Environmental Perspective and Review For Eco-Airport Implementation at Sofifi City, North Maluku

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Abstract— **Indonesia, in the nature of an archipelago, is one of the world's biggest countries with thousands of islands. Due to geographical consideration, the air transportation considered very efficient in moving people or goods from one place to another. This study aims to examine the potential application of the Eco Airport concept in the city of Sofifi, North Maluku, Indonesia. This study raises a case study in Sofifi City, North Maluku Province, Indonesia regarding the potential implementation of the Eco-Airport concept. The method used in this study is to review the profile of Sofifi City based on data from the Central Statistics Agency and review the regulations related to the Eco-Airport concept and airport operations in Indonesia that are still in effect. Based on the reviews that have been carried out and the analysis and comparison with existing airports in Indonesia, it can be categorized aspects that need to be implemented in order to realize the Eco-Airport concept which is divided into eight aspects. All of these aspects are key points in the implementation of an environmentally friendly airport. The implementation of minor aspects in these eight categories is carried out by most of the airports with an Eco-Airport orientation in Indonesia. Although it is still only a small aspect, the resulting impact on the environment is expected to influence other aspects, even related sectors to participate in implementing "green innovations" in various aspects of the implementation of aviation activities.**

Keywords— **Airport, Eco-Airport, Environmental, Maluku Utara.**

I. INTRODUCTION

Indonesia, in the nature of an archipelago, is one of the world's biggest countries, covering 1.9 million square kilometers. Since Indonesia's geographical location, which includes hundreds of islands, air transportation is a "conditio sine quanon," or absolute and inescapable requirement.

As an archipelagic country, which is large and wide, and the human need for fast, safe and comfortable mobility creates the need for transportation arrangements that can support and adapt to these activities. The appropriate transportation is air transportation services, namely by using an airplane because it is considered very efficient in moving people or goods from one place to another.

In air transportation, it is necessary to have a place to provide facilities for aircraft and for users of flight services, both domestic and international, this place is usually called an airport or commonly abbreviated as an airport. According to the Regulation of the Director General of Civil Aviation Number: SKEP/124/VI/2009 [1], an airport is an area on land and/or waters with certain boundaries that is used as a place for aircraft to land and take off, boarding and dropping passengers, loading and unloading goods and intra and intermodal transfers, which are equipped with aviation safety and security facilities as well as basic facilities and other supporting facilities.

The existence of an airport will have a major influence on increasing the economy in a region as well as the national economy, thereby attracting great attention for the government to encourage its development. Thus, this study aims to examine the potential application of the Eco Airport concept in the city of Sofifi, North Maluku, Indonesia. Hopefully with this study, airport planning and design in Sofifi City can apply environmentally friendly concepts, not only to new airport plans, but also to transitions to existing airports.

II. LITERATURE REVIEW

A. Relevance Between Indonesia and Air Transport

Transportation is the activity of transporting or moving goods or people from one place to another, or from a place of origin to a destination. Transportation is the activity of moving goods and/or people from their place of origin to their destination and is one type of activity related to meeting human needs by changing the geographical location of goods and people, causing transactions. The concept of transportation is based on the existence of a journey from origin to destination.

According to Law No. 83 of 2017 [2], the definition of an aircraft is any tool that can obtain lift from the air [3]. In Law no. 2 of 1962 [4], airplanes are transportation that can move from land or water to air or space or vice versa. According to the 2012 Indonesian Infrastructure Initiative Journal "Air transportation, is a cause and effect of economic growth, which creates a 'virtous circle' in economic growth which is followed by an increase in demand thereby creating greater

growth and so on. This is particularly relevant for Indonesia, where the oil and extraction industries (both of which rely heavily on air transport compared to many other industries) are significant contributors to economic growth."

The existence of an airport will have a major influence on increasing the economy in a region as well as the national economy, thereby attracting great attention for the government to encourage its development. However, the construction and development of an airport will unwittingly have an environmental impact and have other negative effects on the community around the airport. Determining the location of the airport and its development need to pay attention to several components, one of which is environmental sustainability. Law Number 23 of 1997 concerning Environmental Management, states that the notion of the environment is the unity of space with all objects, forces, conditions and living things including humans and their behavior that affect the survival and welfare of humans and other living creatures (Article 1 paragraph 1) [5].

