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The Prospects of Salt Industries in Maluku Province Based on Climate Information

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ABSTRACT

This study aims to analyze the prospects of salt industries in Maluku Province based on climate information. The method used in this study is qualitative with a descriptive approach that uses meteorological time series data obtained from the BPS-Statistics Indonesia of Maluku Province. The data collected is the amount of rainfall, number of rainy days, and temperature in 2018. The analysis results conclude that Maluku Province has prospects for developing salt industries. Based on the climate information, the most appropriate locations for the industry establishment are Saumlaki, Geser, and Namlea, and the recommended period for production is July to November.

Keywords: *Climate Information; Industry; Meteorological; Prospects of Industrial; Salt; Time Series Data*

1. Introduction

The Indonesian Geospatial Information Agency research confirmed that the total length of Indonesia's coastline is 99,093 km², the second-longest in the world. Maluku has an area of 705,645 km², comprising 47,350.42 km² of land area, 658,294.69 km² of water area, and 8,287 km² of coastline length. This means that the territorial water area is wider than the land. These vast waters highlight Maluku's magnificent natural wealth, which has not been well managed. For instance, this potential plays a major role in seeding several industries, such as salt industries.

The coastal communities have already had the knowledge of salt farming for generations. Their basic knowledge should be a great potential for developing the salt industries in Maluku. However, this industry has not been established and pioneered by individuals, private sectors, or the government. This affords opportunities for those who wish to develop the salt industries, as salt scarcity in some regions makes the government import the commodity.

In terms of industrial development, Maluku lags behind other regions of Indonesia, posing a grave problem for the local government to foster competitiveness, allowing Maluku to be a productive region. Both central and regional governments should realize that competitiveness in managing their natural and human resources brings prosperity to the region.

Therefore, building a salt industry is one major step to developing a strong economy, overcoming socio-economic inequality, reducing unemployment, reviving the macro and micro sectors, and increasing regional income. According to YN (2018), the eastern regions of Indonesia have considerable potential for land and climate suitable for developing salt industries. Indisputably, this is delightsome. Establishing a salt industry, however, is not easy.

Although most Indonesian regions have broader oceans than land, not all regions can turn simply into the salt industry. Producing good quality abundant salt in the evaporation pond technology involves seawater, climate, soil conditions, labor, and technology (YN, 2018). Of all the factors, the climate has a major influence on salt productivity. This is in line with Rusiyanto et al. (2013), contending that salt production is strongly influenced by the climate and weather of an area. Thus, salt farmers require extensive information about when it is dry and when it rains since unfavorable weather and climate changes might negatively impact natural resource production processes and operations (Bahri et al., 2019). Therefore, an initial assessment of the salt industry development plan involves the climate analysis, qualified locations, and other determining factors analysis. On this basis, this study aims to determine the prospects of salt industries in Maluku Province based on climate information.

2. Research Methodology

This research was conducted in Maluku Province. Nine meteorological stations were built in Ambon, Tual, Samlaki, Banda Naira, Seram Bagian Barat, Amahai, Geser, Namlea, and Dobo to monitor the climate. All of these stations were the object of this research. The method used in this study is a qualitative method with a descriptive approach to analyze the meteorological time series data obtained from BPS-Statistics Indonesia of Maluku Province. The data are the amount of rainfall, rainy days, and temperature in 2018. The data were then compared with site requirements and qualifications for the construction of a qualified salt pond, as in the guidebook of integrated salt and artemia integrated business development, including air temperature of >32° C, low rainfall (i.e., between 1000-1300 mm/year or 100 mm/month), and a long dry season without rainy days for at least 120 days (Adi et al., 2006).

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3. Results and Discussion

3.1. Climate Analysis

Rain is the primary climate element in Indonesia. Since its high diversity, climate studies are specific to the rain factor (Boer, as cited in Adiraga & Setiawan, 2014). To produce salt, the area must have a long dry season of at least four consecutive months without meaningful rain (not more than 10 - 20 mm) per 10 days. Meanwhile, technical prerequisites for rainfall are between 1000-1300 mm/year or 100 mm/month. **Table 1** presents rainfall data taken from nine meteorological offices in Maluku Province.

