huts out of the reeds that grew in the Lagoon and traded with the people of the coast, offering fish, vegetables, and salt, thus obtaining what they
could not produce (Distefano, 2014). Coastal regions have historically attracted human settlements, especially where river deltas dissect the coast. Lagoons, environments of unique ecological value, are typically observed in these deltaic regions and occupy 13% of the world's coastal regions. In the last century, these environments have become more vulnerable to the effects of intense hydrodynamic and atmospheric events (Seminara et al., 2011).

Land subsidence has occurred in the Venetian territory at a variable rate depending on the geological events (Bortolami et al., 1985). Land sinking as a natural phenomenon has occurred since the origin of the city (6,000 years b.p.), and the evolution of the Lagoon slowing down in time has assumed significant importance for the Lagoon environment after the human intervention (Gatto & Carbognin, 1981). In relatively recent times, subsidence, induced by groundwater withdrawals, became a real problem with the industrial boom after World War II. The progressive groundwater exploitation led to a notable depression in the aquifer-aquitard system and a severe sinking of the land surface. The alarming rates of occurrence in Venice threatened the city's very existence, which ran the risk of disappearing into the Lagoon because of its shallow ground elevation, from 70 centimeters to 1 meter above mean sea level (Carbognin et al. 2004).

The delicate and fragile ecosystem is the largest wetland in the Mediterranean. The North Adriatic Sea and Venice Lagoon appear to be the most vulnerable zones to sea level rise (SLR) in Italy, where several square kilometers of land are at or below sea level (Molinari et al., 2018). Most of the wetlands and beaches of the approximately 300 km (186 miles) of North Adriatic coast present medium-to-high vulnerability to inundation and flooding (Lambeck et al., 2011; Torresan et al., 2012). The Lagoon itself is quite shallow, on average around 1.5 m (6 inches). Most areas are only 80 cm (31 inches) deep, but there are deep tidal channels that cut through the very shallow
parts (Umgiesser et al. 2004). Another particularity of the Lagoon is the salt marshes that cover around 15% of the total area (Umgiesser et al., 2004).

_Acqua alta_ is most likely to occur between September and April. It is an unusually high tide, which rises enough to flood parts of Venice. This flooding is most dramatic when a higher-than-average tide coincides with various other phenomena - such as heavy rainfall inland from the Venetian lagoon, a wind blowing in from the Adriatic Sea, or an area of low pressure. Precipitations are predicted and monitored, and forecasts are published each day on the council's Centro Maree (Tide Centre) website in local newspapers, and on electronic displays around town (one is located at Piazzale Roma). Predictions based on lunar tides are available months in advance, so tourists or visitors could know whether _acqua alta_ is possible during vacation and holidays. But short-term factors such as atmospheric pressure, wind, and rainfall make a big difference, and at times of exceptionally high tides, the forecasts may be updated several times daily.

Coastal flooding is a mix of several tidal and non-tidal progressions acting at different temporal and spatial scales (Woodworth et al., 2019 as cited in Ferrarin et al., 2022). Venice is in a semi-enclosed regional basin with one of the largest tidal ranges (the height difference between high tide and low tide) and extreme sea levels (ESLs) in the Mediterranean Sea (Conte & Lionello, 2013). According to Orlić (2001) and Lionello et al. (2021), as studied by Ferrarin et al. (2022), the sea level in Venice is the superposition of the following contributions attributable to different physical processes, including:

- **Astronomical tide**: a mixed semidiurnal tide prevails in the northern Adriatic Sea with eight principal tidal constituents, four semi-diurnal and four diurnals (Lionello et al., 2005).
- **Storm surge**: the response of the sea level to synoptic air pressure and wind forcing. In Venice, storm surge events are driven mainly by the south-easterly wind (Sirocco) blowing
over the Adriatic Sea or a combination of north-easterly wind (Bora) over the northern Adriatic Sea and Sirocco over the south Adriatic Sea (Lionello et al., 2012).

- **Seiches**: free sea-level oscillations in the Adriatic Sea with periods determined by the normal modes of the basin that are triggered mainly by previous storm surges when the atmospheric forcing vanishes. The decay time of these oscillations is estimated at three days (Cerovečki et al., 1997; Bajo et al., 2019). The two main modes have periods of about 21.8 and 10.7 h, which are close to the periods of the principal diurnal and semi-diurnal tidal constituents, respectively (Lionello et al., 2005).

- **Meteo-tsunami**: large waves driven by mesoscale atmospheric pressure disturbances often associated with fast-moving weather events, such as severe thunderstorms, hurricanes, and other storm fronts. Such high-frequency sea-level oscillations are generated by resonance in the open sea when the perturbation propagation speed approaches that of the shallow-water barotropic waves (Pasarić & Orlić, 2001).

- **Local wind setup within the lagoon**: with strong NE (Bora) or SE (Sirocco) winds, the difference between sea levels on the south and the north side of the lagoon may exceed 50 cm (19 inches) (Mel et al., 2019). Even if Venice city center is little affected by these fluctuations, since it is close to the node of the oscillation of the water level in the lagoon, a high-frequency wind setup (of the order of 10 cm) has been observed under strong winds (Ferrarin et al., 2021).

- **PAW surge**: long-lasting sea-level anomalies generated by air pressure and wind disturbances associated with planetary atmospheric waves (PAW) having characteristic wavelengths ranging from 6000 to 8000 km (Holton, 1973). These events may result in a
prolonged interval of high sea level in the northern Adriatic Sea, providing long-term preconditioning for many flood events in Venice (Pasarić & Orlić, 2001).

- **Inter-decadal, inter-annual and seasonal (IDAS) sea-level variability**: the occurrence of extreme sea levels (ESL) also displays marked seasonal to decadal variability associated with large-scale atmospheric and oceanic circulation patterns (Zanchettin et al., 2021; Lionello, 2005). According to Valle-Levinson et al. (2021), interannual variability of mean sea level (MSL) in the northern Adriatic can be explained mainly by astronomic forcing associated with lunar precessions, solar activity, and the interaction, or interference, between these factors.

- **Relative sea-level rise (RSLR)** is a long-term process connected to climatic change and land subsidence (Zanchettin et al., 2021). In the 1872–2000 period, the combined subsidence and sea-level rise resulted in a relative rise of 31 cm (12 inches) (Pasarić & Orlić, 2001), determining a substantial increase in the frequency of floods in Venice (Lionello et al., 2012).

The above-listed contributions have values of the order of tens of centimeters (storm surge is potentially the largest one, exceeding one meter (39 inches) in extreme cases. The level of 110 cm (43 inches), which defines a tide as an exceptional high-water event, is presently characterized by a return period of approximately 0.25 years. At the beginning of the 20th Century, this figure was about 2.2 years (Carbognin et al., 2010). The flooding events of 110 cm above data point or more could increase to 20–250 times per year with respect to the present annual frequency of 4 times (Carbognin et al., 2010).

Until 2007, Venice still used sirens dating to the Second World War to warn its residents of floods. Now the historic sirens have been replaced by a more modern system. When the tide is
predicted to reach over 110cm (43 inches) a recording of the old-style sirens will still be sounded to warn of *acqua alta*. This will be followed by another signal of a series of electronic notes to alert Venetians to the level of flooding expected -- the more tones sounded, the higher the water, from one tone predicting 110cm (43 inches) to four rising notes indicating serious flooding of 140cm (55 inches). The speakers are concealed inside bell towers and public buildings.

To avoid flooding, the Venetians have long known from practical experience that a house floor or street pavement must stand somewhat above the level of high tides and seasonal storms when it is built. Due to the combined effect of climate change and subsidence, the city of Venice faced an increase in frequency and intensity of flooding events that periodically submerged parts of the old city center (Baldin & Crosato, 2017; Carbognin et al., 2004). The lowest point in the city center is the entrance hall or vestibule of the Basilica of San Marco, which is located at an altitude of 63+ cm and currently is flooded about 250 times a year (Distefano, 2014). Based on tide-gauge records, there has been a rise in SLR of about 23 cm over the last century. It is estimated that 10 cm of this change was due to the pumping of groundwater to run the industrial complex of Porto Marghera in the years between 1930 and 1970 (Barends et al., 1995).

The Venetian SLR has risen at an average rate of 2.5 mm (0.1 inch) per year in the past 150 years due to mean sea level rise and the sinking of the ground by natural and anthropogenic subsidence, which accelerated the SLR rate up to 5 mm (0.2 inch) per year in the period 1950–1970 (Z2021), leading to an increased frequency of floods (L2021). The lowest part of the central St Mark’s Square is approximately 55cm (27 inch) above the present mean sea level (Lionello et al., 2021).

Venice is at the one end of the Adriatic, a corridor for the Scirocco wind (Zanchettin, et al 2006). The frequency and intensity of the waves against the Lagoon bulkheads is increasing and
the safety of Venice is threatened by a phenomenon similar to windscreen fatigue (Bosco et al., 2007). In 2010, UNESCO noted that the average water level in Venice Lagoon was 30 cm (12 inch) above the 1897 standard (Molinari et al., 2019; UNESCO, 2015). The most dramatic flooding event was the disastrous event of November 4, 1966, when water levels were 1.94 m (6.36 ft) (Trincardi et al. 2016). Since then, the frequency of flooding has steadily increased (Ferla et al., 2007; Lionello et al., 2021a) due to local land subsidence and relative sea-level rise driven mainly by climate change (Carbognin et al., 2004; Zanchettin et al., 2021). The second most dramatic flooding happened on November 12, 2019, when the water levels reached 189m (6.2 ft) (Povoledo, 2019). Venice has co-existed with the sea for more than a millennium and created and adopted numerous interventions to adapt to flooding and the aqueous milieu. During the past 20 years, the region and Italian State have opted for a technological experimental solution of mobile flood gates at the three entrances (Figure 5) to Venice Lagoon from the Adriatic (MOSE, 2021).

Figure 5: MOSE Flood Barriers Inlets.
Source: Chioggia, Malamocco & Lido
Modulo Sperimentale Elettromecanico (MOSE) — is a series of 78 large movable underwater barriers that can be mechanically raised to 3 meters (9.5ft) above the surface when needed to block extraordinarily high tide surges. The barriers rotate up to a 45 degree angle (Figure 6) to prevent seawater from entering the Lagoon any time the elevation in the Adriatic achieves 110 cm above the official datum. The project’s focus is to not only protect the city from increasing flooding and high tides, but also to restore and protect the ecosystem in the lagoon as well.

Work on the US $7 billion MOSE project began in 2003, more than 20 years after the proposal was submitted, but a corruption scandal and financial strain have derailed progress on the barriers. On October 3, 2020, a historic and memorable moment for Venice and its inhabitants occurred. After decades of delays, controversy, and corruption, the city finally trialed its long-awaited flood barriers against the tide. All 78 barriers were fully raised, and while the water level rose to 132 cm (4.3 ft) outside the MOSE, inside the lagoon, it remained at 70 cm (2.3 ft), enough to keep San Marco dry (Buckley, 2020). According to CityLab, the city must act with urgency since scientists predict that the Mediterranean Sea could rise 152 cm (5 feet) by 2100, which would cause Venice to flood twice a day (Cooper, 2019).
There is also the opposite phenomenon called *acqua bassa*. When this happens, the water in some canals is so low (from -50 cm, even down to -70 cm) that boats get stuck, and the waterways cannot be used. The destructive impact from the water on the houses is also visible at that time below the waterline. *Acqua bassa* happens less often than *acqua alta*, but it has been occurring more frequently in the last years because many canals haven’t been dredged and cleaned for a long time. Due to changes in the law (*Legge Speciale*), all financing went primarily to the MOSE project instead. As with *acqua alta*, it’s a matter of patience (a couple of hours) until the water flows again normally (Gugliuzzo, 2017).

Venice and its Lagoon were added to the list of United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites (WHS) in 1987 based on the six criteria of outstanding cultural, environmental, and landscape universal value encompassing the historical and artistic relevance of the city and the exemplarity of the ecosystem. The World Heritage List of 2021 comprises 1,121 cultural and natural heritage sites across 167 countries, based on their Outstanding Universal Value (OUV) (UNESCO, 2021). According to a study published in 2018 by Nature Communications, climate change is threatening dozens of UNESCO World Heritage Sites (WHS) found in low-lying coastal areas in the Mediterranean, and Venice is one of the sites where flood risk may increase by 50%, and erosion risk by 13% until 2100 (Reimann et al., 2018). In 2015, UNESCO warned that Venice might not be included in the list of UNESCO WHS in danger if Italy does not ban large cruise ships from entering the city’s Lagoon and develop a sustainable tourism strategy. In summer of 2021, Italy announced that large cruise ships were banned from entering Venice’s waters and have also declared the city’s Lagoon a national monument whose fragile ecosystem must be protected from the downsides of mass tourism (Pianigiani & Bubola, 2021).
Venice, Mestre, and the other mainland suburbs were merged into a single administrative entity in 1926 and governed as one Comune since then. Today, 70% of the Comune di Venezia resides on the terraferma; the local administration is obliged to focus their attention on the needs and perceptions of these voters. This imbalance has resulted in the large-scale mismanagement of the lagoon territory by policymakers who do not necessarily understand the peculiar, interdependent dynamics which dictate the culture, social fabric, and economic pressures of Venice.

Although Venice is portrayed as a cultural and mostly tourist city, it has government, city services, residents, and a university (Davis & Marvin, 2004). Visitors often fail to see or intuit such ordinariness. Instead, they come to the city looking for the image they have previously formed of Venice – the vision of the Most Romantic City in the World (Davis & Marvin, 2004). Venice was not since its settlement the “most romantic city” in the world. Initially, the city existed for practical purposes, not touristic, much fewer romantic ones. Outsiders would come mostly for economic, political, and commercial purposes. “Some in continual rotation from their home and some in a state of almost permanent residency in Venice” (Davis & Marvin 2004, p.12.). Venice thrived as a commercial and financial hub for much of the Middle Ages (Momigliano, 2020). Due to its geographic position between Constantinople and Western Europe, a trade of spices, silk and salt was ideal (Momigliano, 2020). But as the center of trade moved from the Mediterranean to the Atlantic, Venice lost centrality, and by the end of 18th century, when it fell under foreign rule, its decline was unstoppable.

By the 1600s, visitors and bourgeoise from England and France shifted their attention to products that could not be found back home in London, Paris, or elsewhere in Europe, such as a particular sense of style, gambling, prostitution, and perversion of whatever the visitor required
Davis & Marvin, 2004). As such, Venice became the first postmodern city selling no product other than itself and living off the entrance fees of tourists ever since the early 18th century when its former sources of revenue ran dry (McCarthy, 1963).

Thanks to the rail links through the Alps, many middle-class British, Germans, and French flooded Venice with foreigners, developing a new form of tourism. Some were looking for the same source of inspiration that had once inspired Goethe, Shakespeare, Byron etc., while others were looking for romance. The intense popularity that Venice gained globally brought approximately 13 to 14 million visitors to the historic center of Venice, in a city with nearly 50,000 inhabitants (source).

By the end of 20th century, Venice became what economists describe as a “tourism monoculture” borrowing the term from the risky agricultural practices of growing single crops (Momigliano, 2020). On average, there were no fewer than eighty-nine foreigners in the city at any given time for every 100 Venetians who lived there-- the highest tourist-to-resident ratio in Europe, and nine times that found in Florence, Italy (Isman, 2000). As noted by Davis & Marvin (p.4, 2004), tourists, while visiting Venice, “are consuming not so much of the Venetian culture, but rather the images of that culture, and for the most part as quickly as possible.” Over 80% of visitors stay less than a day, which created the term day trippers. In addition, visitors tend to focus on certain periods of the day, and certain parts of the city, creating the ‘overcrowding’ phenomenon discussed later in this chapter.

2.4 Tourism in Venice

Tourism in Venice has grown increasingly since the late 1970s when the explosion of hotels and tourist service started to flank the progressive loss of economic functions, with regulations and policy regimes eventually adapting and favoring such changes (Salerno & Russo,
While Venice grew in visitors and popularity, and the progressive use of space by the visitors, (construction of hotels, restaurants, coffee shops substituting hospitals, local shops, and facilities for residents), more and more residents have been displaced from the historic center (henceforth: HC) marking a steady erosion of the city’s social mass (De Rita 1993, Russo 2002a, Costa & Martinotti, 2003, Fregolent & Vettoretto, 2017, Minoia 2017).

The acceleration of the tourist nature of the city could be situated in the 20th century when Venice started its modern expansion into the mainland. At the same time, the insular historical city HC became the object of strict conservation intended to preserve its value and maintain its primary functions as an international pole of arts, culture, and entertainment (Fregolent & Vettoretto, 2017). During the last 60 years, Venice’s HC has been going through an articulate process of population restructuring by which “poor and low-middle classes [had] no other choice than to move out of the city center, and possibly become daily commuters involved in servient economies exploiting the city landscape” (Minoia, 2017, p. 263).

Since the construction of the industrial settlement of Marghera in 1917, the population of the Venetian mainland has been growing steadily, while the population of the HC shrunk to less than a third compared to the post-war period (Salerno & Russo, 2021). This evolution nuances a “spatially separated urban society” in which the working and middle classes flee with jobs to the mainland, while insular Venice remains mainly a site of residence for upper-class rentiers (Fregolent & Vettoretto, 2017, pp. 83–84).

At the same time, tourist activity in the city constantly increased. Zannini (2014) identifies two main phases of tourism growth in Venice in the 20th century; the former, from the post-war period to the 1980s, consists of an elite market developing into mass tourism (with the constant growth of arrivals from a total of 1,669,000 in 1952 to the 4,389,000 in 1992). From the 1990s to
the present day, it is characterized by the rise of global ‘postmodern’ tourism trends, national and local easing on urban regulations, and the simultaneous decline of Marghera’s industrial strength (Salerno & Russo, 2020). In this stage, the growth curve undergoes a further surge (Barbiani & Zanon, 2004), reaching the most recent official estimation of around 28 million visitors a year (30 million for Lanapoppi, 2015), 80% of which are day visitors, a trend which is “decisively upwards” (Van Der Borg, 2017, p. 15). This quantity of visitors pouring into the city yields an average visitors-per-resident/day ratio of more than 1.5, or, in other words, “500 visitors per year for each resident of the 750 hectares of the historical urban fabric” (Fabbri et al., 2020, p. 41).

Figure 7 shows a crescendo phenomenon of the number of arrivals and nights in Venice from 1949 to 2019 (Annuario del Turismo, 2019).
For the purpose of this research, the most reliable available data stopped at the year 2019 due to the outbreak of COVID-19 in early 2020 that has disrupted domestic and international travel at a larger scale never encountered before. Data show that the coronavirus pandemic hit the global tourism sector hard in 2020 and 2021. In Italy, the number of international tourists’ arrivals dropped significantly, reaching about 1.1 million in March 2020 (Statista, 2021). In April 2020, this figure decreased further, as just 809,000 international travelers were recorded at the Italian borders. In September 2021, the volume of inbound tourists in Italy totaled around 6.9 million, increasing over the same month of 2020 but remaining way below pre-pandemic levels (Statista, 2021). International tourism is a very important resource for the city’s tourism sector, as inbound travelers account for most of the total tourist arrivals in Venice. In 2019, the United States was the leading international tourist market in Venice, but this scenario changed drastically in 2020, due to the health crisis. Between 2019 and 2020, the number of U.S. tourist arrivals dropped from 844,000 to roughly 43,000 (Statista, 2021). As the number of inbound tourist arrivals went down, so did the number of domestic travelers in Venice. As of 2020, the highest number of domestic visitors came from the neighboring region of Lombardy. However, domestic tourist arrivals from Lombardy passed from about 152,000 to approximately 103,000 between 2019 and 2020.

