

## Enabling Low-Carbon Tourism Through Technology Transfer in Indonesia: A PESTEL Analysis

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### *Abstract*

The tourism and travel sector has contributed significantly to Indonesia's economic growth and robust development. Despite its positive impact, tourism and travel business activities also potentially impact environmental loss. In order to reduce these negative impacts, the new concept of tourism, namely low-carbon tourism, which focuses on environmental sustainability, can be implemented as the enabler. One of the factors that can support the implementation is the existence of environmentally friendly technology that requires a technology transfer process. This paper aims to overview the role and implication of technology transfer for enabling low-carbon tourism in Indonesia and outlining a conceptual framework for addressing the political (P), economic (E), social (S), technological (T), environmental (E), and legal (L) factors that constrain and support in enabling low-carbon tourism through technology transfer in Indonesia. A qualitative library research method and PESTEL analysis were employed to analyze and map the implications of external factors influencing the development of low-carbon tourism through technology transfer in Indonesia. The paper denotes that all the factors (political, economic, social, technological, environmental, and legal) were interrelated. Nevertheless, the economic factor was the only one with a moderate policy to encourage businesses to use green practices, particularly for the carbon tax policy. Consequently, there was still an opportunity for monetary policy to promote low-carbon tourism.

**Keywords:** low-carbon tourism; technology transfer; PESTEL analysis.

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## 1. Introduction

Tourism is a dynamic and fastest industry that boosts global economic growth. According to current global data, travel and tourism's direct contribution to GDP was approximately 5.8 billion U.S. dollars in 2021 (Statista, 2022). Although the COVID-19 pandemic devastated the tourism industry, the sector recovered almost 60% of pre-pandemic levels, and international tourist arrivals almost tripled from January to July 2022 (+172%) compared to the same period of 2021 (UNWTO, 2022). Meanwhile, data in Indonesia show that in the period 2016 to 2019, the contribution of the tourism sector to the national Gross Domestic Product (GDP) was equal to the value of the Gross Domestic Product of Tourism (GDP), increasing from 4.63% in 2016 to 4.97% or reaching 1.734 trillion rupiahs in 2019 which shows the value-added contribution of the tourism industry to the entire Gross Added Value (GAV) for the national incomes (Badan Pusat Statistik, 2021). Apart from its benefits to the global and national economy, the tourism industry also has the potential to contribute to environmental problems, including the increasing levels of greenhouse gas (GHG) emissions as access to the increasingly massive use of fossil energy (Zhu et al., 2017); failed of ensuring the cleanliness of destinations based on waste management inability (Chaabane et al., 2019; Tsai et al., 2021); and contributes to more than 5% of global greenhouse gas emissions, with transportation accounting for 90 %, and by 2030, a 25% increase in CO<sub>2</sub>-emissions from tourism compared to 2016 is expected from 1,597 million tons to 1,998 million tons (Statista, 2021).

With the background of efforts to reduce the negative impact of tourism in its development, the concept of low-carbon tourism emerged that focuses on environmental sustainability (Zhu et al., 2017). According to Yu-ming (2010), low-carbon tourism is a new concept of tourism that aims to reduce CO<sub>2</sub> emissions and create a healthy and sustainable environment by creating low-carbon tourist attractions, building low-carbon tourist facilities, preserving carbon-absorbing environments for tourist experiences, and promoting low-carbon consumption patterns (Yu-ming, 2010). Closely related to the concept, the study of He & Wang (2021) indicates that a low-carbon tourism implementation is a form of transformation of traditional tourism that is susceptible to impact ecological damage, which then creates green and ecological tourism patterns. It is vital for environmental protection and sustainable tourism development (He & Wang, 2021). Moreover, the study of Bhaktikul et al. (2021) denotes that the practice of low-carbon tourism has an impact on the emergence of environmentally friendly agriculture, forest restoration-conservation, improved public health management, and strengthening community participation to support changes in tourism patterns by the concept of sustainable tourism (Bhaktikul et al., 2021). The implementation of the concept is also following UNWTO recommendations in order to realize the transformation of sustainable and environmentally friendly tourism, namely by strengthening the measurement and monitoring of the impact of CO<sub>2</sub> emissions in the tourism sector, accelerating decarbonization in the tourism business, and involving the tourism sector in carbon reduction efforts (World Tourism Organization, 2021).

The transformation of the tourism sector to climate change and environmental conservation mode, in the context of low-carbon tourism, is also in line with current tourist trends and interests, which is illustrated by the results of the latest Booking.com research survey (Booking.com, 2022)-from more than 30,000 travelers across 32 countries and territories, highlighting the impact of their trips, with 71% of global travelers confirming that they want to travel more sustainably over the coming 12 months, which is a 10%

increase over what was surfaced through the 2021 data. With 81% of travelers confirming that sustainable travel is essential to them, 50% of respondents cited that recent news about climate change has influenced them to make more sustainable travel choices. Over 35% of global travelers confirmed that the sustainability efforts of accommodations and transport services providers play a vital role in their property and transport decisions, respectively. 70% of global travelers confirmed that they would be more likely to choose sustainable tourism activities (Booking.com, 2022).

Moreover, one of the supporting factors in implementing low-carbon tourism is the presence and utilization of technology. According to Can & Hongbing (2011) and Zhang et al. (2016), within the framework of the low-carbon tourism development model, technology is placed as a method for implementing the concept, which focuses on the dimensions of tourism infrastructure support, which includes energy efficiency of amenities, water conservation, new energy, low-carbon transport, and those related to the travel experience in the context of pollution emissions controlling (Can & Hongbing, 2011; Zhang et al., 2016). A study by Shih & Yao (2020) denotes that Innovative technology products can be used to facilitate awareness and concern for environmentally friendly tourism, and tourists' awareness of the environment is also supported by technology (Shih & Yao, 2020). According to this study, Zhu et al. (2017) show that the low-carbon paradigm in the tourism industry can be accelerated by adopting and encouraging the use of low-carbon technologies (Zhu et al., 2017). Thus, technology is essential in supporting decarbonization efforts for a sustainable environment through low-carbon tourism.