Table 1. Maluku's Annual Rainfall of 2018

Month	Ambon	Tual	Saumlaki	Banda Naira	Seram Bagian Barat	Amahai	Geser	Namlea	Dobo
Jan	236	244.2	334.8	362.0	374	214	356.7	335.6	244.5
Feb	120	383,0	109.5	227.0	151	73	227.2	48.6	281.5
Mar	203	417.7	203.7	118.0	200	75	201.4	100.6	371
Apr	292	297.1	51.6	248.0	244	258	380.3	229.7	251.1
May	797	283.7	308.7	482.0	288	338	352.4	79.1	169
Jun	847	173.6	110	145.0	243	272.2	69	-	66.1
Jul	542	80.8	86	90.7	285	315.5	74.8	129.3	52.8
Aug	298	19.1	1.8	33.2	184	371	82.5	29.6	22.5
Sept	411	38.4	1.0	131.0	47	189.4	53.8	34.0	43.5
Oct	29	14.3	6.0	75.2	104	116.6	21.1	-	72.1
Nov	27	278.3	90.0	232.0	135	134.9	153.9	91.8	78.5
Dec	146	424.7	254	328.0	149	93.9	232.4	51.4	384.2

Source: Badan Pusat Statistik Provinsi Maluku (2019)

Table 1 above indicates that most Maluku regions (Tual, Saumlaki, Geser, Namlea, and Dobo) are suitable for producing salt as their rainfalls are <100 mm/month for four consecutive months. In general, July to November have low rainfall below 100 mm/month, particularly in Tual, Saumlaki, Geser, Namlea, and Dobo (see **Table 2**).

Table 2. Maluku's Rainy Days of 2018

Month	Ambon	Tual	Saumlaki	Banda Naira	Seram Bagian Barat	Amahai	Geser	Namlea	Dobo
Jan	22	12	29	24	23	17	19	25	23
Feb	18	23	17	25	15	19	18	13	14
Mar	22	23	18	23	20	15	19	15	27
Apr	21	20	12	24	22	17	20	11	16
May	30	26	24	30	23	22	25	15	22
Jun	28	19	23	28	21	23	11	-	23
Jul	29	18	15	21	27	28	10	16	14
Aug	18	9	6	11	15	29	9	7	13

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Month	Ambon	Tual	Saumlaki	Banda Naira	Seram Bagian Barat	Amahai	Geser	Namlea	Dobo
Sept	18	12	1	11	15	19	9	5	11
Oct	10	3	1	6	13	10	7	-	6
Nov	13	20	9	21	16	15	14	14	18
Dec	21	27	20	22	17	20	20	16	22

Source: Badan Pusat Statistik Provinsi Maluku (2019)

According to Kurniawan et al. (2019), temperature affects the water evaporation rate; the greater the evaporation, the greater the number of crystals that settle. In addition, salt production depends on the evaporation rate of saltwater. For this reason, the data about temperature must be recorded at the meteorological stations (see **Table 3**).

Table 3. Maluku's Temperature of 2018

Month	Ambon	Tual	Saumlaki	Banda Naira	Seram Bagian Barat	Amahai	Geser	Namlea	Dobo
Jan	31.8	31.2	31.3	18.2	26.7	31.8	31.9	30.7	30.3
Feb	32.1	31.1	32.6	22.0	27.2	31.4	34.4	27.4	30.1
Mar	32.6	30.8	32.0	23.0	27.4	31.9	33.8	30.9	29.8
Apr	31.4	30.9	32.6	22.4	27.1	30.7	30.2	30.3	30.5
May	29.9	30.6	30.0	23.0	33	29.6	32.7	31.3	30.1
Jun	29.1	29.6	29.5	23.0	32	28.3	33.9	-	29.4
Jul	28.5	29.1	29.1	20.5	31.5	27.8	34.9	31.2	29.0
Aug	28.8	30.0	29.4	22.6	32.5	28.7	32.0	30.6	30.4
Sept	29.8	30.5	30.6	22.0	33.6	28.8	34.2	31.6	31.0
Oct	30.9	32.2	31.9	21.2	33.5	30.2	32.6	32.5	31.9
Nov	32.9	32.5	33.2	23.0	33.8	31.7	33.4	30.9	31.6
Dec	33.9	32.2	33.1	18.2	34	32.3	39.6	31.4	30.4

Source: Badan Pusat Statistik Provinsi Maluku (2019)

Table 3 shows that most areas in Maluku Province have temperatures above 30°C, eligible for technical prerequisites (> 32°C). The areas with temperatures above 30°C are potential locations for salt business development, e.g., East Sumba with 28.8° C – 31.4° C (Banepa, 2014), and Maluku has a temperature of 30°C - 34°C. Pranowo et al. (2013) state hot temperatures are more important than dry air (low humidity). This indicates that the air temperature in Maluku Province is eligible for the construction of the salt industry.

3.2. Territory Analysis

Maluku Province consists of nine regencies and two municipalities with 120 subdistricts and 1,414 villages. **Table 4** below presents the regional suitability analysis in Maluku Province based on climate.