B. Airports

In today's modern human activities, it is very important to prioritize fast mobility, be it for work or traveling for tourism. Because of such needs, a mode of transportation is needed that can support and adapt to human needs and has proper supporting facilities. The appropriate transportation for this need is by airplane because it is very efficient in moving people from one place to another. Due to the high number of aircraft use in Indonesia, attention must be paid to airports as a place to provide facilities for aircraft and for users of aviation services, both domestic and international [6].

According to Annex 14 of ICAO (International Civil Aviation Organization) [7], "An airport is a certain area on land or water (including buildings, installations and equipment) that is intended either in whole or in part for the arrival, departure and movement of aircraft. The definition of an airport according to PT (Persero) Angkasa Pura I is an airfield, including all buildings and equipment that are minimally complete to ensure the availability of facilities for air transportation for the community [8].

C. General Concept of Eco-Airports

According to the Regulation of the Director General of Air Transportation Number: SKEP/124/Vl/2009, airport is an area on land and/or waters with certain boundaries that is used as a place for aircraft to land and take off, boarding and dropping passengers, loading and unloading goods and places for intra and intermodal transfers. transportation, which is equipped with aviation safety and security facilities as well as basic facilities and other supporting facilities. Meanwhile, environmentally friendly airports (eco-airports) are airports where measurable measurements have been taken of several components that have the potential to have an impact on the environment to create a healthy environment at the airport and its surroundings. Therefore, in every activity in the implementation and development of airport development, eco-airport must be considered so that the airport can function effectively and efficiently, not only from the technical aspect but also from the environmental aspect [6].

One of the eco-airport assessments is the management of wastewater, the existence of sanitation infrastructure and facilities at the airport, as well as the utilization of waste water using the 3R (Reduce, Reuse, Recycle) system, in this case the Central Government and Local Governments have an important role to play in realizing the objectives of the implementation. eco-airport concept to PT. Angkasa Pura I (Persero) as the airport manager in Indonesia. So, with this an organization will run well from time to time or a predetermined period.

Eco-Airport (ecological airport) refers to an airport concept that aims to provide a healthy and ecologically friendly atmosphere [9][10]. The new eco-airport idea is now being implemented in five airports: Soekarno Hatta (Jakarta) [11], Juanda (Surabaya), Ngurah Rai (Denpasar), Hang Nadim (Batam), and Sultan Mahmud Badarudin II (Batam) (Palembang). The development of eco-airport was preceded by the establishment of Eco-Airport Council in each airport [12]. The implementation of eco-airports for carbon emissions is done by planting trees, using environmentally-friendly building materials, reducing the use of glass in order to avoid global impact, calling on airlines to use new types of aircraft, cultivating cars in apron areas using biofuels, as well as diverting long- term operations with solar powered cells that can also decrease the airport operational costs [10] [13] [14].

Based on the Regulation of the Director General of Civil Aviation Number: SKEP/124/VI/2009 concerning Environmentally Friendly Airports in the management and monitoring of the environment at the airport, there are eight components, which consist of components;

- Natural Environment
- Waste Management
- Soil Contamination Control
- Water Quality and Quantity Control
- Vibration and Noise Control
- Energy Management
- Air Quality Atmosphere

In order for the airport to function effectively and efficiently, not only in terms of technical aspects but also from environmental aspects, every activity in the implementation and development of airport development must pay attention to eco airports [15].

Based on the Transportation Research and Development Agency of the Ministry of Transportation 2018 on Realizing Green Aviation in Indonesia explained that the implementation of eco airports in Indonesia actually started in 2009 with the issuance of the Director General of Civil Aviation Regulation No. SKEP/124/VI/2009 concerning Guidelines for the Implementation of Environmentally Friendly Airports (Eco Airports).

The objectives of implementing Eco Airport based on the Regulation of the Director General of Civil Aviation Number: SKEP/124/VI/2009 are;

- Realizing an airport that has a global vision of the environment,
- Implementing an integrated, harmonious and harmonious airport management with the surrounding environment,
- Organizing airports that can support the achievement of sustainable development.

