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Climate Change and Tourism Sustainability in Jeju Island Landscape

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Abstract: The transformation of tourism as a reaction to climate change involves the adoption of a low-carbon route, which comprises policy and institution reforms, behavior changes, and climate change action as major components. Using Jeju Island in the Republic of Korea as a case study, this research highlights the potential of an organic relationship between climate change reaction and the development of sustainable tourism. The situation on Jeju Island, which is detailed in this study, highlights the link between low-carbon tourism and initiatives for mitigating climate change. This article outlines how climate action congruent with climate change and sustainable tourism may be implemented on Jeju Island. In addition, the link between climate change and sustainable tourism is studied in depth by evaluating the likelihood of the failure of a number of climate change-response programs. This approach emphasizes how the example of Jeju Island might be a small step toward addressing climate change and sustainable tourism issues in developing countries.

Keywords: sustainable tourism; climate change mitigation; climate actions; Jeju Island

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1. Introduction

As part of a new sustainable development agenda, the UN 2030 Agenda for Sustainable Development establishes a series of sustainable development goals (SDGs) "to end poverty, protect the planet, and ensure prosperity for all" by 2030 [1]. Given the UNWTO's emphasis on sustainable tourism and the sector's economic importance, the Sustainable Development Goals (SDGs) and the associated Millennium Development Goals (MDGs) have become focal points for the study of tourism's contribution to sustainable development and the sustainability of tourism as a whole [1–3]. The objective of this study is to provide an institutional perspective on the tourism sector's approach to the SDGs and the conceptualization of sustainable tourism.

The situation on Jeju Island, which is discussed in this paper, demonstrates the link between low-carbon tourism and strategies for mitigating climate change. The most effective and fundamental strategy for combating global warming is the reduction in greenhouse gases emitted by the planet. There are two steps that must be taken in order to simultaneously reduce global greenhouse gas emissions. The first step is to decrease the number of greenhouse gases released into the atmosphere, and the second is to remove any greenhouse gases that have already been released. The connection between Jeju Island's plan to mitigate the effects of climate change and low-carbon tourism is based on these two initiatives to reduce carbon emissions.

The current agenda for sustainable tourism is highly connected with the challenge of climate change [4]. The relationship between climate change and tourism is quite intricate. Climate change is already impacting investment, planning, and operations in the tourist industry [5]. Tourism's competitiveness, sustainability, and geography will be transformed by the direct and indirect effects of accelerated climate change and comprehensive governmental responses [6,7]. Any phenomenon that has a negative impact on economic growth endangers cultural assets and heightens security threats is incompatible with sustainable tourist development.

Managing the carbon risk associated with the transition to a net-zero economy is the most crucial job for avoiding and managing the climate-induced destruction of sustainable tourism. In other words, this includes preventing water from approaching the toxic bottom or the decarbonization transition. This involves the massive task of decarbonizing tourism in order to meet the sector's emission reduction goals. The Tourism and Climate Change Declaration In 2005, it was estimated that tourism accounted for around 5 percent of worldwide anthropogenic CO_2 emissions [8]. Recent research [9] boosted the expected contribution to around 8%.

Tourism cannot be deemed sustainable until it can be decarbonized to a level commensurate with the science-based policy objectives of the Paris Climate Accord. The IPCC Fifth Assessment Report identified the incompatibility of the aforementioned tourism emissions growth trend with requirements to stay within the +2 C limit [10]. Recognizing the need to modify this emission trajectory, the World Travel and Tourism Council (WTTC) [11] set the first emission reduction goal for the industry at 50 percent below 2005 levels by 2035. Later, the United Nations World Tourism Organization adopted this goal (UNWTO). In 2019, the WTTC signed the UNFCCC Climate Neutral Now initiative, pledging to achieve climate neutrality (i.e., net-zero emissions) by 2050 in accordance with the science-based goals of the Paris Climate Agreement.

Especially on islands, climate change tends to worsen the issue of sustainable tourism's devastation. Long-distance island travel by airplane is a substantial contributor to global warming due to its emissions of greenhouse gases. Thus, island tourism not only contributes to its own extinction but also to the repercussions of global warming, including the average increase in sea level and severe weather occurrences. Numerous experts believe that owing to global warming and sea level rise, many of the world's islands will be swamped [12].

Even though islands are able to withstand recurrent flooding and may even be growing in size as a result of their adaptation to the increase in sea level [13], they still face a number of ecological concerns. Therefore, eliminating the causes of climate change is the essential approach for averting the collapse of tourism's viability due to climate change. Climate change is caused by carbon, which results in global warming. Therefore, to eliminate the source of climate change, carbon must be eliminated. Two methods exist for removing carbon dioxide from the atmosphere. The first is to minimize carbon emissions, and the second is to absorb already created carbon emissions. It is ideal to seek sustainable tourism by including those two methods to mitigate climate change in tourist operations. Jeju Island tourism is an example of sustainable tourism development that is based on climate change mitigation.

2. Jeju Island Study Description

The tourism industry on Jeju Island (see the red circle in Figure 1 for the location) began slowly around 1960 when the necessary transportation and lodging facilities were established. Jeju's first travel agency, "Jeju Tourist Information Center," was established in April 1955, followed by the establishment of daily air routes between Jeju and Seoul and regular passenger ships between Jeju and Mokpo or Busan. In addition, the Jeju Tourist Hotel, with 30 rooms, debuted as a tourist hotel in Jeju. In the early days of Jeju's tourism policy, the central government was in charge of everything.

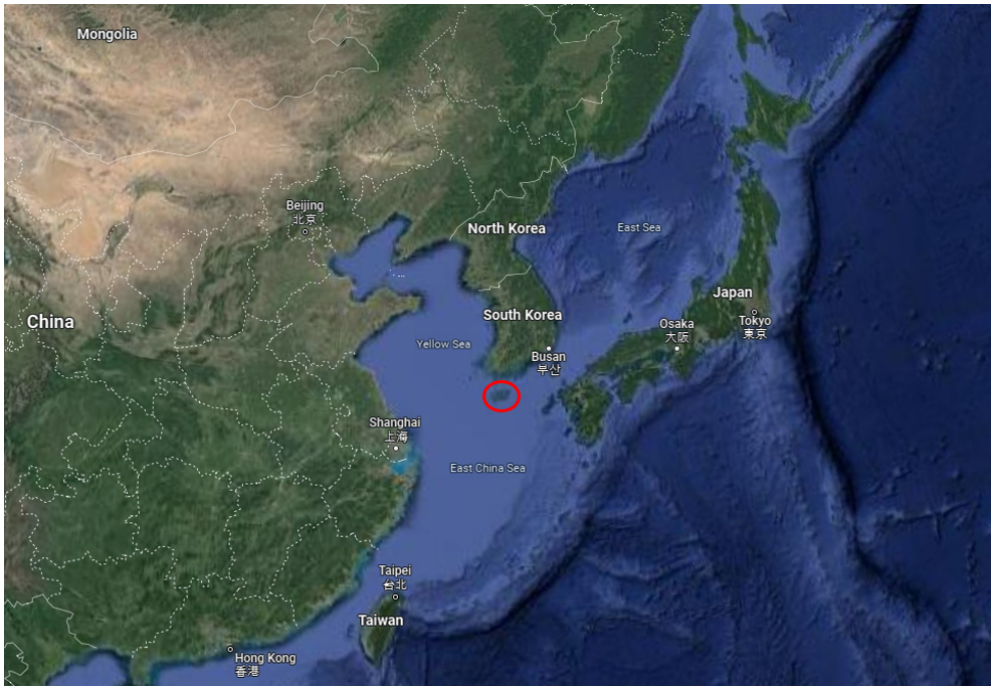

Figure 1. The location of Jeju Island (Source: Google Map).

In 1966, in accordance with the 'Comprehensive Land Construction Planning Act,' the government designated the entire island of Jeju as a 'specific area' and developed and expanded Jeju's tourist destinations. With the establishment of the Jeju Island Tourism Comprehensive Development Plan (target period 1973–1981) to develop the Jungmun Tourist Complex, tourist areas, and provincial parks, Jeju's tourism development began in earnest. In 1966, roads were opened sequentially across the entire island of Jeju.

In the 1980s, as Korea entered the era of mass tourism, Jeju was reborn as Korea's premier honeymoon destination. Large accommodations such as the Jeju Grand Hotel and the Korea Condominium were constructed, followed by the Jeju Folk Village and the Jeju Sculpture Park. With the liberalization of international travel in 1989, it began to lose its luster. Due to the International Monetary Fund's foreign currency crisis, Jeju's tourism industry's external competitiveness declined dramatically in the late 1990s [14].

In the 21st century's wave of openness and globalization, a new change was required. As a breakthrough, the government and Jeju Island chose to establish a "Free International City" by enacting the Jeju Free International City Special Act in April 2002. This is an ambitious plan to develop Jeju as a tourism and recreation hub in Northeast Asia and to create a free international city where people, goods, and capital are free to circulate. As a result, the tourism industry has experienced significant quantitative expansion.

The tourism industry on Jeju Island has a significant impact on the local economy through various ripple channels (hub and spoke) and holds a prominent position in the Jeju economy. Since the late 2000s, Jeju's tourism industry has grown rapidly as the number of tourists has increased (see Figure 2).

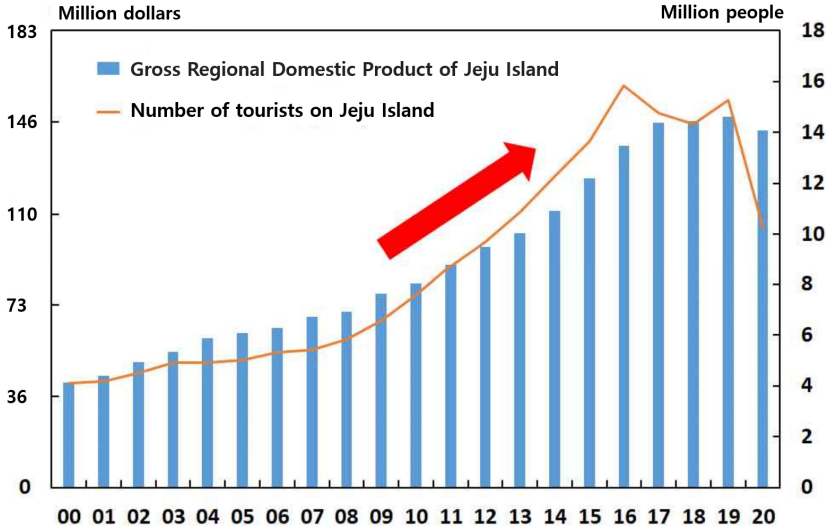

Figure 2. Gross regional product and number of tourists on Jeju Island [14] (Source: Bank of Korea).

