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Sustainable tourism and environmental degradation in the Rinjani-Lombok Unesco Global Geopark

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Abstract

The island of Lombok is one of the most popular tourist destinations in Indonesia. Unfortunately, the tourism industry in Indonesia has negative impacts on the environment. Indonesia's large flow of tourism is one of the largest contributors to waste and environmental degradation annually. The purpose of this research is to find out how large of a threat Indonesia's tourism industry is to environmental degradation, in the case of the Rinjani-Lombok UNESCO Global Geopark, West Nusa Tenggara. This research used qualitative research with data collection from document-based research, internet-based research as well as interviews with relevant stakeholders such as local government and non-governmental organizations. The results of the research show that environmental damage is caused by the tourists that aren't aware of their impacts on the environment as well as a lack of effort from the government to provide facilities that are adequate to reduce waste being produced in these areas.

Keywords: Environmental Degradation; Indonesian Government; Rinjani-Lombok; Sustainable Tourism.

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1. Introduction

For Indonesia, the largest archipelago with vast natural wonders, nature-based tourism is a critical point of view to the economy, with Indonesia's current Minister for Tourism and Creative Economy Sandiaga Salahuddin Uno aiming for the tourism industry to make up 12% of Indonesia's Gross Domestic Product (GDP) (Kemenparekraf RI, 2019). In 2019 Indonesia's tourism contributed a total of 4,7% of its GDP; a rate that has dropped to 4,1% in 2020 due to the COVID-19 pandemic. This drop of 0,6% was felt heavily across the nation, especially in the communities that rely heavily on a high flow of tourists such as Sade Village and Sembalun in Lombok.

The Mount Rinjani National Park (*Taman Nasional Gunung Rinjani*) is one example of a nature-based tourist destination located on the island of Lombok in the province of West Nusa Tenggara, Indonesia. The park has a total area of 41,330 ha that covers one-third of the Island of Lombok (Rinjani National Park, 2021). Rinjani National Park has been designated as a national park and conservation area based on a Decree from the Minister of Forestry No. 280/Kpts-VI/1997 on May 23, 1997 (Rinjani National Park, 2021). It is also written in Law No. 5 1990 on the Conservation of Natural Resources and its Ecosystem Article 1 Passage 14 that a National Park is an area that has the purpose of conserving and protecting the nature and ecosystem within, strictly controlled and monitored to ensure it retains its original form; with the only activities permitted including those for research, conservation, educational purposes, cultural practices, and tourism (No, 1990).

Unfortunately, although TNGR has been designated with such a critical role in Lombok's ecosystem, there is still mismanagement in its development. This has resulted in environmental degradation that can be seen from issues such as an increase in waste and poor waste management, bad agricultural practices that have resulted in eutrophication in critical water supplies, and the damage caused by a rapidly growing tourism industry which demands facility development has not been met as of yet. A large portion of the island has been designated as a tourist destination, and with the designation of two-thirds of the island as the Rinjani-Lombok UNESCO Global Geopark in 2018, an even larger portion of the island has been designated as an integrated tourist destination that has continued to grow in popularity both among domestic and foreign travelers. Some of the most iconic destinations are that of nature-based tourism and geotourism, including Mount Rinjani which has become popular amongst mountaineers as well as Gili Matra; a chain of three islands (Gili Trawangan, Gili Meno, and Gili Air) which has a fast coral reef that is popular amongst divers.

While this increase in tourist flow has boosted the economy, it has resulted in massive damages to the environment in the Rinjani-Lombok UNESCO Global Geopark area, especially in areas critical to the island's ecosystem. The development of the tourism industry in Lombok, like that of most places in Indonesia, is currently done unsustainably with a primary focus on increasing the flow of incoming tourism and providing amenities to match these larger numbers such as hotels, transportations, and many more similar facilities (Budisetyorini et al., 2017); at the same time aspects such as waste management and excess carbon emissions as a result of this increase in tourism has been overlooked for far too long.

1.1. Purpose of study

If sustainable tourism is developed and conducted properly, sustainable economic development would still be accomplished; the protection of natural resources, landscapes, and the environment does not necessarily mean halting or completely stopping economic development. Thus, this paper aims to provide a solution as to how actors in the tourism sector can mitigate the threat of environmental degradation in the Rinjani-Lombok UNESCO Global Geopark through a Penta helix approach in sustainable tourism development with special regards to the UNESCO Global Geopark model for development.