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Table 4. Climate-Based Conformity Analysis

No	Territory	Climate Parameters	Month	Conformity Analysis Results
1	Ambon	The amount of rainfall: < 100 mm, in 4 months Number of Rain Days: < 10 days Temperature: > 30°C	Oct Jan – Apr Oct – Dec	Unqualified Inconsistent Qualified
2	Tual	The amount of rainfall: < 100 mm, in 4 months Number of Rain Days: < 10 days Temperature: > 30°C	Jul – Oct Aug – Oct Jan – May, Aug - Dec	Qualified Inconsistent Qualified
3	Saumlaki	The amount of rainfall: < 100 mm, in 4 months Number of Rain Days: < 10 days Temperature: > 30°C	Apr, Jul – Nov Aug – Nov Jan – May Sept – Dec	Qualified Qualified Qualified
4	Banda Naira	The amount of rainfall: < 100 mm, in 4 months Number of Rain Days: < 10 days Temperature: > 30°C	- Oct -	Unqualified Inconsistent Unqualified
5	Seram Bagian Barat	The amount of rainfall: < 100 mm, in 4 months Number of Rain Days: < 10 days Temperature: > 30°C	- - May – Dec	Unqualified Unqualified Qualified
6	Amahai	The amount of rainfall: < 100 mm, in 4 months Number of Rain Days: < 10 days Temperature: > 30°C	Oct Jan – Apr, Oct – Dec	Unqualified Inconsistent Qualified
7	Geser	The amount of rainfall: < 100 mm, in 4 months Number of Rain Days: < 10 days Temperature: > 30°C	Jun – Oct Jul – Oct Jan – Dec	Qualified Qualified Qualified
8	Namlea	The amount of rainfall: < 100 mm, in 4 months Number of Rain Days: < 10 days Temperature: > 30°C	Aug – Dec Jun, Aug – Oct Jan, Mar - Dec	Qualified Qualified Qualified
9	Dobo	The amount of rainfall: < 100 mm, in 4 months Number of Rain Days: < 10 days Temperature: > 30°C	Jun – Nov, Oct Jan, Feb, Apr, May Aug – Dec	Qualified Inconsistent Qualified

Source: Data Processed

Table 4 above indicates that Ambon, Seram Bagian Barat, and Amahai are unqualified due to their amount of rainfall and rainy days. In addition, Banda Naira has absolutely no climate suitability due to the amount of rainfall, rainy days, and temperature. This highlights that

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Ambon, Banda Naira, Seram Bagian Barat, and Amahai offer no reasonable prospects for salt industries.

As for Saumlaki, rainfall is <100/month for six months (July to November). This fulfills the technical requirements of rainfall of <100/month for four months. Also, from August to November, Saumlaki has less than ten rainy days (10-20 mm per 10 days) with a temperature above 30°C. This is highly suitable for the salt industry for the drying process can be faster and maximum.

Furthermore, Tual has a total rainfall of <100/month for five months, from July to October. However, this conformity is not supported by the number of rainy days, despite its temperature being above 30°C. This concludes that Tual is not eligible for the salt industry.

Dobo has rainfall <100/month for six months from June to November, fulfilling the technical requirement for the rainfall amount of <100/month for four months. Its temperature is above 30°C in January, February, April, Mey, August to December. However, as it has less than ten rainy days, Dobo is not qualified for the salt industry.

The climate data of Geser highlights the suitability for a salt industry as the amount of its rainfall is <100/month for five consecutive months from June to October, with 10-20 mm per 10 days in the months, and air temperature is above 30°C. Due to its conformity with the technical prerequisites for a salt industry establishment Geser is another prospective region.

Namlea shows similar suitability as Geser and Saumlaki. This is indicated by its rainfall amount of <100/month for four consecutive months from August to December, the rainy days of 10-20 mm per 10 days in June, August to October, and its temperature above 30°C from March to December. Since these climate data meet the technical prerequisites for the salt industry, Namlea is also prospective.

4. Conclusion

The research results above conclude that Maluku Province has the prospect of salt industries. Based on the climate information, the most appropriate locations for the establishment of the salt industries are Saumlaki, Geser, and Namlea, and the recommended period for salt production is July to November. Ambon, Tual, Banda Naira, Kairatu, Amahai, and Dobo are unqualified because of their local climate, namely the amount of rainfall, high rain days, and erratic temperatures.

However, further research is necessary to conduct observations in those three areas to examine their seawater levels, and wind speed directions since other contributing factors should be carefully considered apart from the climate. If the industries are successfully developed, as immense micro industries are created, the unemployment and social inequality can be reduced, and the local income is increased. Hence, the central and regional governments must provide business capital and training to create a superior quality salt.

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6. Declaration of Conflicting Interests

The authors have declared no potential conflicts of interest concerning this article's research, authorship, and/or publication.

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