2.4.1 Environmental Impact of Tourism in Venice

Theoretical and empirical studies suggest that while tourism has a positive contribution to economic growth and development (Mikayilov et al., 2019), it is one of the major contributors of environmental degradation. A proliferation of tourism events is mainly followed by an increased demand for energy for several functions such as transportation, food supplying, housing, and the managing of tourism-related attractions (Becken 2013; Gössling 2002, 2013; Neto, 2003; Becken & Hay, 2007; Perch-Nielsen et al., 2010; Rosselló-Batle et al., 2010; Dawson et al., 2010; Saenz-
de-Miera & Rosselló, 2014), which is likely to lead to increased CO₂ emissions and environmental degradation (Xuchao et al., 2010; Tovar & Lockwood, 2008).

Global tourism represents 10% of global exports and contributes significantly to global gross domestic products (GDP) supporting more than one in ten jobs worldwide in 2019 (WTTC, 2021). During the pre-pandemic years, international arrivals and tourism receipts have been growing an annual 3-5%, outpacing the growth of international trade, and in 2016 exceeded 1 billion and US $1.2 trillion, respectively. An economic activity at this scale and pace has a heavy impact on the environment. Transportation, accommodation, catering, marine tourism, shopping, and food are key ingredients of travel, and energy and carbon-intensive commodities, rendering tourism a potent contributor to climate change (Appendix D). A study by Lenzen et al. (2018) projects that tourism will constitute a growing part of the world's greenhouse gas emissions due to its high carbon intensity and continuing growth. Tourism increases the physical pressure on fragile environments and may be seen as a threat to the social unity of culture and community.

Environmental degradation can occur in multiple ways. Tourism has become something of a double-edged sword for Venetians of late, where it both keeps livelihoods afloat while simultaneously smothering aspects of its centuries-old way of life. The vast daily influx of tourists has driven up the cost of living to the point that many locals are being forced out of their hometowns to survive. While overtourism had been held in check by the pandemic, it now threatens to reassert itself as travel restrictions across the world begin to loosen. Before the pandemic, Venice was drawing as many as 80,000 tourists each day, approximately 25 million per year. The heavy congestion had gotten so bad that the UNESCO World Heritage Committee considered adding Venice to its list of endangered heritage sites. The decision was abandoned after Italy banned large cruise ships from entering Venice's waters earlier this month (Rizzo, 2021).
Al-Mulali et al. (2014) studied the relationship between tourism arrivals and CO2 emissions from the transportation sector. The study used panel data of 48 top international tourism destinations and concluded that in all country cases, tourism arrivals significantly increase transportation-related CO2 emissions. Paramati et al. (2017) examined the effect of tourism on economic growth and carbon dioxide emissions for the case of Eastern and Western European Union (EU) countries. Results of the study revealed that, in the case of Eastern EU, tourism increases CO2 emissions while it decreases the emissions in Western EU countries. Current joint efforts by the World Travel & Tourism Council (WTTC), in collaboration with the United Nations Environment Program (UNEP), the United Nations Framework Convention on Climate Change (UNFCCC), and Accenture, developed the Net Zero Roadmap, which highlights the current status quo and provides solutions addressing the most pressing global challenges of our times on how to decarbonize to achieve a net-zero future and protect the world (World Travel & Tourism Council, 2021). The study presents a new decarbonization target corridor framework, along with an overview of key decarbonization levers and corresponding action items for each industry in scope. By indicating three different corridors for net zero trajectories, the framework proposes that certain industries will be able to achieve the net zero goal earlier than others (World Travel & Tourism Council, 2021).

2.4.2 Socio-Cultural Impact of Tourism in Venice

The socio-cultural impact of tourism in Venice is defined by the social interactions within the Venetian community and how people culturally interact as observed through social communications, relations, and material artifacts. While social impacts of tourism refer to changes in people’s lives living in destination communities, cultural impacts of tourism refer to changes in the arts, products, customs, rituals, and architecture of people (Pizam & Milman, 1986). Therefore,
the term socio-cultural impacts refer to changes to residents’ everyday experiences and their values, lifestyle, intellectual and artistic products (Glasson et al., 1995). The interaction between the two could either develop positive or negative impacts. According to Burns and Holden (1995), when there is a significant contrast between the receiving society’s culture and the origin culture, it is likely that impacts will be most significant. For various reasons, host communities often are the weaker party in the interactions with their guests and service providers, leveraging any influence they might have. Impacts arise when tourism changes value systems behavior, threatening residents’ identity. If practiced sustainably, tourism can generate positive impacts. It can serve as a supportive force for peace, foster understanding between people and cultures, foster pride in cultural traditions, and help avoid urban relocation by creating local jobs. If practiced in an unsustainable, changes or loss of native’s identity or values can cause commodification, loss of authenticity, exodus, and adaption to tourist demands (Cooper et al., 1998; Oppermann & Chon, 1997). Negative socio-cultural impacts of tourism can irritate the local community due to tourist behavior. Out of unawareness, tourists often fail to respect local customs and moral values treating destinations as a mere commodity. The positive aspect of socio-cultural tourism includes seeing tourism as a source of force, strengthening communities, re-evaluating culture, and traditions, encouraging civic involvement and pride, facilities developed for tourism can benefit residents (Horváth, 2018).

Commodification happens when tourism can turn local cultures into commodities when religious rituals, traditional ethnic ceremonies, and festivals are modified to conform to tourist expectations (Fainstein, 2007). Moreover, once a destination is sold as a tourist product, and the tourism demand for souvenir, arts, entertainment, and other commodities begin to exert influence, fundamental changes in human values may occur. The commodification of cultural goods can lead
to cultural erosion (Fainstein, 2007). Valuable sites may no longer be valued when perceived as
good to trade. The last decades have seen much more demand for sustainable tourism, which has
led scholars to seek development, planning, and consumption methods that promote the quality of
cultural and natural resources (Weaver, 2007). As a result, researchers have emphasized the need
to decentralize tourism development and integrate it into community-defined development goals
(Sharma, 2004).

The sustainable community approach to tourism has been indicated as empowering
communities and affording them opportunities to break from the destructive influences of mass
tourism (Sharma, 2004). The boom of short-term holiday rentals in Venice (such as Airbnb) has
commodified the historical center and favored a growing dissatisfaction between hosts and guests
(Bertocchi & Visentin, 2019). The commodification of residential space creates further financial
pressure within the entire housing market, based merely on the potential for more significant profit
by converting long-term resident units to tourist use (Young & Markham, 2020). The issue forced
many residents to move out towards the mainland and other regions.

As with any economic development, tourism creates changes that can transform the quality
of life of the hosting community. Changes in the host community’s quality of life are influenced
by two significant factors: 1) the tourist-host relationship and 2) the development of the industry
itself (Smith, 2014; Ratz, 2002). Social and cultural changes to host societies include changes in
value systems, traditional lifestyles, family relationships, individual behavior, or community
structure (Ratz, 2002). The sustainable development approach to planning tourism is vital. Most
tourism development involving stakeholders such as tourists, tourist businesses, and community
residents depends on attractions and activities related to the natural environment, heritage, and
culture (Ahn et al., 2002). Sustainable development has been applied to tourism, particularly
tourism that relies on natural resources and involves human beings and their culture (Mbaiwa, 2005).

For Venice, it is essential to highlight and understand the geographical patterns of the tourism industry and how the increase in tourism has threatened the social sustainability of the historical city and affected the entire historical city center. In their analysis of the physical and social over-capacities of global tourism in Venice, Bertocchi and Visentin (2019) have identified two trends that have characterized Venice for several years now. These are the city's depopulation because of residents leaving and the continuous growth of the tourism sector, represented by an increase in the number of day-trippers and overnight stays.

The tourism industry shares with residents, governments, and all people the responsibility to protect and maintain the heritage resources of destinations, which are required to sustain economics and be passed on undamaged to future generations. Tourism can help raise awareness of the natural and cultural sites stimulating the feeling of pride in local and national hermiate and interest in its conservation. This recognizes the importance of the continuity of natural resources and the continuity of culture, and the balance within the culture to think globally and act locally (Dwyer & Edwards, 2010).

2.4.3 Economic Impact of Tourism in Venice

Tourism has a Janus-faced character (Sanchez & Adams, 2008). For many destinations, tourism has become the most critical economic development vehicle, yet it is also the most problematic and complex issue to tackle. Heritage cities have always attracted many visitors, generating benefits and costs. In other words, when the costs exceed the benefits, tourism development is no longer sustainable. Interventions become necessary because the pressure of tourism—with its economic power—modifies spaces, alters facilities, and blocks infrastructure.
These changes are reflected in the inhabitants themselves, who in turn change attitudes, habits, and perceptions (D'Eramo, 2017)

The scarcity and infectiveness of regulations in Venice have undoubtedly increased residents’ vulnerability and livelihoods. Over the past two decades, free-market principles have been followed rigidly by the various local government administrations (Bertocchi & Visentin, 2019). This can be seen, for example, in the liberalization of retail stores, where the pre-existing network of small shops, manufacturers, and workshops has made way for enterprises primarily focused on tourism traffic, with little direct relevance to Venetian culture (Salerno, 2018). It can also be seen in the internationalization of real estate, especially housing, which has exacerbated the crisis of housing affordability for local Venetians (Bertocchi & Visentin, 2019). According to Van der Borg (2017), in the last 25 years, the number of tourism arrivals in Venice has increased by four times due to the continuous expansion of the global tourism market. While the evolution of tourism demand brings economic profits, it could also bring dissatisfaction and challenges at the local level when mass tourism exceeds the city's carrying capacity.

Additionally, more tourism does not always mean more profits. Russo (2002b) highlighted that the average duration of day-trippers was eight hours, and many tour operators promoted day trips rather than overnight stays. Day trips are a form of tourism that contributes marginally to the destination's economy (Bertochhi et al., 2020). The UNWTO has defined the tourism carrying capacity as the maximum number of people who may simultaneously visit a tourist destination without destroying the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors’ satisfaction (1981). Middleton and Hawkins (1998) define carrying capacity as a measure of the limit beyond which an area may suffer from the adverse impacts of tourism. Chamberlain (1997) defines it as the level of human activity a site can
accommodate without the area deteriorating, the resident community is adversely affected, or the quality of visitors experience declining. Clark (1997) defines carrying capacity as a certain threshold level of tourism activity beyond which there will occur damage to the environment, including natural habitats (Trumbic, 2001).

The increasing pressure of tourism, of day-tripping, which seems to be more costly and less beneficial than tourists, is progressively de-qualifying Venice as a tourist destination. Russo (2002) highlighted that the tourists’ motivations for visiting cultural attractions of Venice put the city in the latter stage of the resort life cycle - nearing stagnation and decline. The socio-economic carrying capacity may be defined as the total number of visitors that can be allowed without hindering the other functions that the city performs. This aspect is closely linked to the phenomenon of crowding out (Van der Borg, 2001). Costa, Gotti, and Van der Borg (1996) calculated the socio-economic impact of tourism in Venice through the visitor-resident ratio compared to several other European heritage cities. In the historical center of Venice, the ratio was calculated at 89:1, while for the wider Venice municipality, this dropped to 27:1. The evolution and distribution of commercial structures in Venice's city center are described by Zanini et al. (2008), who demonstrated the reshaping of the city in terms of retail business. Their work monitored the increase in shops dedicated to tourists between 1967 and 2007, showing the touristification in some districts and the “progressive marginalization of some areas excluded from the tourist routes” (Zanini et al., 2008 p.17).

2.5 Climate Change

The two main definitions of climate change come from the IPCC (Intergovernmental Panel on Climate Change) and UNFCCC (United Nations Framework Convention on Climate Change). The IPCC is an international body responsible for assessing the science connected to climate
change by evaluating published literature. IPCC was created in 1988 by the world Meteorological Organization (WMO), and the United Nations Environmental program (UNEP) with the objective of creating a guidance for policymakers in understanding the scientific basis of climate change. It provides regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation. The IPCC is divided into three Working Groups and a Task Force. Working Group I deals with The Physical Science Basis of Climate Change, Working Group II with Climate Change Impacts, Adaptation and Vulnerability, and Working Group III with Mitigation of Climate Change. According to the IPCC, climate change is “any change in climate over time whether due to natural variability or as a result of human activity” (IPCC, 2014, p.5).

UNFCCC is the international treaty created at the United Nations Conference on Environment and Development; the Rio Earth Summit held in Rio de Janeiro in 1992 (Table 1). The treaty called for ongoing scientific research, regular meetings, negotiations, and future policy agreements designed to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner.

Under the UNFCCC, the term climate change is defined as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods” (UNFCCC, 1992, p.3). The difference in the two definitions has raised questions of reliability. Pielke (2004, p.34) argues that the incompatibility between the definitions used by science and policy organizations is an obstacle to effective action. “The underlying reasons for the different definitions had a pathological impact on the policy and politics of climate change. Specifically,
the UNFCCC definition of climate change leads to bias against adaptation and politicization of science”.

There are various steps taken to fight against climate change on a global scale. The most recent initiative, such as the UNFCCC, is the 2015 Paris Climate Agreement which recognizes the need to reduce risks and impacts of climate change by different approaches and decrease the global average temperature limit to 1.5C above pre-industrial levels (UNFCCC, 2015). Tourism is affected by climate change because of the large number of tourism-dependent coastal economies regardless of the increasing human-induced pressures it brings to coastal areas (Hall, 2006, Scott et al., 2012a). IPCC reported that “the impact of climate change on coasts is exacerbated by increasing human-induced pressures” (Nicholls et al., 2007, p.317), including tourism because of the relative attractiveness of the coast in contemporary society.

Table 1: Climate Change Institutional Framework.
Source: Author. Following Atzori (2016)

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<td><strong>Established</strong></td>
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2.5.1 The Advancement of Climate Change Research in Tourism

The scientific research on climate and tourism can be traced to the 1960s. Early literature refers to the period between 1960 and 1970 as the *formative stage* since it saw a massive investment into science and research in climate and weather forecasting to inform human social-economic activities, especially in planning (Bugyi 1963; Perry 1972; Crowe 1975; Mings, 1978). Lamb (2002) defined the early 60s as *climate revolution*. The advancement of metrology and climatology enabled man to understand the relationship between climate and social-economic conditions and use climate information in planning (Scott et al., 2012). Early research indicates how climate information became an essential element in decision-making. This marked the earliest tourism research interest in understanding the importance of weather in decision making and how it affected travel demand, as indicated by research done in the 1960s throughout the late 1970s by Mandauer, (1970) (as cited in Scott et al., 2012, p. 60). Mandauer attempted to establish the *value of weather* in the view that tourists are climate-sensitive, and he wondered how a destination would be affected by the weather in the tourist place origin.

In the 1980s, a low publication of research on climate change and tourism led to a period of stagnation (Escourrou, 1980; Mieczkowski, 1985; Scott et al., 2005). However, in the 1990s, anthropogenic climate change was acknowledged, and this led to a renewed interest among tourism researchers who were keen to understand how climate change would affect the tourism industry (IPCC First Assessment Report, 1990; IPCC Second Assessment Report, 1995; Scott et al., 2012).

Starting with 2000, a period of *turning point* was noticed in literature. This saw an increase in the volume of publications worldwide. International conferences were organized, including three conferences organized by the International Society of Bio-metrology under an established
Commission on Climate, Tourism, and Recreation. This commission organized conferences in 2001, 2003, and 2007, focusing on tourism and climate research themes. The conferences produced an extensive collection of research papers which is viewed as the largest body of knowledge in the field (Perry, 2000; IPCC Thirds Assessment Report, 2001; Agnew & Viner, 2001; Bürki et al., 2003; Hamilton & Tol, 2004; Hall & Higham, 2005). With the increase of urgent needs to address the issue of climate change mitigation, and clear concerns where tourism was estimated to contribute 5% to global greenhouse gases (GHG) contributing to anthropogenic climate change (Njoroge, 2015), current trends dating from 2006 to present have generated new literature (Scott et al. 2006; Gössling & Hall, 2006; IPCC Fourth Assessment Report, 2007; Amelung et al., 2007; Becken & Hay, 2007; Gössling et al., 2008; Moreno & Becken, 2009, IPCC Fith Assessment Report, 2013-2014; Hall et al., 2015; IPCC Sixth Assessment Report, 2021).

2.5.2 Climate Change Impacts in Coastal Cities and Adaptation Measures

Since 1880, Earth’s temperature has risen by 0.14°F (0.08°C) per decade, and the rate of warming over the past 40 years is more than twice that-- 0.32°F (0.18°C) per decade since 1981. In 2020, the Earth experienced the second-warmest year on record based on NOAA’s temperature data, and land areas were record warmth (Global Climate Report, 2020). In 2020, the surface temperature was 1.76°F (0.98° Celsius) warmer than the twentieth-century average of 57.0°F (13.9°C), 2.14° F (1.19° C) warmer than the pre-industrial period (1880-1900), and, given the latest developments of international climate change negotiations, additional warming cannot be excluded. The ten warmest years on record have occurred since 2005. From 1900 to 1980, a new temperature record was set on average every 13.5 years; from 1981-2019, a new record was set every three years. According to Global Climate Report (2021), the year was characterized by much-warmer-than-average 2021 temperatures across much of the globe, with record-high annual
temperatures across parts of northern Africa, southern Asia, southern South America, as well as across parts of the Atlantic and Pacific Oceans. Meanwhile, cooler-than-average temperatures were limited to parts of the central and eastern tropical Pacific Ocean. However, no land or ocean areas had a record-low temperature for 2021.

According to research on climate change impacts in tourism on coastal and marine environments, over 97% of scientific peer reviewed journals agreed that climate warming trends over the past century are caused by human induced activities (Layne, 2017; Cook et al 2016). Anthropogenic pressure, inadequate regulation, and legislation undermine the integrity of marine and coastal ecosystems and lessen its ability to cope with the added stressors of climate change (Layne 2017). Climate scientists agree that the planet’s temperatures have risen steadily in recent years because of the accumulation of CO₂ (generated from fossil fuels, coal, oil, and natural gas), and other greenhouse gases (GHG) in the atmosphere, which trap heat from the sun (Camarda & Grassini, 2003). IPCC presents a prediction for how the situation looks by 2100 (Figure 9 & 10).

![Figure 8: Trend and Predictions of Greenhouse Gas Concentrations in the Atmosphere. Source: IPCC (2013 - AR5)](image)
Climate change is expected to have severe impacts on coastal areas due to sea level rise (SLR). This can increase flood risk, coastal erosion, and loss of low-lying systems (e.g., deltas, coastal lagoons, barrier islands) due to permanent inundation (Kirwan & Megonigal, 2013; Passeri et al., 2015), and environmental refugees (Nicholls, 2004). The most recent mean global SLR projections by the Intergovernmental Panel on Climate Change (IPCC, 2014) range from 0.32–0.63 m by 2081-2100 for the Representative Concentration Pathway (RCP) 4.5 and RCP 6.0\(^3\) emissions scenarios. Other IPCC emission scenarios increase the likely envelope to 0.26-0.82 m (IPCC, 2014). Independent estimates of future sea level suggest that global SLR could approach or possibly exceed 1 m by 2100 (Nicholls, 2011; Kopp et al., 2016; Antonioli et al., 2017).

\(^3\) RCP4.5 and RCP6.0 Two intermediate stabilization pathways in which radiative forcing is stabilized at approximately 4.5 W m\(^{-2}\) and 6.0 W m\(^{-2}\) after 2100 (IPCC, 2021)
Other estimates predict that sea level rises of up to 2 meters due to the contribution of Antarctica’s melting (Scherer et al., 2016; Molinari et al., 2019).