2. Research Method

2.1. Data collection method

This paper uses a qualitative research method with data collection conducted through document-based research as well as internet-based research. We also have conducted interviews with several stakeholders in the tourism sector; in particular those in Indonesian UNESCO Global Geoparks such as the Rinjani-Lombok UNESCO Global Geopark as well as the Batur UNESCO Global Geopark. In this research, the authors are determined to find the correlation between the increase of tourism flow and the environmental impact seen in the Rinjani-Lombok UNESCO Global Geopark.

Other data collected include from the internet that provides information on tourism flow, environmental degradation as well as waste management issues in Lombok. The Penta helix model to sustainable tourism that is developed and proposed in this paper uses previous studies conducted in several other tourism destinations in Indonesia that have taken similar approaches.

2.2. Population

Data collected by the authors are derived from government publications including the West Nusa Tenggara Environmental and Forestry Agency and the West Nusa Tenggara Tourism Agency, as well as the works of non-government organizations based in Lombok such as Ddoro Care.

3. Results

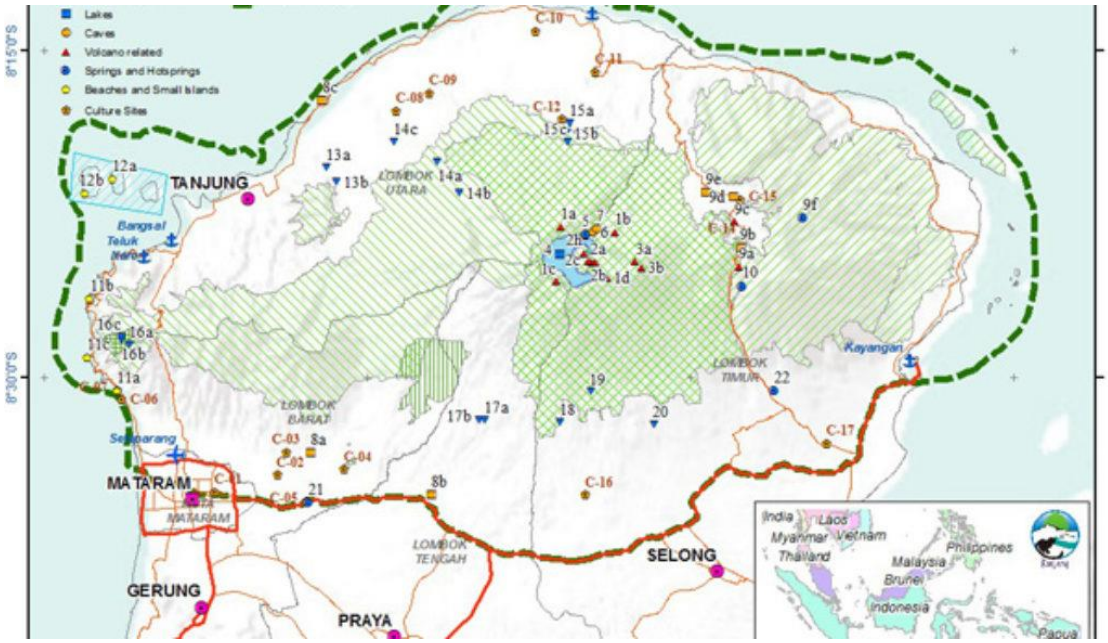
3.1. The threat of Environmental Degradation from the Tourism Industry

The Rinjani National Park serves as a buffer zone for life on the island of Lombok. Encompassing an area equivalent to one-third of the island, it is a vital area and the heart of the very island. This area of great importance was then even further extended to two-thirds of the island with the designation of the Rinjani-Lombok UNESCO Global Geopark in 2018. With the identification of several key geo-heritage, bio-heritage, and cultural heritage, this area has been marked as a Nationally Strategic Area (*Kawasan Strategis Nasional*) by the Indonesian government due to its significant biodiversity, geodiversity, and cultural diversity that is crucial for Lombok's ecosystem; both for the natural world in Lombok as well as for humans living on the island.