Concerns about the structural vulnerability of Jeju's economy, which is highly dependent on the tourism industry, have intensified in recent years as external shocks have caused tourism demand in Jeju to be highly volatile. In 2018 and 2020, when the number of tourists decreased due to the conflict with China and COVID-19, Jeju's economic growth rate was −0.9% and −6.6%, respectively, which was significantly slower than the national rate (2.9% and −0.9%), demonstrates its extreme vulnerability to external shocks [14].

It rose from 4.11 million in 2000 to 15.85 million in 2016, but its growth slowed in 2017 as a result of the conflict with China. Tourism revenue in Jeju increased by an average of 32.8% per year from 2006 to 2019, from 1.4 trillion won to 7.4 trillion won, and its share of Jeju's total output rose from 9.6% to 20%. As of 2019, there were 26,955 tourism businesses and 90,270 tourism employees in Jeju, representing 40.8% and 31.5% of all businesses and employees in Jeju, respectively [14].

Changes in the external environment, such as the generalization of short-distance air travel as a result of the proliferation of low-cost airlines and economic growth in China, appear to be the primary reasons for the rise in domestic and international demand for Jeju tourism. In a short period of time, the number of tourists has increased faster than at any of the world's major island tourist destinations (see Figure 3).

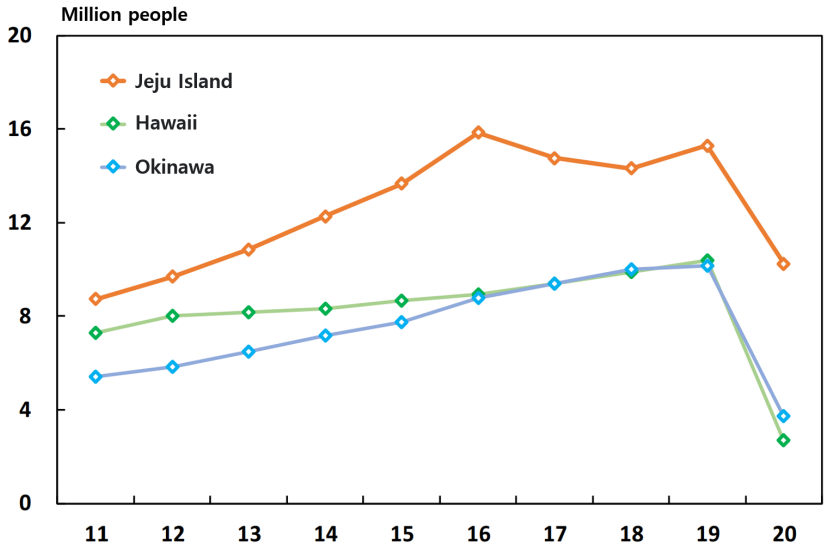

Figure 3. Comparison of annual tourist numbers with famous island attractions [14] (Source: Bank of Korea).

In addition, unlike other Korean tourist destinations, Jeju Island is not affected by the season and exhibits low seasonal characteristics, as tourists visit evenly throughout the year. As a result, as tourism revenue is generated evenly throughout the year, it will gradually have a ripple effect on the economy of Jeju, assuming there is no external shock (see Figure 4).

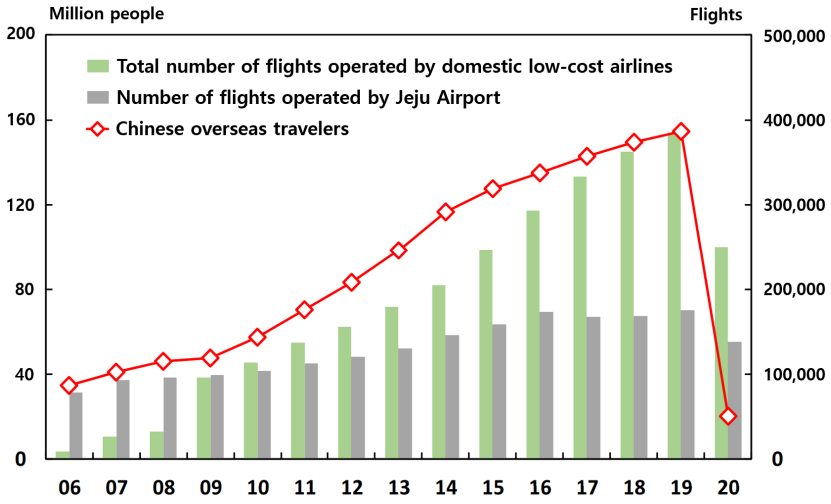

Figure 4. The number of low-cost flight routes and the number of Chinese tourists [14] (Source: Bank of Korea).

Tourism and related industries directly benefit from the increase in tourists, but the environmental and social costs resulting from the increase in floating population must be borne by the entire provincial society. This unbalanced structure of benefit and cost-sharing halved the economic sensibility of the tourism industry and contributed to tourists' negative perceptions. In fact, a survey on the perception of tourism among Jeju residents [15] revealed that while the residents recognize the economic significance of the tourism industry, they are concerned about its negative impact on the residential environment, including traffic congestion and garbage [14].

Due to the rapid expansion of the tourism industry, traffic increased faster than the expansion of transportation infrastructure, resulting in congestion-related social costs (see Figure 5). The number of registered vehicles and volume of traffic on major roads increased significantly, primarily due to an increase in the number of rental cars and commercial vehicles.

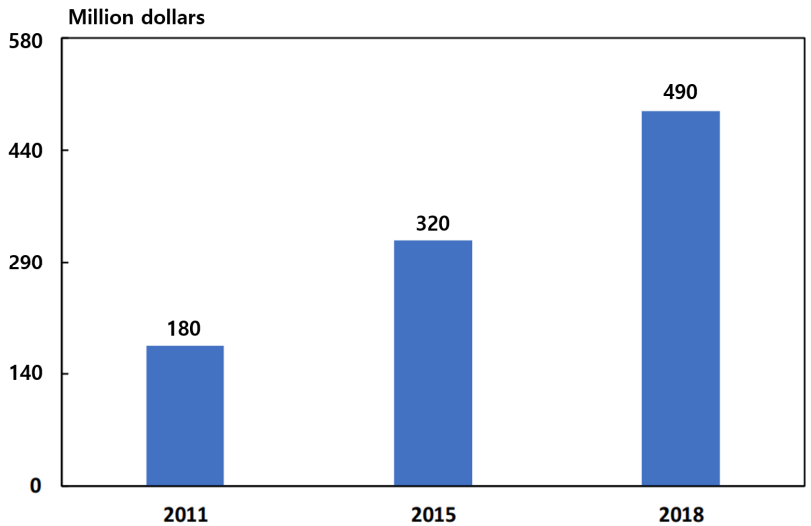

Figure 5. Traffic congestion costs [14] (Source: Korea transport institute).

Environmental pollution issues, such as household waste and greenhouse gas emissions, are worsening as a result of the influx of tourists and are emerging as a barrier to Jeju's economy's sustainable growth. Due to the rapid increase in the number of tourists and residents, the amount of household waste produced has skyrocketed, reaching the province's maximum capacity.

Additionally, GHG emissions are increasing, particularly in the transportation sector, which may result in a long-term decline in agricultural, fishing, and tourism productivity. The transportation sector is responsible for 46.9% of Jeju's greenhouse gas emissions (30.1% from roads, 13.3% from aviation, and 3.5% from shipping [16]. As a result of estimating the productivity loss and cost of damage in Jeju as a result of global warming, the damage scale relative to GRDP and the cost per ton of carbon is greater than in other regions [17].

In some areas, there is also the possibility that a large number of commercial facilities will move in, that congestion issues caused by an influx of tourists will worsen, and that the area's long-term competitiveness as a clean image and tourist attraction may decline. When applied to the classification according to Butler's tourism life cycle theory (see Figure 6) [17], it can be seen that tourism in Jeju is in the early stages of entering the stagnation stage as a result of the social costs associated with tourism [14].

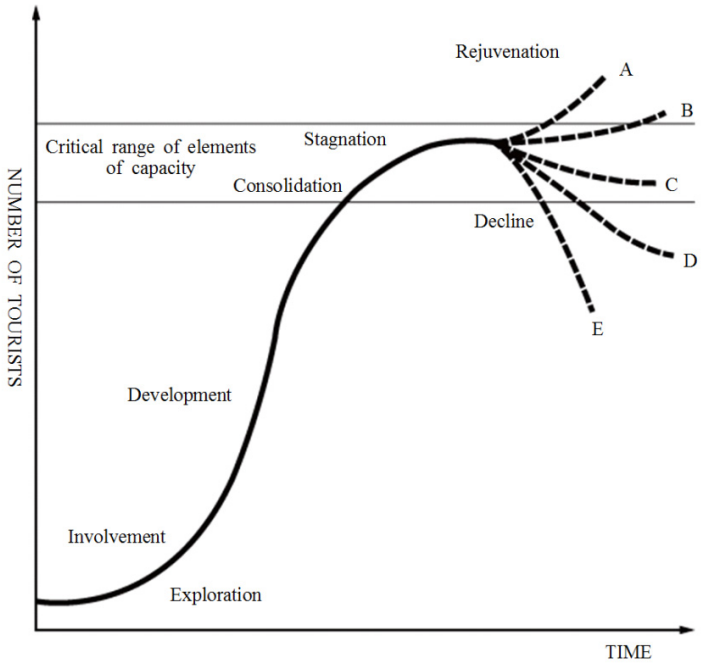

Figure 6. Tourism area life cycle [17].

When Butler finally hit a plateau, he realized that there were two ways out: renewal or decline. In the final iteration of his model, he considers five possibilities ranging from complete revitalization to complete decline. Curve A shows that successful redevelopment leads to renewed growth; curve B shows that modest changes to capacity levels lead to growth; curve C shows that tourism is stabilized by cutting capacity levels; curve D shows that continued overuse of resources and a lack of investment leads to decline; and curve E shows that war, disease, or another catastrophe immediately collapses tourism.