Global coastal cities have experienced greater vulnerability to climate hazards. Several studies examined the vulnerabilities of global coastal cities to climate hazards. Among them, De Sherbinin et al. (2007) described the vulnerabilities of Mumbai, Rio de Janeiro, and Shanghai, discussing the implications of the results for city planners and managers, and highlighting some of the political obstacles to better disaster preparedness. Varrani and Nones (2017) compared Jakarta and Venice and suggested a mixed approach of adaptable planning instruments that consider future uncertainties. Fu et al. (2016) compared adaptive planning strategies for sea-level rise of US coastal cities. Atzori et al. (2018) analyzed the climate change impact in Florida’s coastal destinations. Findings in the study show that most tourists would not likely choose to visit the same destination again if the environmental attributes that made them choose that destination disappeared due to climate events. Lyle and Mills, (2016) assessed coastal flood risk in a changing climate for the City of Vancouver. Findings show that in the present day, a 500-year (0.2% chance of occurring each year) event would result in 1700 displaced households, and almost 500 damaged buildings. The same storm event with 1 m of sea level rise would incur dramatically more impacts: 4000 displaced households with over 800 damaged buildings.

The impact of SLR on coastal areas includes erosion, inundation, impeded drainage, increased risk of riverine flooding, and salinity intrusion into freshwater supplies. SLR also affects coastal development, and livelihoods. Still, the most pertinent loss to the tourism sector includes loss of coastal habitat and beach area through the process of ‘coastal squeeze’ defined by Pontee (2013, p. 206) as “one form of coastal habitat loss, where intertidal habitat is lost due to the high-water mark being fixed by a defense or structure such as a sea wall, and the low water mark
migrating landwards in response to SLR”. Impeded drainage and increased risk of riverine flooding, salinity intrusion into freshwater supplies, and higher water tables can adversely affect the stability of foundations of coastal infrastructure. Despite the joint efforts and the scientific community recognizing climate change as a significant threat to ecosystems and human wellbeing, not much progress has been made in regulating its source. The long-term nature of the problem, and the need for coordinated action as well as the uneven and uncertain distribution of costs and benefits of climate policies, explain the deadlock of international climate negotiations. The policy-making authorities have primarily focused on mitigation and less on adaptation measures. As stated by De Sherbinin et al. (2007), more attention should be given to adaptation to the climatic changes that are already underway and will be exacerbated by future emissions of greenhouse gases.

Adaptation has been acknowledged worldwide as a strategy to cope with the inevitable impacts of climate variability and change (IPCC 2001, 2007a,b; EC 2009a). Coastal system studies have increasingly focused on the development of adaptation strategies and measures to deal with SLR (IPCC 1990, 2007a; EC 2009b). Adaptation to climate change, which is essential to manage present risks and the potential for more serious future changes, has entered the planning agenda of many cities around the world (Araos et al., 2016; Juhola & Westerhoff, 2011).

In its 2001 assessment report, the IPCC suggested that, when evaluating adaptation options, the question of how good these options are according to a plurality of values and dimensions of analysis needs to be addressed (IPCC, 2001). This question frames climate change adaptation as a dynamic social and institutional process rather than a problem requiring technical solutions (Hinkel et al., 2010). Indeed, van Nieuwaal et al. (2009, p.8) in Munaretto et al. (2014) argue that
“dealing with climate adaptation not only demands a rethink of how we arrange our social-ecological or social-technical systems but also how we govern them”.

Bosello’s (et al. 2013) approach to post-2012 climate policy argues that adaptation can help mitigations. The study's results show that an early investment in mitigation measures followed by investment in adaption is the correct approach to climate change measures allowing governments and private sectors to adapt and prevent versus reacting after the event occurs. Anticipatory adaptation gathers all the measures where a stock of defensive capital must already be operational when the damage materializes (Bosello et al., 2013). A good example of these activities is coastal protection. Investments must begin before the damage occurs and, if well designed, become effective in the medium long-term (Bosello et al., 2013).

The pioneering studies on the relationship between mitigation and adaption is analyzed by Hope et al. (1993), who suggested integrating mitigation and adaption into the PAGE Integrated Assessment Model. PAGE, however, defined adaptation exogenously, and, therefore, it cannot determine the optimal characteristics of mitigation and adaptation portfolio. The first assessments of the optimal mix of adaption and mitigation where both mitigation and adaptation are endogenous have been proposed by Bosello et al. (2010), de Bruin et al. (2017), and de Bruin et al. (2009). The authors highpoint the existence of a tradeoff between the two strategies. Due to scarce resources, investing more into mitigation implies fewer resources for adaption. Successful adaption reduces the marginal benefit of mitigation, and a successful mitigation effort minimizes the damage to which it is necessary to adapt. In the short-medium term, mitigation only slightly lowers the environmental damage stock and, therefore, does little to decrease the need to adapt. Since the first indications contained in the 1997 Kyoto Protocol, iterated in Marrakech in 2001 and
strengthened in Bali in 2007, the growing emphasis on adaptation witnesses the political and scientific consensus of the necessity of joint mitigation and adaptation effort (Bosello et al. 2010).

The AD-WITCH model was proposed to assess the relationship of mitigation and adaptation, linking adaptation, mitigation, and climate change damage within an integrated assessment model of the world economy. The AD-WITCH model builds on the World Induced Technical Change Hybrid or WITCH model, an intertemporal optimal growth model in which forward-looking agents choose the path of investments to maximize a social welfare function (Emerling et al., 2016, Bosetti et al., 2009). According to Bosello et al. (2010), the introduction of mitigation decreases the need to adapt and vice versa. However, the second effect is stronger than the first. Mitigation reduces the environmental damage stock only marginally and, therefore, it has a limited impact on the need to adapt, which remains significant, particularly during the first decades. Sensitivity analysis over the different discount rates indicates that lower values favor mitigation over adaptation. Intuitively lower discount rates increase the relative weight of future damages, favoring mitigation, which is more effective in the long term. De Bruin, Dellink, and Agrawala et al. (2009) repeated the analysis with an updated calibration of adaptation costs and benefits and proposed regional details using the DICE model. Adapting is better than mitigating when damages are low in terms of utility. The reverse occurs when damages increase. In this case, mitigation is the preferred option to avoid greater, long-term damages (Bosello et al., 2010). Bosello (2008) compared adaptation and mitigation in a similar setting, using the FEEM-RICE model with endogenous technical progress (Buonanno et al., 2000). Differently from de Bruin, Dellink, and Tol (2009) and de Bruin, Dellink, and Agrawala (2009), adaptation is modeled as a stock of defensive capital accumulated over time with periodical protection investments. In that setting, mitigation should be optimally anticipated to early periods, and adaptation should be
postponed to later stages. This is the first critical qualitative difference with previous contributions. Njoroge’s (2015) literature review study conducted on climate change and adaptation measurements, identified six relevant domains within the tourism sector (Figure 10).

![Climate Adaptation Knowledge Domains in Tourism Research](source: Adapted from (Njoroge, 2015))

**Business Adaptation** is seen as a means for sustainability or continuity of operations. Climate change has a profound impact on tourism businesses (Simpson et al., 2008a), and regions that are very sensitive to climates, such as coastal zones and ski resorts operators, will have to develop strategies (possibly relying on new technology) that ensure product divestment and all-year-around tourism (Kaján & Klemettilä, 2013; Kaján & Saarinen, 2013; Saarinen & Tervo, 2006 as mentioned in Njoroge, 2013).

**Sustainable Adaptation** is one of the most challenging strategies for the tourism sector. Njoroge's research proves that the issue of sustainable adaptation in tourism research started
emerging in 2014 (2015), and since then, achieving sustainability has been widely featured in tourism and climate change policies.

**Consumer Adaptation** and behavior prediction under different weather conditions to climate change is relatively a new research niche in literature. Atzori et al. (2018) has examined the tourists' perspective concerning how potential seasonal and geographic shifts in tourism demand could be mitigated by implementing adaptation measures. The study results suggest that despite the urgency for tourism destinations to address climate change, not enough research had previously examined the tourists' perspective prior to this study. Findings also suggest that seasonal and geographic shifts in tourism demand could be mitigated by implementing adaptation measures at the destination level. Furthermore, while climate change is expected to increase tourism business operation costs due to increased heating and cooling costs under extreme weather conditions, it is also expected to alter the accommodation rate in the future. An increase in accommodation costs will imply tourist buying behavior (Scott et al., 2012). Consumers are considered the most flexible as compared to destinations and tourism operators. Therefore, it is expected that tourism operators will continue working to work on strategies to meet the changing market demands in different destinations, i.e., adapting.

**Destination Adaptation.** There has been a call for destinations to pull efforts for adaptation in the post-Djerba declaration on Tourism and Climate Change of 2003, and in research, there is a clear show of interest among researchers. The outcome has been studies that explored perceptions of the destination's risks and vulnerability among the destination's tourism actors, and further explored actions taken under adaptation pathways/portfolios and options. Most of these studies

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4The participants gathered at the First International Conference on Climate Change and Tourism, held in Djerba, Tunisia, from 9 to 11 April 2003, convened by the World Tourism Organization, upon an invitation of the Government of Tunisia with the objective to address pursuits and activities of the United Nations system in the field of climate change, and more generally, in that of sustainable development
have focused on the three key stakeholders, including tourism businesses, policymakers, and communities (supply-side), to aggregate actions taken at a destination's individual, local, regional, and national levels (Njoroge, 2015).

Frameworks for Adaptation. The earliest framework for adaptation was conceptualized as: behavioral adaptation, technical adaptation, and management adaptation (Scott et al., 2006). This did not provide a tool to guide tourism stakeholders through the adaptation process (zd). Attempts were further made by Becken & Hay (2007), who used a risk approach, but it found little use due to the complexity of the tourism sector. Later, a more reformed framework was developed through extensive analysis of tourism literature across the globe on adaptation approaches which was constellated in a UNWTO document named *A Framework for Climate Change Adaptation in Tourism Sector* (Simpson et al., 2008a).

Adaptation Policy. For the first time, tourism came into the light of climate change global policy in 2003. This was at the First International Conference on Climate Change and Tourism, held in Djerba, Tunisia, from 9 to 11 April 2003, convened by the World Tourism Organization, upon an invitation of the Government of Tunisia. The conference's outcome was a declaration on the need for tourism stakeholders at all levels (grass-root to global level) to respond to climate change through good policies. Several researchers have done follow-ups to understand various aspects of climate policies within the tourism sector. Becken & Clapcott (2011) studied national policy on climate change in Fiji and New Zealand to understand the existing policy setting, policy concerns, and challenges in policy development. Pentelow & Scott (2011) used the tourism arrival model to examine the implication of the proposed climate policy in the tourism-dependent Caribbean region. The result indicates that under the 'business as usual' scenario, there would be a negligible change in arrivals from Key source regions in Europe and North America, unlike under
a strict climate policy scenario (post-2020), which would significantly decrease in arrivals. Similar studies have been done in other regions, including Berrittella et al. (2006), who studied the impact of climate change on domestic and international tourism; Dubois et al. (2011) report on future tourism mobility of the world population by looking at emission growth versus climate policy; Hamilton et al. (2005) looked at climate change, and international tourism, and a study by Peeters & Eijgelaar (2014) argues that reducing tourism transport through mitigation policy may be less severe than is often believed.

2.5.3 Adaptation Measures to Climate Change in Venice

For decades, Venice has grappled with the future of its residents and the long-term habitability of the urban city (i.e., Seraphin et al., 2018), but in 2021, due to lack of policy implementation and adaptation measures, the city faced uncertainty and concerns. During the last 500 years, major engineering works have been carried out inside the Lagoon, including diversion of rivers, the building of the inlet jetties, and dredging both existing and new artificial channels (Gambolati & Teatini, 2014). Several institutions possess administrative and technical competence to deal with problems related to climate change in Venice. Among these are Italian governmental agencies at the state (national), regional, provincial, and municipal level as well as UNESCO (2015). Munaretto and Huitema (2012) have analyzed water and environmental management in the Venice Lagoon and have concluded that the existence of the Special Law no. 789 of 1984 inhibits participation and real polycentricity, making it difficult to change policy and address problems on a bioregional scale. The complex division of responsibilities, and the extensive set of public and semipublic authorities (i.e., the Water Authority, the Veneto Regional Government, the Superintendency for the Architectural and Landscape Heritage of Venice, the Venice Port Authority) involved in the management of the Venice Lagoon suggest that the system indeed
exhibits a certain degree of polycentricity in the sense that power is shared among many actors with overlapping responsibilities. The authors suggested adaptive co-management to manage challenges of environmental governance, including uncertainty (Molinari et al., 2020).

To reduce CO₂ emissions and other climate-altering gases, Venice has adopted a local strategy, expressed by the Munaretto and Huitema (2012) drawn up within the framework of the European Covenant of Mayor’s initiative. This strategy represents the effort of the city, its institutions, entities, and civil society towards the mitigation of climate change, with a minimum target of 20% reduction in the civil sector of emissions compared to what was recorded in 2005 by 2020. The target was achieved in 2016 (Città di Venezia, 2022). On 30 April 2020, the City Council approved the adhesion of Venice Municipality to the new Global Covenant of Mayors for Climate and Energy, which led to a new Action Plan for Sustainable Energy and Climate (SECAP) by 2022 to achieve the 40% (minimum) reduction of CO₂ emissions by 2030. In December 2019, an assignment was given to support drafting the mitigation plan to the company SOGESCA srl. The Plan will also include a series of adaptation measures that are being developed with the support of CO.RI.LA⁵ - consortium for coordination of research activities concerning the Venice Lagoon system. In the summer of 2018, the letter of adhesion to the deadline 2020 program promoted by the C40 Cities Network (Climate Leadership Group) was signed, which commits the City of Venice to develop a series of actions that lead it to become neutral regarding greenhouse gas emissions by 2050. The target intends to reduce greenhouse gas emissions by 2030, while developing technologies and new actions that pursue the objective of sequestering the CO₂ emitted

⁵ CO.RI.LA is an association between the Ca'Foscari University of Venice, the IUAV University of Venice, the University of Padua, the National Research Council and the National Institute of Oceanography and Experimental Geophysics, supervised by the Ministry of Education, University and Research.
from the atmosphere, aiming to become an increasingly resilient city, that is, capable of adapting to environmental changes related to climate change (Città di Venezia, 2022).

With Council Resolution no. 266/2018, the Municipal Administration has undertaken initiatives to start the drafting of the new Climate Action Plan (adaptation and mitigation). The first step of this new plan is an assessment of the risk and vulnerability to climate change for the entire territory of the Municipality of Venice (mainland, Venice historic center, islands, and Lagoon) plus the proposals for adaptation actions with a horizon of 2050. This assessment is currently being drafted with the support of CO.RI.LA. On the mitigation side, during 2020, the new emission inventory relating to 2018 (GPC standard) was drawn up, and the foundations for new virtuous actions were laid, with the support of SOGESCA srl⁶. The decision was made by all the municipal offices that deal at various levels with planning measures for mitigation and adaptation to climate change such as land management, urban mobility, and energy efficiency (Environment, Urban Planning, Public Works, Hydraulic Risk, Traffic and Mobility, Energy Systems, Civil Protection, Construction, Centro Maree, UNESCO Site, Public Green, etc.)

According to the Climate Action Plan for Venice, adaptation in human systems is adapting to current or foreseeable climate change and its effects to moderate the damage or exploit favorable opportunities for sustainable development (Comune di Venezia, 2020). The consequence of climate change on coastal tourism has been studied over five decades, but more focused studies have emerged in the last 15 years (Kajan & Saarinen, 2013). Venice has a long history of adaptation to flooding. Early Venetians developed technologies to build on the water, construct

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⁶SOGESCA is a consultancy and engineering company specialized in environmental, work safety and energy efficiency issues. It provides services to companies and public bodies at local, national, and international level. It offers highly professional support in environmental, safety and energy auditing, management systems designing and updating, permit services, due diligence, energy efficiency projects, planning, integrated management of waste, water and energy, life cycle assessment (LCA) and CO2 emissions.
firm foundations, and raise building heights (Mancuso 2014). Archeologists have found signs that ancient Venetians gradually raised the ground level as high as 2 m (79 inch) (DiStefano, 2019). In St. Mark’s Square, the lowest point of Venice, there are five levels of older pavement beneath today’s plaza (Keahey 2002). The inhabitants of Venice diverted the lower course of the rivers to shape the city to their needs (Caniato 2005). In the 16th and 17th centuries, city planners actively altered the lagoon and surrounding environments, building canals to help facilitate shipping and further river diversions, as well as constructing sea barriers. During the 18th century, work continued to improve navigability, and at the barrier island of Pellestrina, the murazzi (walls made of cemented rocks) were constructed to form barriers against the sea.

Several flood protection measures were adopted in Venice to counteract the flooding events, especially after the big flood of 1966. They can be subdivided in wide-spread interventions and the mega-technical barrier system, first proposed in 1981 and funded through the 1984 Special Law. The main goal of the Special Law is to protect Venice and the other Lagoon settlements from high water by implementing different integrated measures (Munaretto et al., 2012). The Special Law for Venice regime has been established since 1973. The Law n. 171 of April 16, 1973, the Law n. 798 of November 29, 1984, and the Law n. 139 of February 5, 1992, are the main laws that set objectives, responsibilities, instruments, measures, and economic resources for carrying out safeguarding activities.

The following interventions stem from this legislation: (1) restoration of the seriously damaged murazzi (seawalls) beginning in 1990, (2) nourishment of eroded beaches, (3) prohibition of methane extraction and drilling of new artesian wells, (4) elevation of low-lying parts of the urban center, (5) construction of lagoonal wetlands, and (6) dredging of internal Venice canals (Table 1). The city is constantly confronted with the problem of acqua alta. To allow pedestrian
mobility around the city at high tide, a network of walkways is installed along the main pedestrian routes. In the late 1990s, in addition to the laws, the Italian government set water quality objectives and regulated the total maximum load of several pollutants specifically for the Venice Lagoon and the water bodies of its catchment basin (Munaretto et al., 2012). Gambolati et al. (2009) have proposed a program of anthropogenic uplift of the city of Venice that would involve the injection of seawater into a 600–800m deep brackish aquifer underlying the Venice Lagoon (Comerlati et al., 2003, 2004). According to Comerlati et al. (2003, 2004), Venice might be very uniformly raised by 25cm over a 10-year period based on injection boreholes and at controlled injection rates.

The MOSE project aims to protect Venice and the other Lagoon islands up to a sea level of 300 cm, way above the historic level of 194 cm. The control and management of the system take place from the control room at Arsenale Nord. In case of high tides of 110 cm or more, the barriers raise to separate the sea from the Lagoon. In such an event, the barriers are filled with compressed air to rise out of the sea. Once the danger is gone (usually within 4 hours), the barriers are filled with water to lower them below sea level. Depending on the tide, they might be used simultaneously, separately, or even partially with only a limited number of gates. To avoid interference with the port activities, locks have been installed next to the barriers of Malamocco (merchant ships), Chioggia, and Lido (fishing boats, emergency vessels, and pleasure craft) to ensure that ships can enter or exit the Lagoon when the barriers are up.

According to Umgiesser (1999), Ammerman & McClennen (2000) and Pirazzoli (2002), MOSE does not protect Venice from floods between 80 and 110 cm (at 80 cm, San Marco square is flooded) when a significant (up to 12%) fraction of the city is submerged; this situation can
occur a sizable number of times. Secondly, MOSE might become rapidly obsolete because of the expected SLR due to global climate change (Comerlati et al., 2004).