Although it has not been illustrated explicitly and described for tourism sector purposes yet, the Government of Indonesia framework policy showed that the use of technology plays a vital role in the context of decarbonization, as stated in the Indonesia Long-Term Strategy for Low Carbon and Climate Resilience 2050 (Ministry of Environment and Forestry, 2021). Even though the latest global data contained in the 2022 Global Innovation Index shows that although there is an increase in Indonesia's ranking from 80<sup>th</sup> in 2021 to 75<sup>th</sup> in 2022, the ecological sustainability and knowledge creation sub-indicators are still relatively low (World Intellectual Property Organization, 2022). The Indonesian government realized the lack and gap of technologies existing, so one of the scenarios in the direction of the national policy to support low-carbon development is by technology transfer process (Ministry of Environment and Forestry, 2022). A study by Weko & Goldthau (2022) denotes that there is an urgent need to address the low-carbon technology gap by promoting initiatives and mainstreaming technology transfer, including intellectual property rights (IPR) sharing platforms (Weko & Goldthau, 2022). Furthermore, successful implementation of technology transfer in developing countries requires capacity development and implementation of innovations, active involvement of end-users, implementation of cost-reflective tariffs, and establish an environment (Urban et al., 2015). However, based on literature searches, data, and information by the author, there have yet to be any best practices or research that specifically raises and elaborates on the issue of the transfer of low-carbon technology in the tourism sector, especially in Indonesia.

Due to the need for more research and literature that elaborates on low-carbon technology transfer in the tourism sector, this research aims to identify and elaborate on the external factors that predispose and influence the development of technology transfer that enables low-carbon tourism in Indonesia by enacting PESTEL analysis. The scope of the PESTEL analysis includes political, economic, social, technological, environmental, and

legal factors. This paper will mainly focus on reviewing and presenting policies, legislations, and related subjects, as well as relevant literature that is currently limited.

## **2. Methods**

This study uses a qualitative library research method. This method is used in this research because it can explain comprehensively the characteristics of the phenomenon or problem that is the focus of the research (Creswell, J. W., & Creswell, 2018). In this study, we overview the role and implication of technology transfer on low-carbon tourism. Then a strategic analysis is carried out using the PESTEL approach (political, economic, social, technological, environmental, and legal) analysis (Anton et al., 2021; Yüksel, 2012). This approach aims to analyze six external factors that can have a significant influence on enabling low-carbon tourism through technology transfer in Indonesia, namely political, economic, social, technological, environmental, and legal. In addition, this approach helps understand situational factors and internal and external analysis (Gregoric, 2014; Nicula & Spanu, 2019). The data used in this study comes from secondary data originating from books, journals, articles, report documents, and laws and regulations that elaborate and address the research problems raised, namely the enabling low-carbon tourism through technology transfer in Indonesia. Furthermore, the data and information are processed, analyzed descriptively analytically, and synthesized so that they can elaborate and answer research issues.

In detail, this research consists of three paths, these are:

- 1) Identify issues related to low-carbon tourism and its relation to the technology transfer process as an enabler to support sustainable tourism through library research. In this research process, the data used in this study comes from secondary data originating from books, journals, articles, report documents, and laws and regulations.
- 2) Conduct external factor analysis through PESTEL analysis. Through this analysis process, several factors, including political, economic, social, technological, environmental, and legal, are analyzed qualitatively to find a more comprehensive description of strategic issues and factors which influence the process of technology transfer to enable low-carbon tourism.
- 3) Discusses the results of PESTEL analysis in order to obtain strategic implications. These implications are helpful as a preference for arranging strategic recommendations relevant to the technology transfer mechanism in the context of enabling low-carbon tourism.

## **3. Results, Analysis, and Discussions**

### **3.1. Research findings**

Using PESTEL analysis, the strategic issues and external factors that impact the development of the technology transfer on low-carbon tourism will be now identified. This analysis also denotes provisions that typically can affect or be impacted by any related activities, targets, or policies.

### **3.1.1. Political**

#### ***3.1.1.a. Policies related to low-carbon tourism***

The Indonesian government's policy regarding Low Carbon development has been included in the National Medium-Term Development Plan 2020 – 2024. The government makes Low Carbon Development a priority program in National Priority No. 6, "Building the Environment, Improving Disaster Resilience and Climate Change." More specifically, the national priorities are broken down into three policy groups, namely: (1) improving the quality of the environment; (2) increasing disaster and climate change resilience; and (3) applying a low-carbon development approach, with the target of achieving GHG emission reduction in the 2020 - 2024 RPJMN is 27.3% and towards 29% by 2030 (Utomo et al., 2020).

This target is one of the efforts to maintain the quality of the environment and natural resources that have the potential to hinder the sustainability of Indonesia's economic growth, one of which is in the tourism sector. One of the policies offered in Indonesian tourism is low-carbon tourism. The low-carbon Tourism Policy is discussed in two basic approaches: 1) Policy implications for current climate change impacting the tourism sector, and; 2) Policies, programs, and actions that impact climate and tourism (Ramasamy & Swamy, 2012). Both approaches require a low-carbon pathway through awareness (measurement and disclosure of emissions associated with tourism activities) and optimization (instruments and strategies to improve mitigation and adaptation in the tourism sector) as critical elements (UNWTO, 2021).

The commitment to developing low-carbon tourism has also been stated in various Integrated Tourism Master Plans. One of the policies stated is sustainable tourism. One example is ITMP Lombok-Gili Tramen (Presidential Regulation No. 84/2021), sustainable aspects in tourism activities are applied to avoid excessive exploitation in tourism development. The Indonesian government's concentration is not only on environmental aspects but also on social and economically. The concept of tourism development is carried out through environmental governance to maintain, improve the quality and quantity of natural resources, and avoid and reduce damage and pollution from tourism activities.

Related to sustainable development in tourism destinations, in order to be able to observe the concept of low-carbon tourism, tourism destinations must be able to manage resources as well as waste and emissions. Various indicators in environmental sustainability policies for the development of low-carbon tourism in tourism destinations are contained in the Regulation of the Minister of Tourism and Creative Economy No. 9/2021, including that tourism destinations must have energy efficiency programs, be able to control the source and amount of water used for tourism needs and their impact on the community and ecosystem, have a sustainable water treatment system, has solid waste management programs, programs or activities to reduce emissions, carbon offset schemes from tourism activities, programs related to environmentally friendly transportation, as well as programs related to reducing the effects of light pollution. The policy of developing low-carbon tourism destinations will increase public reputation and trust in the Indonesian tourism sector to support the acceleration of economic recovery and open up job opportunities.