Jeju Island is currently experiencing a variety of social costs, such as environmental issues related to the quality of life of its residents and damage to its clean image as a result of an increase in tourism, which hinders the possibility of Jeju's economy growing sustainably. When considering the limitations of quantitative growth through an increase in the number of tourists, it will be necessary to focus on qualitative growth, such as high value-added efforts, mutual growth with local communities, and ensuring long-term sustainability in order to develop the tourism industry in Jeju in the future [14].

3. Current and Emerging Threats and Impacts of Climate Change in the Case Study

As was previously stated, tourism is the primary economic driver of Jeju Island and a significant source of foreign currency income. Such tourism is considered a climate-dependent industry, and because Jeju Island's popularity has increased due to its pleasant climate, the effects and impacts of climate change may have a variety of negative effects on Jeju's tourism industry. Off the coast of Jeju Island, numerous climate-related threats have already been detected.

3.1. Tourism at Threat from Rising Sea Temperatures

The East Sea and the East China Sea are among the six seas with the most extreme seawater warming among the 52 Large Marine Ecosystem (LME) seas introduced by National Oceanic and Atmospheric Administration in the United States to protect the world's coastal regions (super-fast) (see Figure 7). Jeju Island is situated in the East Sea and the East China Sea, where the rate of water temperature increase is approximately three-and-a-half times the global average.

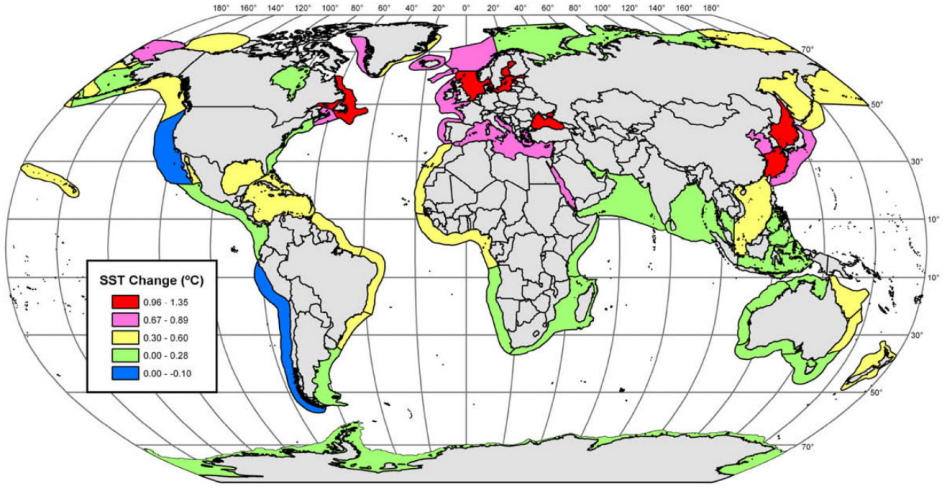

Figure 7. Sea Surface Temperature Change in Large Marine Ecosystems: 1982–2006 [18].

While Jeju Island's temperature has increased by 1.7 °C over the past 58 years, the sea water temperature has increased by 2 °C over the past 36. The rise in seawater temperature on Jeju Island is closely linked to the rise in global temperature and the Yangtze River low salinity fountain in China, which is adjacent to Jeju Island. China's summer floods have significantly worsened as a result of global climate change. This is supported by the likelihood of heavy precipitation.

Extreme precipitation refers to a phenomenon in which the amount of precipitation significantly deviates from the normal value or exceeds or falls short of a given benchmark. In other words, it means torrential rain in the short term and summertime drought. During the rainy season in East Asia, in the western part of China, particularly in the Yangtze River region, it rains heavily for a brief period, followed by a period of high temperatures and drought. As the life cycle of the summer monsoon, which dominates summer weather, became clearer, the Yangtze River region experienced more extreme precipitation. In China's Yangtze River basin, the frequency of flooding has increased due to global warming [19].

Considering the data on climate change in Korea as a result of global warming, the rate of temperature increase on the Korean Peninsula over the past 100 years (1912–2008) was 1.70 °C, while the global average rate of increase over the same time period was 0.74 °C. It was discovered to be higher than that of the city, and the urbanization-induced increase in temperature was remarkable [20]. According to the National Institute of Fisheries Science, the rate of increase in surface water temperature in Korean waters has exceeded the rate of increase in global sea temperature, and the average annual increase in surface water

temperature over the past decade (1995–2004) has increased by 0.67 °C [21]. Particularly, the results of the analysis of changes in water temperature along the coast of Jeju Island indicate that Jeju Island's coast has warmed by 0.31 °C over the past 21 years [22].

Desertification is the greatest threat posed by such an increase in seawater temperature. A rise in water temperature caused by global warming is the leading cause of sea desertification. Calcium carbonate is only soluble in carbon dioxide-containing water, and the lower the water temperature, the more soluble it is. As the temperature of seawater rises as a result of global warming, its solubility decreases, and calcium carbonate that is not dissolved eventually adheres to the seafloor and rocks.

Inhabiting seaweeds such as seaweed, kelp, and Ecklonia cannot grow if the rock is coated with calcium carbonate. Sea desertification is the disappearance of seaweeds in rocky coastal areas and their replacement with limestone algae such as coral reefs, which destroys the entire marine ecosystem. It is simple to comprehend when viewed as desertification that occurs on the ocean rather than on land. When the rock's surface turns white or red, this is known as a 'whitening event'. (see Figure 8).

Figure 8. Whitening event on rocks in the sea off the coast of Jeju Island (Source: Korea Fisheries Resources Agency).

In the case of Jeju Island, more than 30 percent of the entire coastline is affected by bleaching [20]. This phenomenon also diminishes the ocean's purification capacity. Algae, a marine plant, is the base of the marine ecosystem's food chain, and species diversity can only be maintained if algae production is increased. Destruction of marine biodiversity is directly related to the development of marine desertification.

Jeju Island's coastal and aquatic tourism is negatively affected by sea desertification's destruction of marine biodiversity. Numerous tourists who visit Jeju Island appreciate scuba diving and the coastal scenery. The value of coastal and aquatic tourism is comprised of "on-reef" values, which include scuba diving and snorkeling, and "reef-adjacent" values. These reef-adjacent values include sandy beaches, protected waters, healthy fisheries, coastal protection, and picturesque views, all of which are benefits of healthy coral reefs.

If sea desertification on Jeju Island continues, the island's most popular tourist attraction will vanish. The desertification of the sea surrounding Jeju Island results in the destruction of marine resources and the disappearance of natural attractions. This signifies the end of sustainable tourism.

3.2. Tourism at Threat from Sea Level Rise

In the past 40 years, the sea level around the Korean Peninsula has risen approximately 2 mm per year, and the Jeju Island region has risen approximately 4 to 6 mm per year,

demonstrating the greatest impact of sea level rise in the country (Korea Hydrographic and Oceanographic Agency 2015). In the second half of the 21st century, the sea level on Jeju Island is projected to rise by 53–65 cm, according to the IPCC climate change scenario [23].

37% of Jeju's coastline is susceptible to natural disasters due to sea level rise [24]. The map above depicts the distribution of each disaster vulnerability rating for the coastal areas within 1 km of the coast of Jeju, taking into account various factors such as current and future climate change, flooding and tsunami damage, population change, development projects, and low-lying terrain. This is a data analysis of comprehensive disaster vulnerability due to sea level rise, which demonstrates 'disaster vulnerability'.

In the map seen above, Grade 1 signifies the greatest degree of catastrophe risk, while Grade 4 represents the lowest (see Figure 9). The eastern region of Jeju was determined to be the most vulnerable, followed by the western and northern regions. In contrast, the southern region exhibited comparatively low vulnerability. 37% of Jeju's coastal areas were vulnerable to sea level rise, including 8.5% of disaster-vulnerable Grade I areas and 28.5% of Grade II areas. By region, Vulnerability Grade I is concentrated in the eastern coastal area, and the western portion of Jeju is also highly vulnerable. In contrast, some southern regions of Jeju Island were analyzed and found to have relatively low vulnerability scores.

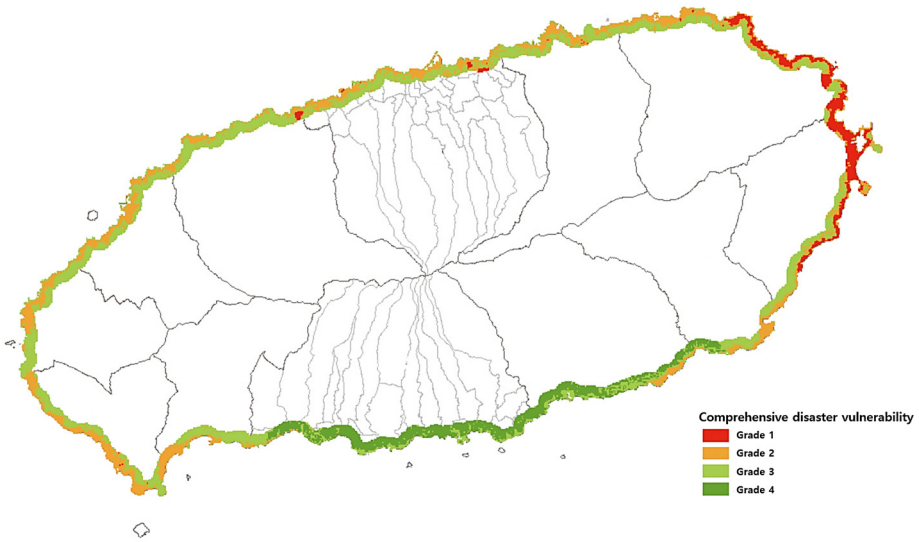

Figure 9. Distribution map by general disaster vulnerability rating [24].

These sea-level increases result in the loss of sand, flora, and beach erosion damage on Jeju Island. Sea level rise is not the primary cause of beach erosion; it also has the potential to exacerbate the problem by lowering the extent of the beach. Also, approaching waters to diminish the area of Jeju Island's coastal ecosystems, which are the foundation of its nature-based tourist industry. Many of Jeju Island's beaches are high-use settings with intense strain on dune ecosystems and little room for escape.