The Rinjani-Lombok Geopark contains the island's primary water source, at the Segara Anak Lake located at the center of the Geopark; the Mount Rinjani caldera. The caldera lake spans an area of approximately 6720000 m^2 with a depth of around 230 meters—this this serves as the main water supply to the entire island with an integrated chain of waterfalls, rivers, and lakes traveling to the corners of the island supplying freshwater to almost every community on the island. Not only that, if seen from the ecological aspect, the composition of vegetation in the Rinjani-Lombok Geopark, it can be seen that the area plays a vital role in allowing life to flourish with its variety of habitats that sustain life; including forests and swamps that act as water catchment areas for its surrounding communities (Rinjani National Park, 2021).

Figure 1

Map of Rijani-Lombok UNESCO Global Geopark with the Rinjani National Park shaded in green. (Rinjani Geopark, 2021)



Seeing how vital the Geopark is for the island of Lombok, it is concerning to see some issues still present in the development of the area (Sadikin et al., 2020). Visitors that come to the Geopark contribute to the accelerating rate of environmental degradation that is happening in the area. Human activities as a subsequent result of Lombok becoming one of Indonesia's ten priority tourism destinations have resulted in unmitigated destruction in Rinjani's critical natural ecosystems and unsustainable rapid development to meet the increasingly large number of annual visitors. A lack of proper facilities and infrastructures necessary to meet these numbers includes the lack of a proper waste management system in key tourist destinations such as the villages in the district of Sembalun located at the foot of Mount Rinjani as well as an increase in waste produced in these destination has resulted in immeasurable destruction in these vital ecosystems.

Sembalun at the present moment has difficulty addressing the issue of waste management both from the agricultural sector as well as tourism due to being located on higher altitude with terrain that makes it difficult for provincial municipal waste systems to support. At the moment much of the waste is untreated with a lack of proper landfills to meet the need of the villages. An increase in contamination of water sources from poor agricultural practices have resulted in early signs of eutrophication showing in the area, and the waste generated from tourism has resulted in several complaints from actors in the tourism sector themselves who contribute to the issue but rely on nature-based tourist destinations like Rinjani to remain clean for these destinations to appear attractive and remain appealing. This issue has only further worsened after the 2018 Lombok earthquake that cut off Sembalun from the rest of the island; with the only two roads connecting the area to the rest of the island collapsing.

Meanwhile key marine ecosystems such as that found in the popular diving area Gili Matra Area has endured an increase in tourist flow resulting in large waste being poured into the ocean, with plastic waste and pollution from boats being primary contributors to the destruction of the marine ecosystem in the area, not to mention the rapid rate of coral bleaching that continues to threaten to destabilize the ecosystem completely; resulting in vast ecological damages and loss in marine biodiversity.

In 2008 the total of visitors in Lombok reached a total of 544,501 people, but by 2019 this total had increased drastically to that of 3,706,352 people (Dinas Pariwisata Nusa Tenggara Barat, 2021). It was only due to natural disasters that occurred in the third quarter of 2018 as well as the COVID-19

pandemic in 2020 that notable dips were seen. This unanticipated sharp and rapid increase of tourism flow was failed to be met with expansion and improvement of public facilities, which resulted in damages towards areas of conservation and other nature-based tourism destinations which suffered from environmental damages and loss of natural habitat. The rate at which tourism has increased in Lombok has immeasurable consequences for the environment and a multitude of factors of externalities in unsustainable tourism development including the rapid increase in flow and population growth has increased issues affecting the environment such as a continuous increase in municipality waste generated (Tobing, 2005).