### ***3.1.1.b. Policies related to technology transfer***

Technology transfer policy in Indonesia is an important issue considering that the contribution of various ministries/institutions is still low since the new order era until now. The policy issue is closely related to the lack of programs or activities from ministries/institutions downstream of the results of technology development and innovation activities to its users. One of the policy alternatives that is a breakthrough to minimize technology transfer problems is strengthening the Technology Transfer Office (TTO) policy (Kireyeva et al., 2020). The policy is viral in various developed countries in downstream technology and innovation to Industry and Users (Algieri et al., 2013). For example, some developed countries, such as America, Australia, Canada, Japan, and the United Kingdom, and other developed countries have implemented TTO as an effective technology transfer policy (Chakroun, 2017).

Developing TTO should be considered part of a comprehensive strategy in the technology transfer process to drive innovation and technology growth in Indonesia to achieve optimal results. The technology transfer policy aims to increase the productivity of technology development activities and bring technology owners closer to their users, such as (Industry, society, and government). Another objective of this policy is that transferring technology through investment in business entities from developed countries can produce a significant economic impact if these activities can be linked to domestic producer networks in the value-added production chain. Strengthening the technology transfer process can also improve people's ability to utilize science and technology to benefit society and the state.

Another policy carried out by the Indonesian government through the technology transfer program is the transfer of knowledge from foreign workers to Indonesian workers. The use of labor is facilitated through investment in Indonesia, which allows multinational companies to hire foreign workers. Using foreign workers by foreign investors entering Indonesia provides opportunities for Indonesian workers to improve quality and competitiveness through technology/knowledge transfer. Even though Indonesia is open in terms of the use of foreign workers, the government still tries to protect Indonesian citizen workers by implementing regulations. Among others, foreign workers entering Indonesia must be 'skilled' workers so that it is possible to transfer skills/knowledge, which encourages the improvement of the competence of the Indonesian workforce.

Various technology transfer policy models in Indonesia will be able to realize the purpose of technology transfer in improving people's capabilities and generating economic impacts for the country. The technology transfer model is an alternative to produce an innovation ecosystem that can affect industry, society, and government independence. The two policies above will be very useful in strengthening the tourism sector and incredibly sustainable tourism development.

### **3.1.2. Economic**

#### ***3.1.2.a. Contribution of low-carbon tourism to economy***

Countries worldwide are currently designing and implementing low-carbon development strategies to achieve economic, social, and environmental sustainability. These strategies aim to reduce long-term greenhouse gas emissions and increase resilience due to climate change. The problem is associated with a typical high-carbon economy. So that all countries in the world handle climate change mitigation to achieve a low-carbon economy

(Pan et al., 2020). Furthermore, it is necessary to explore measures in environmental protection and a system for calculating the number of carbon emissions to evaluate low-carbon economic development at the regional and national levels (Andrew & Forgie, 2008; Böhlinger & Rutherford, 2013).

Low-carbon economic development is related to the concept of sustainable tourism. The contribution of tourism to a low-carbon economy has been widely taken into account by various countries. A low-carbon economy in the concept of tourism will create a higher standard of living and a better quality of life by creating opportunities for developing advanced technologies in the tourism business to minimize the high number of job opportunities (Luo et al., 2016). According to Pongthanaisawan et al. (2018), The main driving force of the low-carbon tourism sector in economic growth can be seen through the amount of foreign capital investment, tourism growth, and job creation.

**Table 1.** The Contribution Of the Tourism Sector to the National Economy

Indicator	Unit	2019	2020	2021	2022*	2023*
Amount of investment in the tourism sector	Million USD	840.66	2,000.15	2,200	2,420	2,680
Number of National Tourists	Million trips	722,2	524,6	603	633-703	660-733
Number of Foreign Tourists	Million visits	16,1	4,05	1,5	1,8-3,6	3,5-7,4
Number of tourism workers	Million People	20.76	20.43	21.26	21.64	21.93
Tourism GDP Contribution	%	4.8	2.24	2.40	3.60	4.10

\*Projection Data

Source: MOTCE Data, 2022

### 3.1.2.b. Economic policy instruments

Various countries have implemented the role of economic policy instruments in low-carbon economic development. In developing low-carbon tourism, these various policy instruments can be tax policies, management of tourism industry permits, and financial subsidies (Zachariadis et al., 2020) for tourism players. These policy instruments are used to change the pattern of private and foreign investment decisions and consumer behavior toward cleaner, greener, and more resource-efficient consumption and production patterns. Meanwhile, economic policy instruments supporting the above policies must be complemented by other supporting instruments such as regulations, the application of technology, and the socialization of tourism actors' awareness in a low-carbon tourism transition to generate other economic benefits.

Economic instruments have a critical role in becoming the dominant policy tool in cost-effectively achieving low-carbon tourism development. Related to tax policy, the use of green bonds in fiscal policy has supported low-carbon economic schemes, which can be used as infrastructure financings such as bridges, roads, and other infrastructures. that lead to a low-carbon tourism model and are used to address short-term policies in financial markets and governments (Semmler et al., 2021). Strengthening investment through current stimulus and recovery programs can be done appropriately based on sustainable, inclusive,

and resilient recovery. In addition, consistent efforts are needed to synergize low-carbon development priorities with tourism policies to improve the instrument's effectiveness. The policy aims to facilitate a viable, cost-effective, fund-friendly transformation acceptable to the community in the concept of low-carbon and resource-efficient tourism.

### **3.1.3. Social**

#### ***3.1.3.a. Contribution to social development***

Low-carbon tourism has a positive impact on social and community economic development. The development synergizes with community development to increase employment and income and strengthen social capital (Jiang et al., 2013). Social capital is built through community participation in developing low-carbon tourism to solve environmental problems. Increasing new knowledge and skills are used by the community in maintaining the tourism ecosystem to grow and develop sustainable tourism schemes. The contribution of low-carbon tourism development will also result in job creation through community development by mobilizing community skills, changing people's mindsets, thinking creatively for solutions to future problems, and utilizing community resources for sustainability.