The loss of sand is a significant issue for tourism on Jeju Island, as severe weather events accelerate natural erosion rates, resulting in a drop in amenity value and, in the worst-case scenario, the loss of beach access or unsafe beach profiles. Combined, sea level rise and severe weather events increase the danger of erosion. Consequently, this has a significant impact on Jeju Island's sustainable tourism.

4. Climate Actions, Strategies, and Actions for Mitigation and Adaptation in the Case Study

4.1. Institutions & Policy Changes

4.1.1. Smart Grid Policy

Across the globe, climate change and energy security have become pressing concerns. Changes in energy supply and use will need to be substantial for Jeju Island to achieve its

goals of a low-carbon economic transformation and energy security. Low-carbon power can be delivered more effectively and reliably via the use of a smart grid. It paves the way for the incorporation of alternative energy sources, gives tourists more control over their energy use, and reduces prices for everyone. Investment, action on regulatory and commercial objectives, innovation, and research have propelled Jeju Island to the forefront of smart grid development.

In accordance with the Jeju Special Autonomous Province's ordinance on the establishment of administrative organizations and quotas, the local government was to establish a Department of Future Strategy. Future Strategy Bureau's principal initiative is the smart grid industry promotion policy. The present grid is highly dependable and can accommodate typical variations in power use. Flexible yet high-carbon energy production technologies are used to rapidly alter supply in response to daily swings in demand, and the scale of the electrical infrastructure and power stations is normally built to comfortably satisfy peak demand.

In spite of difficulties encountered by the provincial government of Jeju Island on the way to decarbonization, such difficulties were successfully met. Some of the difficulties were

- As consumption patterns change, such as with the adoption of electric vehicles, there is likely to be a corresponding shift in demand for power at the distribution level.
- In order to compare, thermal power's constant output can't compare to the ebb and flow of electricity produced by renewable sources such as wind and solar.
- Distributed renewable generation, such as rooftop solar panels installed at the residential and community level, is a valuable energy source to meet local demand, but it alters the amount of electricity drawn from the distribution network and necessitates a connection that can supply electricity to the network when in excess.
- Increased international connectivity for renewable energy imports and exports; link with offshore wind generating.

Due to the unpredictable nature of power generation, shifting demand patterns, and the requirement to permit electricity flow in both directions, innovative, flexible methods of balancing supply and consumption are essential with the widespread adoption of low-carbon technology. To put this theory into practice, the provincial government of Jeju Island has constructed a Smart Grid Demonstration Complex, with longer-term ambitions to construct a Smart Grid Complex throughout all of Jeju Island.

The Jeju Smart Grid Demonstration Project is a project promoted in Gujwa-eup, Jeju-do, with the goal of promoting the commercialization and export industrialization of related technologies through the early construction of the world's largest and most advanced smart grid demonstration complex. The project was completed in two stages: the basic stage of infrastructure construction (2009.12~2011.05) and the expansion stage (2011.06~2013.05), in which various business models were integrated and operated. Furthermore, a total of KRW 239.5 billion was invested, with KRW 68.5 billion coming from the government budget and KRW 171 billion coming from private capital. It is a large-scale project that involves 168 companies and 12 consortiums of smart grid-related companies, such as electric power, communication, automobiles, and home appliances [25].

4.1.2. Electric Vehicle Supply

In 2012 the provincial government of Jeju Island established the 'Carbon Free Island' plan for greenhouse gas reduction and energy independence, with the goal of replacing 75% of all registered cars with electric vehicles by 2030. New internal combustion engine vehicle registration will not be allowed in Jeju Island after 2030.

In 2013, Jeju began distributing 160 electric vehicles to the private sector for the first time in the country and has since supplied 2000 to 7000 electric vehicles annually. Along with the expansion of new and renewable energy sources, the supply of electric vehicles is an important component of the plan to make Jeju "carbon-free".

In 2015, the provincial government of Jeju Island passed an ordinance encouraging and activating the use of electric vehicles. Local governments have since established and implemented policies to promote the supply and use of electric vehicles that are appropriate for regional characteristics. As a result, the first mid- to long-term comprehensive plan for electric vehicles was established and announced in August 2015, the second mid- to long-term comprehensive plan for electric vehicles was established and announced in March 2018, and the third mid- to long-term comprehensive plan for electric vehicles was established and announced in March 2020. Based on the previous plan's results, the 4th mid- to long-term comprehensive plan (2022~2030) has been established and is being implemented to reflect the changed conditions [26].

The number and proportion of registered electric vehicles increased as a result of these institutional efforts, as did the scale of operation of electric vehicle chargers. Furthermore, satisfaction with electric vehicles is being managed at a relatively high level as the number of electric vehicles and charging infrastructure increases. According to Jeju's active electric vehicle supply policy, the number and proportion of registered electric vehicles are increasing year after year. Electric vehicle penetration increased from 2.49% at the end of 2017 to 4.03% at the end of 2018 and 4.69% at the end of 2019. In 2020, the proportion of electric vehicles exceeded 5%, and by the end of 2021, the proportion had risen to 6.33% (see Table 1).

Table 1. Number and proportion of registered electric vehicles on Jeju Island by year (source: Jeju Special Self-Governing Province).

	2017	2018	2019	2020	2021
Number of registered electric vehicles	9258	15,480	18,128	21,216	25,427
Proportion of electric vehicles to total vehicles in Jeju Island	2.49%	4.03%	4.69%	5.39%	6.33%

The goal of an electric vehicle dissemination policy is being pursued in a variety of ways, including not only general vehicles but also commercial vehicles. Electric vehicle conversion of relatively long-distance taxis, buses, rental cars, and trucks has been heavily promoted. As of the end of 2020, the proportion of electric taxis had increased from 12.6% to 21.2%, while the proportion of electric buses had increased from 4.0% to 6.0%. Visitors account for 8.9% of rental car usage. The proportion of electric trucks, in particular, increased rapidly. 5.0% of private trucks and 5.7% of commercial cargo trucks are electric. When comparing the proportion of electric vehicles to new cars registered in Jeju over the last two years, cargo trucks, taxis, and buses account for a sizable proportion (see Table 2).

Table 2. The ratio of electric vehicles to all vehicles on Jeju Island as of 5 January 2022 (source: Jeju Special Self-Governing Province).

	Private Vehicles			Commercial Vehicles			Government Vehicle	Total
	Car	Truck	Rental Car	Taxi	Bus	Lorry		
Number of registered electric vehicles	17,067	3567	2607	1098	172	243	484	25,427
Total number of vehicles registered	283,047	74,667	29,380	5175	2863	4283	2408	401,825
Electric Vehicle Ratio	6.0%	5.0%	8.9%	21.2%	6.0%	5.7%	20.1%	6.3%

This electric vehicle supply policy supported by the provincial government of Jeju Island contributes to a global climate change crisis and a decrease in Jeju's greenhouse gas emissions.

The annual reduction in carbon dioxide (CO_2) emissions per electric vehicle are 1.1 tons per year [27]. According to the Republic of Korea's Ministry of Environment [28], electric vehicles emit 98.1 g less carbon dioxide per kilometer than gasoline vehicles. Based on the survey findings [29] that each electric vehicle travels 1560 km per month and 18,720 km per year, it can be concluded that each electric vehicle reduces carbon dioxide emissions by 1.84 tons per year [28].

4.1.3. Green Building Design Standards

Due to global warming and the worsening of air pollution, the importance of energy savings and greenhouse gas reduction in the energy-intensive building industry is emphasized even more. By establishing the Green Building Construction Plan (2017) and Energy Vision 2030, Jeju Special Autonomous Province aims to achieve its greenhouse gas reduction objective in the building sector. As part of the Green Building Construction Plan and Energy Vision 2030, it is intended to promote the early settlement of green buildings and improve the quality of life of Jeju residents by systematically implementing design guidelines for new buildings in the eco-friendly and energy sectors. Implementation of the system for green building design guidelines is subject to the approval of the housing construction project (more than 30 units), and residential buildings are subject to the submission of an energy-saving plan (buildings with a total floor area of 500 m or more, detached houses, zoological and botanical gardens, air-conditioning facilities, etc.).

The following describes the direction of the green building design guideline system: In consideration of Jeju's local situation, awareness of green architecture, and technological environment, the first step is to expand or subdivide the target of the application of green building design standards in stages and to prepare standard contents. The second objective is to establish the level and content of the standard for energy consumption evaluation targets (business facilities, education and research facilities of at least 3000 square meters, and public buildings of at least 500 square meters) based on the energy-efficient design standards. Third, for other buildings that fall under the energy-saving design objective, the standard is set at a limited level and gradually raised in consideration of the Jeju local environment.

The green building design guideline system consists of three main components. First, application standards are established for the application target based on the size and function of the building. This applies to buildings subject to the submission of an energy-saving plan and apartment houses subject to the approval of the housing construction project plan and is divided into three stages based on the size of the building. Second, the design standards are comprised of environmental performance and management, and energy fields and are applied in accordance with the existing system and scale, such as green building certification and energy efficiency grade certification. The environment field specifies matters pertaining to green building certification, environmental performance, and environmental management, whereas the energy field specifies matters pertaining to building energy efficiency rating certification and passive, active, and innovative technology elements based on EPI performance indicators. Thirdly, incentives are provided to buildings that meet design requirements. The building standards (floor area ratio and height) relaxation ratio is based on the building energy efficiency grade and green building certification, and the acquisition tax reduction or exemption for buildings is based on the building energy efficiency grade, green building certification, and zero energy building certification [30].

4.2. Behavioral Changes

4.2.1. Long-Term Stay Tourism by Means of Walking

Globally, in both developed and developing countries, tourism plays a significant role in boosting economies. As a result, it creates one out of every ten new employments

worldwide and accounts for nearly 10% of global GDP. Tourist destinations need to be close to many modes of transportation. Increased accessibility to products, services, and employment opportunities is only one of the many positive effects of improved transportation infrastructure that trickles down to surrounding neighborhoods. The problem is that tourists place a burden on services and infrastructure. Transportation accounts for the vast majority (75%) of tourism's carbon dioxide (CO_2) footprint. Over the previous two decades, emissions from tourist transportation have gradually increased, reaching about 1600 million metric tons of CO_2 in 2016 and accounting for 5% of total CO_2 emissions connected to energy production [31].