Other solutions, including raising the pavements or increasing the resistance to water flooding at the three inlets, have also been proposed. Some of these solutions have been implemented. For example, in the lowest suburbs, the sidewalks and the channel banks have been raised by 50 cm, while works at the inlets are ongoing. Complementary to the raising of street pavements, which is being implemented wherever possible in the city, they study the possibility of deep fluid injection to raise the entire lagoon bottom below the Venice area. The idea is concerned with injecting seawater into a brackish geological formation located 600–800 m below the city and raising the lagoon bottom because of the rock swelling caused by the pore pressure increase in the injected formation. Injection technology is currently available from the petroleum industry and has been used worldwide over the last 40–50 years, with facilities across the United States discharging a variety of fluids into more than 400,000 injection wells [U.S. Environmental Protection Agency (USEPA), 2002]

Water injection is performed for different purposes. ENI-E&P, the Italian national oil company, has also been reinjection of salty formation water in the northern Adriatic basin (the same basin that underlies Venice) The water extracted along with gas from the Malossa field, located about 200 km west of the Venice Lagoon, has been pumped at a rate of 1000–3000 m3 d⁻¹ for several years through two injection wells into an 1100- to 1350-m-deep sandy formation characterized by average porosity and permeability of 23% and 3 × 10⁻⁷ ms⁻¹, respectively. The increasing challenge posed by flooding could be ameliorated with the aid of the MOSE system (Comerlati, 2004).
Table 2: Flooding Measures in Venice, Italy.
Source: Adapted from (Molinari et al., 2019)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FLOODING MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td>Construction of walls “murazzi” (walls made of cemented rocks).</td>
</tr>
<tr>
<td>1970S:</td>
<td>A network of walkways is installed along the main pedestrian routes.</td>
</tr>
<tr>
<td>1980S:</td>
<td>The protection of ground floors, adaptation of electrical systems, and placement of steel barriers at the entrance to buildings</td>
</tr>
<tr>
<td>&gt;1984:</td>
<td>Interventions from Special Law:</td>
</tr>
<tr>
<td></td>
<td>(1) restoration of the murazzi (seawalls);</td>
</tr>
<tr>
<td></td>
<td>(2) nourishment of eroded beaches;</td>
</tr>
<tr>
<td></td>
<td>(3) prohibition of methane extraction and drilling of new artesian wells.</td>
</tr>
<tr>
<td></td>
<td>(4) elevation of low-lying parts of the urban center.</td>
</tr>
<tr>
<td></td>
<td>(5) wetland creation.</td>
</tr>
<tr>
<td></td>
<td>(6) dredging of internal Venice canals.</td>
</tr>
<tr>
<td>1994–1998:</td>
<td>Public paved areas are being raised, to defend against tides up to 100–110 cm.</td>
</tr>
<tr>
<td>AFTER 1998</td>
<td>There was not enough money to comply with the intervention for (1) (2) and (5) every 10 years, as planned.</td>
</tr>
<tr>
<td>2003</td>
<td>MOSE (Experimental Electromechanical Module) completed in 2021</td>
</tr>
<tr>
<td>&gt;2005:</td>
<td>Flood information by alarms in real time via web and smartphone</td>
</tr>
</tbody>
</table>
2.6 Overtourism

Overtourism describes the situation in which “the impact of tourism, at certain times and in certain locations, exceeds physical, ecological, social, economic, psychological, and/or political capacity thresholds” (European Parliament, 2018, p.22). According to Godwin (2017), overtourism describes destinations where hosts or guests, locals or visitors, feel that there are too many visitors and that the quality of life in the area, or the quality of the experience has deteriorated unacceptably due to rising tourist numbers. Challenges arising from this are, above all, alienated inhabitants, an overburdened infrastructure, damage to nature, or threats to culture and heritage (European Parliament, 2018). This often leads to conflicts between the population and tourists. Therefore, the phenomenon overtourism can be defined as “the impact of tourism on a destination, or parts thereof, that excessively influences perceived quality of life of citizens and/or quality of visitors experiences in a negative way” (UNWTO, 2018, p.4). This results from the lack of management and the uncontrolled development of tourism (UNWTO, 2018).

Europe is confirmed as the first continent in the world to receive half of the international arrivals of the entire planet (pre-COVID pandemic). This is mainly based on three strong points: the cultural heritage, the diversity of the country, and the quality of the offer (Statistico, 2018). European cities with their main attractions, such as historical centers, monuments, and sights, are particularly affected by tourists. These squares and cities are quickly flooded by large crowds of people (Dodds & Butler, 2019).
2.6.1 Cause of Overtourism in Venice

Visitor numbers have been rising steadily for decades, as anyone who lives in a popular tourist city or who has visited certain beaches or landmarks will attest. An important role in an increased number of tourists plays promotional and marketing actions. For instance, in the second half of the 1980s, the promotional expenses of Venice were extremely high. In 1988, more than 1.2 billion US dollars were invested in marketing activities in Venice (van Der Borg, 1992), even though concerning tourism-related issues were already known in the 1970s (Horváth, 2018).

Venice had grown increasingly dependent on tourism at least since the late 1970s, when the proliferation of hotels and tourist services started to flank the progressive loss of economic functions, with regulations and policy regimes eventually adapting and favoring such changes. While the increased orientation towards the visitor economy and the progressive intensification of the use of space by visitors (Indovina, 1988) has gone hand-in-hand with processes of displacement of the resident population, marking a steady erosion of the city's social mass (Costa & Martinotti, 2003; De Rita, 1993; Fregolent & Vettoretto, 2017; Minoia, 2017; Russo, 2002a), the uptake of the housing market by STR since early 2010 has driven the domain of tourist commodification to an unprecedented scale.

Page's (2009) study of managing the visitors and their impacts in Venice, Italy, highlights the increased competition between residents and visitors on the use of space within the historic city. According to the study, up to 34% of the public space in Venice is used by visitors and 49% by the residents. During special events, the use by visitors increases to 56%, adding to the congestion of the city. The Italian city of Venice has become an emblematic example of a destination struggling with what is now frequently called overtourism. As analyzed by, for example, Van der Borg (2017), over the past 25 years, the number of arrivals of tourism has
quadrupled. The number of day-trippers was estimated to be around 5 million in 1988. At present, the number of excursionists (day-trippers and overnight stays) is believed to be between 22-25 million per year, almost five times as many as at the end of the 1980s (Bertocchi et al., 2020). There is extensive literature on visitor impacts in national parks and at cultural heritage sites and on the wide range of negative impacts that tourism has on local communities ranging across the economic, social, and environmental challenges of sustainability (Goodwin, 2017).

Since the end of the 1980s, the sustainability of tourism development in Venice has been linked with the concept of tourism carrying capacity. Simulations of the carrying capacity of Venice by Costa and Van der Borg (1988) and Canestrelli and Costa (1991) have confirmed that tensions exist between the city’s tourism development process and the livability of the city for its inhabitants and non-touristic economic activities. In many overtourism narratives, Venice is one of the most relevant cases of overtourism. It, therefore, has become a laboratory for studying the conflicts that emerge when tourism numbers continue to grow, and the quality of the tourism flow continues to decline (Bertocchi et al., 2020). Most recently, the issue of short-term rentals and housing accessibility gave life to the term short term city analyzed by Salerno and Russo (2020). Their study focused on how Venice became an urban form that accommodates the dwelling practices of temporary populations as tourists at the expense of a stable resident population. The study refers to Venice as a short-term city which, according to the authors, “reorients to the transits and dwelling practices of a transient population like short term-visitors, while the mass of the stable population shrinks” (Salerno & Russo, 2020, p.3).

Since 2000, short-term accommodation or rental (STR) has been common in most popular tourist cities, such as Venice, Florence, Barcelona, Amsterdam, etc. One of the reasons that allowed short-term accommodation to rise is the development and appearance of low-cost airlines
with low-cost flights mainly within the European Union. The growing literature on the impacts of STR hints at the shrinking of affordable housing supply, the rise of rents, and the associated interrelated processes of capital concentration, exclusion, and displacement (Barron et al., 2021; Celata et al., 2017; Cocola-Gant & Gago, 2019; Lee, 2016; Wachsmuth & Weisler, 2018). Due to the deterioration of the housing stock, the increasing frequency of floods, increasing numbers of inhabitants continue to move from the historic city to mainland urban centers (Favero, 2014). As a result, the ancient city has become a residential, tourist, and cultural center (Molinari et al., 2019). Approximately 70% of the sales of residential property in Venice involve international buyers, and consequently, the housing costs in Venice are the highest of any Italian city, almost US $5000/m2 (Idealista 2015).

The rise of the internet and shared economy has facilitated access to knowledge and the shift of the economic barycenter towards Central Europe, Asia, and South America. Brazilian, Chinese (the sixth market for Venice), and Russian clientele have gained importance, and their contribution to total tourist expenditure has grown considerably during the last decade (Bertocchi et al., 2020). Cruise tourism has been a significant source of overtourism in the Mediterranean. Thousands of passengers spill out into port cities each day, returning to the ship in time for dinner. Passengers often spend very little in the destinations, yet ensure that historic streets, monuments, cafes, and shops are crammed with people, creating an unpleasant experience for residents as well as for visitors who may be staying on land and spending money locally.

The share of cruise ship passengers of the total number of tourists in Venice is five to six percent, which means that 1.6 million out of a total of 25 to 35 million come to Venice by cruise ship every year (Neumeier, 2019). Cruise ships bring profit, but not all of it goes towards the Venice historic center. A 2013 study by University Ca' Foscari, Venice, estimated that the cruise
industry's overall business brought to the city is estimated to approximately 290 million euros. The data included direct and indirect business with the government and private companies and included food supplies, laundry service, and money spent by cruise day-trippers in the city (as little as 19 euros or approximately US $21 per capita). That figure also included 5.6 million euros from cruise vessels. Recent newspapers have shown that not all the news about Venice is dim and negative. Post-COVID Pandemic has seen some positive outcomes. From banning large cruise ships to regulating Airbnb rentals, responsible tourism advocates see a new path forward for Venice post-pandemic (Itzkowitz, 2022).

The central governmental approval law banning cruise ships from St. Mark's basin and Giudecca canal to lessen overcrowding in those areas was highlighted in 2020. In a statement released to Reuters, the government said that it wanted to reconcile the needs to protect the artistic, cultural and environmental heritage of Venice and its lagoon with those related to cruise activity and goods traffic (Buckley, 2020). Ships larger than 40,000 tons will have to dock in the industrial Marghera Port on the mainland about eight miles from the center of Venice at least until the government can find a permanent solution. The plan is to hold public meetings about the possibility of building a new cruise terminal outside the lagoon (Itzkowitz, 2022). However, digging new canals for new terminals means more damage to the ecosystem and anti-sustainability practice for the Lagoons infrastructure. Previously, the authorities had agreed to reroute large ships away from the basin of St Mark's and the Giudecca Canal, where the ships are just meters away from the city center, but to have the dock in Marghera.

At the beginning of 2022, a long battle regarding a fee to enter the city of Venice was established. Mayor Luigi Brugnaro first announced a plan to charge tourists a fee to visit the city in December 2018, but it was put on hold during the COVID pandemic. Now it seems the city will
begin requiring tourists to reserve a ticket in advance starting in 2022. The details are still being finalized, including how much tourists will be charged, how it will be enforced, and the exact implementation date. The authorities are working on a system to discourage day-trippers and encourage high-quality experiential tourism paving the way on a global level to develop an unprecedented system for offsetting the negative consequences of overtourism.

Di Maglie (2022) confirmed that for tourists staying in hotels and other structures, Venice will be accessible without any limitations and that the city’s goal is to control the flow of visitors from a *smart control room* using artificial intelligence, which will also help regulate transportation and other services. A January 7, 2022, report from Euronews stated that the plan for 2022 is only to allow travelers to visit the city after they have booked a 5-euro (US $5.70) ticket online. The Italian newspaper Venezia Today reported that the *tassa di sbarco* (disembarkation tax) will range from €3 to €8 (US$3.50–$9) for day-trippers, but that tourist staying in the city’s hotels—where a city tax is already added onto the bill—will be exempt. The paper also reported that the city's administration discusses an app for bookings and barriers to enforce them, in addition to 500 CCTV cameras installed throughout the city, for police to monitor visitors.

More recently, a new initiative called *Venywhere* was launched in December 2021 by the Università Ca’ Foscari and the Fondazione di Venezia. The nonprofit group that protects Venice’s cultural heritage aims to convince people who can do their jobs remotely to do so in Venice. The goal is to attract young professionals and digital nomads in a bid to repopulate its historic center.

### 2.6.2 Consequences of Overtourism in Venice

Venice isn't sinking as much as it is shrinking. Venice has been facing problems of degenerating housing stock and declining population since the 60s (Pacione, 1985). A more recent concerning issue is the depopulation of the historic center, such as the migration of inhabitants.
from the city center to the outskirts of the mainland (Milano, 2017). Residents are not migrating from their island city motherland to a foreign mainland out of necessity or for convenience's sake; rather, they are trying to reach a difficult balance between their island and mainland identity (Casagrande, 2015).

In 1973 the Italian Parliament passed the so-called Special Law for Venice (State Printing Service and Mint, 1973). Article 1(1) of the Law reads: “The safety of Venice and of its Lagoon is declared a problem of the highest national interest”. Article 5 established a Committee for the Safety of Venice, which includes a UNESCO official and must approve any public or private work impacting the territory within the lagoon (Art. 6(1)). The Law also allocated money for public works and aid for Venice residents. In the Italian constitutional system, however, a Law providing for expenditures needs to be refinanced by Parliament every year, and the funds earmarked for the Law have been subject to a major reduction in the past years (Municipality of Venice, 2008).

Since then, little progress has been made to resolve the fundamental problem of flooding and planning problems. To a large extent, the initial root of the problem was the construction of the industrial estate at Porto Marghera (1917). Since the local authorities could not finance the project, the power of decision-making passed to other cities causing a significant threat towards environmental problems of the modern city. In 1926 the territory of the Comune di Venezia was extended to include Porto Marghera, and from this date, the island city was legally tied to the growing industrial complex. The main achievement of the first development plan for the enlarged area was the provision of a workers' city of 30,000 inhabitants at Porto Marghera to house the labor force attracted by the new industries. The master plan of 1937 added an extensive new housing area at Mestre, which was further enlarged in 1942 (Zanetto & Lando, 1980). The population growth of the Mestre area has been extremely rapid. It showed a sixfold increase over the first half
of the 20th century, growing from 20,000 at the beginning of the century to 130,000 in 1958. The growth of this mainland population center has been a factor contributing to the current physical and demographic problems of Venice. However, a lesser-known aspect of these tourism containment policies is related to limiting the incidence of a tourism economy in order to give residents a wider choice of jobs, ensure the provision of services targeted at residents, and safeguard the city’s historical and cultural heritage beyond the scope of its utility for tourism. Venice was for centuries a great maritime, colonial, and commercial power. Large cruise ships have come to symbolize the struggle to prevent tourism from monopolizing the Venetian economy. Currently, cruise ships literally pass through the city to enter or leave the port of Venice, crossing the Giudecca Channel, and brushing up against St Mark’s Square. In principle, the Government, and the Venice Harbormaster’s Office have already ordered such ships to take different routes, but before this can be done, it is necessary to excavate a new channel within the lagoon (Casagrande, 2015).

The demographic decline is popularly attributed to the economic and logistical constraints of Venetian life. Car parks, which can be found only around Rome Square, are very expensive, and so are boat moorings; the latter must be granted by the public authorities since all water areas are State property in Italy. Basic goods, such as groceries, are also more expensive since they must be carried by boat and by foot. The same applies to construction, and even renovation works without counting the legal limitations and proceedings.

The current socio-demographic imbalance cannot be reversed until local authorities are able to offer housing conditions comparable with those on the mainland and policy measures for short-term accommodation. In the meantime, sizable investments have been made by public and private actors to turn the city into an educational and cultural hub. The city hosts the Venice
International Film Festival, the International Art Exhibition, and the International Architectural Exhibition. All three events are internationally renowned and funded by the Italian Government via the Biennale Cultural Corporation (La Biennale di Venezia, 2021). Venice also hosts two universities (Ca' Foscari University of Venice and IUAV University of Venice); an academy (Venice Academy of Fine Arts); and the Venice International University, an international academic consortium. The city is also home to a UNESCO Office, and the Venice Commission of the Council of Europe. This emphasis on cultural hub status is rooted in the exceptional ability of small islands to be the sites of highly visible creative cities (Khoo et al., 2015). Despite some success in the cultural area, overall, the policies that have been adopted and implemented in order to stop or reduce Venice’s depopulation and consequent loss of identity and cultural heritage have failed.
Chapter 3: Methodology

3.1 Introduction

This chapter describes the methodology used to complete this research. First, a research design is presented. Second, data collection is described followed by survey development and pilot testing (third). The fourth section includes a summary of how the data was analyzed, followed by reliability and validity, and in the last section limitations are presented.

3.2 Research Design

A case-based methodology allows for a broad range of investigations to understand and propose how preservation can be utilized to prepare for future problems. The empirical methods consider the diverse needs of impact assessment, adaptation planning, and long-term decision-making. The latter includes the requirements of strategic decision-makers and policy implementation. Research in these overlapping topics leaves significant gaps, highlighting the lack of current research about coastal community planning where sea-level rise will inevitably cause areas to be irreversibly flooded. The effects of community-based prevention programs have been widely investigated using case methodology (Tellis, 1997). The case study methodology is one way of conducting social science research when focusing on a contemporary phenomenon within a real-life context (Yin, 1994). The quintessential characteristic of case studies is that they strive towards a holistic understanding of cultural systems of actions (Feagin et al., 1990). Its purpose is description, although attempts at explanation are also acceptable (Babbie, 1998).

The study employed a two-stage methodological approach. In the first stage, the objective was to analyze the local government’s response to environmental damage, marine tourism activity, degrading life quality, and residential outmigration due to mass tourism and more frequent flooding. This stage’s primary source of information was census data analyzing trends and changes
in the tourism sector and outmigration. In addition to the local and international news reporting, government and stakeholders’ positions concerning regulations and relevant information are included. Other sources included official websites, archival documents, and peer-reviewed journals. Using statistical analysis, the research measured existing (i) mitigation policies, (ii) successes, (iii) challenges, and (iv) tourism-tailored policy opportunities. In the second stage, an online survey collected information from scholars, experts involved in local authorities, government officials, representatives of environmental and civic groups, and natural and social scientists in Venice involved in urban planning and tourism preservation to identify what adaptive measures and decisions will be needed for long-term planning strategies. The qualitative approach aims to illustrate how adaptation policies have emerged in Venice.

3.3 Data Collection

Before reaching out to key informants using the survey, an application was submitted for the Institutional Review Board (IRB) approval to the Office of Human Subject Research at the University of New Orleans to assure that appropriate steps are taken to protect the rights and welfare of human participating in the research.

The primary source of qualitative data for this project was surveying key informants and experts in the research area. Potential respondents were identified solely because of their knowledge and research that fits the study area on safeguarding Venice. Experts were chosen due to their engagement in local and international newspapers, public meetings, participation in conferences, and advocacy. Contact information (phone and email address) was collected through public sources (websites, public social media pages such as LinkedIn, and phone listings). General contact information was used with organizations for whom specific individuals are not readily or publicly available.
The survey was distributed using the Qualtrics software. Qualtrics (2018) has become very popular among researchers who design non-interactive online experiments. The advantage of selecting a web-based survey in this not funded and time constrained research consists of time management, and it is more affordable and more accessible to administrate than other forms of a survey, as they are self-administrated. Surveys are a well-established method of collecting data within social science research (Dilman, 1999). Survey research is usually associated with the deductive approach, and it is a very useful method available to social researchers interested in collecting data for describing a population too large to observe directly (Babbie, 2010). In a survey, information is gathered from a sample of individuals, usually a fraction of the studied population.

Additionally, the survey can be distributed in several languages and provide access to dispersed samples around the globe. Survey software has several advantages over platforms designed explicitly for experiments; they require no programming skills, are entirely web-based, and offer a more intuitive and streamlined interface. These features make creating, editing, and managing studies easier to use survey software than using more conventional experimental platforms (Molnar, 2019).