Bhaktikul et al. (2021) revealed that based on the analysis related to social & community development of a low-carbon economy, low-carbon tourism facilities, and low-carbon culture in the Thai region could be utilized for the sustainable development of low-carbon communities. Community participation through local organizations or communities will continue to promote low-carbon tourism development, resulting in a sustainable economic impact in the region. People are beginning to realize the critical role of low-carbon tourism in preparing themselves through community economic development because of the uniqueness of their identity, beauty, and natural wealth. They follow the philosophy of a sustainable independent economy.

One of the contributions of low-carbon tourism development is related to the increase in the number of workers in the tourism sector (Table 1). In 2019, the number of workers was 20.76 million, which will increase in 2023 to 21.93 million people or an increase of 1.17 million people over five years. The increase in the number of workers is in line with strengthening community participation in improving the tourism sector. Through the concept of low-carbon tourism, social development has a significant role. The existence of new technology that must be applied in sustainable tourism development requires an additional skills from the community or tourism workforce. The need for these workforce skills will create new jobs, thus supporting low-carbon tourism in the future.

#### ***3.1.3.b. Human resources capacity***

The existence of Human Resources (HR) has an essential role in the development of low-carbon tourism. HR plays a critical factor in realizing successful performance. In some tourism industries, the human factor is the key to success in tourism development. Human resource development in the tourism industry faces global challenges that require solutions to penetrate global competitiveness. One competitiveness that can be developed understands the development of low-carbon tourism. Human resource capacity in tourism development is necessary today because it differs from the concept of tourism in general. One of the solutions that need to be taken is to improve HR competence through improving the quality of education and appropriate training.



Human resources are a significant workforce and a scarce resource in low-carbon tourism development. The scarcity of low-carbon human resources is particularly highlighted in the low economic development of carbon through the tourism sector. According to (Chen et al., 2018), improving performance through human resource capacity development in a low-carbon economy can be done using Low-Carbon Knowledge, Low-Carbon Professional Skills, and Potential for low-carbon innovation. Tourism entrepreneurs and the tourism workforce urgently need increasing knowledge through low-carbon tourism. It aims to provide awareness regarding the vital role of low-carbon tourism in mitigating climate change.

In addition, tourism human resources must improve the expertise and skills of the tourism workforce in using low-carbon technology. It is one of the agendas in the process of transferring technology from technology providers to the workforce in order to be able to understand the elements of technology used in the development of low-carbon tourism. Furthermore, it is necessary to consider strengthening capacity derived from the potential for low-carbon innovation so that workers can understand the use of these innovations in tourism destinations. Human resource capacity building in the development of low-carbon tourism has a vital role in the success of the transformation. With a record of strengthening human resource capacity, it must continue to be supported by tourism entrepreneurs and the government as regulators of low-carbon tourism development. For this reason, capacity-building schemes by this theme must be structured and systematically arranged to realize competitive human resources.

### **3.1.4. Technological**

#### ***3.1.4.a. Clean and green technologies urgency***

The utilization of technology in the development of low-carbon tourism will include all social, cultural, managerial, and value-added activities of the tourism industry by combining and enhancing technological advances in the growth of the tourism economy (Lopes et al., 2021). The application of technology can be made with the use of environmental technology, green technology, and clean technology, which aims to preserve the environment and natural resources and minimize the negative impact of human involvement (Chakrabarti, 2014). The rapid growth of tourism forces the tourism industry to use sustainable technology to produce greener products through greener processes. In order to mitigate the impacts of climate change, it demands that the tourism industry take green-oriented technological measures to reduce the heavy environmental footprint.

The application of green technology requires transformation at almost every step of the entire value chain. Protecting ecosystems around tourism destinations is emphasized to reduce waste and greenhouse gas emissions as a follow-up to the carrying capacity of environmental ecosystems and conservation of biodiversity. These technologies must adopt an environmental carrying capacity-based planning process and maintain sustainable development within the scope of safety, health, and environment so that it remains guaranteed at all times (L. Solomon et al., 2019). One of the uses of green and clean technology allows tourism actors to return the adverse effects of tourism activities to the ecosystem. In that way, the use of these technologies significantly impacts the development of the tourism environment in the long term.

Clean and green technology in recent years has become increasingly popular regarding the mitigation of global warming or climate change. The growth of this

technology is a solution to replacing materials, processes, and products that can damage environmental conditions, especially in tourism development. According to (Green Journal, 2021), Some of the reasons needed to implement clean and green technology, namely:

- a) Reducing carbon emissions
- b) The transport sector of cars, trains, planes and ships produces more than 28 per cent of greenhouse gas emissions, and is the uk's largest contributor to harmful gases. To reduce greenhouse gas production, using electric vehicles has become a popular and growing solution for greener transportation.
- c) Offers a more environmentally friendly energy source
- d) Green technology through natural energy, such as solar panels, wind turbines, dams, and geothermal wells, can be an excellent alternative today. Using alternative energy impacts reducing greenhouse gases and fossil fuels that will not run out, and global warming will slow down.
- e) Providing clean water
- f) Green technology can overcome the shortage of clean water and the high level of global warming. Technological innovations in filters and converting dirty water into safe drinking water can be applied in various destinations. Green technology devices will be combined with environmentally friendly energy to work in rural areas without electricity.
- g) Conserving wildlife
- h) Wildlife is constantly threatened due to human activities, natural disasters, disease, and climate change. Some wildlife researchers mostly use technology to study animals in the wild. In addition, researchers use technology to educate the public, especially students, through guidebooks or virtual tour guides. Various agencies are also using technology to promote wildlife conservation to the public.

**Table 2.** Obstacles and challenges from implementing green technology

Indicator	Obstacles	Challenges
Economic	There will be additional costs in the construction of green technology. The development time of technology is quite long, in contrast to the technologies commonly used.	Higher costs of applying green technology and green materials.
Technology	There is still an element of uncertainty in the material and leveling. The green technology specifications are still rudimentary. Green technology operations that only some understand.	Technical difficulties during the process of building and applying technology. Maintenance technology is different from ordinary products. There are no guidelines for developing environmentally friendly technology to be applied in each location.
Awareness	Lack of knowledge about green technologies and materials. There are limitations to information and benefits of the use of green technology.	There is still an unawareness from the industry of the impacts of climate change. The ignorance of the industry with green technology. It requires excellent communication and interest in the utilization of green technology.
Management	Lack of support and rules for the use of green technology from the government. There is no monitoring scheme related to the use of green technology.	A lengthy planning and approval process for new green technologies and recycled materials. More time is needed to implement green technology practices on-site.