D. Environmental Regulations in Indonesia

A good and healthy environment is a human right for everyone as mandated in Article 28H Paragraph (1) of the 1945 Constitution of the Republic of Indonesia that [16]: "Everyone has the right to live in physical and spiritual prosperity, to have a place to live, and to have a good living environment. and healthy and have the right to health services". Article 1 number 1 of Law Number 32 of 2009 concerning Environmental Protection and Management (PPLH) [17], hereinafter referred to as the PPLH Law states that "The environment is a unitary space with all objects, forces, conditions, and living things, including humans and animals. behavior, which affects nature itself, the continuity of life, and the welfare of humans and other living creatures. Article 1 number 2 of the PPLH Law states that: "Environmental protection and management is a systematic and integrated effort carried out to preserve environmental functions and prevent environmental pollution and/or damage which includes planning, utilization, control, maintenance, supervision, and law enforcement".

III. METHODOLOGY

This study raises a case study in Sofifi City, North Maluku Province, Indonesia regarding the potential implementation of the Eco-Airport concept. The implementation of the concept is expected to be applied to the planning and design of new airports that will be made in the future, as well as the transition of the existing airport concept into an Eco-Airport. The method used in this study is to review the profile of Sofifi City based on data from the Central Statistics Agency and review the regulations related to the Eco-Airport concept and airport operations in Indonesia that are still in effect. The analysis is carried out to produce several detailed application recommendations that can be applied in the future.

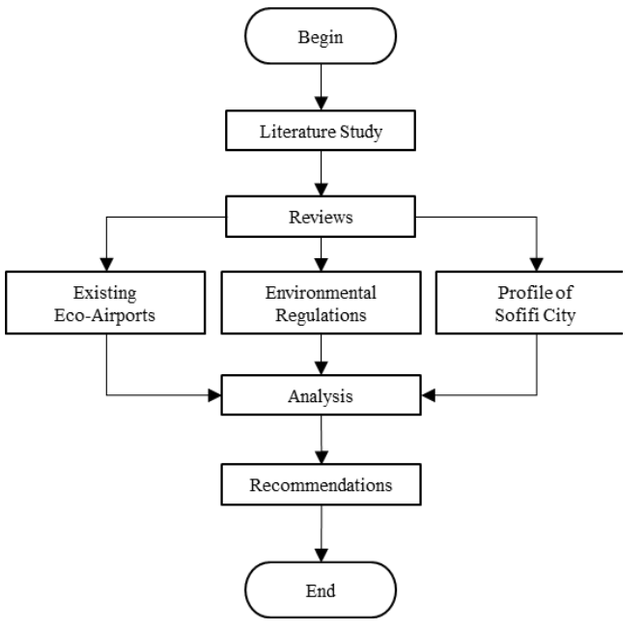

Fig. 1 Flowchart of the Study

IV. RESULT AND DISCUSSIONS

A. Profile of Sofifi City

Maluku Utara province was formerly a part of Maluku province, namely Maluku Utara regency and Halmahera Tengah regency. Then, through Law No. 46 of 1999 and Act No. 6 of 2003 in Maluku Utara province was officially established on October 4, 1999. At the beginning of its establishment, the capital of Maluku Utara province in Ternate is located at the foot of Mount Gamalama, for 11 years. Precisely until August 4, 2010, after 11 years of transition and preparation of infrastructure, capital of Maluku Utara province was transferred to the City Sofifi located on Halmahera Island is the biggest island [18] [17].