The number of visitors has increased, while efficiency gains have lowered emissions per passenger. Governments everywhere are starting to worry about the repercussions of tourism, and several are making efforts to lessen the industry's environmental effects. Reducing travel could be the best option for lowering transportation-related carbon emissions. That is to say, staying put for an extended period of time at a place may be the most effective strategy for reducing the negative effects of travel on the environment.

Olle trekking on Jeju Island is a popular tourist activity that encourages visitors to stay for an extended period of time. Olle, its original meaning was 'the narrow alley leading to a home from the street' in the dialect of Jeju. Based on the concept of Olle, Jeju Olle non-profit corporation designed and branded an Olle hiking trail along the coastline of Jeju Island in 2007 (see Figure 10). After this, more and more hikers are making their way to Jeju to experience the island's renowned natural beauty. As a result, 'Olle' has gained notoriety among Korean hikers and is now widely regarded as a typical trekking route. The natural beauty of the shore and the mountains in Olle is what draws visitors there, as they may indulge their senses at their own leisure and enjoy the scenery without feeling rushed.

Figure 10. Tourists trekking along the Olle Trail (Source: Jeju Olle corporation).

According to the Jeju Special Self-Governing Province Visiting Tourist Facts Survey [32] conducted by the Jeju Provincial Government, the average length of stay for tourists on Jeju Island is between three and four days. On the other hand, visitors to olleh trekking tourism activities were found to stay an average of 10 days, with 65% of their trips being solo excursions [33]. This indicates that Olleh trekking is closely associated with low-carbon tourism. It can be said that Olleh trekking is an action for low-carbon tourism activities because the long tourist stay period, especially for solo travel, minimizes unnecessary travel and transportation for tourism activities.

4.2.2. Low Carbon Footprint Food Tourism

Globalization has brought food, health, and economic issues to the forefront [34]. Grown goods such as spices, fruit, and rice have been traded over vast distances for centuries. With ever-increasing volumes, however, the issue of food miles and the supply chain is just one component of carbon emissions and climate change as a whole. Food consumption is a factor in the calculation of the carbon footprint [35]. The emphasis on reducing food's food miles and fostering connections between local initiatives and consumers is part of a larger plan to reduce global carbon production.

A food's "food miles" are the total distance it traveled from its point of production to the plate. The "food miles" or total distance that an item of consumption was transported is one indicator of its environmental impact [36]. Researchers have compared emissions at every stage of the food chain in a number of reports. Up to and after the farm gate, carbon emissions connected to food production can be estimated. In the United Kingdom, for instance, only about 12 percent of the food chain's total greenhouse gas emissions come from transportation (including wholesale, retail, packaging, and fertilizer production) [37]. According to Li et al. [38], transportation accounted for 19% of total food-system emissions, indicating that global food-mile CO_2 emissions are 3.5–7.5 times higher than previously estimated.

Aware of the fact that reducing food miles is directly related to reducing carbon emissions, a major contributor to climate change, low-food-mile tourism activities are being conducted on Jeju Island, with Jeju Haenyeo as their focal point. Jeju Provincial Government and Jeju Haenyeo Association are providing tourists with low-food-miles tourism based on Jeju Haenyeo food, emphasizing the low carbon footprints of the foods traditionally consumed by Jeju Haenyeo (see Figure 11).

Figure 11. Jeju Haenyeo is cooking freshly caught seafood and selling it to tourists (Source: Author's photo).

Jeju Haenyeo consistently prepared and consumed seasonal organic food. The almost nonexistent carbon footprint of Jeju Haenyeo food is its most distinguishing characteristic. Without exception, all of the food served at Jeju Haenyeo consists of either raw seafood that has been freshly harvested from the ocean or food that has undergone very brief cooking. This indicates that the food mile for Jeju Haenyeo is very short and that it is also a food with low carbon emissions.

By encouraging tourists to consume Jeju's food, the provincial government of Jeju aimed to accomplish two goals. First, it was to reduce carbon emissions caused by the consumption of Jeju Haenyeo food by tourists. The second objective was to enable tourists to recognize the gravity of carbon emissions and participate in the movement to reduce carbon emissions through tourism. To achieve this objective of Jeju Haenyeo Food Tourism, the local government of Jeju Island collaborated with coastal village residents.

4.2.3. Marine Garbage Upcycling and Tourism

Upcycling is the practice of utilizing inventive design to create new materials or products from discarded or unwanted materials or products. Upcycling is predicated on the utilization of technology and manufacturing processes with consideration for the environment and greenhouse gas emissions. The reduction in waste-related greenhouse gas emissions and the implementation of the 3Rs (reduce, reuse, recycle) are consistent with the global waste management agenda [39]. The provincial government of Jeju is providing tourists with a tourism program that combines diving in the Jeju Sea with upcycling of marine debris.

The problem of marine debris in Jeju is directly related to environmental issues as well as the conservation of Jeju-do haenyeo. The Jeju provincial government has been continuously operating the Eco-RUN program, an eco-friendly travel product, to solve the problem of marine debris and contribute to the local community through tourism content. 'Eco-RUN' means running to create a foundation for sustainable and eco-friendly travel in Jeju, and it is a Jeju tourism program that considers not only health but also the environment and the local community (see Figure 12).

Figure 12. Using the Diving Experience Tour program, gather marine trash (source: Jeju Special Self-Governing Province).

Zero carbon, zero plastic, zero disposable products, and zero waste are promoted and experienced by the Eco-Run tourism program. Participants enter the water wearing the same wetsuits, goggles, and net baskets as the haenyeo. While participating in the diving activities of Jeju Haenyeo, divers collect a variety of marine debris, from large items like tires and bicycles to smaller items such as waste bottles, toothbrushes, fishing nets, and buoys.

The collected marine debris is used as works of art by artists working on Jeju Island (see Figure 13). A storytelling exhibition is held that uses marine debris collected from the sea to create an ocean that is gradually purified from the polluted ocean. In addition, after viewing the exhibition space, visitors can experience upcycling. The meaning of these activities is that it is a tourism program that allows local governments, non-profit civic groups, and villagers to experience resource circulation through upcycling marine debris based on marine experience activities.

Figure 13. Art exhibition using the collected marine debris (source: Jeju Special Self-Governing Province).

4.2.4. Ecological Education for Children

In order to combat climate change, education must play a central role. Parties to the United Nations Framework Convention on Climate Change (UNFCCC) are tasked with implementing public education and awareness campaigns on climate change, as well as ensuring public involvement in related programming and access to relevant information [40].

People's mindsets and actions may be influenced by and aided by educational opportunities. Young people may learn about the consequences of global warming and adaptation strategies in the classroom. The young, in particular, may benefit much from education since it gives them the tools they need to make a difference in the world. In this vein, the Office of Education of the Jeju Special Autonomous Province has planned ecological education for children and is in the process of promoting it. Regarding education about the climate crisis, the "Green Smart Future School" program is being implemented.

The Green Smart Future School education project aims to disseminate practical actions for carbon neutrality, with 11–14-year-olds as the target audience. The project consists primarily of two programs. The first program is "Practice for Climate Action 1.5 °C". The program is administered in accordance with an application titled "Climate Action 1.5 °C". Children recognize the importance of climate action by participating in a climate action quiz contest utilizing a climate action journal and a climate action-related quiz accessible through the application.

"Carbon Piggy Bank" is the name of the second program. The carbon piggy bank refers to activities such as school forests, vegetable gardens, gardens, and ponds that can reduce the amount of carbon already emitted. In response to the climate crisis, the school space will be redesigned through the carbon piggy bank program, and unused school land will be used to construct an ecological environment learning center. Through the activities of the carbon piggy bank program, children gain knowledge on how to create an environment that reduces carbon.

4.3. Climate Actions

4.3.1. Flight with Low Carbon Footprint

Air travel is responsible for a minimum of 2.5 percent of all annual greenhouse gas emissions globally. Depending on what CO_2 and non-CO_2-induced effects of commercial aviation you account for, it might even be up to 5 percent. Flights produce mainly carbon dioxide from burning fossil fuels (see Figure 14). While this already equals a large number of emissions right now, passenger numbers are predicted to double by 2037 and emissions to reach up to 15 percent by 2050 [41]. This means that the negative effects of air travel on climate change will be more severe than ever before. Since planes are the primary mode of transportation for tourists visiting Jeju Island, carbon emissions from airplanes are also a major concern for Jeju Island's tourism industry.

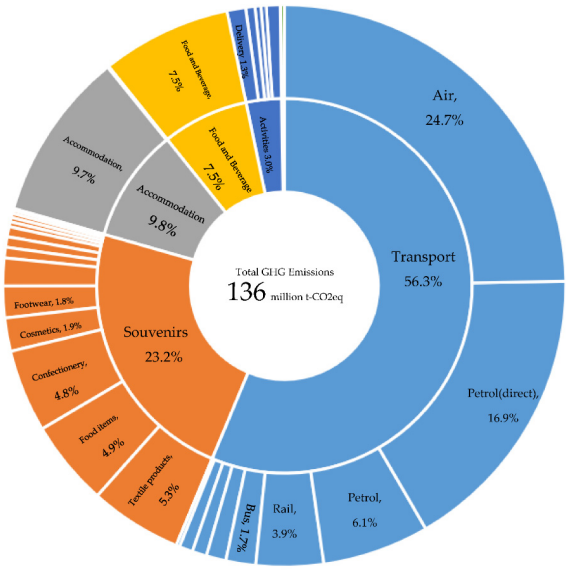

Figure 14. Each product and Services Category type of Total GHG Emissions [42].

Jeju Air is a popular airline among visitors to Jeju Island. Jeju Air was established as a joint venture between the provincial government of Jeju Island and the Aekyung Group. Aekyung Group contributed 15 billion won (75%), and Jeju Island contributed 5 billion won (25%). It was established on 25 January 2005, at Jeju International Airport, with the intention of enhancing air traffic on Jeju Island and enhancing the convenience of Jeju residents and visitors. Jeju Island and the Aekyung Group established two strategies for Jeju Air's climate action as major shareholders. The first objective is to promote SAF's introduction (sustainable aviation fuel).