Table 1

Number of Annual Visitors in Lombok in 2008-2020, processed by the author from Dinas Kebudayaan dan Pariwisata Nusa Tenggara Barat and Rinjani National Park (2016)

Year	Domestic	International	Total
2008	213,926	330,575	544,501
2009	232,525	386,845	619,370
2010	282,161	443,227	725,388
2011	364,196	522,684	886,880
2012	471,402	691,436	1,163,142
2013	565,944	791,658	1,352,602
2014	752,306	876,816	1,629,122
2015	1,149,235	1,061,292	2,210,527
2016	1,404,328	1,690,109	3,094,437
2017	1,430,249	2,078,654	3,508,903
2018	1,204,556	1,607,823	2,812,379
2019	1,550,791	2,155,561	3,706,352
2020	39,982	360,413	400,595

Based on the table above it can be seen that both domestic and international travelers that visit Lombok had almost consistently increased annually, with the few exceptions being that of 2018 and 2020 due to the 7.0 magnitude earthquake in 2018 and the COVID-19 pandemic respectively. Despite the lowered number of tourists in the years following the earthquake, the Rinjani Geopark area still suffered significant habitat loss and sustained environmental damages as a result of activities in the tourism sector from the previous years that have yet to be mitigated. There is now an increase in land areas that are vulnerable to large scale habitat loss, deforestation, and environmental degradation due to unsustainable tourism development, with the TNGR conservation land under threat of suffering a loss as large as 20,000 hectares annually, with critically endangered areas as large as 161,193 hectares (Sadikin et al., 2020).

The devastation to these critical ecosystems risks having an overspill to other areas of life on the island, not just to the natural world but to human civilization as well. As human activities for economic growth become increasingly close to the natural world, the buffer between the two begins to diminish which results in rapidly increase habitat loss and environmental damage (Markum et al., 2004).

The rapid development of the tourism industry for economic growth in such an unsustainable manner has exacerbated these negative impacts, with other accompanying factors such as increased

carbon emissions from flights and clearing land and vital habitats for tourism infrastructure including landmarks, hotels, and amenities have contributed to further damage. The Board for the Rinjani National Park has noted a drastic increase in waste generated in the area due to the rising number of visitors. A survey conducted in 2016 by the Community for Mountain Cleaning and the Student Association for Environmental and Adventure Activities (*Mahasiswa Pecinta Alam*) there was a total of 453 tonnes of waste discovered in eight different national parks and mountains in Indonesia, with Mount Rinjani in Lombok taking first place holding a large amount of plastic waste (Arifin, 2016).

This is due to the high numbers of visitors not being met with a system for waste management that can account for the amount of additional waste being generated by the growing tourism sector. Waste can be categorized in its three states of matter: solid, liquid, and gas; with the last one including carbon emissions and pollution. At the current time, Lombok is ill-equipped to handle additional waste generated from its tourism sector, and a lack of an integrated waste management system that is sustainable and promotes a circular economy remains an issue. Most waste generated is untreated and thrown in landfills, rivers and water supplies, and wildlands themselves; contributing to further damage to the environment (Arida, 2012). In 2019 a reported total of 80% of West Nusa Tenggara's municipal waste was left untreated, and in the past years, the amount of municipal waste generated per capita in the province continued to grow. The table below illustrates this progression.

Table 2

West Nusa Tenggara Municipal Waste Generated in 2019 (Dinas Kehutanan dan Lingkungan Hidup Nusa Tenggara Barat, 2021)

No	City/Regency	Waste (Tonne/Day)	Sent to Landfill (Tonne/Day)	Recycled (Tonne/Day)	Unprocessed	
					Tonne/Day	Percentage
1	Mataram City	314,30	283,00	15,71	15,59	5%
2	West Lombok	469,56	60,00	0,56	409,00	87%
3	North Lombok	149,15	21,00	0,00	128,15	86%
4	Central Lombok	645,73	12,25	5,81	627,67	97%
5	East Lombok	801,74	15,40	0,08	786,26	98%
6	West Sumbawa	92,39	28,70	3,25	60,44	65%
7	Sumbawa	311,85	115,97	6,24	189,64	61%
8	Dompu	164,27	39,60	0,00	124,67	76%
9	Bima	325,94	20,00	19,56	286,38	88%
10	Bima City	113,83	46,00	0,00	67,83	60%
	Total	**3.388,76**	**641,92**	**51,21**	**2.695,63**	**80%**

The consequences that can be seen as a result of tourism are easily identifiable due to the trend of locations where excess waste is generated primarily being found in that tourist destinations. Vital water sources are contaminated with solid and liquid municipal waste, and poor agricultural practices risk eutrophication further damaging these water supplies. Not only does this threaten the vital water sources necessary to sustain life on land such as vegetation, but these waste-contaminated waters also flow directly to the ocean, which threatens the already vulnerable marine ecosystem to the brink of collapse. Even the tourism sector is facing effects from its actions, as the loss of preserved nature to unmanaged waste has reduced the aesthetics of these destinations making fewer visitors come due to negative publications online outlining the issue of waste in Lombok.