3.4 Questionnaire Development

The study followed guidelines on ethics suggested by Babbie (2010), where the respondent participated voluntarily, and the instrument was designed not to harm respondents who volunteered to participate in the study. Confidentiality was secured to protect respondents’ identities. After analyzing the gaps in literature and data gathering, 22 research questions were developed of which 8 were multiple choice questions and 14 open questions. For the questionnaire to be successful, the questions need to be concise, simple, and persuasive to meet the research objectives.
The decision on the questions was primarily influenced by the existing literature related to current adaptations measures in Venice for economic, environmental, and socio-cultural conditions, and stakeholder’s involvement in future predictions. The proposed items were then discussed with the committee members (Dr. Farris, Dr. Stich, and Dr. Bordelon) who revised and made recommendations on how to best address the research questions. First, the survey was pilot tested with a sample composed of three respondents from the cohort program. The aim was to receive general feedback regarding the clarity and understandability of the instrument, time accuracy, and to gather preliminary understanding of the distribution and structure of the data. The participants in the pilot test were solely testing the method, and the feedback received was implemented to tailor the survey.

3.5 Data Analysis

For this research, a thematic analysis has been applied. The thematic analysis is a method that identifies patterns or themes within qualitative data (Braun & Clarke 2006; Clarke & Braun, 2013). According to Maguire & Delahunt (2017), this framework is arguably the most effective approach in social science because it offers a clear and usable framework for thematic analysis.

Braun and Clarke’s (2006) 6-step framework has served as a guideline for data analysis, by 1) becoming familiar with the data, 2) generating initial codes, 3) generating preliminary themes, 4) reviewing themes, and developing sub-themes, if necessary, 5) defining themes, and 6) writing up the findings.

Once the report was retrieved from the Qualtrics application system, documents were uploaded on Dedoose software. In Dedoose, data were coded according to the themes and subthemes created based on the familiarity with the data. Open coding technique was used, which means there were no pre-set codes; codes were developed and modified as the researcher worked
through the coding process. The researcher worked through each transcript coding every portion of text that seemed to be relevant to or specifically addressed the associated research question (Table 3).

Secondary quantitative data analyzed in this study were retrieved from reliable sources. The number of international tourism arrivals and presence in Venice and the mainland, and other relevant material regarding out migration and future demographic predictions were retrieved from the World Population Review, City of Venice (Annuario del Turismo, 2019) and ISTAT (Istituto Nazionale di Statistica).
### Relevant Literature


Brambati et al. 2003; Carbognin et al. 1995, 2004, 2010; Gatto and Carbognin 1981; Co.Ri.La, 1999; Few et al., 2007; Nicholls and Klein 2005; Munaretto et al., 2012; Nelson, 2021; Tosi et al., 2002, 2010; Teatini et al., 2010; Vianello, 2021

Antonioli et al., 2017; Carbognin et al., 2010; Co.Ri.La 1999; Plag, 2008; Vellinga et al., 2010

Costa & Van Der Borg, 1988; Russo, 2002; Kundzewicz, 2002; Vianello, 2016, Umgiesser, 2020;


Casagrande, 2016; Jaafar et al., 2015; Jimura, 2011; Kebete, 2022; Russo & Van Der Borg, 2002; Mbaiwa, 2005.

### Conceptual Framework

**Stage A (Stressor Activities)**

What deliberate changes are made to manage climate change stressors and mass tourism activities in Venice?

**Stage B (Environmental stressor)**

Who currently manages climate change mitigation strategies and predictions? Is this working?

**Stage C (Socio-Cultural stressor)**

What is the Venice resident’s migration prediction and resettlement?

### Associated Research Questions

What is SLR projections for Venice region by 2100?

What adaptation measures have been implemented to save Venice?

What is the Venice resident’s migration prediction and resettlement?

How are stakeholders involved in the current efforts to stabilize Venice’s future?
<table>
<thead>
<tr>
<th>Reference</th>
<th>Stage</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bertocchi and Visentin, 2019; Dodds and Butler 2019; Tapper, 2017; UNWTO, 2018. Settis, 2016; Davis 2004; Sharma, 2004</td>
<td></td>
<td>How has ever-increasing tourists influenced Venice?</td>
</tr>
<tr>
<td>Buttler, 1993; Weaver &amp; Lawton 2002</td>
<td>Stage D (Economic Stressor)</td>
<td>How important is the concept of re-thinking tourism in coastal areas to encourage land protection and cultural heritage preservation?</td>
</tr>
<tr>
<td>Canestrelli &amp; Costa, 1991</td>
<td></td>
<td>If sea level continues to rise, what will happen to tourism?</td>
</tr>
<tr>
<td>Becken &amp; Clapcott, 2011; Dubois et al. 2011; Pentelow &amp; Scott 2011; Peeters &amp; Eijgelaar 2014. Sauer, 2021.</td>
<td></td>
<td>What policy implementations measures have key tourism stakeholders adopted?</td>
</tr>
</tbody>
</table>

(table 3 cont.)
3.6 Reliability & Validity

Yin’s definition of analysis “consists of examining, categorizing, tabulating, testing, or otherwise recombining both quantitative and qualitative evidence to address the initial propositions of a study” (2002, p. 109). To increase the reliability of the information in a case study is to maintain a chain of evidence (Yin, 1994, p.98). According to Babbie (1998), reliability is a matter of whether a particular technique, applied repeatedly to the same object, would yield the same result each time.

Before distributing the survey, a list of potential respondents was created. To address the reliability of this research, only a specific category of respondents was invited to participate in the survey, asking questions that were relevant to them and their field of study. Those include tourism and hospitality stakeholders with years of experience and expertise in the field of destination management or climate crisis communication, or individuals currently serving in a leading position at the National Tourism Board/ National Tourism Office of foreign countries in the U.S.A. (i.e., Italian National Tourist Board North America or academicians and scholars with 5+ years of teaching and research experience in the field of destination management, marketing communication, and crisis communication). To test the reliability of the participants, an introductory set of questions was delivered asking participants if they were qualified for taking the survey. This step proved to be helpful in informing the participants that this research is designated only and exclusively to those operating in the field of tourism.
3.7 Limitations

There are numerous limitations to online experimentation: experimenters have much less control over participants, who in turn tend to be less attentive, less motivated, and more likely to make errors (Paolacci et al., 2010). Despite being a reliable and powerful tool for gathering data, the survey software has a significant limitation: they do not allow real interaction between respondents. As pointed out by Arechar, Gächter, and Molleman (2018):

“Studies of social behavior often use survey software [...] and emulate interactions through post hoc matching. Although this approach can be powerful, it does not permit the study of repeated, ‘hot’ interactions where live feedback between participants is essential” (p. 100). In addition, online studies can suffer from significantly higher attrition rates than those found in on-site experiments (Zhou & Fishbach, 2016). This limited ability to have real-time interaction prevents a lot of experimental economists from conducting online experiments, depriving them of the potential benefits of online experimentation.

Initially, the survey was meant to be delivered in person. Due to the COVID-19 pandemic and travel restrictions, conducting interviews on-site was impossible, and the web survey was the most reliable source for completing the research. Despite delivering the survey in two languages (English and Italian), some questions might not have been well understood or explicit to the respondents based on their level of knowledge and understanding.

In-person surveys allow for a follow-up question or more explanations when answers are short. In that case, the interviewer could clarify questions that seem unclear or customize the question based on the respondent’s professional background and professional experience.
Chapter 4: Findings

4.1 Introduction

This research investigates how projected climate change impacts and over-tourism may affect the Venice region in the long term. In particular, the research documents adopted measures and explores whether the current adaptations are enough to protect Venice from flooding and Venetian residents from fleeing the historic center by 2100. Findings indicate that the accumulation of i) the frequency of floods due to global warming, ii) the pressure of unregulated mass tourism, iii) the high price of housing and rentals, and iv) the opportunities created by extending the tourist accommodation into private homes gradually contribute to the ‘exodus.’

Venice is often referred to as the sinking city, and unfortunately, there is some element of truth in it. The city is now 25 cm (0.82 inch) lower than the sea level at the beginning of the 20th century. One of the underlying reasons is using the groundwater from the subsoil under the city for daily life. As a result, the frequency of reaching a water level of 110 cm (3.6 ft) increases over time. The term high water, locally known as acqua alta is an often-used terminology for Venetian’s garnering attention from the national and international news media who seem to worry much more about it than the residents (Table 3).

The theory of environmental impact sequence in tourism proposed by OECD in the 1980s was used as a theory of reference to evaluate whether the three pillars of sustainability, the environmental, socio-cultural, and economical approach to sustainable development would have a more significant impact on the community. The findings analyze the pillars of sustainability from the prospective of flooding due to increased sea-level rise and global warming, and second, from the prospective of out-migration of locals and residents due to over tourism overcrowding the streets and exceeding the carrying capacity of the Venice region. Because of the two occurrences
(flooding and fleeing), Venice is becoming depopulated as residents move from the archipelago to Mestre’s mainland, or other regions.

Table 4: International News Media Addressing the Phenomenon Acqua Alta in Venice.

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Year</th>
<th>Publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>See tourists wade through Venice's flooded squares and cafes as acqua alta tides hit again</td>
<td>Towey</td>
<td>Nov 9, 2021</td>
<td>Yahoo News</td>
</tr>
<tr>
<td>Tourists wade through Venice square hit by unseasonal flood</td>
<td>Reuters</td>
<td>Aug 9, 2021</td>
<td>Reuters</td>
</tr>
<tr>
<td>Worsening Off-Season Floods in Venice Triggers Fears About Climate Change Impacts</td>
<td>Barry</td>
<td>Oct 22, 2021</td>
<td>Insurance Journal</td>
</tr>
<tr>
<td>Venice's world-famous 'streets of water' left dry after dramatic low tides drained its canals</td>
<td>Bhardwaj</td>
<td>Feb 28, 2021</td>
<td>INSIDER</td>
</tr>
<tr>
<td>Venice Holds Back the Adriatic Sea</td>
<td>Nasa</td>
<td>Nov 6, 2021</td>
<td>NASA</td>
</tr>
<tr>
<td>Venice on flood alert all week, MOSE in action</td>
<td>ANSA</td>
<td>Nov 2, 2021</td>
<td>ANSA</td>
</tr>
<tr>
<td>Venice 1 Year on From Devastating Flooding: No More Acqua Alta?</td>
<td>Hughes</td>
<td>Nov 12, 2020</td>
<td>Forbes</td>
</tr>
<tr>
<td>A High Tide in Venice</td>
<td>Lozza</td>
<td>Oct 19, 2020</td>
<td>Earth Island Journal</td>
</tr>
<tr>
<td>Venice’s Desperate 50-year battle against floods</td>
<td>Van Boom</td>
<td>Oct 9, 2020</td>
<td>CNET</td>
</tr>
<tr>
<td>Venice holds back the water for first time in 1,200 years</td>
<td>Buckley</td>
<td>Oct 5, 2020</td>
<td>CNN</td>
</tr>
<tr>
<td>Venezia, la guida speciale che non mostra ai turisti i monumenti ma gli effetti dell’acqua alta</td>
<td>Crispino</td>
<td>Set 24, 2020</td>
<td>Corriera della Serra</td>
</tr>
<tr>
<td>Venice Flooding Brings City to ‘Its Knees’</td>
<td>Povoledo</td>
<td>Nov 13, 2019</td>
<td>The New York Times</td>
</tr>
<tr>
<td>After Venice Floods, Volunteers Wade in To Help Salvage What They Can</td>
<td></td>
<td>Nov 18, 2019</td>
<td>NPR</td>
</tr>
<tr>
<td>Event Description</td>
<td>Author</td>
<td>Date</td>
<td>Source</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>-------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>High Tides in Venice Floods the Streets with Up to Five Feet of Water</td>
<td>Romano</td>
<td>Nov 12, 2019</td>
<td>Travel + Leisure</td>
</tr>
<tr>
<td>Venice’s Rising Tides Leave Businesses Struggling to Stay Afloat</td>
<td>Sylvers &amp; Legorano</td>
<td>Nov 15, 2019</td>
<td>The Wall Street Journal</td>
</tr>
<tr>
<td>Venice experiencing worst floods in 50 years</td>
<td>National Geographic Staff</td>
<td>Nov 13, 2019</td>
<td>National Geographic</td>
</tr>
<tr>
<td>Venice floods threaten priceless artwork and history — and a unique way of life</td>
<td>Bellware</td>
<td>Nov 17, 2019</td>
<td>The Washington Post</td>
</tr>
<tr>
<td>Is Venice Sinking? Worst Floods in a Decade Swamp Three-Quarters of the City</td>
<td>Brennan</td>
<td>Oct 30, 2018</td>
<td>News Week</td>
</tr>
<tr>
<td>Acqua Alta, or Venice Underwater</td>
<td>Taylor</td>
<td>Oct 30, 2018</td>
<td>The Atlantic</td>
</tr>
</tbody>
</table>

(4.2 Data Collection)

Information presented was collected from scientific literature, archive analysis, census data and a web survey. The researcher created the web survey based on the literature to ensure necessary material was obtained to address the research questions. The survey was created via Qualtrics and distributed via email. The target population for the research was composed of tourism stakeholders, academic professionals, destination management experts, employees of local authorities, and community leaders. Furthermore, the researcher looked at the existing pieces of law and regulations, policy plan and programs, news articles and notes. The use of scientific peer reviewed articles allowed to distinguish between local perspectives and scientific data regarding flooding and out migration in Venice. Local newspaper provided publics’ perception of Venice’s governance and destination management issues.
While frequently reading the transcripts to get familiar with the material, the researcher assessed the quality of the data, whether responses were ambiguous or contradictory and if the responses aligned with the research questions.

4.3 Coding Data

Data was collected using the Qualtrics software system. After the first screening of the responses, Saldaña's (2016) book was used to get familiar with the coding methods and recommended applications. For the first coding cycle, structural coding was applied (Guest et al., 2012; MacQueen et al., 2008; Namey et al., 2008) as an acquaintance and general overview of the data. According to the authors, structural coding applies a content-based or conceptual phrase to a segment of data that relates to a specific research question to code and categorize the data corpus (Saldaña, 2016). The technique is suitable for studies with multiple participants or exploratory investigations to gather topics lists or indexes of major categories or themes (e.g., this research looks for what actions or policies have local government and tourism stakeholders of the coastal communities adopted to protect resident's livelihood. Hence the code: coastal management solutions). For the second cycle of coding, eclectic coding was applied for refining the first cycle choices (Saldaña, 2016 p. 74), synthesizing the variety and number of codes into a more unified scheme. This second cycle developed the final themes and subthemes for the research (see Appendix C).

Initially, 60 experts were invited to participate in the survey. Among them, 43 participants showed interest in partaking in the survey. However, only 20 responses have been considered complete for the research questions. The participants who had not been selected chose to exit the survey without answering all the questions. The 20 responses were uploaded to Dedoose software under the media tab. Each respondent was given an alphabetical letter for their first and last name
to keep the responses confidential. No one outside of the research group has access to their information.

The coding was an elaborate long process that was repeated twice. The structural coding helped sort data into patterns and understand if all the information will be coded or only the information needed to answer the research questions. Passages were labeled with keywords addressing the research questions or commenting on an issue (e.g., marine tourism; re-think tourism; future suggestions, lessons learned, solutions, MOSE). The goal was to make sense of the information, rather than summarizing data which Clarke & Braun (2013) call ‘pitfall.’ Data analysis and representation were applied using Creswell et al. (2008) Belotto, (2018), and Maguire & Delahunt (2017).

Table 5: Number of Codes Resulted from the Survey.

<table>
<thead>
<tr>
<th>Themes</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 ENVIRONMENTAL</strong></td>
<td></td>
</tr>
<tr>
<td>1.1 Coastal Management Solution</td>
<td>37</td>
</tr>
<tr>
<td>1.1.1 Policymaking Experts</td>
<td>9</td>
</tr>
<tr>
<td>1.2 Marine Tourism</td>
<td>27</td>
</tr>
<tr>
<td>1.2.1 Impact of Cruise Ships</td>
<td>23</td>
</tr>
<tr>
<td>1.3 Sea Level Rise (SLR)</td>
<td></td>
</tr>
<tr>
<td>1.3.1 MOSE Effectiveness</td>
<td>9</td>
</tr>
<tr>
<td><strong>2 SOCIO-CULTURAL</strong></td>
<td>19</td>
</tr>
<tr>
<td>2.1 Long Term Impacts</td>
<td>38</td>
</tr>
<tr>
<td>2.1.1 Over Tourism</td>
<td>5</td>
</tr>
<tr>
<td>2.1.2 Out-Migration</td>
<td>4</td>
</tr>
<tr>
<td>2.1.3 Cultural /Heritage Tourism</td>
<td>2</td>
</tr>
<tr>
<td><strong>3 ECONOMIC</strong></td>
<td>8</td>
</tr>
<tr>
<td>3.1 Demand Shift for Tourism</td>
<td>18</td>
</tr>
</tbody>
</table>
3.1.1 Mountain Area 2
3.1.2 Inland 5
3.2 Re-Think Tourism Concept 15

Additional Findings

4 SOLUTIONS 39
4.1 Long Term Solutions 12
4.2 Short Term Solutions 2
4.3 Save Venice Initiatives 10
    4.3.1 Policy Implementation Measures 1
    4.3.2 Mitigation Strategies 0

5 FUTURE SUGGESTIONS 29
Code Application 353

(table 5 cont.)

4.4 Respondent’s Profile

Among 20 respondents, 11 (55%) participants responded in English and 9 (45%) in Italian (Figure 11). Respondent’s fields included Academia, National Tourism Organization, Tour Operator Agency, DMO’s, Cruise lines and Hotel Company and Other.

Figure 11: Respondent’s Language Use
Source: Author
The biggest percentage of responses were recorded from Academia and Other (Figure 12). Although several of the respondents did represent the Hotel & Lodging industry, according to their professional title, they chose to identify themselves as other.

Most of the participants served in the role of academia (50%), 15% in the role of director, 5% in the role of community leader, and 30% identified themselves as other professionals (Figure 13).
A considerable ratio of the participants (40%) has been working for more than 20 years in the field (Figure 14). An interesting observation was made regarding the future’s optimistic and less optimistic views based on years of experience. For example, a correlation was established between years of expertise and the question “Where will Venice be in the next 80 years or by 2030 and 2100?” The results show that those working in the field for more than 20 years have witnessed a lack of accountability and timely policy-making implementation and adaptation measures protecting Venice from flooding. A standard answer to this question was Venice will become: “Atlantis,” “depopulated,” “under the sea,” or “not a place to live.” They also have opted for long-term planning solutions when asked what adaption measures they recommend implementing.

![Figure 14: Respondent’s Years of Activity](source: Author)

Those who had been working in the field between 10-20 years (30%) were very concerned with Venice “losing its identity,” becoming a poorer city, and more likely a “theme park due to loss of authenticity.” While the group who has been working in the field for less than ten years (30%) have been witnessing changes in the past year, such as a ban on large cruise ships entering the Lagoon, imposing a maximum quota for tourists per day, and possibly adoption of a tourist entry fee in 2022, giving hopes for changes and an improved Venice such as “less crowded,” “better quality of tourists,” “diversity in entrepreneurship beyond tourism field.”
Out of 20 participants, only two believe that Venice authorities focus enough on protecting cultural and historical heritage in coastal cities vulnerable to climate threats. In comparison, 18 participants think there are insufficient actions to protect local cultural heritage in coastal cities that are higher at risk due to their proximity to water. Among suggested solutions, 17 participants agreed that the focus should be on long term planning; 14 believe that tailored solution is essential to each coastal city; 7 agree that better assessments protocols are essential; 14 argue that community involvement and participant is pertinent, 10 recognize that using technology to coordinate mitigation is inevitable; 12 participants share the argument that researching and information sharing is crucial, and only 3 participants consider that the engagement of NGO’s is fundamental (Table 5).