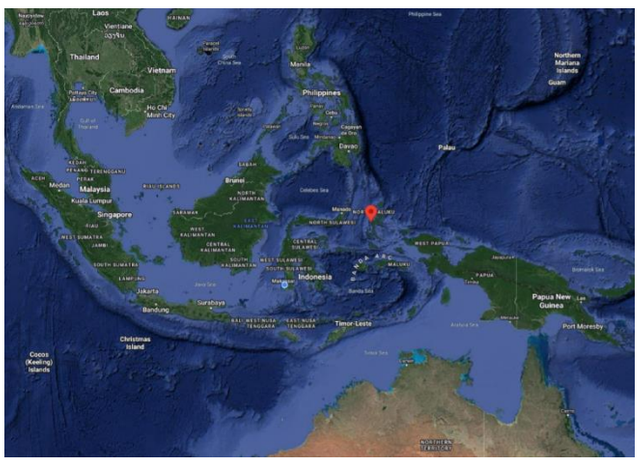

Fig. 2 Sofifi from Perspective of Republic Indonesia's Archipelago

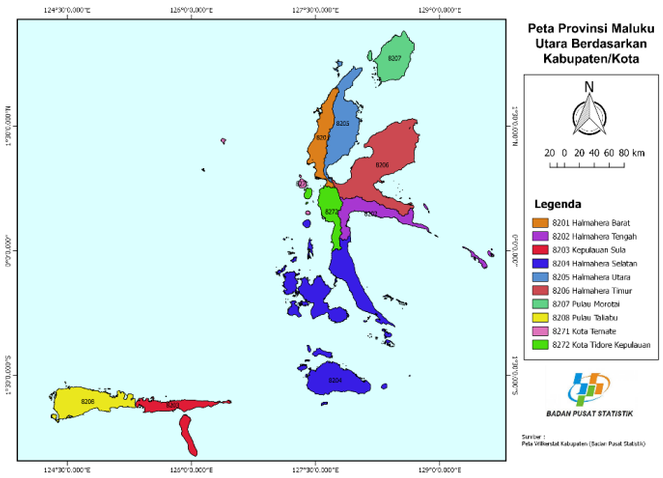

Fig. 3 Map Of Maluku Utara Province

The Provincial Government (Pemprov) of North Maluku together with the City Government (Pemkot) of Tidore Islands have provided land to build an international airport, which will be the main entrance and exit to Sofifi, the capital of North Maluku Province. According to the Regional Secretary, the plan for the construction of this international airport is to be prepared in Loleo, because the location is very strategic because it is in the middle. From the south, there are South Halmahera and Central Halmahera Regencies. While on the north side there are North Halmahera, East Halmahera, West Halmahera and Morotai Island, while for the west there are Tidore and Ternate cities and access from Sofifi to Loleo only requires a distance of 30 KM [18].

B. Environmental Regulations Perspectives on Eco-Airport Planning

One of the environmental pollution is air pollution which can be sourced from aircraft noise. Article 1 point 1 of Government Regulation Number 41 of 1999 [19] concerning Air Pollution Control states that "Air pollution is the entry or inclusion of substances, energy, and/or other components into ambient air by human activities, so that the quality of ambient air decreases to a certain level which is causing ambient air to not be able to fulfill its function".

Article 3 of Government Regulation Number 41 of 1999 concerning Air Pollution Control states that: "Protection of ambient air quality is based on ambient air quality standards, ambient air quality status, emission quality standards, exhaust emission thresholds, disturbance level standards, noise thresholds and air pollution standard index."

Article 1 number 1 of Law Number 1 of 2009 [20] concerning Aviation, hereinafter referred to as the Aviation Law states that: "Flight is a unified system consisting of the use of airspace, aircraft, airports, air transportation, and security, the environment. , as well as supporting facilities and other public facilities." Flights are carried out at an airport or called an airport, shortened to an airport. Article 1 number 33 of the Aviation Law states that: "An airport is an area on land and/or waters with certain boundaries that is used as a place for aircraft to land and take off, is a facility where airplanes take off and land, get on and off. passengers, loading and unloading of goods, and places for intra and intermodal transportation, which are equipped with aviation safety and security facilities, as well as basic facilities and other supporting facilities".

Article 260 concerning Environmental Preservation of the Aviation Law stipulates that:

- Airport business entities or airport operating units are obligated to maintain noise and environmental pollution thresholds at airports and their surroundings in accordance with the thresholds and quality standards set by the Government.
- In order to maintain the noise and environmental pollution threshold as referred to in paragraph (1), airport business entities or airport management units may limit the time and frequency, or refuse to operate aircraft.
- In order to maintain the noise and environmental pollution threshold as referred to in paragraph (1), airport business entities or airport operating units are obligated to carry out environmental management and monitoring.
- Further provisions regarding the level of noise, pollution, as well as environmental monitoring and management shall be regulated in a Government Regulation.

The provisions of Article 260 Paragraph (4) of the Aviation Law can be implemented by stipulating a Government Regulation, namely PP No. 40 of 2012 concerning the Development and Preservation of the Airport Environment. PP No. 40 of 2012 [21] requires every airport to implement an environmentally friendly airport. Environmentally friendly airports that are implemented in stages by establishing airport environmental management and monitoring plans, carrying out airport environmental management and monitoring activities, evaluating the results of airport environmental management and monitoring that have been implemented, and reporting on the implementation of environmentally friendly airports to the Minister.