Sustainable aviation fuel is known as SAF. It has the same chemical composition as conventional fossil jet fuel but is produced from renewable resources. Over the fuel's whole lifespan, using SAF reduces carbon emissions compared to conventional aviation fuel. Feedstocks include, but are not limited to, leftover cooking oil and other non-palm waste oils from animals or plants; solid waste from homes and businesses, including packaging, paper, textiles, and food scraps. Forestry waste, such as scrap wood, and energy crops, such as rapidly reproducing plants and algae, are two other possible resources.

Jet fuel packs a lot of energy for its weight, and it is this energy density that has really enabled commercial flight. Today, there aren't any other viable options for transporting groups of people quickly over very long distances, so we're dependent on this type of fuel in aviation. Depending on the sustainable feedstock utilized, manufacturing process, and supply chain to the airport, SAF may reduce carbon emissions by as much as 80% relative to the conventional jet fuel it substitutes [43].

The second is the utilization of carbon brakes. Jeju Air is replacing aircraft brakes with carbon brakes that are lighter in weight than existing steel brakes in an effort to reduce carbon emissions. Beginning with the replacement of the brakes on four aircraft in 2019, five aircraft in 2020, and 12 aircraft last year, This year, three aircraft were replaced, bringing the total number of aircraft replaced and in operation to 24.

By replacing steel brakes with carbon brakes, each aircraft's weight is reduced by 320 kg. In the case of the one-way Seoul-Jeju service, 11.52 kg of fuel and 36.4 kg of carbon dioxide emissions are saved. Through the use of 21 aircraft equipped with carbon brake replacement, we saved 160 tons of fuel in the past year. This results in a 505-ton decrease in carbon emissions.

4.3.2. Utilization of Renewable Wind Energy

Manufacturing and constructing offshore wind turbines do produce some emissions. But these are very small in comparison to emissions from fossil fuels—and vastly outweighed by the emissions saved by using offshore wind instead of fossil fuels [44].

Carbon dioxide is emitted during the manufacturing, installation, operation, and eventual decommissioning of offshore wind turbines. Simply put, the production of steel and other components, as well as vessel transport and heavy transportation, all, require the use of fossil fuels. We are working on carbon-free alternatives for the future, but for the time being, these are the only options for constructing offshore wind farms.

Life cycle greenhouse gas emissions are the most accurate measure of CO_2 output because they account for emissions made at every stage of a technology's lifecycle, from initial development to final disposal. Remember that during wind-powered electricity generation, no carbon dioxide is released into the atmosphere (see Figure 15).

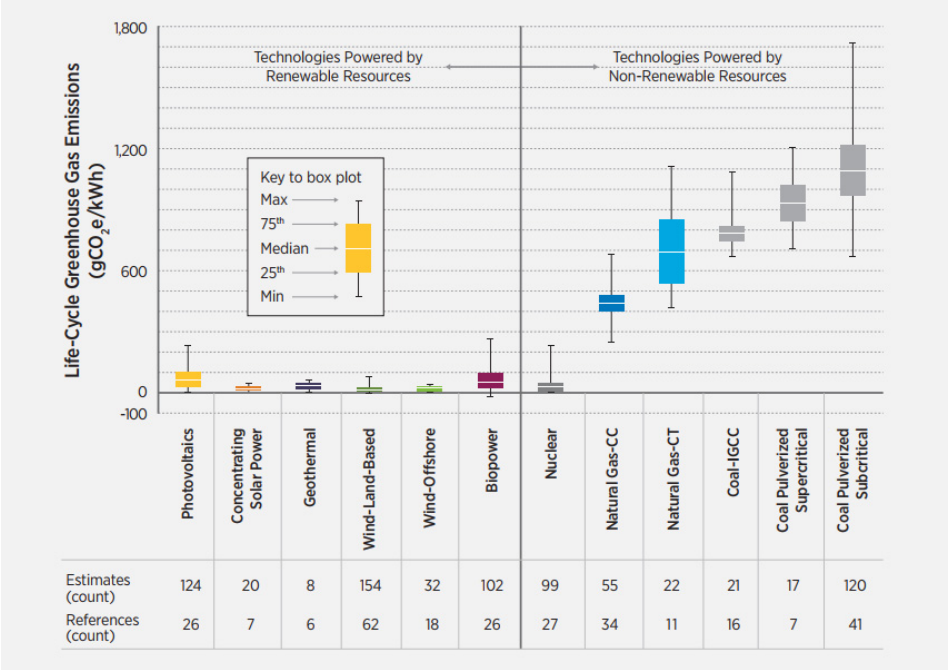

Figure 15. Summary of a systematic review of estimates of life-cycle GHG emissions from electricity generation technologies [45].

Greenhouse gas emissions from renewable energy sources are, on average, much lower than those from fossil fuels like coal and natural gas throughout the entire energy production process. Compared to the roughly 980 g CO_2/kWh generated by coal and the roughly 465 g CO_2/kWh generated by natural gas, the CO_2 emissions from wind energy are relatively low, at around 11 g CO_2/kWh. When compared to wind energy, coal's carbon footprint is nearly 90 times larger, while natural gases are more than 40 times larger.

Jeju Special Self-Governing Province is one of the regions having a higher renewable energy penetration rate than the national average. Jeju Island has actively promoted new and renewable energy projects under the name "Energy Independent Island" since the launch of the "Carbon Free Island (CFI)" policy in 2012. In consequence, the proportion of renewable energy generation on Jeju Island, which was only four percent of the total in 2011, increased to thirteen and a half percent in 2019. Wind energy generation is the largest of these industries. It is the consequence of employing the peculiarities of the windy island region actively [46].

On Jeju Island, 22 wind power plants have been completed (294 MW of electricity production), with 10 more under construction (720 MW of electricity production) (see Figure 16). The majority of Jeju's wind farms were built near the coast. The electricity

generated there is collected at mid-mountain substations and then transmitted to the area assigned to each substation. The majority of Jeju's coastal tourist destinations use electricity generated by wind power plants (see Figure 17). In addition, the power produced by 22 wind power plants on Jeju Island is delivered to charging stations for electric vehicles located across the island.

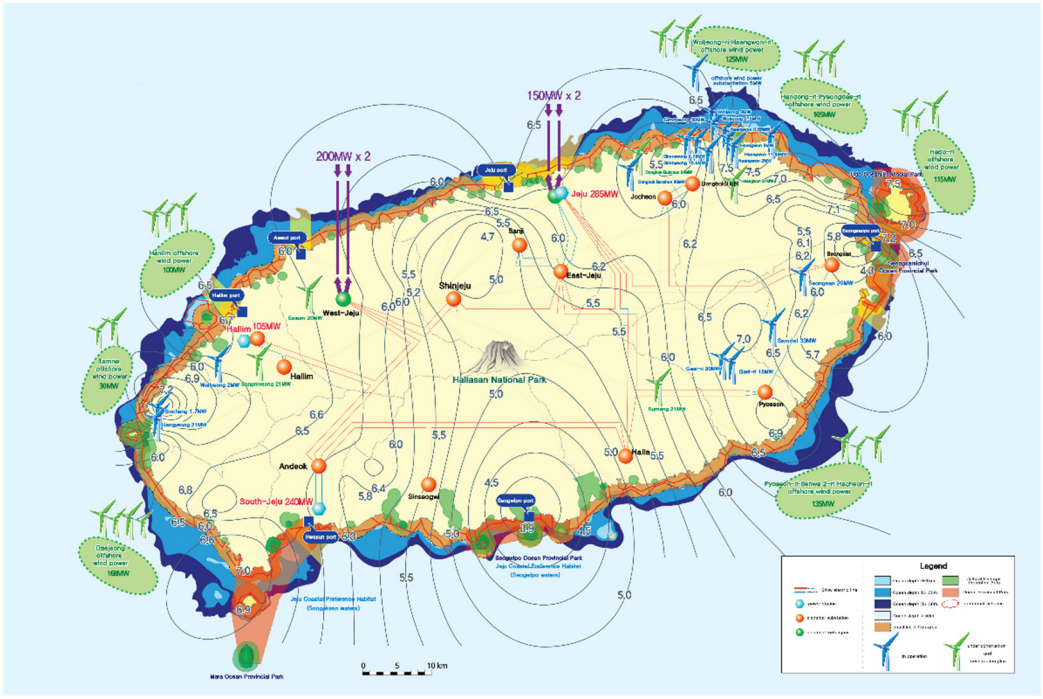

Figure 16. Distribution map of wind power generation in Jeju Island (source: Jeju Special Self-Governing Province).

Figure 17. A wind power plant built on the coast of Jeju Island (Source: Authors' photo).

This means that tourism on Jeju Island is shifting away from energy derived from fossil fuels, particularly petroleum. Because of this, the tourism industry—and the island's overall economy—is less susceptible to the ebb and flow of oil prices and the effects of burning fossil fuels in a fragile ecosystem. Eco-friendly tourists who are ready to pay a premium for sustainable tourism experiences, as seen on Jeju Island, believe that the switch to renewable energy would offer extra profits.

4.3.3. Carbon-Neutral Renovation of Tourist Buildings

The local government of Jeju is considering carbon emission reduction beginning with the construction of tourist destinations' various buildings. A restaurant building where tourism based on Jeju Haenyeo cuisine with a low food-mile footprint is in progress is a good example. The building was renovated to reduce carbon emissions, and the Jeju Haenyeo community received funding. The relationship between renovation and carbon emission reduction explains why the Jeju local government did not construct a building for low food mile tourism based on Jeju haenyeo food but rather acquired an abandoned building and renovated it.

Renovating an old structure is better for the environment and the economy than establishing a new structure. The significant disparity is due to the greater use of virgin materials in new construction, which results in a greater total amount of greenhouse gases being released over the course of their entire life cycle. Everything from digging up the raw materials to hauling them to the construction site to actually building something to tearing down the old structure. As a result, the environmental impact of constructing something new is much higher than that of fixing something up (see Figure 18).