Source: Authors Analysis

### 3.1.4.b. *Obstacles and Challenges*

Green technology's use in mitigating climate change impacts has its own obstacles and challenges. According to (Hasan & Zhang, 2016), there are four indicators in compiling potential for obstacles and challenges in implementing green technology: Economics, Technology, Awareness, and Management. Preparing this potential aims to eliminate all adverse impacts that will arise in applying green technology so that the tourism industry can prepare all implementation strategies to be by the common corridors. The following are the obstacles and challenges of implementing green technology, which is as follows:

### 3.1.5. Environmental

#### 3.1.5.a. *Impact on environmental resources and climate change*

Tourism is one of the sectors experiencing climate change-related impacts (Aygün Oğur & Baycan, 2021), which is unpredictable in the 21st century and is expected to affect the tourism sector directly and indirectly (S. Solomon et al., 2007). Various impacts of climate change on the tourism sector can be felt directly and indirectly. The impacts that are directly felt are increased changes in rainfall, warmer winters, warmer summers, extreme events, and ultimately a decrease in climate suitability for tourism activities, as well as indirect impacts are reduced snow or natural degradation, environmental changes due to climate change impacts such as rising sea levels, loss of biodiversity and disease (Nadal, 2014).

**Table 3.** Impact of Climate Change on tourism

No.	Climate Change Impact	Tourism Implication
1.	Warmer temperatures	Changing seasons, stressful heat, rising cooling costs, infectious diseases, and forest fires threaten tourist destinations and natural heritage.
2.	The presence of extreme Hurricane intensity	Risks to tourism facilities, damage to tourism infrastructure, obstructed transportation, business disruptions, negative signals of nautical tourism
3.	Changes to precipitation	Water shortages, floods at tourism sites, landslides close accessibility, water droughts on natural attractions
4.	Sea level rise	Coastal erosion, loss of coastal areas, costs to maintain and protect sea and seaside defenses, disrupted transportation potential, threats to seaside hotels/resorts
5.	Sea temperature rise	Coral bleaching, degraded marine resources in tourist destinations, loss of marine diversity
6.	Changes in biodiversity	The loss of natural attractions, the decline of diving tourists

Source: Layne (2017)

The potential impacts of climate change can be more strongly felt in the tourism sector, one of which is explained as limiting tourism mobilization due to climate change mitigation and adaptation policies that will affect international tourism conditions (Scott, 2011). Another impact of this will also affect every tourist destination. The adverse impacts experienced will affect the condition of natural resources and the environment, reducing the quality of tourism products and the attractiveness of tourist destinations and impacting the

local economy. The threat of climate change, such as forest fires and floods due to changes in rainfall, will threaten the safety of tourist destinations and natural tourism it will interfere with the environmental health of the tourism sector (Michailidou et al., 2016). Strengthening the environmental sector through low-carbon tourism will be able to minimize the impact of climate change that occurs. In addition, a governance pattern is needed in each tourist destination so that it will realize sustainable tourism.

### **3.1.5.b. National governance**

The implementation of low-carbon tourism has been stated in the environmental sustainability standards contained in the Regulation of the Minister of Tourism and Creative Economy No. 9/2021. The regulation adheres to the systematics of sustainable tourism in tourism destinations under the Sustainable Development Goals scheme. Governance, especially in low-carbon tourism, includes resource management and waste and emission management such as energy conservation, water service management, water quality, wastewater management, solid waste management, GHG emissions, climate change mitigation, low-impact transportation, and light and noise pollution.

**Table 4.** Governance in the implementation of low carbon tourism

<b>Criteria</b>	<b>Type of Governance</b>
<p><b>Energy conservation.</b> Destinations have targets to reduce energy consumption, increase the efficiency of use, and increase the use of renewable energy.</p>	<ul style="list-style-type: none"> <li>- Programs to reduce energy consumption;</li> <li>- Alternatives to creating or utilizing renewable energy (Biomass, Micro/mini Hydro, Geothermal, Solar panels, windmills/turbines) that are socialized and promoted by the destination.</li> <li>- Forms of investment in the construction of new and renewable energy (NRE) plants for destinations</li> <li>- Providing incentives or rewards for business entities that encourage energy-efficient implementation.</li> </ul>
<p><b>Water stewardship.</b> In the case of high water risk, the purpose of water stewardship is to identify and actively work with business entities to ensure that use for tourism does not conflict with the needs of the local community and ecosystem.</p>	<ul style="list-style-type: none"> <li>- Guide in writing or verbal appeals during regular joint forums to conserve water use;</li> <li>- Independent efforts of the destination to check the condition of the water;</li> <li>- Facilitation or support of regulations that contain sanctions or fines when activities carried out by business entities cause the risk of high water.</li> <li>- Community involvement and local governments that supervise business entities in water use;</li> <li>- Efforts to reduce dependence on a single water source.</li> <li>- Signage or other markers to save the water use.</li> </ul>
<p><b>Water Quality.</b> Destinations use standard standards to monitor water quality for drinking, recreational, and ecological purposes.</p>	<ul style="list-style-type: none"> <li>- Management systems that measure and monitor water quality;</li> <li>- Periodic mechanisms that support data collection and reporting on the quality of drinking water and water in recreational areas;</li> <li>- The implementation of water monitoring refers to environmental health quality standards and water health requirements from the local Health Office;</li> <li>- Management systems or programs that seek to improve water quality;</li> <li>- Signage or other markers indicate drinking water refill stations in recreational areas.</li> </ul>