Table 6: Recommended Adaption Measures Selected by the Respondents.
Source: Author

<table>
<thead>
<tr>
<th>Measure</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Time Planning</td>
<td>23%</td>
</tr>
<tr>
<td>Tailored Solutions/Mitigations</td>
<td>19%</td>
</tr>
<tr>
<td>Community Involvement and Participation</td>
<td>18%</td>
</tr>
<tr>
<td>Research and Information Sharing</td>
<td>15%</td>
</tr>
<tr>
<td>Use of Tech to Coordinate Mitigation</td>
<td>12%</td>
</tr>
<tr>
<td>Better Assessments Protocols</td>
<td>9%</td>
</tr>
<tr>
<td>NGO Engagement</td>
<td>4%</td>
</tr>
</tbody>
</table>

When asked to provide examples of proactive actions or policies that local government and primary tourism stakeholders of the coastal communities have adopted to protect the residents' livelihood, participants have listed several cities and the respective initiatives that aim to protect
coastal regions from flooding and raise awareness about the fragility of the shorelines (Table 3). If considered transferable, these initiatives could serve as a model to other coastal cities.

Respondent Q advocates for laws that protect tourism: “Barcelona, for example, bans apartments for tourist use on floors above the first to ensure that it does not become a city inaccessible to the inhabitants in terms of prices. Limit the number of ships entering but start mainly with the stakeholders and create a cohesive and integrated plan of action and work that does not involve only the political parties.”

Respondent M listed a few solutions including: “Encourage tourists to use public transportation to reach Venice instead of using cruise ships. Raise awareness on the environmental and cultural heritage of the city and of the surrounding territory. Encourage slow tourism (an alternative to mass tourism) which spreads out the surrounding territories (e.g., Riviera del Brenta; Treviso; Colli Euganei).”

A majority of the respondents agree that better coastal management at the global level is necessary for sustainable growth and the advancement of tourism. For example, Respondent B believes that it will be beneficial “to work with stakeholders in creating a cohesive and integrated action plan that does not involve only political parties.”

Findings have displayed that the policymaking and experts in charge do not do enough for Venice’s protection. When asked who is responsible for climate change mitigations and predictions, Respondent Q believes that: “whoever is managing the climate mitigation solution is not sufficient.” Respondent N thinks that: “academia should have a more prominent role in formulating strategies and predictions.”

The IPPC contributes to data reporting and making predictions for the future but has marginal capacity to persuade public policies. According to participants, any management
commands undertaken by political organizations are insufficient since a chaotic collection of agencies are leading the plans. For decades, mitigations have been delayed. An example of a delayed flooding barrier is the MOSE system. Unfortunately, the conditions in which MOSE was made are dictated by political proposals causing too many difficulties. Its maintenance is overly expensive, and the delays have caused uncertainty about its efficiency in the long run. If the impact of climate change leads to the rise of oceans and seas for the next 80 years, the “MOSE system will remain a band-aid solution.” It will temporarily protect from some surges, but it will also move the current problems around the Lagoon area and cause others.

The solution does not consist of implementing one mechanical system but applying multiple resources to tackle global warming and other measures to avoid SLR. Respondent E thinks: “climate change is too strong a factor that transcends human, mechanical remedies.”
Table 7: Respondent’s Examples of Adaption Measures Adopted in Other Coastal Cities.
Source: Data Collected from October to December

<table>
<thead>
<tr>
<th>City, Country</th>
<th>Adaptation Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>London, UK</td>
<td>The Thames Barrier</td>
<td>A moveable flood defense located on the River Thames, built to protect the densely populated floodplains to the West from floods associated with exceptionally high tides and storm surges.</td>
</tr>
<tr>
<td>NYC, USA</td>
<td>Oyster-Tecture</td>
<td>A plan to seed oysters in the waters of the Bay Ridge Flats off Brooklyn to recreate a long-lost natural oyster reef protecting the city from rising waters</td>
</tr>
<tr>
<td>Roseto degli Abruzzi, Italy</td>
<td>Walls of rocks</td>
<td>A man-made protection of shoreline protecting from high waters</td>
</tr>
<tr>
<td>Slovenia</td>
<td>Blue Flag beach</td>
<td>One of the world’s most recognized voluntary awards for beaches, marinas, and sustainable boating tourism operators.</td>
</tr>
<tr>
<td>Venice, Italy</td>
<td>MOSE</td>
<td>78 flood barriers that open and close during high tides protecting the Venetian Lagoon and the Lido Island, from the Adriatic Sea during high tides</td>
</tr>
<tr>
<td>Costa da Caparica, Portugal</td>
<td>Artificial coastal protection &amp; Sand nourishment</td>
<td>To minimize losses and stabilize the coastline groins, seawalls were constructed in addition to artificial sand nourishment of the beaches and dunes with 3-million-meter cubes of sand dredged from the navigation channels</td>
</tr>
<tr>
<td>Rotterdam, Netherlands</td>
<td>Construction of ‘flood-proof’ buildings, flood proof public areas, floating communities and ‘building with nature’</td>
<td>This strategy focuses on prevention; storm surge barriers are being optimized, rainwater storage to delay drainage is being created (including green roofs and facades, less paving and more flora in public streets and neighborhoods, water squares and infiltration zones integrated into the infrastructure).</td>
</tr>
<tr>
<td>Barcelona, Spain</td>
<td>RESCCUE Plan&lt;sup&gt;7&lt;/sup&gt;</td>
<td>The underground sewer network is represented by a 1D sewer model while the surface flow is computed using a 2D model. The 2D model reproduces the urban surface topography and is essential to achieve a more realistic simulation of the flow spreading across complex urban surfaces, with results such as flow depths and velocities anywhere in the urban model area.</td>
</tr>
</tbody>
</table>

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<sup>7</sup> The RESCCUE Toolkit includes a set of innovative datasets, methodologies, models, and tools to analyze urban resilience based on a multisectoral approach. These tools will help cities with their climate change resilience strategy and will also improve their current capacity to cope with emergencies. The plan for Barcelona is available at: [https://toolkit.resccue.eu/wp-content/uploads/2020/11/Barcelona-Resilience-Action-Plan_Toolkit.pdf](https://toolkit.resccue.eu/wp-content/uploads/2020/11/Barcelona-Resilience-Action-Plan_Toolkit.pdf)
The Oyster-Tecture project in New York aims to seed oysters in the waters of the Bay Ridge Flats off Brooklyn to recreate a long-lost natural oyster reef. Oyster beds act as a natural filtration system and could clean millions of liters of harbor water each day — a single oyster can filter 3 liters of water an hour.

The Thames Barrier in London is a moveable flood defense located on the River Thames, downstream of central London in the United Kingdom. Spanning a cross-section of the river 520 meters wide, the barrier is the second most extended movable flood barrier globally, after the Netherlands' Oosterscheldekering (Eastern Scheldt storm surge barrier). Since 1982, the Thames Barrier was built to protect the densely populated floodplains to the west from floods associated with exceptionally high tides and storm surges.

Blue Flag certification is one of the world's most recognized voluntary awards for beaches, marinas, and sustainable boating tourism operators, contributing to the Sustainable Development Goals. To qualify for the Blue Flag certification, a series of stringent environmental, educational, safety, and accessibility criteria must be met and maintained. Central to the ideals of the Blue Flag program is the aim of connecting the public with their surroundings and encouraging them to learn more about their environment.

Barcelona, alongside Lisbon and Bristol is one of the three cities implementing RESCCUE toolkit – the Resilience Plan to Climate Change. While all three cities have adopted different strategies, Barcelona used the 1D/2D model approach. In 1D/2D USMs, the underground sewer network is represented by a 1D sewer model, while the surface flow is computed using a 2D model. The 2D model reproduces the urban surface topography and is essential to achieve a more realistic simulation of the flow spreading across complex urban surfaces, with results such as flow depths and velocities anywhere in the urban model area (Henonin et al., 2013).
4.5 Tourism Demand Shift

When asked where the demand shift for tourism will evolve if coastal areas become inevitably affected by climate threats and flooding, participants believe that the tourism industry will shift inland towards small villages and rural areas, mountainous areas, or other coastal areas less affected by SLR several miles away from the coast. Some also suggested that demand will most likely be related to culinary (food & wine) tourism. One participant considers that the demand will likely be a double-edged sword, meaning, on the one hand, tourism will move towards safer areas (higher ground and protected zones). On the other hand, a smaller subgroup will be attracted by disaster tourism where flooded cities and landscapes become attractions themselves. However, the shift depends on what policy strategies will be used, how adaptive strategies will be implemented, and what areas will be safe to visit in terms of infrastructures and environmental protection.

The Covid-19 pandemic was a good example of analyzing the direction of tourism during a global crisis. Tourism shifted quickly from urban areas to the countryside in the pandemic, introducing a new concept called ‘proximity tourism.’ Proximity tourism is specifically authentic for Europe, where culturally and historically rich regions are adjacent. Following the outbreak of the pandemic with confinement restrictions worldwide and a new awareness of the impact of travel on environmental sustainability in terms of carbon emissions and destination resources, proximity tourism gained new light as a feasible alternative for tourism consumers (Salmela et al., 2021).

Thus, there will be a shift in destinations, nevertheless those who have the means and affordability of traveling will continue to do so. It highly depends on the supply. If the supply has anticipated generating new products and experiences that are appealing to demand (probably a
different one) and urban planning and marketing are adjusting, there will be less interest in the previous one. In conclusion, all stakeholders must act together.

4.6 Re-Thinking Tourism Concept

Most participants agreed that re-thinking tourism is a fundamental concept for advancing sustainability. After the COVID pandemic, it became clear that a tourism reset must be done. The global disruption has brought several positive effects on the climate and the environment. Due to movement restrictions and a slowdown of social and economic activities, air quality has improved in many cities, reducing water pollution and greenhouse gas emissions. Findings show that it is essential not to perpetuate old behaviors and activities based on mere financial considerations but instead to focus on long-term strategies that make the destination attractive in the long run and do not damage the inhabitants’ quality of life.

Cultural heritage plays a critical element in the way we re-think tourism. It cannot be preserved without the involvement of local communities, who live in coastal areas and contribute to the maintenance, preservation, and sensible use of local resources and promotes environmental conservation initiatives. That, in turn, advances sustainable development of tourism, as seen by Kebete (2022) in Figure 15, which recognizes that cultural tourism projects need to be developed to appeal to the tourist. This can be achieved by getting community members involved and enhancing the authentic presentation of the community’s unique cultural heritage.
Until recently, host communities have been often excluded from involvement in the development of the territory and from the economic interests of individuals who exploit the territory (with natural resources) for their benefit (Singh et al., 2003). Hence Respondent F affirms: “As tourism is a fickle/variable industry (witnessing COVID impacts), communities have the prime rights to the area and resources they live on.”

Traditionally, tourism is seen as fun, games, and recreational leisure that brings profits to the receiving communities (Davidson, 2012). However, protecting a destination’s cultural and historical patrimony goes beyond the financial use. This approach should no longer be assumed as the only possible response to sustainable destination management. Re-thinking tourism could prevent conflicts between beneficiaries and host communities, particularly concerning overtourism phenomena (preventing tourist monoculture on the one hand and the consequent depopulation on the other hand) in areas like North Adriatic in Italy. Tourism brings people from other areas into
the community. Without local engagement, there should not be any development. It is the main solution, allowing future generations to enjoy these historic and culturally rich places without losing the national heritage. According to Respondent H: “Re-thinking tourism is a no-brainer. Destinations need to reinvent themselves, pivoting on identity.” Meanwhile, two participants believe that re-thinking tourism is moderately important issue, and it is a much bigger concern beyond tourism that must be analyzed at the global scale.

4.7 Coastal Management and Marine Tourism

The influx of international visitors leaves a heavy toll on the host community. Respondents feel that annually there are too many visitors in the Venice region and that the quality of life, and the quality of the experience has deteriorated excessively. Findings show that the flow of international visitors, especially tourists who arrive with large cruise ships, crowd the city, leaving an overwhelming feeling for locals and visitors; contribute to the environmental degradation and damages the destination by offering short-term financial support instead of long-term sustainable support. The social and economic impacts are far more harmful than beneficial to the receiving community.

Respondent F argues that: “Sudden influxes of tourists make navigation of central Venice difficult and frustrating. Tourism has also crowded out the variety of types of shops that residents need (e.g., hardware stores) and marginalized medical facilities. Rents have increased because of the short-term rental availability (e.g., Airbnb, Booking.com etc.) and the promotion of monoculture of tourism related jobs.”
Respondent I believes that the impact of large cruise ships in Venice: “It certainly brings economic profits but climatic and environmental losses.” Other participants equally agreed that short-term tourism brings temporary monetary profits, but cruise ships damage the natural environment of the Lagoon on the long-term.

Respondent K states: "Loss. Cruise ships bring hardly any added value to destinations. The highest revenue for the destination is in accommodation - cruise ship tourists sleep on the ships, eat there and often have their own tour guides. So, at the end of the day the only added value is a few stops at souvenir shops and museum entrance fees. Maybe a coffee here and there. Additionally, they cause massive damage to maritime life and to the architecture of the city which creates massive costs."

Respondent F believes: “Financial profit comes into operators catering for cruise ship tourists - but these are often not Venetian operations. Loss is considerable in quality of life and cost of living of residents and in terms of quality of experience of tourists. Structural damage to the city and its waterways is also a major factor.”

Respondent E argues: “Cruise ships should be banned in Venice. It doesn't need the volume of visitors, who add very little financial or social benefit to the city.” In synchrony, participants agreed that policy implementation for marine tourism regulations, particularly the access of large cruise ships into the Lagoon, is fundamental for controlling mass tourism and slowing down the adverse side effects of environmental degradation.
4.8 Out-Migration Measures

While the Venice region is fighting with the pressing issues related to SLR, climate challenges and socio-economic sustainability, residents are fleeing the historic city. The frequency of floods, the pressure of tourists, the high price of property, and the opportunities created by extending the hospitality industry into private homes are all contributing to the migration.

Census data show a significant increase in tourism from 2003 to 2019, except for 2020, when tourists number decreased due to the COVID-19 pandemic (Fig.16). The pre-pandemic tourist-resident ratio in Venice was 69:1. In contrast, data on out-migration show a significant decrease in the Venice population during the years 2011-2021, leading to the conclusion that there is a correlation between the increase of tourists and Venice population decline. Approximately 258,325 residents in the Venice region (World Population Review, 2022), barely a third of the population over the past sixty years (Fig.17). Previous research by Bertocchi and Visentin (2019, p.10) shows that possible reasons and motivations that pushed residents from the historic center of Venice included: (1) lack of services for residents (shops, groceries, cinema, hairdresser); (2) too many tourists; (3) life has become too expensive; (4) Venice is itself inconvenient; (5) lack of jobs; (6) possibility to rent out their house; and (7) personal reasons. To manage the tourist arrivals and lessen the impact on the coastal community, in 2011, a tourist tax was introduced in Venice to let tourists who spend the night contribute to the cost of the city’s maintenance. In 2021, the Italian government announced the ban on large cruise ships entering the Venetian Lagoon (Buckley, 2021) and the implementation of a day-trippers’ entrance fee to the city in works by the end of 2022. However, the policy implementation is slow, and post-pandemic tourism is booming in the coastal regions, increasing the number of visitors to the pre-pandemic years. The research calls for
urgent action and law implementation faster than previously managed to meet the Venice region’s sustainability and avoid more residents depopulating the historic city.

Venice continues to lose residents, and the loss is about three inhabitants a day since the beginning of 2021. COVID and mortality among the aged have contributed to the decline, but the diminishing of the residents is now a fact that has progressed for many years, without an indication of the trend reversing. The pandemic has intensified the crisis of the Italian system, but in Venice, it is felt even more because there is little else beyond the tourism industry.

Figure 16: Number of Tourist Arrivals in the Italian Municipality of Venice from 2003 to 2020. Source: STATISTA (2021)
Figure 17: Venice Region Residential Population from 2011 to 2022. Source: World Population Review. Available at: https://worldpopulationreview.com/world-cities/venice-population

Figure 17 endorses that from 2011 to 2022, a significant decrease in residents has been registered. Furthermore, Figure 18 shows a population decline since 2001. At the current moment the population growth rate in the Venice region is - 0.11%.
The majority (78%) of participants in this research agree that Venice could experience climate-driven human migration in the foreseeing future. Previous census data shows that population decline has been a phenomenon that started before the pandemic when the tourism industry was still blooming. The findings lead to the discussion that residents leave the city due to unlivable conditions created by mass tourism, increase in housing, rise in rent, and the monoculture of the tourism sector as the main economy.

The designation of Venice as a World Heritage site has immensely increased the attraction of the historical city, whereas inexpensive mass transportation and the diversification and growth of tourist accommodation and short-term rentals in the historic center have triggered a massive influx of people that the fabric of this fragile city is unable to absorb. If one owns a house or an apartment in Venice, renting it to tourist is simply too profitable, in comparison to living in it, and more financial resources will be needed for its very costly maintenance.
Figure 19: The Demographic Trend of the Resident Population in the Municipality of Venice from 2001 to 2020. Source: Graphs and statistics on ISTAT data as of 31 December of each year.

Figure 20: Population Movement and Calculation in 2021. Source: Adapted from Municipality of Venice - Electoral Service and Military Leverage, Statistics on Municipal Registry Data (2021)

Based on Figure 20, from October 2021 to November 2021, there were about 62 residents who migrated from the historic center of Venice, 51 migrated from the Estuary, and 44 individuals arrived in the mainland. The city of Venice has estimated the population forecast for the following six years, and the results show a slight decrease in the number of residents each year (Figure 21). The forecast of immigrants is based on projections constructed on the historical series of incoming migratory flows 2014-2028.
4.9 Policy Response

Local authorities in Venice, Italy, are aware of the critical issues affecting Venice. The fragility of the city was brought to national attention after the first highest flooding in 1966 and second highest flooding in 2019. In 1973 the Italian Parliament passed the Law called *Special Law for Venice* (State Printing Service and Mint, 1973). Article 1 (1) of the Law established “the safety of Venice and of its Lagoon is declared a problem of the highest national interest”. The Law also allocated money for public works and aid for Venice residents. However, for the Law to be effective, it needs to be refinanced by Parliament every year, and the funds earmarked for the Law have been subject to a major reduction in the past decades (Municipality of Venice, 2008).

The measures of the Special Law and of similar legislative instruments are aimed at stopping or limiting the depopulation of Venice by granting financial aid to residents and offering support to local undertakings so that they can provide residents with local jobs. Other policies and proposals support to limit the influx of visitors to the city, both to ensure safety and to ease the pressure on residents (Casagrande, 2015). A ban on large cruise ships has come to represent the
struggle to prevent tourism from monopolizing the Venetian economy. A limit on short-term rentals and a landing tax on day-trippers and visitors (tassa di sbarco) are the two most recent policy additions due to residents’ dissatisfaction and protest for the unlimited and uncontrolled flood of tourists.

The management of tourist flows in Venice cannot ignore two fundamental aspects: through booking system and acquisition of a City Pass\textsuperscript{8} card. Booking is essential because only through it the city officials can plan ahead and manage tourist flows, while the City Pass constitutes the tool for control and provides priorities and rights to tourists who book ahead of time.

Limiting the monoculture of tourism to give residents a wider choice of jobs ensures the provision of services targeted at residents and safeguarding the city’s historical and cultural heritage beyond the scope of its utility for tourism. Venice was for centuries a great maritime, colonial, and commercial power. Its economy is thus a pillar of its heritage, not just the other way around (Casagrande, 2015).