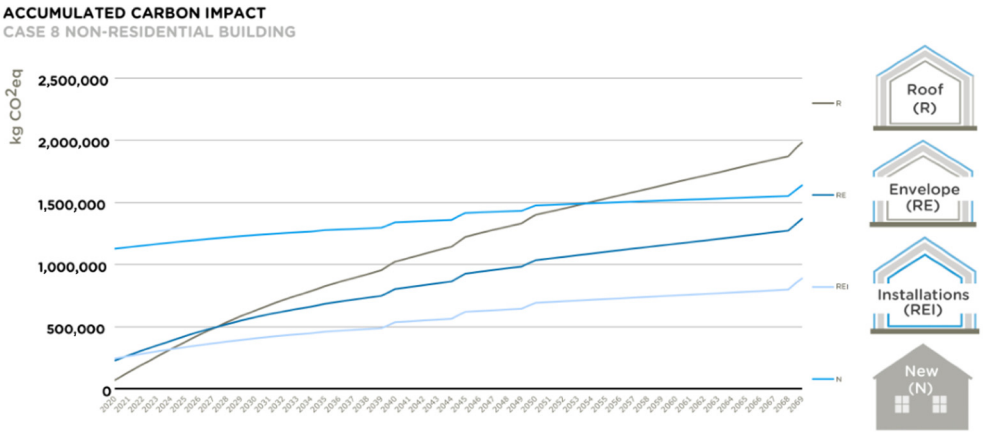

Figure 18. Cumulative climate impact for a commercial building which illustrates the different renovation scenarios and the corresponding demolition and new construction scenario [47].

The graph above shows when climate impacts happen during the lifetime of a building. According to the graph, renovation scenarios have relatively high carbon emissions during the first half of the observation period. Later on, the arc becomes more uniform. In the first 30 years after construction, new-build carbon emissions are shown to be significantly higher than those of renovation. If we prioritize repairs over new construction, we can help the effort to reduce greenhouse gas emissions. This prioritizing is further supported by the fact that the data indicating impacts in 2020 is real data, but the rest of the curve is based on future projections, such as material lifetimes, building operational consumption, and energy supply composition.

To prepare a space for Jeju Haenyeo food tourism, the provincial government of Jeju renovated an abandoned warehouse building on the beach rather than constructing a new building. In the 1970s and 1980s, the abandoned warehouse served as a fishing market for haenyeo on Jeju Island. In the twenty-first century, the building was abandoned as the fish

market relocated to a modern location. The provincial government of Jeju renovated the structure in order to reduce carbon emissions and utilized it for Jeju Haenyeo food tourism.

The provincial government of Jeju also aimed to reduce carbon emissions with the building renovation design. It is designed, for instance, to reduce heating costs by installing insulating glass on the building's walls and, simultaneously, to reduce electric energy consumption by utilizing natural light indoors (see Figure 19). In addition, the interior was designed with stones that were discarded and marine debris that was collected.

Figure 19. In order to save energy, insulation glass is placed, and natural light is employed for inside lighting (Source: Author's photo).

4.3.4. Creation of Marine Forests

Biology is another effective technique to maximize carbon dioxide sequestration. Carbon dioxide from the atmosphere is removed and transformed into biomass, such as a branch or leaf on a growing tree, when plants like trees photosynthesize and grow. Despite the fact that trees store carbon, the storage is vulnerable because the benefits are negated by deforestation or forest degradation, which releases the carbon back into the atmosphere. We must concentrate on long-term solutions when considering carbon sequestration.

Surprisingly, coastal ecosystems store a lot of carbon; they can store up to 20 times more carbon per acre than land forests. In order to estimate how much carbon dioxide is being taken out of the air by macroalgae, Krause-Jensen and Duarte [48] compiled data from previous studies. According to their rough calculation, macroalgae sequester approximately 200 million tons of carbon dioxide per year, which is nearly equivalent to the annual emissions of the state of New York [49].

Macroalgae have gas-filled bladders that allow them to float to the surface and absorb more sunlight for photosynthesis (see Figure 20). These gas-filled bladders allow macroalgae fragments to float for long distances and be transported far from where the macroalgae are grown. Macroalgae are mostly uneaten as they travel across the ocean because they contain unpalatable compounds. When the air bladders rupture, the macroalgae sink to the deep-sea floor, where the carbon is thought to be stored for hundreds or even millions of years, keeping it out of the atmosphere (ibid).

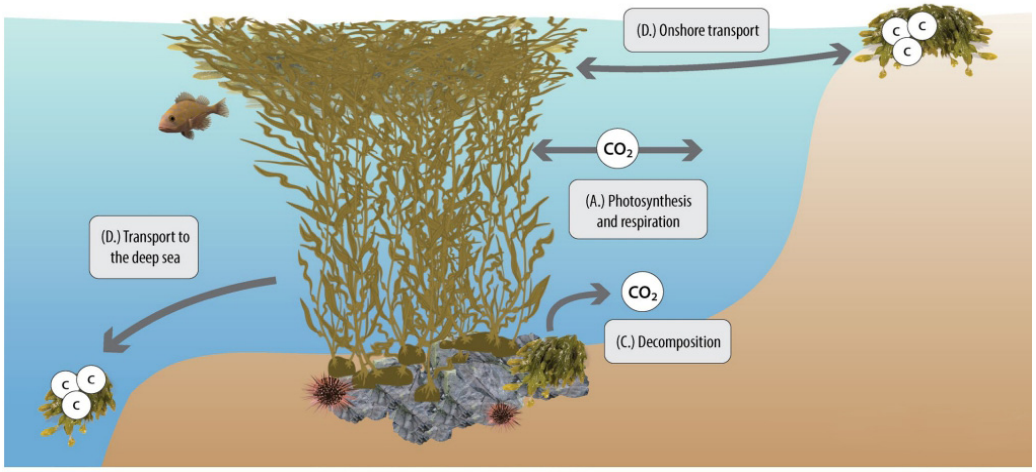

Figure 20. Pathways for sequestration of macroalgae carbon into the deep sea [50].

It was created on a large scale in the entire coastal area of Jeju Island in collaboration with the Jeju Island local government and the Republic of Korea's central government, based on scientific evidence that macroalgae in the sea have an excellent effect in removing previously emitted carbon. Since 2009, the Jeju Provincial Government and the Korea Fisheries Resources Agency have created approximately 9948 ha of sea forests along Jeju's coast (see Figures 21 and 22).

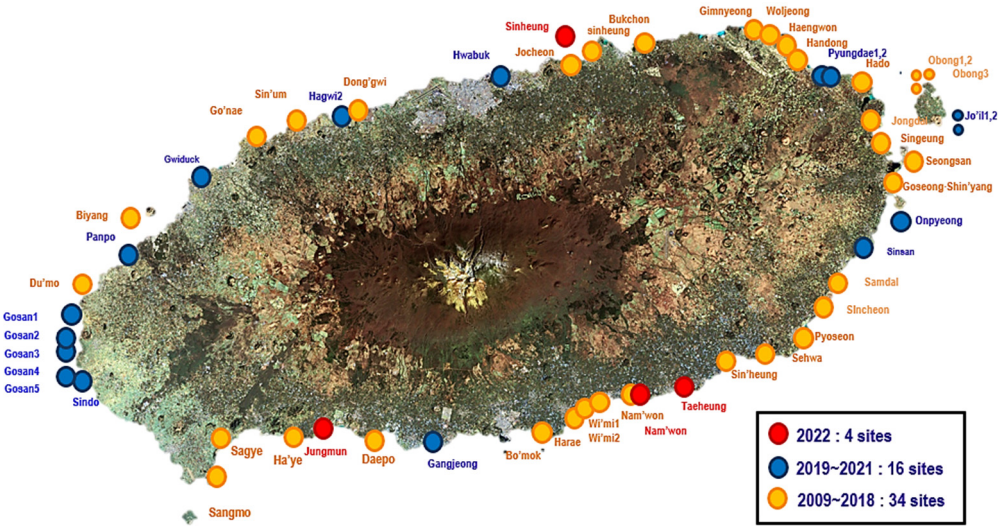

Figure 21. Distribution map of marine forest formation location (source: Korea Fisheries Resources Agency and Jeju Special Self-Governing Province).

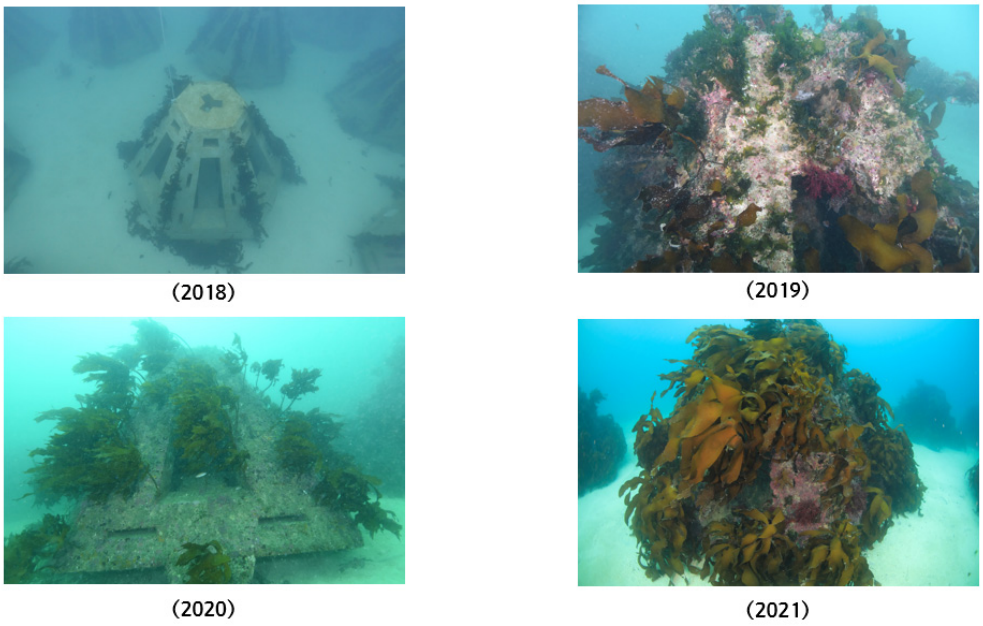

Figure 22. The process of forming a marine forest under the sea (source: Korea Fisheries Resources Agency and Jeju Special Self-Governing Province).

The sea forest on Jeju's coast was created by injecting artificial reefs within 15 m of water, and it serves as an ecological base for the habitat, spawning, and growth of the marine ecosystem's most important aquatic resources. The sea forest on Jeju's coast was discovered to absorb approximately 33,525 tons of carbon dioxide per year (3.37 tons CO_2eq/ha). This is the amount of CO_2 emitted by approximately 22,000 cars, and the sea forest is expected to be reflected in the national greenhouse gas reduction goal for responding to the climate crisis as a carbon sink, in addition to its role as aquatic life habitat and spawning grounds.