Criteria	Type of Governance
<p><b>Wastewater management</b></p> <p>Destinations have clear and enforced guidelines for the placement, maintenance, and testing of discharges from septic tank systems and wastewater treatment.</p>	<ul style="list-style-type: none"> <li>- Written guidance on wastewater treatment at the destination;</li> <li>- Regulations for wastewater treatment in destinations;</li> <li>- Technology utilized for wastewater treatment.</li> <li>- Effective wastewater treatment and reuse/proper liquid waste treatment program;</li> <li>- Watershed (watershed) management system and water sources.</li> </ul>
<p><b>Solid waste management.</b></p> <p>Destinations ensure solid waste is handled correctly and diverted from temporary or final disposal sites by providing a recycling collection system that effectively separates waste by type.</p>	<ul style="list-style-type: none"> <li>- Some programs measure and monitor the volume of solid waste and agencies or units that do so regularly;</li> <li>- The existence of waste management techniques according to the scale and capacity of the destination;</li> <li>- Temporary Shelters (TPS), Waste Banks, and so on are available.</li> <li>- There is a solid waste management system derived from tourism activities.</li> <li>- There is an effort of the "Refuse, Reduce, Reuse, Re-gift, Repair, Recycle, Recover" program is an effort to reduce/eliminate disposable items;</li> <li>- The existence of a solid waste collection mechanism that can be reused or recycled;</li> <li>- The existence of innovations in using solid waste for recycling product models.</li> <li>- There are bins scattered at evenly distributed points in the destination and available in quantities according to waste sorting standards (organic and inorganic or wet waste, plastic, glass, paper)</li> </ul>
<p><b>GHG emissions and climate change mitigation.</b></p> <p>Destinations have targets to reduce greenhouse gas emissions and implement and report on policies and mitigation actions.</p>	<ul style="list-style-type: none"> <li>- The existence of clear regulations relating to the control of greenhouse gas emissions and their reduction targets, such as the Regional Action Plan for Greenhouse Gas Emissions (RAD GRK);</li> <li>- Public and private sector engagement to reduce and minimize greenhouse gas emissions</li> <li>- Socialization of climate change impacts involving communities and local governments, and business entities.</li> <li>- Some programs prioritize the use of renewable energy;</li> <li>- There are tourism programs or activities that can reduce carbon emissions, such as planting mangroves on the coast, the use of solar lighting when camping, and other activities.</li> </ul>
<p><b>Low impact transportation.</b></p> <p>Destinations have targets to reduce transportation emissions from travel to and from destinations. Increased use of low-emission and sustainable vehicles and active travel.</p>	<ul style="list-style-type: none"> <li>- There is the infrastructure that supports low-impact transportation, such as adequate roads for pedestrians, bike lanes, and other infrastructures;</li> <li>- There are alternatives to public transportation from and within the destination.</li> <li>- There is active transportation available as a tourist attraction/activity, such as cycling, walking, trekking, climbing, and other activities;</li> <li>- There are a variety of environmentally friendly transportation options to get to tourist attractions/ attractions;</li> <li>- There is the active involvement of the public sector and tourism business entities in programs or activities focused on environmentally friendly transportation;</li> </ul>

Criteria	Type of Governance
<p><b>Light and noise pollution.</b> Destinations have guidelines and regulations to minimize light and noise pollution. Destinations encourage business entities to follow these guidelines and regulations.</p>	<ul style="list-style-type: none"> <li>- The existence of guidelines or regulations that are carried out consistently, such as regional regulations to clear, to overcome light and noise pollution;</li> <li>- There is the involvement of the community and tourism business entities to participate in programs or activities to overcome light and noise pollution.</li> <li>- Some programs identify and monitor potential light and noise pollution sources involving communities and tourism business entities.</li> </ul>

**Source:** Regulation of the Minister of Tourism and Creative Economy No. 9/2021 Concerning Guidelines for Sustainable Tourism Destinations

### 3.1.6. Legal

#### 3.1.6.a. Legislation on low-carbon tourism

Indonesia's commitment to discussing environmental issues in Environmental Protection and Management is reflected in Law No. 32/2009, emphasizing the impact of climate change on the environment. Furthermore, the government has issued the central policies for overcoming the impacts of climate change as stated in Law No. 16/2016 as a follow-up to the Paris Agreement to the United Nations Framework Convention on Climate Change. In implementing these laws and regulations, the Ministry of Environment and Forestry issued regulations in dealing with climate change, including the Regulation of the Minister of Environment and Forestry No. 33/2016 on guiding the central and local governments in planning climate change adaptation actions and integrating them into regional and sector-specific development plans (Ministry of Environment and Forestry, 2021).

The tourism sector also faces the issue of climate change. Tourism development is carried out systematically, integrated, sustainable, and responsibly while maintaining the sustainability and quality of the environment as stated in Law No. 10/2009 concerning Tourism. The principle of implementing tourism based on the law is implemented by maintaining the relationship between humans and the environment and maintaining nature and the environment. In the development of low-carbon tourism, it has been regulated in the obligations contained in tourists and tourism entrepreneurs by maintaining healthy, clean tourism and obliged to preserve the environment to remain sustainable (Ollivaud & Haxton, 2018; UNWTO, 2017).

To tourism for climate change mitigation and adaptation, one of the development directions of the national tourism industry, as stated in Government Regulation 50/2011 concerning the National Tourism Development Master Plan for 2010-2025, is the development of environmental responsibility. The policy direction is manifested in the form of tourism business management development which refers to the principles of sustainable tourism development, the world tourism code of ethics, and the green economy. Development that refers to the principles of the green economy is the development of management with an approach to economic development that no longer relies on economic development based on excessive exploitation of natural resources and the environment. The green economy is a significant leap away from short-term profit-preserving economic practices that have bequeathed many pressing issues to be addressed, including driving a low-carbon economy. The green economy aims to reduce environmental risks and ecological

scarcity and aims for sustainable development without harming the environment (Barbier & Markandya, 2013), and prioritizing the environment (Loiseau et al., 2016).

As an implementation of various tourism-related regulations, the Ministry of Tourism and Creative Economy develops guidelines for sustainable tourism destinations through the Regulation of the Minister of Tourism and Creative Economy No. 9/2021. The guidelines aim to provide a comprehensive reference on the sustainable management of tourism destinations to realize the management of protection, utilization, and development of the area as a sustainable tourism destination. These destination areas have a role in organizing low-carbon tourism. It emphasizes the existence of a sustainable element in the development of the tourism industry, which aims to reduce the negative impacts that arise due to the rapid development of the tourism industry (GSTC, 2019).

Low-carbon tourism is also associated with transportation issues. Every year, energy use for the transportation sector is the second largest sector after the industrial sector compared to other sectors such as household, commercial and other sectors. Increased vehicle volumes accompany the high demand in the transportation sector. Based on Presidential Regulation No. 55/2012 concerning the Acceleration Program of B-EV for Road Transportation, one of the efforts that can be made in the tourism sector is to utilize electric vehicles in tourism destinations. Efforts to realize low-carbon tourism will slowly become a reality.