\textsuperscript{8} More information on the City Pass card available at: \url{https://www.veneziaunica.it/en/content/how-it-works}
Chapter 5: Conclusion

The purpose of this research was to examine how the current adaptation measures, or the lack thereof contribute to the long-term future for Venice. Essentially, this research sought to understand if policymaking experts are doing enough to protect a UNESCO world heritage site from flooding; risking the loss of cultural heritage either by the SLR or population decline due to tourists exceeding Venice’s carrying capacity. This chapter discusses a summary of the findings, followed by implications, limitations, future suggestions and lastly lessons learned.

5.1 Summary

“Venice is very fragile, it is fragile because it is built on water, and it is fragile in its social composition, due to the exodus of the resident population. It is also fragile because of its delicate artistic heritage” (Tattara in Fabbri et al., p.196, 2020).

To summarize, there are two factors to consider when it comes to analyzing the future of Venice: (i) flooding from SLR; and (ii) residents fleeing the city due to mass tourism exceeding city’ carrying capacity. Since the first major flood in Venice in 1966, the city has gained national and international media attention, becoming a UNESCO world heritage site in 1987 in recognition of its unique historical, archaeological, urban, and artistic heritage and unique cultural traditions, integrated into an extraordinary natural landscape. An electromechanics system has been in the works for more than 20 years to protect Venice Lagoon from flooding and avoiding catastrophic events. Other local agencies that have advanced solutions include local agencies (e.g., the Venice Water Authority; the Venice Municipality-Tidal Forecasting and Early Warning Center, the Consortium for Coordination of Research Activities Concerning the Venice Lagoon System [Co.Ri.La.], the National research Council-Venice Office, and Centro Internazioanle Città d’Acqua). According to IPCC, low lying coastal areas could face a SLR between 30 cm (0.95 ft)
and 1.1 m (3.6 ft) by the end of this century (IPCC, 2001, 2007, 2014). These are the grimmest SLR projections ever made by IPCC, and it is evident that for a city situated only 80 cm above the mean sea level, an increase in water up to 1 m (3 feet) would be disastrous. Plag (2008), predicts a scenario of water rise up to 1.35 m (4.5 ft) in 2100. Therefore, it is of utmost importance to see how the city can be safeguarded against this global threat. The environmental, socio-cultural, and economic concerns will undoubtedly begin to feed into the changing nature of tourism as a business activity as consumers recognize how vital climate change and environmental risks are associated with global warming.

Venice is inundated with tourists and surrounded by water. The historic city is one of the most regarded tourist places globally, and in recent years tourism has grown exponentially. Despite the COVID-19 travel suspension, tourism seems to be returning to the pre-pandemic times gradually. Venice attracts the same number of tourists as London (approximately 20 million visitors for 8.9 million residents pre-COVID), despite being a historic center made up of approximately 50,000 inhabitants. Tourists from Brazil, India, and China for example move more frequently than ever. The offer of accommodation in Venice is, in fact, limited and expensive, and with the increase of tourists, those who visit the city during the day have increased more than proportionally. In recent decades Venice had experiencing a convergence of political interests that have led to the exploitation of the city with a short-term perspective, which is in opposition with the theory on sustainable tourism, as requested by UNESCO to protect the heritage of humanity (World Tourism Organization, 1998, p.21).

Findings show that tourism should not be seen primarily as an economic factor but also as the socio-cultural and environmental factor contributing to the advancement of climate actions and activities. Tourism is a force for good and ensuring that residents, habitats, wildlife benefit from
tourists’ presence are an integral part of that. Stakeholders, researchers of tourism, and climate policy actors should find ways to make the destination a better place to live in and visit, protecting the city’s residents in the long term.

Planning early for tourism development can prevent destruction of infrastructure and expensive mistakes, avoiding the gradual deterioration of environmental assets significant to tourism. Planning and implementing multiple adaption options require complex decision-making and novel approaches to coastal resource management (Few, Brown, and Tompkins, 2007). Significant legal, institutional, financial, and organizational barriers must be addressed (IPCC 2007a; EC 2009a). Because adaptation responses strongly depend on specific local geographical, climatic, and socioeconomic characteristics of coastal regions (IPCC 2007a), sound scientific, technical, and resource management knowledge needs to be tailor-made at the local level. Traditional coastal defense strategies (i.e., building defense infrastructure) can no longer be assumed as the only possible response in coastal areas increasingly at risk due to SLR (Kundzewicz 2002; Few, Brown, and Tompkins 2007). Scientists and practitioners alike conclude that a balanced mix of non-structural (e.g., enhancement of the flood warning system, legislations, policy, regulations, management and planning instruments) and structural (e.g., improvement of the stormwater network through sea walls, dikes, dams, storm surge barriers, diversions and beach nourishment, salt-marsh protection and reconstruction) measures based on scientific knowledge is crucial to maintain ecological, economic, and social coastal functions developing long-term adaptation strategies to reduce the flood risk for current and future climatic conditions (Munaretto et al., 2012). For the historical Venetian city, the interventions achieved in Venice (e.g., the elevation of the urban center, alarms in real-time, etc.) and the barrier islands, such as nourishment and restoration of seawalls, have worked well. Regarding adaptation measures to flooding and
SLR, today's debates are related to the MOSE system. The discussion is absent about the future of the barrier islands (in Lido and Pellestrina) and the economic, environmental, and socio-cultural vulnerabilities that Venice may face by 2100 in light of a 50–100 cm rise in sea level. In short, Venice has over-relied on the prominent experimental infrastructure alternative and has failed to incorporate long-term adaptive management solutions. To effectively implement adaptive mechanism, it must overcome its institutional fragmentation constraints and involve community members in decision making and preservation of infrastructure.

5.2 Theoretical Implications

Findings indicate that additional attention needs to be placed on identifying and testing new sustainability frameworks for managing global movements. Therefore, proposing additional variables to the conceptual framework where socio-cultural and economic factors are included in addition to the pre-existing environmental impact sequence in tourism (proposed by OECD in 1980) offers a holistic method to the issue of safeguarding the city’s historical and cultural heritage beyond the scope of its utility for tourism, in addition to resident’s livelihoods.

The addition of socio-cultural and economic impact to the conceptual framework analyzing the environmental impact in a coastal city with reliance on tourism proves that adaptation and multidisciplinary research are needed to develop a durable coastal city. Examining the case of Venice from the socio-cultural cohesion resulted in long term impacts such as resident’s out-migration from the historic center to the mainland or other regions, ‘touristification’ due to a more significant amount of tourists exceeding the city’s carrying capacity, and concerns on how to protect the cultural heritage of a nominated UNESCO world heritage site in the long run. From the economic impact, exploring the city of Venice led to an investigation of how Venice could benefit from the exceptional demand for tourism in a sustainable matter. The results developed concepts
such as ‘re-thinking tourism’ and ‘demand shift for tourism,’ shifting attention on ‘proximity tourism’ and ‘slow tourism.’

While proximity tourism focuses on culturally and geographically adjacent cities, slow tourism is an approach to travel that emphasizes connection to local people, culture, foods, and music. It refers to a trip that is meant to educate while remaining sustainable for the local community and the environment. Promoting activities that empower the local community and support groundbreaking strategies is the foundation of sustainability in tourism. As people become more empowered in the decision-making process, they become more involved in the entrepreneurial side of development, and their level of stewardship increases.

Coastal cities with similar tourism concepts are categorized as vulnerable to sea-level rise, and depopulation could use the proposed advanced framework to investigate what aspects should be protected and where attention should be focused next. Developing coastal tourism that will maximize the benefits to tourists and lessen the environmental and socio-cultural impacts for locals is vital to longevity and coastal resilience. There is the need to promote such concepts to secure the destination’s well-being through effective planning, skills development, proper implementations, controlled monitoring, thinking of long-term policy frameworks, and lateral vision.
Table 8: Conceptual Framework After Coding Data.
Source: Author

<table>
<thead>
<tr>
<th>Relevant Literature</th>
<th>Conceptual Framework</th>
<th>Associated Research Questions</th>
<th>Coded Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbognin, et.al., 2010; IPCC 2001, 2007, 2014; Russo 2002; Settis, 2016.Van der Borg, Costa, Gotti 1966.</td>
<td><strong>Stage A (Stressor Activities)</strong></td>
<td>What deliberate changes are made to manage climate change stressors and mass tourism activities in Venice?</td>
<td>Coastal Management Solutions (MOSE system; A ban on large cruise ships entering the Lagoon)</td>
</tr>
<tr>
<td>Brambati et al. 2003; Carbognin et al. 1995, 2004, 2010; Gatto and Carbognin 1981; Co.Ri.La, 1999; Few et al., 2007; Nicholls and Klein 2005; Munaretto et al., 2012; Nelson, 2021; Tosi et al., 2002, 2010; Teatini et al., 2010; Vianello, 2021</td>
<td><strong>Stage B (Environmental stressor)</strong></td>
<td>Who currently manages climate change mitigation strategies and predictions? Is this working?</td>
<td>Policy Making Experts (i.e., IPCC, Inter-ministerial Coordinating Committee; Interregional Superintendence of Public Works, former Water Authority of Venice)</td>
</tr>
<tr>
<td>Antonioli et al.,2017; Carbognin et al., 2010; Co.Ri.La 1999; Plag, 2008; Vellinga et al., 2010</td>
<td>What is SLR projections for Venice region by 2100?</td>
<td>Coastal Management Solutions</td>
<td></td>
</tr>
<tr>
<td>Costa &amp; Van Der Borg, 1988; Russo, 2002; Kundzewicz, 2002; Vianello, 2016, Umgiesser, 2020;</td>
<td>What adaptation measures have been implemented to save Venice?</td>
<td>Structural Protection Measures (sea walk, dams, storm surge barriers, beach nourishment, salt-marshes protection, and reconstruction i.e., MOSE) Non-Structural Protection Measures (legislations, policy regulation, planning instruments, campaigns i.e., #enjoyrespectvenezia; ban of large cruise ships)</td>
<td></td>
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<tr>
<td>Brambati et al. 2003; Carbognin et al. 1995, 2004, 2010; Gatto &amp; Carbognin 1981; Tosi</td>
<td><strong>Stage C (Socio-Cultural stressor)</strong></td>
<td>What is the Venice resident’s migration prediction and resettlement?</td>
<td>Out-Migration (Long Term Impacts)</td>
</tr>
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</table>

| Casagrande, 2016; Jaafar et al., 2015; Jimura, 2011; Kebete, 2022; Russo & Van Der Borg, 2002; Mbaiwa, 2005. | How are stakeholders involved in the current efforts to stabilize Venice’s future? | Heritage Tourism |
| Bertocchi and Visentin, 2019; Dodds and Butler 2019; Tapper, 2017; UNWTO, 2018. Settis, 2016; Davis 2004; Sharma, 2004 | How has ever-increasing tourists influenced Venice? | Overtourism |
| ButlHer, 1993; Weaver & Lawton 2002 | **Stage D (Economic Stressor)** | How important is the concept of re-think tourism in coastal areas to encourage land protection and cultural heritage preservation? | Re-thinking tourism concept |
| Canestrelli & Costa, 1991 | If sea level continues to rise, what will happen to tourism? | Demand shift for tourism |
| Becken & Clapcott, 2011; Dubois et al. 2011; Pentelow & Scott 2011; Peeters & Eijgelaar 2014. Sauer, 2021. | What policy implementations measures have key tourism stakeholders adopted? | Policy Response (i.e., ban on tourists landing and a city entrance fee for day trippers) |

(table 8 cont.)
5.3 Practical Implications

Analyzing the issue of flooding (SLR) and fleeing (out-migration) from an environment, socio-cultural and economic perspective allows for a broad analysis of the missing policy regulation and better destination management. This method could be useful in the following ways:

Findings show that attention needs to be given to both sides of the environment (SLR) and out-migration nexus: identifying adaptations strategies that allow people to remain where they currently live and work. Additionally, identifying rethinking tourism strategies that protect residents’ livelihoods while also welcoming tourists. A high priority should be given to policy plans and programs to manage these two issues and make Venice more competitive in other productive sectors but tourism and shifting global and local attention from tourism exclusively to the reactivation of other urban ecosystems, services (use of technology and remote work), and use of textile and furniture industries, ensuring a sustainable alternative to mass tourism.

The involvement of communities and grassroots organizations allows for developing solutions that create a sustainable relationship between the host community and the visitors. Investing in adaptation measures for the long term encourages policymaking experts to educate residents of coastal communities on how to adapt to the new reality and what sacrifices it takes for Venice to remain a protected cultural site as once seen in history.

Reactive structural protection measures are necessary, as the implementation of storm surge barriers at the local level, but proactive non-structural protective measures such as policy regulations and legislation at the macro scale level are also required. Suggested SLR solutions include artificial land building and injecting water into the underground.
5.4 Limitations

The results of the present research are based on several data collection strategies and information resources offering advantages and disadvantages. One of the advantages was that developing and distributing a web survey allowed the researcher to reach out to a greater number of participants in a shorter period without the extensive travel. An internet-based participatory process can open locations that have the technology, but where travel is not easy (i.e., COVID pandemic) or affordable (Kelman, 2021). One of the disadvantages was that the researcher could not follow up with clarifications for questions that were answered vaguely or asking participants to elaborate on their initial answers.

Other limitations include providing correct definitions about Venice Municipality and Venice historic city. Throughout the literature, peer reviewed journal authors often fail to distinguish between the Municipality of Venice and Venice, the historic city. The Municipality of Venice covers an area of about 415 square kilometers. It is articulated around the two separate centers of Mestre, in the hinterland, and Venice, at the center of the Lagoon, a territory inserted in the UNESCO Site Venice and its Lagoon upon the act of its registration in 1987. The municipality is divided into six districts (Municipalità), two of which are made up solely of islands (Venice and the Lido), which together contain approximately 264,919 people.

The Venice Lagoon contains hundreds of islands, but it is the archipelago of the historic city of Venice (hereafter Centro storico or Venice) and is the most popular attraction area for tourists. The city of Venice had approximately 50,000 residents in 2021. While both numbers are reported correctly, it is essential to distinguish between the historic city of Venice and the Municipality of Venice for the purpose of transparency.
Additional limitations include lack of participation from local authorities and policymaking experts. No answers could be collected from the mayor of Venice, Luigi Brugnano, nor Venetian municipal government agents that were invited to take the survey.

5.5 Policy Recommendations

Based on the review of responses from experts and participants, some patterns were more generalized. The researcher was able to extract key words which were used in parallel with the literature review that resulted in recommendation policy presented in this section.

Investment is necessary to strengthen climate monitoring networks in areas where the tourism sector is vital to local economies, to improve climate risk management and climate change adaption in the tourism sector (Scott & Lemieux, 2010). Since 2002 a significant portion of government funding allocated to Venice has been distributed on building the MOSE flooding system. The delayed manufacturing of the system and costly maintenance have slowed down the dredging and repair of canals. Based on the findings, the researcher suggests implementing a climate finance policy restructuring and objectively allocating climate finance towards the water and waste-water system, maintaining historic buildings and other cross-sectoral land use, implementing the tourist entrance fee to the city; and upgrading the public transportation system with the use of taxes received from the large cruise ships and boats entering the Lagoon.

Past knowledge of climate change allows current and future predictions about Venice's viability by 2100. Research shows that we have access to sufficient information predicting the future of coastal cities if immediate adaption strategies are not taken seriously. Policy-making stakeholders and local authorities have taken longer to implement solutions, allowing more catastrophic events to occur, such as the second highest flooding in Venice on November 12, 2019. The policy recommendation includes taking urgent actions and establishing a joint international
rescue initiative with the support of multidisciplinary research both in home markets [push factor] and destinations [pull factors]\(^9\) in the different travel decision-making framework through education, research, and innovation. In this context, home market refers to one’s place of origins and destination, the place one visits.

Educating the next generation of tourism professionals to utilize climate information to reduce climate risks and adapt to climate change in the decades ahead is a priority, and it is essential for tourism and hospitality program around the world to incorporate climate risk management training into curriculum. The recommendation also includes educating visitors while exploring a UNESCO world heritage site on the preservation and fragility of the destination. In the case of Venice, the quantity of visitors is just as important as the quality of visitors.

Mitigation policies are typically studied with international macro-economic models and implemented through large-scale tax-quota schemes. On the contrary, adaptation policies often take the form of project-based activities with local, site-specific relevance. The latter is identified as an ideal scenario for Venice where adaptations measures are needed at the destination level. Consequently, the usual approach to adaptation has a microeconomic perspective. Reconciling the two views is problematic but at the same time necessary. Bosello et al. (2010) suggest that the interaction between adaptation and mitigation must be analyzed with a macroeconomic angle to derive strategic long-term policy insights.

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\(^9\) Push and pull factors refer to tourist’s motivations for travelling to a particular destination Crompton explains that there are 7 push factors including escape from a perceived mundane environment, exploration and evaluation of self, relaxation, prestige, regression, enhancement of kinship relationships and facilitation of social interaction, and 2 pull factors which are novelty and education (Crompton, 1979).
5.6 The Coastal Equilibrium Model

As a result of this research, a coastal destination equilibrium model is presented. My model incorporates Butler’s Tourism Area Life Cycle (TALC) Model and contemporary adaptation measures to assess a coastal city’s stages or threats of involvement. According to Butler (1980), the final stage of a destination lifecycle indicates either decline or rejuvenation. The following actions are necessary to find an equilibrium between decline and rejuvenation:

Stage I: Criteria to identify coastal city threats

Stage II: Action steps for awareness

Stage III: Solutions: policy adoption and implementation

Table 9: Coastal Equilibrium Model.
Source: Author

<table>
<thead>
<tr>
<th>Stages:</th>
<th>Stage Description:</th>
</tr>
</thead>
</table>
| I Criteria to identify coastal city threats: | – Vulnerable to climate threats  
– Depopulation (due to touristification)  
– Loss of unique assets (cultural and historical patrimony)  
– Apathy from the local community and residents |
| II Actions steps for awareness:   | – Substantial advertisement initiatives both in-home markets [push factor] and destinations market [pull factors]  
– Willingness to diversify tourism monoculture  
– Promote proximity tourism (in my backyard tourism)  
– Adopt slow tourism |
| III Solutions: policy adoption and implementation | – Utilize climate information and incorporate climate risk management training into the school curriculum  
– Educate visitors on the preservation and fragility of the destination  
– Upgrade the local public transportation system and encourage the use of public versus private  
– Adopt long-term planning adaptive measures  
– Objectively allocating climate finance towards adaptation strategies |
The model could be applied to coastal cities that rely on tourism as one of the primary sources of the economy. Some specific examples of countries highly dependent upon tourism include Fiji (travel and tourism total contribution to GDP equal to 35.7%) and Vanuatu (50.6%) in the South Pacific Ocean, but also Macau (92.8%) in South-East Asia, Maldives (48.7%) in the Indian Ocean, and Bahamas (47.2%) and Aruba (82.8%) in the Caribbean region (Marsiglio, 2017).

5.7 Future Research

It has been pointed out how cultural heritage tourism is a means of providing economic benefits to the communities through sustainable development and community empowerment (Breenm 2007; Jimura, 2011). However, there is insufficient research examining how heritage tourism supplements economic, socio-cultural, and environmental settings of tourist destinations (Kebete, 2022). This research has highlighted that the case of Venice offers insights on what the future could possibly look like for Venice by 2100, and offer as an example for other coastal cities that share similar characteristics and settings, where climate change poses a significant threat to the environment and tourism economy (i.e., Alexandria, Egypt; Amsterdam Netherlands; Bangkok Thailand; Charleston, South Carolina; Dhaka, Bangladesh; Houston Texas; Jakarta Indonesia; Lagos Nigeria; Miami, Florida; New Orleans, Louisiana). The scope illustrates common themes emerging in the coastal cities, existing challenges, managing solutions and actual measures being taken to mitigate impacts), increased regulations, tailor-made solutions, and policy frameworks.