Lombok's atmosphere also faces critical issues with this phenomenon, as an increase in carbon emissions from large numbers of air, sea, and land travel result in pollution lowering the quality of air in Lombok. The West Nusa Tenggara Government has noted an increase in nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) in Lombok in the agriculture, transportation, and commercial sector from 2016-to 2018. The table below shows the increase in nitrogen dioxide and sulfur dioxide in Lombok from 2016-to 2018 in the transportation, agricultural, and industrial sectors (The History of Rinjani National Park, 2021).

Table 3

Air Quality Measurement in Lombok 2016-2018 (µg/m3), processed by the author from Dinas Komunikasi Informatika dan Statistik Nusa Tenggara Barat

Sector	2016		2017		2018	
	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2
Industry and Agriculture	43	119.76	73.83	50.1	20.21	41.8
Commercial	55.9	72.62	34.89	52	40.76	43
Transportation	44.21	45.961	36.35	58.7	28	48.7

As shown, the development of Lombok, including that of the tourism sector has an effect not only on the ecosystems on land and underwater but has also increased emissions contributing to air pollution and lower air quality as well as greenhouse gas release into the atmosphere which contributes to climate change. The waste and emission produced in the development of infrastructure and amenities such as the Mandalika Special Economic Zone also have untold consequences for the environment as hotels, the Mandalika Moto GP circuit, as well as other development plans in the area, generate waste and pollution while also reducing the number of natural habitats available on the island. This transforms much of those critical wild areas necessary to conserve into commercial areas, which will increase emissions, destroy nature-based tourism aesthetics, and have devastating consequences for the environment (Krishnamurti et all, 2017).

3.2. The Pentahelix Model for Sustainable Tourism Development

With all those aforementioned issues threatening the island's natural landscape, an alternative approach to tourism development is critical to mitigate and prevent further damages that result in environmental degradation. One of the growing consensuses is that tourism must be developed sustainably; bringing forth the concept of sustainable tourism. Sustainable tourism is a concept of developing the tourism industry in a manner that takes into consideration factors of externalities to ensure that not only are the needs of the now met but the needs of the future; ensuring that the often limited and non-renewable resources we have at the moment can still be present and available to be granted to future generations (Nofriya, 2016).

Through sustainable tourism, it is hoped that negative externalities of the tourism sector such as waste, carbon emissions, and damages to the environment, tourist destination, and local tangible or intangible cultural heritage can be minimized. The development of sustainable tourism is a concept that is gaining in popularity, with many nations attempting to develop their models and approaches to do so. The development of alternate means to take on the issues present in tourism such as how to develop accommodations and amenities, account for population growth and local communities, as well as preserve the significant heritage and the environment remains at the forefront of the concept.

Arida (2012) highlights that per the United Nations Environment Programme (UNEP) and the United Nations' World Tourism Organization (UNWTO) sustainable tourism has several principles:

1. The development of tourism must involve local communities to support local sustainable economic growth to instill in them a sense of care, responsibility, and commitment to preserving the environment.
2. Reach a balance between the needs of tourists as well as that of the community through cooperation amongst actors in the tourism sector (local community, government, the tourism industry, and organizations surrounding the tourism destination).
3. The development of tourism involves all stakeholders.
4. Make it easier for small to medium enterprises to grow and create jobs for the local community.
5. Tourism must support local businesses and communities.
6. Cooperation amongst local communities to create attractions and develop tourist destinations and provide tourism packages.
7. In its development, clear regulations regarding tourism must be taken great care of in establishing and monitoring as well as evaluating its effects on the tourism sector, community, and environment.
8. The development of tourism must ensure sustainability and must economically benefit local communities without burdening or creating losses for future generations.
9. Tourism must be built on the principle of optimization and not exploitation.
10. There must be implemented a periodical monitoring and evaluation process to ensure tourism is developed following the principles of sustainable development.
11. There must be transparency and openness in the use of available resources.
12. Establish programs that aim to increase human capital in local communities to be involved in sustainable tourism development.
13. Tourism must be able to achieve three qualities; quality life for local communities, quality tourism services, and quality experience for tourists.