To realize this, the Indonesian government commits to reduce carbon emissions as stated in Law No. 71/2021 and Presidential Regulation No. 98/2021, which set a target of reducing greenhouse gas emissions in Indonesia by around 29 percent with its efforts and 41 percent with international support by 2030. Indonesia sets a Net Zero Emission target by 2060 or sooner if it receives international support. Indonesia can get opportunities for green job creation, decarbonization of the transportation sector, and carbon trading arrangements, especially in the tourism sector.

### ***3.1.6.b. Legislation on technology transfer***

Low-carbon tourism should be able to be done slowly by utilizing technology transfer schemes. In the scheme, technological innovation is used as one of the most effective methods in reducing carbon emissions and saving resources by implementing energy-efficient and sustainable business practices, especially in the tourism sector (Kumar & Kumar, 2019; Razzaq et al., 2020). The technology transfer process is contained in government Regulation No. 20/2005 with the meaning of transferring the ability, utilizing, and mastering science and technology between institutions, agencies, or people, both within the domestic environment and those from abroad to the country or vice versa. It aims to improve the ability of the community to utilize and master science and technology for the benefit of society and the state. This technology transfer mindset could accelerate the realization of low-carbon tourism in sustainable schemes.

The implementation of technology transfer is carried out without conflict with the provisions of laws and regulations. In Law No. 11/2019 on the National System of Science and Technology, the technology transfer process can be carried out commercially and non-commercially. One of the things that can be done is to utilize the intellectual property and the results of research and development activities that are transferred technology and not declared confidential by the provisions of laws and regulations. This technology transfer can be done with licenses, cooperation, and other technology science services. Licensing and

Cooperation schemes are more in demand by the industry in the technology transfer process because it is related to ownership assets (Blair, 2016), where the owner of the technology and the recipient of the technology can have the advantage of utilizing both schemes.

So far, Law No. 11/2019 only regulates that technology transfer can be carried out commercially and non-commercially, as stated in Law No. 11/2020 on Job Creation. The implementation of technology transfer must comply with the provisions in Article 29 paragraph (2) of Law No. 11/2019. It accelerates technology-based economic growth, which will later synergize with the Central and Regional Governments. Thus, technology transfer is challenging according to Law No. 11/2019 and Law No. 11/2020. The role of regulatory agencies is quite essential in the implementation of technology transfer. It is intended so that technology transfer can be one of the top priorities in rapid investment growth by current conditions. In addition, it is better to hand over technology transfer obligations to the Government than to the parties involved in the investment to create a maximum technology transfer climate.

In addition, the regulation of technology transfer or knowledge transfer is regulated in Presidential Regulation No. 20/2018 on the use of foreign workers. According to the regulation, every employer of a foreign company/foreign worker must appoint Indonesian workers as accompanying workers (except for foreign workers who hold the positions of directors and commissioners). The Regulation of the Minister of Manpower of the Republic of Indonesia No. 10/2018 concerning Procedures for the Use of Foreign Workers also mentions the obligation of foreign companies to transfer technology to Indonesian workers through foreign workers. Both regulations are used to protect the volume of foreign workers entering Indonesia as well as a means of improving the skills of the Indonesian workforce to be able to be competitive. Until a specific time limit, it is hoped that Indonesian assistance workers can adopt the skills and knowledge of foreign workers and be able to hold positions without having to involve these foreign workers.

### **3.2. Discussion**

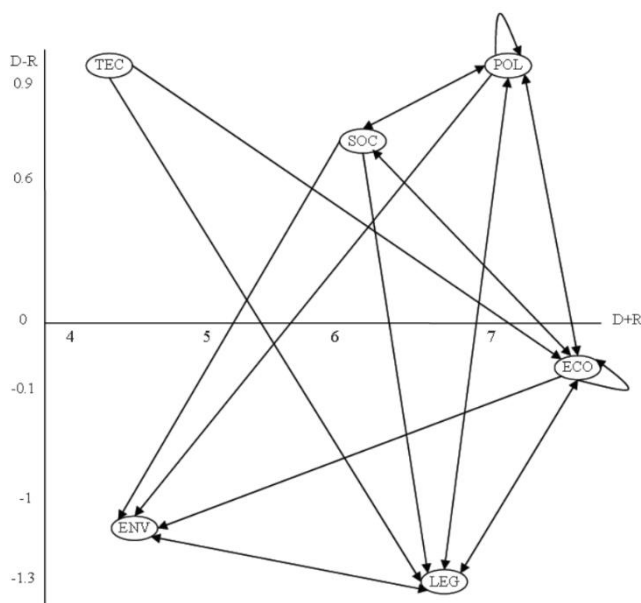
Based on the PESTEL analysis in the previous section, each factor influences Indonesia's readiness to implement low-carbon tourism. According to the model by Yuksel (2012), political factors are the most influential factors. However, many other factors influence the political factors, such as socio-cultural, legal, and economical. Interestingly, the environmental factors that are the central issue in developing low-carbon tourism do not have much influence on the political decision-making process. In other words, environmental issues are not a determining factor in formulating policies on low-carbon tourism.

Although Indonesia already has a low-carbon development policy framework in the Medium-Term Development Plan 2020-2024, the model by Yuksel (2012) in **Figure 1** shows that the relationship between the low-carbon development goals and the environmental issues is fragile. Because the primary policies are not based on environmental policies by design, the derivative policies, such as the Integrated Tourism Master Plan of The Lombok-Gili Tramen, will be less in raising the interest in environmental sustainability, even though they are based on the concept of sustainable tourism.

While the political development policies do not make environmental issues the central theme, technology transfer policies in Indonesia are more focused on investment and business objectives, such as increasing productivity and economic impact. There is no obligation for investors to implement a low-carbon technology policy. As a result, the



technology transfer process can work in the tourism industry, but there is no guarantee that the industry will use low-carbon technologies.