Investing in climate finance presents an opportunity for coastal cities to advance on the agenda for sustainable development goals (SDG) and a “push” at the national level for countries to meet and exceed their climate action plans achieving alignment with Paris Agreement. Even though adaptation was a key pillar for the Paris Agreement, very little climate finance has been
invested in adaption measures. According to Puri (2021) a total of US $580 billion was invested in climate funding in 2017-2018, and for every US $18 of climate finance invested in mitigation efforts, only US $1 has been invested in adaptation efforts to date. While climate mitigation initiatives focus on making the impacts of climate change less severe by preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere, climate adaptation means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the damage they can cause or taking advantage of opportunities that may arise. In essence, adaptation can be understood as the process of adjusting to the current and future effects of climate change. This gap in climate finance could be considered an opportunity for the government to incentivize investment in climate adaptation projects and respond to coastal cities effectively and be better prepared for future climatic events.

5.8 Lessons Learned

Environment policies that aim to reduce climate change and its impacts will also influence the development of coastal tourism. Induced by economics and policies, these effects may be the result of rising costs, lower wages, higher unemployment rates, and restrictions in transport, heating, or others (Lockwood & Medlik, 2003).

In the case of Venice, adaptation measures are an urgent necessity at the destination level. If Venice now attracts a massive number of tourists, an increase in flooding and precipitation (as predicted earlier 250 times a year) may turn into a tourist boomerang effect, with reduced demand to visit the city due to climate events. Adaptation will be expensive, and policymakers will have to demand climate financial aid to delay catastrophic events. Therefore, planning allocating equal climate money to adaptation measures as much as is done to mitigation measures are relevant for the sustainable development of the city.
Tourism can adapt if the cultural value of sites remains preserved by residents and local inhabitants. Re-thinking tourism campaigns allow the opportunity to move coastal tourism to inland tourism and enhance regional and mountain areas by promoting local customs and traditions. Tourism proved to be flexible and adaptable if we preserve the heritage of places. Excessive tourism in Venice should not be considered as an opportunity with a long-term vision capable of transforming tourism from a source of conflict to the pillar of the economy of a living city.

The world of scientific research is fundamental, as support to reliably elaborate the forecast models relating to the various phenomena. It is necessary to involve the experts of the various municipality sectors, forming a working group that can then filter the contents of the plan in the daily administrative action. The plan's outcomes could be implemented and monitored daily. The final goal is the identification of concrete actions that can be carried out in certain times to reduce Venice's vulnerability to the impact due to climate change and to increase the knowledge and awareness of the problem of overtourism on the part of local administrators, i.e., those who, in the daily government activities, determine the possibility of a city to make itself less vulnerable to flooding and outmigration.
References


Annuario del Turismo (2019) Comune di Venezia, Assessorato al turismo: Available at: https://www.comune.venezia.it/sites/comune.venezia.it/files/immagini/Turismo/Adt19%20ing%20over%204%201%2021%2081%29.pdf


Gugliuzzo, E. (2017). The “Serenissima” at hazard: the Historical Phenomenon of Acqua Alta in


Itzkowitz, L. (2021 April 9) Can Venice prevent a overtourism replay post pandemic. *Afar*


Kebete, Y. (2022). Heritage tourism as a driver of socio-economic development and implications for sustainable tourism: Dropped from previous research works. Academic Letters, Article 4785


La Biennale di Venezia, (2021) Available at: https://www.labiennale.org/en


Masters, F. (2019, November 14). *Venice has its worst flood in 53 years*. *Scientific American*.


Povoledo (November 13, 2019) Venice flooding brings city to its knees. *New York Times*


Tung, A. M. (2001). *Preserving the world's great cities: the destruction and renewal of the historic metropolis*.


Appendices

Appendix A: IRB Letter

THE UNIVERSITY of NEW ORLEANS
INSTITUTIONAL REVIEW BOARD

Memorandum

Principal Investigator: Bethany Stich
Co-Principal Investigator: Monica Farris
Co-Principal Investigator: Nina Balan
Date: March 27, 2022
Protocol Title: Climate Change And Urban Tourism: Preservation Strategies and Destination Management Policies In Coastal Cities: The Case Of Venice
IRB Number: 04Jul21
First Approval Date: July 9, 2021

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has deemed that the requested modification of the research and procedures of the above-named protocol is compliant with the University of New Orleans and federal guidelines and meets the standard for being exempt from further IRB review.

Researchers maintain the responsibility for ethical research practices in exempt research. Any additional changes to the procedures or protocols that change the eligibility of the study for exemption must be reviewed and approved by the IRB prior to implementation.

I wish you much success with your research project. If you have any questions, please do not hesitate to contact me at 280-7481.

Sincerely,

Roberto Refinetti, PhD
IRB Chair
Appendix B: Survey Instrument

Introductory questions:

1. Are you interested in participating in this multi-round Delphi study?
   - Yes/No

2. Please provide your information below. The data will be used only to identify participants for round two of the survey.
   
   Name:
   Email:
   Organization:

3. Which of the following best represents your field?
   - Academia/Scholar
   - National Tourism Organization
   - Tour Operator/Travel Agency
   - Tourism/Destination marketing agency
   - Cruise Company
   - Hotel Company
   - Other

4. In what capacity have you worked in this field?
   - Director
   - Assistant
   - Professor
   - Community leader
   - Other

5. Please note the number of years you have worked in this field of work
   - Less than ten years
   - 10-20 years
   - More than 20 years

Research questions:

Please answer all the questions to the best of your knowledge. Many of the questions are multiple-choice and can be answered with only a single selection. Space is also provided for you to comment on the underlying reasons for your responses. We encourage you to consider a range of plausible scenarios and factors (i.e., environmental, socio-cultural, economic, etc.) when formulating your answers.
1. In your opinion, do local authorities/governmental entities focus enough on protecting cultural and historical heritage in coastal tourist cities that are vulnerable to climate threats?
   - Yes
   - No
   Explain/Reason.

2. In your opinion, what should coastal cities focus on moving forward? (select all that applies)
   - Long term planning
   - Tailored solutions/mitigations
   - Better assessments protocols
   - Community involvement and participation
   - Use of technology to coordinate mitigation
   - Research and information sharing
   - NGO engagement

3. Can you think of proactive actions or policies that local government and/or primary tourism stakeholders of the coastal communities have adopted to protect the residents' livelihood? Give an example of coastal cities that serve as an example. Explain/Reason.

4. If coastal cities become inevitably affected by climate threats such as higher precipitations and increased annual flooding, where transfer of demand for tourism will go? Explain/Reason.

5. How important is the “re-think tourism” concept in coastal areas to encourage land protection and cultural heritage preservation?
   - Very important
   - Moderate important
   - Not important
   Explain/Reason

6. How do you consider the flow of international visitors to the city of Venice, Italy?
   - Normal
   - Crowded
   - Overwhelming

7. Do you think the environmental impact of the increasing numbers of marine tourism, specifically cruise ships coming through the port of Venice, brings profit or loss to the city? Explain/Reason.

8. How do cruise ships affect the Venetian community directly and indirectly?
9. Please provide any actions or policies that members of the international community could undertake to reduce the likelihood that Venice becomes a commodity. Explain/Reason.

10. Where do you think Venice, Italy will be by 2030 if the number of day-trippers and international visitors keeps increasing? Explain/Reason.

11. Where do you imagine Venice, Italy, will be in 2100 if we do not take immediate actions for climate threats and implement long-term solutions? Explain/Reason.

12. a. Who are the ‘real’ inhabitants of Venice?
   - Residents
   - Tourist
   - Day Trippers
   - Students
   - Other

12. b. Do you think Venice could experience climate-driven human migration?

13. Are you familiar with Modulo Sperimentale Elettromeccanico (Experimental Electromechanical Module) (MOSE) flood protection system in Venice, Italy?
   - Yes
   - No

14. Do you think MOSE is a sustainable long-term project that will save Venice from chronic flooding in the following 80 years?
   - Yes
   - No
   Explain/Reason.

15. Do you think an artificial land building could save Venice from submerging underwater?
   - Yes
   - No
   Explain/Reason

16. How much of the tourist revenue do you think is invested in rebuilding and preserving the city’s historic buildings (as once seen in history)?
   - Enough
   - Not enough
   Explain/Reason.
17. Are you familiar with organizations that work with local authorities on environmental protection campaigns and preservation initiatives of Venice, Italy? Explain/Reason

18. To your knowledge, what other lessons from coastal cities around the world can be applied to local Venetian policies? Explain/Reason

19. What policy implementation measures have key tourism stakeholders adopted? Are they sufficient? Explain/Reason

20. Who currently manages climate change mitigation strategies and predictions? Is this sufficient? Explain/Reason

21. How are you involved in the current efforts to stabilize Venice's future? What are additional efforts necessary to ensure Venice's habitability in 100 years? Explain/Reason

22. What are additional efforts necessary to ensure Venice’s habitability in 100 years?
### Appendix C: Coded Themes and Subthemes from the Research Survey

<table>
<thead>
<tr>
<th>Theme: ENVIRONMENTAL</th>
<th>Theme: SOCIO-CULTURAL</th>
<th>Theme: ECONOMIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subtheme: Coastal Management Solutions Codes:</strong></td>
<td><strong>Subtheme: Long term Impacts Codes:</strong></td>
<td><strong>Subtheme: Demand shift for tourism Codes:</strong></td>
</tr>
<tr>
<td>Artificial coastal protection (e.g., man-made barriers)</td>
<td>Many very high taxes are paid by tourists who visit the city</td>
<td>It will depend on the management of the adaptation measures and policy implementation</td>
</tr>
<tr>
<td>Implementation of Blue Flag Certification. <em>(Central to the ideals of the Blue Flag program is the aim of connecting the public with their surroundings and encouraging them to learn more about their environment)</em></td>
<td>Venice will be undoubtedly, irreversibly, underwater</td>
<td>Towards other coastal areas that are less affected</td>
</tr>
<tr>
<td>Laws that protect tourism and better management coordination</td>
<td>Cruise ships damage the natural environment of the Lagoon in the long term.</td>
<td>Demand will move to safer areas (higher ground) in terms of infrastructures and environmental protection.</td>
</tr>
<tr>
<td>Protection of shoreline by building walls of rocks, e.g., Roseto degli Abruzzi</td>
<td>“No matter the bulk of investments, the sea is 99% able to reclaim coastal land.”</td>
<td>Tourism will probably spill over to more protected coastal areas</td>
</tr>
<tr>
<td>Ban or limit the number of cruise ships entering the Venice Lagoon and Barcelona</td>
<td>“It is hard to do absolute categorizations.”</td>
<td>“Several miles away from the coast, but tourists would still prefer coastal, water-side areas.”</td>
</tr>
<tr>
<td>Work with stakeholders in creating a cohesive and integrated action plan that does not involve only the political parties.</td>
<td>Underwater</td>
<td>Inland</td>
</tr>
<tr>
<td>“This is a global problem, not a regional or national one.”</td>
<td>Disappeared</td>
<td>Small villages and rural areas</td>
</tr>
<tr>
<td>Thames Barrier- flood management scheme in London</td>
<td>Atlantis</td>
<td>Mountain areas</td>
</tr>
<tr>
<td><strong>Subtheme: Policymaking Actors Codes:</strong></td>
<td>“Depopulated, without identity, more expensive still poorer.”</td>
<td>“Bring back locals to make it more habitable a reduction in tourists, affordable apartments, job security, and incentives.”</td>
</tr>
<tr>
<td>Probably relying on the Region Veneto and the ministry</td>
<td>Theme Park</td>
<td>“Venice is a testing ground for all humanity. I don't think it's more important than other places, but it can become an icon (thanks to its visibility) were to face global challenges.”</td>
</tr>
<tr>
<td>“Not sure who manages them, but it's probably not enough.”</td>
<td>“Already ruined”</td>
<td>Towards a new segment such as food and wine tourism</td>
</tr>
<tr>
<td>“Politicians - I think that academia should have a more prominent role in the formulation of strategies and predictions.”</td>
<td>“With severe problems as a result of cumulative climate change impacts.”</td>
<td></td>
</tr>
<tr>
<td>“Comitatone” – Inter-ministerial Coordinating Committee</td>
<td>“Tawdry, damaged and downgraded as a premium tourism destination.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depopulated, without identity, more expensive, still poorer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Venice will still be here but without an urban and environmental future, worn out by tourists</td>
<td></td>
</tr>
</tbody>
</table>
### Subtheme: Impact of cruise ships Codes

“Directly affect the environment, water pollution, noise, and deterioration of the city's infrastructure. Indirectly take away from the community without economic compensation for this lack they cause.”

“They likely bring short-term profits for tourism and long-term damages for the environment.”

“Losses for many, profits for a few”

“Cruise ships pollute and create the image of a playground that doesn't need protection.”

“They unload thousands of people in the historic center who have no respect for the local community because they believe that no one resides in the city with normal lives and daily commitments.”

“Maritime tourism is one of the highest in terms of environmental impact and that, being day tourists; therefore, most of them do not use hotels or stay overnight.”

“The economic value they bring to the city is very little, but they cause massive damage to the ecosystem and to the architecture of Venice, which creates enormous costs.”

“More losses than profits for the architectural, social and environmental patrimony”

“Should be managed differently.”

“A two-fold approach: for residents and tourists might be damaging while for local tourism entrepreneurs is a business driver tool.”

“Overcrowding the city.”

### Subtheme: Heritage Tourism Codes

“UNESCO could be more assertive in protesting or revoking Venice's world heritage listing if Italy keeps supporting intrusive tourism.”

The city is decaying and needs more investment.

Venice will become a theme park due to loss of authenticity and local population

“Preserving assets is a key enterprise for a destination wishing to sustain its tourism.”

“Cultural heritage cannot be preserved without the involvement of local communities, who live in the coastal areas every day and contribute to the maintenance, preserve the balance between resources and the use of such resources.”

“Venice does not become a commodity.”

“Stop sending day-trippers. Make it a destination that visitors can stay in and learn about the valuable heritage and environment.”

Till these days, the local community is often excluded from decision making and participation in the sustainable development of their territory

### Subtheme: Re-thinking tourism Codes

Rethinking tourism can prevent conflicts and does not harm the inhabitants’ quality of life.

It is a fundamental concept. COVID-19 pandemic showed that tourism needs a reset. It should not go back to pursuing old behaviors and activities for financial profits but seeking long-term solutions that do not harm residents’ livelihood.

Protects the rights of natives and Venetian residents

Destinations need to reinvent themselves, pivoting on identity.

“It allows you to enjoy these locations even in future generations and not lose the national heritage.”

Large corporations do not have a high interest in destination management. They tend to pay little taxes, and the jobs they create are often neglected as it is mainly low-pay service jobs. Therefore, there’s often minimal added value for the destination

(Appendix C cont.)
<table>
<thead>
<tr>
<th>Subtheme: Sea Level Rise Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>“It depends on how other places are affected, too.”</td>
</tr>
<tr>
<td>“It is a much bigger issue, beyond tourism. Tourism stakeholders on their own locally cannot limit climate change.”</td>
</tr>
<tr>
<td>SLR is a global issue</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subtheme: MOSE Effectiveness Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Political tenders dictate the conditions under which it was made, so there have been too many problems.”</td>
</tr>
<tr>
<td>“Mechanical solutions are not enough. Multiple resources are needed on tackling global warming and other measures to avoid sea-level rise.”</td>
</tr>
<tr>
<td>Maintenance is overly expensive</td>
</tr>
<tr>
<td>Temporary solution</td>
</tr>
<tr>
<td>Effective for the time being, not effective in the long term</td>
</tr>
<tr>
<td>The impact of climate change leads to the rise of oceans and seas for the next 80 years, MOSE will remain a band-aid solution</td>
</tr>
<tr>
<td>“It will protect from some surges, but it will also move the current problems around the Lagoon area and cause others.”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subtheme: Out-Migration Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Venice will remain where it is, while the Venetians will not. By Venetians, I mean those who would like to live there, populate it, animate it, and protect it.”</td>
</tr>
<tr>
<td>“In 80 years, at the rate we are going, no tourists will visit: it may be underwater.”</td>
</tr>
<tr>
<td>“It will be further denuded of Venetians and will be even more Disneyland-like than it is currently.”</td>
</tr>
<tr>
<td>“Sudden influx of tourists makes the navigation of locals in Venice difficult. The demand for accommodating and serving touristic activities are forcing out the variety of essential shops that residents need (e.g., hardware stores) and marginalized medical facilities”</td>
</tr>
<tr>
<td>Housing and rental have increased</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subtheme: Overtourism Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Sudden influxes of tourists make navigation of central Venice difficult and frustrating.”</td>
</tr>
<tr>
<td>Tourism has also crowded out the variety of shops that residents need (e.g., hardware stores) and marginalized medical facilities.</td>
</tr>
<tr>
<td>Rents have increased because of short term rentals</td>
</tr>
<tr>
<td>There is a monoculture of tourism-related jobs</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Subtheme: Recommended Policy Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>“UNESCO could be more assertive in protesting or revoking Venice’s world heritage listing if Italy keeps supporting intrusive tourism.”</td>
</tr>
<tr>
<td>“Airlines and hotels could be persuaded to introduce a Venice arrival tax to support protection and restoration methods.”</td>
</tr>
<tr>
<td>Use of public transportation to reach Venice versus using large cruise ships</td>
</tr>
<tr>
<td>Raising awareness on the environmental and cultural heritage of the city and of the surrounding territory</td>
</tr>
<tr>
<td>Listening to local grassroots organizations</td>
</tr>
<tr>
<td>Awareness-raising; further restrictions based on environmental criteria</td>
</tr>
<tr>
<td>Short-term rentals should be limited as there are hardly any residents left in Venice, and real estate prices are enormous for locals.</td>
</tr>
<tr>
<td>Residents should recommend the policy to reach a sustainable balance, while the international community should provide the legal framework and financial aid to achieve them</td>
</tr>
<tr>
<td>“Stop sending day-trippers. Make it a destination where visitors can stay and learn about the valuable heritage and the environment.”</td>
</tr>
</tbody>
</table>

(Appendix C Cont.)
Appendix D: Environmental Impact of Tourism on Venice, Italy

**Increase**
- Gentrification
- Commodification
- Expansion of Tourism
- Increased frequency of flooding
- Marina Development

**DECLINE**

**1960-1970**
- Boom of Tourism
  - The enormous growth in demand for tourism which arose from the economic boom of the 1950s and 1960s has created a new market open to the discovery, creation and organization of new destinations

**2000**
- Climate Events
  - Lower Economic Added Value
  - Depletion of ozone layer which protects life on Earth
  - Number of services in the historic city (hospitals, post office etc.)
  - Local resources (energy, food, raw materials)

**2020**
- Tourism Management
- Environmental resources (water)
- Cultural homogenization

**2050**
- Venice Population Growth Rate -0.11% (World Population Review 202021)
- Climate Adaptation Measures
- Land & Infrastructure degradation

**2100**
- Venice is predicted to flood 250 times/year by 2100
- A matter of years before Venice risks to become Atlantis

**First highest flooding in history of Venice 1966**
- More tourists, higher CO2 emissions
- Number of cruise ships in the Mediterranean
- Number of low-cost airlines & fares
- Number of short-term rentals
- Higher living costs
- Construction of hotels, restaurants, catering, recreation facilities
- Second highest flooding in history of Venice 2019
- Tourists: Residents Ratio 9:1 pre COVID
VITA

The author was born in Telenesti, Republic of Moldova. She obtained a Bachelor’s degree in scientific languages from Università Cattolica del Sacro Cuore in Brescia, Italy in 2013. She obtained a Master of Science degree in Hospitality and Tourism Administrations from the Lester E Kabacoff Schoo at the University of New Orleans in 2016. She joined the University of New Orleans urban studies program to pursue a Ph.D. in urban studies with a concentration in tourism and became a member of Dr. Monica Farris’ research group in 2020, 2021, and 2022 respectively.