The Indonesian tourism sector is beginning to steer away from focusing on quantity-centered tourism destinations and instead shifting towards sustainable tourism as well; especially in the designated UNESCO Global Geoparks of which Indonesia has six at the current time (Rinjani-Lombok, Batur, Belitong, Ciletuh-Palabuhanratu, Toba-Caldera, and Mount Sewu). This is due to the UNESCO Global Geopark being centered around three main pillars: education, conservation, and sustainable economic development of its three main compositions which are biodiversity, geodiversity, and cultural diversity. Per the Ministry of National Development Planning Law No. 15 in 2020 on “the National Plan of Action for Geoparks in Indonesia” Article 6 it is highlighted that in developing geoparks in Indonesia, it must be conducted with special attention to eleven of the seventeen United Nations’ Sustainable Development Goals (Bappenas, 2020). This has resulted in a shift in how the tourism sector in these areas has developed, with the development of the Pentahelix Model for Sustainable Tourism that has been adopted in many geoparks in Indonesia, including Rinjani-Lombok.

The pentahelix model for sustainable tourism is a reference in establishing synergy among all stakeholders in the tourism sector to promote an integrated effort through cooperation to develop the tourism industry more sustainably. It promotes synergy amongst different actors and institutions to achieve the goals for sustainable tourism and sustainable development (Vani et al., 2020). In the pentahelix model several actors are involved, such as local communities, academics, businesses and entrepreneurs, the media as well as local and central governments that work together collaboratively.

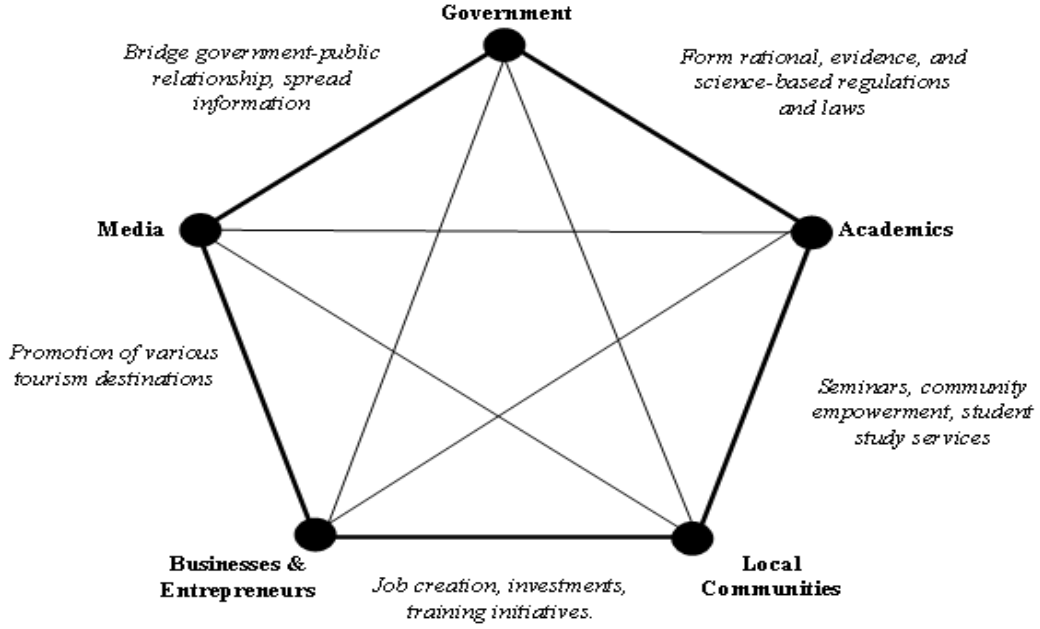
Sustainable development will require the maximization of positive impacts from these partnerships and efforts while minimizing the impacts towards resources as well as vital assets in the tourism industry for the sake of ensuring their availability in the future. Therefore, this can be realized if the actors involved actively participate in these goals set forth. Here the authors argue that for these goals to be obtainable, the mechanisms and roles that these stakeholders hold must be outlined clearly

in the development of the Rinjani-Lombok UNESCO Global Geopark. The following is a brief outline of the roles as well as a diagram outlining potential collaborative efforts and measures that can be taken.