**Figure 1.** The relationship of PESTEL factors

**Source:** Yuksel (2012)

The economic factor is the factor that is more influential on the policy of developing low-carbon tourism. The Policy Guidelines for Sustainable Tourism Destination Development issued by the Minister of Tourism and Creative Economy (Regulation of the Minister of Tourism and Creative Economy No. 9/2021 Concerning Guidelines for Sustainable Tourism Destinations, n.d.) emphasizes more energy efficiency and use of water resources. The carbon offset policy in this regulation only directs the use of environmentally friendly transportation. The main objective of this policy is to accelerate economic recovery and create jobs, but not to reduce carbon emission targets.

In the national economic policies, particularly in the taxation policy, the Ministry of Finance has set policies on carbon taxes. This fiscal policy instrument will try to change the paradigm of investors in allocating funds to specific industries. However, the behavior of Indonesian consumers has yet to lead to environmentally friendly industries. That is why the tendency of investors to support the low-carbon industry is still low. The situation is not a good sign for the low-carbon tourism industry.

In addition to the carbon tax policy, the Indonesian government has begun introducing green bonds to finance the programs addressing climate change's impacts. The problem with the instrument is that there is no limitation for the use of funds raised from the green bonds, especially for projects that have no guarantee to be effective in addressing the climate impacts. On the other hand, tourism is one of many sectors producing the most significant carbon impact. That means the tourism sector's share in obtaining the green bond funding will be very small. Thus, low-carbon tourism development cannot rely on this type of funding.

From a social perspective, the concept of low-carbon tourism has not become jargon in Indonesian society. In developing a tourism-aware social community, materials on the impacts of climate change on tourism have yet to become a topic of discussion at regular meetings. Even though environmentally friendly tourism has become a common topic in discussions, the term low-carbon tourism is still rarely used. Many tourism communities are aware of environmental sustainability. However, the activities carried out are still related to waste management or the application of the circular economy. Low-carbon tourism is much broader than just the concept of waste management. Therefore, Indonesia still needs many programs to increase community readiness in implementing low-carbon tourism. Additionally, the human resource capacity in the tourism workforce needs improvement in using low-carbon technology in their activities.

In terms of the factor of technology itself, Indonesia still has many challenges. As stated in table 2 of potential indicators for applying environmentally friendly technologies, all indicators have obstacles and challenges. The cost is, of course, the main obstacle from the economic aspect because investors are very concerned about it. The low-carbon technology or green technology itself is still something that needs to be clarified in its implementation and the rules of the operational framework. The government still needs to define this low-carbon concept further, especially regarding business permits.

The aspect of the industry, the awareness of the use of green technology, has yet to be developed. More communication sessions with business actors are still needed to encourage the use of green technology. Lastly, from the institutional aspect, no exceptional management handles the green technology application scheme, which is the origin of low-carbon technology in tourism.

From the view of the environmental factor, climate change has an influential impact on tourism activities. However, low-carbon technology does not guarantee a lower impact on the problem caused by the climate. The regulation of the implementation of sustainable tourism in destinations only focuses on energy conservation, clean water availability, waste and pollution, climate change mitigation, and low-impact transportation. The climate change mitigation targets need to specify the technological specification. Therefore, the government must develop specifications for low-carbon technology in tourism.

For the last factor, which is legal, Indonesia already commits to take action on climate problems by ratifying the Paris Agreement on Climate Change. The Sustainable Tourism Council also has guidelines for the certification of a sustainable tourism business. There is also a target for reducing greenhouse gas emissions by 2030. Those are good signs that the government has stepped ahead to build a foundation for a low-carbon business ecosystem. Although the technology transfer process has been regulated in Law No. 11/2019, there are many tasks to define the implementation regulation at the regional level. In other words, foreign investors or workers can transfer technology, but again, there is no guarantee that the technology will be green.

The analysis factors described Indonesia's readiness to implement low-carbon tourism through the transfer of technologies. The situation is that there are few possibilities for Indonesia to expect low-carbon tourism to thrive. Most of the factors, such as political, social, technological, environmental, and legal, show weak support for enabling low-carbon tourism. Only the economic factor has a moderate policy for strengthening the use of green

practices of business conduct, especially for the carbon taxes policy. Therefore, there is still an opportunity to bring up low-carbon tourism through economic policy.

Since the model by Yuksel (2012) shows that the economic factor can influence the political, social, environmental, and legal factors, the development of a more progressive policy on the low-carbon economy may boost the development of the low-carbon tourism industry. Still, from the same model, technology influences economic and legal factors. Moreover, the development in the science and technology policy will also produce a positive impact on increasing the readiness for low-carbon tourism.

#### **4. Conclusion and Recommendation**

The transformation of the tourism sector to climate change and environmental conservation mode, in the context of low-carbon tourism, is in line with the current tourist trends and interests. Therefore, technology is essential to decarbonizing tourism for environmental sustainability and helps implement low-carbon tourism. Using the PESTEL framework, this study constructed an evaluation and illustrated the impact of technology transfer on low-carbon tourism. This paper found that all the factors (political, economic, social, technological, environmental, and legal) were interrelated. While all of the PESTEL factors impact Indonesia's ability to implement low-carbon tourism, political factors are the most consequential. Unexpectedly, environmental concerns did not play a role in developing low-carbon tourism policies.

This study highlighted that despite Indonesia already having a low-carbon development policy framework in the Medium-Term Development Plan 2020-2024, the relationship between low-carbon development goals and environmental issues is tenuous. Moreover, technology transfer policies were more focused on investment and business goals, and the investors were not required to use low-carbon technologies. Technology transfer could work in the tourism industry, but there's no guarantee it will use low-carbon technologies. In reality, there weren't many opportunities for low-carbon tourism to thrive in Indonesia. Political, social, technological, environmental, and legal considerations all point to the impossibility of low-carbon tourism. The economic factor was the only one with a moderate policy to encourage businesses to use green practices, particularly for the carbon tax policy. Consequently, there was still an opportunity for monetary policy to promote low-carbon tourism.

This study has some acknowledged limitations, so that there is a room for improvement in subsequent research. First, a qualitative desk study was the basis for the method. However, employing a different approach and analysis would alter the outcomes. Therefore, a thorough examination should have been conducted to ensure the indicator's robustness. Second, additional empirical investigations are required to demonstrate the relevance of our findings in upcoming research. Determining the significance and implications of technology transfer for enabling low-carbon tourism in Indonesia would therefore require the inclusion of additional variables (such as demographic and informational).

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