

The Impact of Natural Disaster on Resilience of Tourism Performances in West Nusa Tenggara: Random Effect Models (REM)

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Abstract *The aim of this research paper is to examine the impact of natural disaster on tourism performances while using engineering resilience namely government expenditure, transportation and gross domestic regional product. Second, the author(s) want to examine the impact of natural disaster on tourism by including regional effect. West Nusa Tenggara is the main destination for local and international tourist in Indonesia that provides natural and culture-based tourism. The data collected from 2008 – 2019 from various institution namely West Nusa Tenggara Agency for Disaster Management, West Nusa Tenggara Bureau of Statistics, and department of tourism and culture of West Nusa Tenggara. The finding confirms natural disaster overshadows the tourism performances in the past decades. First, the present result indicates that natural disaster has negative impact on tourism performances. Government expenditure and transportation have strong positive impact on tourism performance in West Nusa Tenggara. Thus, it implies that the greater government expenditures and transportation might increase the tourism performances. Higher level of government expenditures can provide better tourism management assistance that will make tourist destination more attractive. In addition, the role of better transportation or infrastructure is to reach more remote and exotic tourist destination. According to the empirical findings, it can be applied that providing natural disaster mitigation or increase the engineering resilience namely government expenditure and transportation can statistically increase the tourism performances in West Nusa Tenggara.*

Keywords: Climate Changes, Engineering Resilience, SDGs, Tourism Performances, West Nusa Tenggara

INTRODUCTION

West Nusa Tenggara is in the Eastern part of Indonesia is one of the tourist destinations that already developed by the government of Indonesia in the last few decades. The province is located in eastern side of Bali and blessed with beautiful tropical beach and rich culture. West Nusa Tenggara consists of Lombok Island which one of the favorites destinations for international and national visitor. Since 2014, as the government of Indonesia published Government Regulation No. 52/2004 regarding the Mandalika Special Economic Zones with goals to increase the economic growth via tourism sector, the occupancy rate of hotel in Nusa

Tenggara Barat and the center of Lombok were increasing steadily. Unfortunately, the Pandemic of COVID-19 forced significant reduction on inbound tourist since the first cases arise (Arbulú et al., 2021; Uğur & Akbıyık, 2020), including West Nusa Tenggara.

The concept of Sustainable Island tourism are completely different compares to non-island tourism, due to the geographic situation (Graci & Dodds, 2010). Furthermore, the sustainable island tourism give the benefit and escalate the economics growth, meanwhile, it also give the bad impact to environmental situation in the island (Torres-Delgado & Saarinen, 2014). However, according to (Graci & Dodds,

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2010) the threat of natural disaster, terrorism, global and local pandemic can be serious terror in the tourism industry. All the three threats mentioned before are negative shocks for the tourism industry (Bhati et al., 2016; Gunn, 1997; Ritchie, 2004).

The research area on the impact of natural disaster to the tourism sector is relatively new, even though some significant studies reported that there is strong relationship between disaster events to the tourism performance (Rindrasih et al., 2019). The study of natural disaster impact on tourism are done in developing namely Indonesia (Hamzah et al., 2012; Rindrasih et al., 2019; Widodo & Hastuti, 2019), Nepal (Ghimire, 2016), Malaysia (Fan et al., 2019; Nurashikin Sungip et al., 2018) and developed countries namely China (Ma et al., 2020; Sun et al., 2018), USA (Kim & Marcouiller, 2015) Australia (Pham et al., 2021), Taiwan (Huan et al., 2004; Wang, 2009), Japan (Chan et al., 2020; Wu et al., 2014), Greece- Island of Crete ((Boulal, 2017) and Macao-Hongkong (U & So, 2020). The study of across countries also can found on the world level (Liu et al., 2019; Rosselló et al., 2020) and ASEAN level (Bhati et al., 2016). Several studies only focus on one event of natural disaster and one regions COVID 19 and the Sars (Lim, 2021; Pham et al., 2021; Chand & Ambadar, 2023), hurricanes (Kim & Marcouiller, 2015), Earthquake (Ghimire, 2016; Huan et al., 2004) and flood (Hamzah et al., 2012; Nurashikin Sungip et al., 2018), but other studies focuses on natural disaster that happened with range of time to see the impact of regional economics and tourism (Bhati et al., 2016; Fan et al., 2019; Liu et al., 2019; Ma et al., 2020; Rosselló et al., 2020; Sun et al., 2018; Wu et al., 2014). These studies surprisingly give the same result, which there is strong but negative relationship between the natural disasters to tourism sector.