1. Academics, which are researchers as well as those in tertiary level education which serve the role of conducting research, educating, and increasing the capacity of the region and the community by identifying issues and potential located in the region while also outlining crucial aspects to maintain in sustainable tourism development.
2. Local communities, which include non-governmental organizations, grassroots movements, as well as other groups in the region that serve to support the community, assist in the development of the region as well as protect and preserve vital parts of the natural ecosystem in the region.
3. The media, which serve to report development progress and any occurrences that need to be given attention to, which is vital in informing the public of these pressing issues that are present in the region.
4. Businesses and entrepreneurs, serve to assist the development of the region's economy, provide new jobs, as well as attract more tourists to the region; boosting the economy even further.
5. State and local governments, coordinate to ensure that all areas of sustainable development are taken into consideration by maximizing the roles of specialized agencies such as the Tourism Agency, the Department of Education as well as the Environment and Forestry Agency and its overarching ministries in the central government. Not only that, but legislative bodies also as well as the executive branch must formulate laws that are vital in ensuring sustainable development can continue while avoiding further environmental catastrophes and the judiciary must uphold these laws.

Figure 2

The Pentahelix Model for Sustainable Tourism Development



In the previous part of this research, the author has outlined how the Rinjani-Lombok UNESCO Global Geopark is facing unmitigated environmental degradation as a result of unsustainable economic development practices, especially from the tourism sector. The major issues present include deforestation, poor waste management, worsening air quality, destruction of vital geosites, and loss of biodiversity. Poor management of the Rinjani National Park and the Global Geopark's wildlife and natural heritage, in particular, that of sites with high tourism flow such as Mount Rinjani has resulted in envi-

ronmental degradation. Therefore a new approach in managing the parks that involve a multi-stakeholder approach focusing on restoring and preserving the bioheritage, geoheritage, and cultural heritage of the park is crucial in preventing the continuation of environmental destruction. The governments and their relevant institution must proliferate better collaboration with local communities, businesses, academics as well as the media to ensure that more sustainable practices in the tourism sector can be achieved.

Regarding waste management, the Indonesian government has regulated policies regarding the matter with Law No. 18 in 2008 on Waste Management as well as Government Regulation No. 81 in 2012 on Municipal Waste Management and Household Waste Management. Unfortunately, as shown above, in reality, Lombok and much of Indonesia are facing a waste crisis. A lack of facilities provided by the government, poor business practices, and a lack of consciousness from civilians on the issue of waste has exacerbated the problem and led to disastrous consequences. The government plays an important role in overcoming the waste problem in Mount Rinjani, but community support here is also very much needed if any change is to be desired. According to the 2009 Law on Environmental Management, mankind and the environment are two things that cannot be separated (Nugraha et al., 2018). Humans and living things have a reciprocal relationship, where human activities will affect the lives of other living things. All parties can and must work together in building and creating a healthy environment, as well as realizing sustainable tourism in Indonesia, especially here in the Mount Rinjani National Park has yet to fully steer away from poor tourism practices.

3.3. Measures taken to mitigate climate change and environmental degradation in the Rinjani-Lombok UNESCO Global Geopark

The Mount Rinjani National Park provides hydrological benefits, stabilization of the local climate, a place for endemic flora and fauna, a center for education particularly on the natural world, as well as tourism (Baharuddin, 2006). Therefore, when the Mount Rinjani National Park sustains environmental damages, it will harm the ecological, socio-cultural, and economic systems of the island and has the potential to result in a far greater catastrophe. The West Nusa Tenggara Provincial Government has formed an agency to deal with the waste problem that occurs in the Mount Rinjani National Park area. The agency that was formed was the Mount Rinjani National Park Centre (*Balai Taman Nasional Gunung Rinjani* or BTNGR). BTNGR is assisted by the surrounding community (mainly workers in the conservation and tourism sector such as porters for trekking), to inform the visitors of the National Park to participate in proper waste management.