The government stipulates rules regarding noise generated by airport activities in the form of Decree of the Minister of the Environment No. 48 of 1996 [22] concerning Noise Level Standards. Article 1 point 1 states that: "Noise is unwanted sound from a business or activity at a certain level or time that can cause disturbance to human health and environmental comfort." The noise level is expressed in Decible units, abbreviated as dB. According to Doelle, a continuous noise level of 65 dB will have an impact on heart disease, 70 dB of noise will cause mental and physical fatigue, psychotic disorders, and 80 dB of noise will cause damage and decrease in hearing power. Therefore, in order to uphold human rights regarding the right of everyone to a good and healthy environment, it is necessary to regulate noise thresholds and supervise their implementation.

Regulation of the Minister of Transportation of the Republic of Indonesia Number PM 54 of 2017 [23] concerning Management of Waste and Chemicals in Aircraft and Airport Operations explains that Waste and Chemicals for Aircraft and Airport Operations are the remains of a business and/or aircraft and airport operational activity that can be cause environmental pollution in the form of waste, waste water and waste of hazardous and toxic materials (B3 waste).

The definition of waste water according to the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.68/MENLHK-SETJEN/2016 concerning Wastewater Quality Standards is residual water from a business and/or activity [24]. What is meant by residual from a business result is water produced or processed from a household activity, industry, airport operations and other activities. Wastewater from airports comes from airport facilities such as toilets, bathrooms, hotels and restaurants

C. Recommendations for Implementation

Based on the environmental review that has been discussed with reference to the applicable regulations, several recommendations can be made in the context of planning and designing an Eco-Airport with criteria;

- Air / Atmosphere; minimize the impact of declining air quality by reducing the volume of air pollutants released from airport operations
- Energy; reduce energy consumption from airport operations which can reduce CO2 . emissions
- Noise and Vibration; reduce noise and vibration levels resulting from airport operations
- Water; prevent contamination and contamination of surface and ground water, reduce water consumption and maintain water resources at airports
- Land; prevent contaminating the soil from oil, chemicals and other materials used in airports
- Waste; reduce, reuse and recycle waste at airports
- Natural Environment; maintain the ecosystem at the airport and its surroundings and create a healthy environment
- Others; determine other environmental targets that are in accordance with the characteristics of each airport

So, based on these criteria, several applications that can be recommended include:

TABLE I
RECOMMENDATIONS ON IMPLEMENTATION

Aspect	Implementation
Air	• Use of Ground Support System (GSS), • Use of Ground Power Unit (GPU), • Use of aircraft fuel supply pipeline system, • use of eco-cars,
	• Promotion of planting vegetation on roofs, walls and indoor areas.
Energy	• Utilization of solar cells, • Utilization of sunlight for lighting terminal, • Installation of heat-reflective films on windows, • Utilization of LEDs, • Utilization of Building Automatic System (BAS), • Photocell sensor installation for efficiency lighting, and sensors on the escalator.
Noise	• Installation of noise abatement shields, and green buffer • zones, • Installation of soundproof facilities.
Water	• Application of rainwater harvesting systems, • Application of gray water utilization systems (gray water treatment facility, gray water reuse equipment), • Use of water-saving faucet packing/automatic faucets.
Liquid Waste	• Application of oil separation / grease trap at kitchen, • Utilization of wastewater treatment facilities.
Solid Waste	• Garbage sorting at the terminal, • Utilization of incinerators.
Natural Environment	• Tree planting, • Procurement of facilities to prevent bird strikes, • Selection of plants to prevent bird strikes, • Making biopore and sigma tanks for water absorption.

V. CONCLUSSION

Based on the reviews that have been carried out and the analysis and comparison with existing airports in Indonesia, it can be categorized aspects that need to be implemented in order to realize the Eco-Airport concept which is divided into eight aspects. All of these aspects are key points in the implementation of an environmentally friendly airport. The implementation of minor aspects in these eight categories is carried out by most of the airports with an Eco-Airport orientation in Indonesia. Although it is still only a small aspect, the resulting impact on the environment is expected to influence other aspects, even related sectors to participate in implementing "green innovations" in various aspects of the

implementation of activities. In addition, to elevate the value of local wisdom, it is also recommended to provide decorations and distinctive design concepts. Thus, the Eco-Airport can be a strong "statement" for the region in the eyes of transportation service users, that the area raises the value of environmental sustainability and sustainable development.

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