The majority of the tourism industries on Jeju Island rely on marine tourism resources. If Jeju's marine resources, which are the source of the island's marine tourism resources, fail, so will the island's tourism industry. Humans know very little about the vast majority of marine organisms. We will not learn anything about the marine life and ecosystems that have existed beneath the ocean's surface for hundreds of years. The ocean may contain secrets, but we risk destroying them before we discover them. If we don't protect the ocean now, our descendants may have a difficult time in the future. The construction of the Jeju Island marine forest is an attempt to mitigate such threats.

5. Lessons Learned from Tested Climate Actions in the Case Study

5.1. Conflict between Stakeholders

The Jeju Provincial Government initiated a project to link climate change mitigation and Jeju tourism. This project aimed to connect climate change mitigation efforts with the revitalization of Jeju tourism. To make the project more concrete, the Jeju provincial government sought the cooperation of several stakeholders (see Table 3). The Jeju provincial government convened a working group of stakeholders from various fields to investigate the relationship.

Table 3. Stakeholders involved in the promotion of Jeju tourism based on climate change mitigation.

Governments Sector	**Jeju Special Self-Governing Province**
Private Sector	Cultural tourism content planning expert group wind power facility industries
Civil Society	Jeju Tourism Association NGOs (environmental protection organizations)

To link tourism activities and climate action in Jeju, the Jeju provincial government, first invited the Jeju Tourism Association and the cultural content planning expert group. We learned about the climate change crisis threatening Jeju tourism activities from the Jeju Tourism Association. We learned how to use the contents of Jeju tourism activities as tourism content related to climate action.

The wind power sector was the site of major stakeholder disagreements. This is because if all profits generated from the sale of wind-generated electricity are returned to the relevant private companies, wind, Jeju Island's shared resource, will be converted into private property. By soliciting feedback from private companies in charge of wind power generation facilities and operations, the Jeju Haenyeo Association, Jeju residents, and the Jeju Provincial Council, the Jeju local government enacted the 'Jeju Special Self-Governing Province Wind Resources Sharing Fund Ordinance'.

Businesses that earn from wind energy give 17.5% of their yearly net revenue to the development profits fund. The "Jeju Special Self-Governing Province Wind Resources Sharing Fund Ordinance" is a legal tool used to accomplish this. There are various ways in which the profits generated from wind power development are used for coastal villages. It is used to encourage the development, use, and spread of new and renewable energy, to help vulnerable people get energy, and to educate people about new and renewable energy and promote it.

5.2. The Role of Local Governments as Conflict Mediators

Tourism on Jeju Island based on climate change mitigation was able to launch successfully due to the amicable management of conflicts between project stakeholders, particularly those relating to wind power generation. For the purpose of resolving the conflict, the provincial government of Jeju has established the Conflict Mediation Council. Six steps comprised the procedure for resolving conflicts at the Conflict Mediation Council meeting.

Step 1: Application Research Step
Step 2: Constituting the Council
Step 3: Preparation of basic operating rules for the Council
Step 4: Commencing the coordination of the council
Step 5: Preparing a draft consultation
Step 6: Developing an agreement

In the initial phase, a working team was formed that clarified the opinions of conflicting parties and simultaneously resolved the conflict. Step 2 involved determining if additional stakeholder participation was required to manage the conflict. Additionally, a mediator was chosen to resolve disputes between stakeholders. In the third stage, working-level officials and stakeholders reached an agreement to prepare basic operating rules for the efficient operation of the council. In step 4, the agenda and issues to be discussed by the participants were clearly outlined, and periodic meetings for discussion and consensus-building were held. In step 5, issues were discussed and mediated among stakeholders, and a draft agreement was drafted. In step six, a final agreement was drafted and written in collaboration.

Through conflict management and agreement among stakeholders for Jeju tourism based on climate change mitigation on Jeju Island, they gain a clearer understanding of the path to success. Additionally, this enhances one's relationship with the sustainable tourism project. Consequently, you will be able to prioritize tasks effectively. If climate

action projects are to be successful, numerous parties involved must encounter and learn to manage conflict. When dealing with multiple stakeholders, conflict is necessary for fostering creativity, problem-solving, and the development of climate action projects. Conflict can yield numerous benefits for the climate action project and its participants if managed properly. It assists stakeholders in determining what they value most, establishing productive relationships with other stakeholders, and achieving their desired outcomes, among other things. It has been demonstrated that healthy conflict benefits climate action projects by allowing people to release pent-up emotions, fostering the growth of climate action projects, and sparking new ideas.

6. Conclusions

The manner of implementation is increasingly seen as the deciding factor in the success or failure of climate initiatives rather than the acts themselves. There is a significantly more nuanced context for climate action, however, as is well recognized. It is argued that climate actions always resemble 'dilemmas' that are resistant to change, have multiple possible causes, and have potential solutions that vary in place and time according to the local context and that these factors that shape and influence implementation are complex, multifaceted, and multilevel [51].

As this level of comprehension has developed, the provincial government of Jeju Island has come to realize that more has to be done to guarantee that intentions are translated into outcomes or, in other words, to prevent the failure of climate change programs. Instead of allowing climate action plans to drift into total or even partial failure, the provincial government of Jeju Island is starting to take an interest in measures to enhance and support the climate action policy process, particularly the implementation phase.

The following is a summary of the essential elements of the climate action project created by the Jeju local government that can be duplicated as they were in successful climate action projects in developing nations. First, it is essential to foresee and plan for the reasons for climate change project failure. Second, a program to assist climate action initiatives must be established.

6.1. Identifying the Causes of Climate Action Project Failure

According to the consensus of various Jeju Island public officials in charge of climate action initiatives, there are four primary reasons why climate action programs fail. First, too optimistic expectations; second, ineffective decentralized governance; third, improper cooperative project choices; and fourth, the project cycle's caprices.

Be wary of too optimistic climate action project assumptions. The likelihood of a climate action project's success is often based on four factors. The first misconception is that the purpose and significance of a climate action initiative would be readily communicated. Second, in order to support a climate action project, enough information on its budget, timeline, benefits, and drawbacks must be established in advance, but this is seldom the case. Thirdly, the stakeholders are misunderstood. People often exaggerate their capacity to reconcile divergent viewpoints, which is rarely simple in actuality. Fourth, organizations in the public sector are characterized by their pursuit of quick outcomes. Civil service institutions, by their very nature, prioritize short-term results, and it should be acknowledged that this may be harmful to the eventual success of climate action.

The second issue is dispersed governance's inefficiency. The difficulty of establishing a particular degree of consistency at the private level may be a problem for government-led climate change efforts. Even if governance is centralized as opposed to decentralized, its execution will rely heavily on local conditions. In addition, planners of climate action projects must consider the tangled engagement of several parties with diverse information sources.

Third, there is an absence of collaborative project development. In spite of the fact that the majority of interventions will almost definitely have far-reaching effects on external parties, projects have a tendency to be designed in administrative silos. In addition, despite rising scholarly interest in the development of concepts and instruments to promote

inter-organizational collaboration, progress has been, at best inconsistent and restricted. Inadequate collaborative project planning and the inability to establish a common ground for public problem-solving via constructive management of differences remain two of the leading drivers of future implementation problems [51].

Fourth, the instability of the project life cycle Climate action project creators (politicians and officials) are often not held responsible for the consequences of their projects; in the case of failure, they will likely have moved on or resigned. As a result, individuals are readily enticed by the promise of short-term outcomes. This might result in rushing through climate action programs rather than diving into the ugly, time-consuming, and aggravating intricacies of how things can really play out. There is evidence that the political will required to push the development of long-term projects tends to wane with time. The worry is that the people who come up with climate action projects would gain credit for getting the law passed rather than for solving any problems that may arise during implementation. The latter is more likely to be seen as 'someone else's concern'.

6.2. Establishment of a Process for Supporting Climate Action Projects

A four-step procedure must be designed in order to successfully implement a climate action initiative. First, the development of climate action projects; second, the monitoring and administration of climate action projects; third, the support of climate action projects; and fourth, the evaluation of climate action projects.

In the first step, project preparation, the civil officials engaged in the project analyze the viability of the climate action project from the outset and, in reality, pay more attention to the implementation's practicability through improved project design. In such situations, a project-wide plan should be developed during the drafting phase, covering areas such as planning, governance, stakeholder engagement, monitoring, review and evaluation, and strategies for resource management [51].

For the second phase, monitoring and administration of the climate action project, it is necessary to form a department responsible for tracking and managing the project's progress. Local governments (or central governments) should create a department at a higher level to supervise climate change policies scattered across the civil service. In order to track and manage climate action projects, the higher level should focus on three factors.

The primary duty is performance monitoring. This entails assessing a constant stream of departmental performance data in order to track progress toward important policy objectives. The second activity is problem-solving. This includes doing field visits to identify distribution bottlenecks and regions where more resources may be needed to address specific problems. The third is an evaluation of progress. This requires supplying government authorities with frequent progress reports. While the bulk of these units has been headquartered in the government's center, this is not a prerequisite; others may be established in key ministries or for special priority initiatives [51].

The third phase, support for the execution of the climate action project, refers to assistance with the initiative's actualization. Due to the inherent complexity and duration of climate action projects, tracking and managing them may not be sufficient to ensure effective implementation. The implementation of climate change programs necessitates hearing the views of individuals on the front lines because frontline employees are more familiar with the problems of delivery than climate action project strategists.

This assistance is more concerned with fostering the art and craft of policy implementation than with elucidating legal responsibilities or addressing the need for legislative guidance, although both are crucial. It involves identifying what is being conducted well, what needs better, and how to produce additional capacity in the most efficient manner. All of this will need the formation of an intermediate body to bridge the divide between national and local narratives. The formation of "intermediary organizations"—groups of varying forms that promote successful implementation alongside and frequently under the direction of the government—is one approach.

The fourth phase is to assess the level of completion of the climate action initiative. Here, wit is constructive; it will seek solutions to a number of crucial problems. Was the problem correctly identified? Were there any major omissions? Were any important data left out of the analysis? Were the aims of the climate action project met? Are the taught lessons useful to future endeavors? In a rational, evidence-based environment, the answers to these questions may be utilized to modify implementation trajectories and influence decisions about whether to renew, prolong, or stop a project [51].

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