A digital platform has also been developed to help this through the creation of the Mount Rinjani Trekking mobile application. This is done as a measure to reduce the amount of waste generated in the Mount Rinjani National Park area to reduce the rate of environmental damage. The West Nusa Tenggara Environment and Forestry Service has also built a waste management movement in its area, namely the Eight Pillars Movement (*Gerakan Delapan Pilar*). Among these pillars are building regulations, providing better facilities that can meet the needs of the large tourism flow and increasing population, encouraging independent waste management, revitalizing cooperation, socialization of sorting waste from the source, diversifying waste bank businesses, massive education and campaigns, involving as many parties as possible, and industrializing the islands waste management system to ensure efficiency and promote circular economy.

In addition, in the social dimension, the ecotourism and geotourism learning process greatly affects the sustainability of the tourism industry. Geotourism itself refers to tourism based upon the geopark development model—focusing on preserving and promoting the geodiversity, biodiversity,

and cultural diversity of an integrated region. Meanwhile, ecotourism is tourism based on natural resources, developing environmental aspects in terms of conservation and village development to improve the local economy (Tanaya & Rudiarto 2014).

Ecotourism is linked heavily with education as it promotes an understanding of the value of the environment, culture, and natural resource management towards travelers. Education here is not only a means of knowledge transfer but also provides mutual understanding related to the environment, inspire people to care for the natural world, and pique their interest in participating in environmental conservation by promoting a unique experience while still following responsible tourism and ecotourism practices and paying attention environmental management and preservation. For Mount Rinjani, spreading awareness surrounding conservation and ecotourism is carried out by the Tourism Office or BTNGR, but awareness remains low among local communities as the attention of the local community remains largely limited to climbing and trekking activities. Therefore, education and dissemination of knowledge related to ecotourism are very necessary in this case.

According to Law No. 32 of 2009 Article 1 Paragraph 2 concerning Environmental Protection and Management, states that systematic and integrated efforts are carried out to preserve environmental functions and prevent environmental pollution and damage including planning, utilization, control, maintenance, supervision, and enforcement. Every human being certainly wants to live in a healthy, clean, and well-preserved environment. However, to achieve all of this, a shared understanding and willingness to commit to efforts to preserve the environment is critical. Various efforts made to protect the environment must not only come only from the community, but all stakeholders in the area play an important role in this. Although various efforts have been made by the government in overcoming environmental problems, without the awareness and support of every individual and community, business, the media, and academics it will not be easy to achieve the goal of developing Lombok's tourism industry more sustainably and mitigating environmental degradation suffered as a result of decades of poor tourism management.

4. Conclusion

From this research, the authors can conclude that the environmental damage sustained in the Rinjani-Lombok UNESCO Global Geopark and island of Lombok as a whole is a result of unsustainable tourism development that focuses on increasing the quantity and flow of tourists without matching the need for facilities such as proper waste management, renewable energy technologies, environmentally friendly public transportation and improving amenities. While the provincial government of West Nusa Tenggara, and by extension, the government of Indonesia as a whole, have improved greatly upon the level of response to the environmental and climate crisis being faced through the designation of Rinjani as a national park and later on a global geopark; the recent development of Lombok as a priority tourist destination and the special economic zone has worsened the impact of human activities on the environment.

Therefore, a more robust and holistic approach to tourism must be taken, that takes into account of negative externalities that the tourism sector has towards life on the island. The Penta helix approach takes a multi-stakeholder collaboration to promote sustainable tourism development that focuses on ensuring that the region remains preserved and protected in all three core aspects of the geopark; its bio-heritage, geoheritage, and cultural heritage. By providing a platform for local communities, government actors, businesses and entrepreneurs, the media, and academics to come together and collaborate, the Rinjani National Park and Global Geopark Secretariat would be able to ensure these reforms take place.

Tourists themselves have the responsibility to contribute to this effort by becoming more conscious of their impact on the environment and the best practices to minimize them. Not only that but

regulations must also be reformed and applied more strictly in critical zones for conservation; understanding from local wisdom that sometimes the most sustainable development is no development at all—instead focusing on preserving the natural world as best as possible by minimizing human activities in the area and creating a buffer between civilization and the wild.

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