The impact of natural disaster on tourism sector strongly determined by the level of vulnerability of the economics (Kim & Marcouiller, 2015). The impact of disaster can create physical-damage such as destroy infrastructure and school building, and non-physical such as human loss and created traumatic for people which have negative impact on regional economics and tourism sector. The more resilience or less vulnerable economics will lead to less impact of natural disaster. For instance, place with mature economics usually have the ability to invest on building school and infrastructure with disaster mitigation system and have many mitigations (Brown et al., 2019). The better mitigation system significantly reduces the impact of natural disaster. So, the author(s) can imply that the stronger economies lead to less disaster impact, more adaptive and well-prepare for the future disaster, and vice versa (Barbhuiya & Chatterjee, 2020).

Resilience or vulnerability can be determined by several factors. Kusumastuti et al. (2014) published resilience index in Indonesia toward natural disaster. The resilience

indeks classified by social, community capacity, economic, institutional, infrastructure and hazard. Parsons et al. (2016) developed the concept of resilience based on (Kusumastuti et al., 2014) and adding more details such as top-down approach and named it by Australian Natural Disaster Resilience Index. The concept of ANDRI classified in two indicators namely adaptive capacity and coping capacity. The adaptive capacity focuses more on resources, skills and opportunities, while coping capacity is on social character, economic capital, infrastructure and planning, emergency services, community capital and information and engagement. Furthermore, (Barbhuiya & Chatterjee, 2020) established comprehensive resilience models by using macroeconomics data namely transportation, trade, GDP and public administration. Examining of the determinant of resilience that mentioned before, the author(s) highlight that economic aspect; infrastructure and government spending are the core factor of resilience.

In the case of Indonesia, there are limited studies examine the impact of natural disaster on tourism. A qualitative study in Bali Tourism reported that the impact of Mount Agung Eruption in 2017 can decline inbound tourism 20 – 30 percent (Rahmawati et al., 2019). However, the same concept of study proved a different result in the case of Bali and Yogyakarta (Rindrasih, 2018). In this study the author describes that the majority of international tourist in the 2 main destinations do not pay attention for natural disaster and it won't influence their decision to visit places. Other studies also validate both of the result from Rahmawati et al. (2019) and Rindrasih (2018). The next studies examine longer time range, which is 20 years with Multi Input Intervention Analysis in Bali, Jakarta and Kepulauan Riau Provinces (Purwa & Atmanegara, 2020). This result supported both of the argument and highlight that natural disaster has negative impact on international tourism performance, unless with a different magnitude and pattern.

The present research will evaluate the impact of natural disaster on tourism sector by using GDP, infrastructure and government spending as control variables. The conceptual framework developed from the concept of resilience from (Kusumastuti et al., 2014), (Parsons et al., 2016) and (Barbhuiya & Chatterjee, 2020). The author(s) choose West Nusa Tenggara because of the priority focus of government in the current state, so that, the output of this research can be one of the inputs for policy makers. Second, West Nusa Tenggara becoming more famous for both domestic and international traveler. Third, there are limited studies that focused on tourism sector in West Nusa Tenggara. First, the author(s) want to examine the natural disaster effect on tourism performances using panel data regression. Second, the author(s) want to see the impact of natural disaster on tourism with regional effect by creating dummy region on panel data regression.

DATA AND METHODOLOGIES

Data

The focus of this present research is to examine the relationship between natural disaster to tourism performances in Lombok Island. The panel data collected from eight counties and two cities located in West Nusa Tenggara - Nusa Tenggara Barat (NTB) from 2008 – 2019 yearly. The present research using hotel occupancy from Tourism Agency for Nusa Tenggara Barat as a proxy for tourism performances. The hotel occupancy ratio are used by researcher as a proxy for tourism performances in Farid Said et al. (2019); Hamzah et al. (2012); Rahmawati et al. (2019) and Rindrasih (2018). According to *Indicators for Measuring Competitiveness in Tourism* (2013), the hotel occupancy can measure of tourism flows in accommodation, as well as capturing the percentage growth or decline year-on-year in overnights in all types of accommodation. The author(s) want to capture of both, international and national visitor who stays in Lombok for tourism activities. The difficulties of using the hotel room occupancy are the existing of illegals or unregistered hotel, so the research will focus on all types of accommodation, namely, the star hotel room and non-star hotel room. The author(s) noted that the hotel occupancy is the indicator

also have multiplier effect to the economy such as creating jobs for local worker, transportation and create another demand for food and beverages.

Next, to assess the impact of natural disaster to tourism performances the present research is using the impacted people from natural disaster as a proxy for natural disaster events. The author(s) collect data from Nusa Tenggara Barat's Board for Disaster Management. The majority of previous study used dummy variable (Ma et al., 2020; Mariyono, 2017; Muryani et al., 2020; U & So, 2020; Wang, 2009; Yudhistira et al., n.d.) and exposure index (Canh & Thanh, 2020; Lan et al., 2021). While many researcher argue that the impact of one disaster is different comparing to other disaster, for example flood and earthquake (Barbhuiya & Chatterjee, 2020). The author(s) take note that the larger disaster gives the larger impact to community, economy and tourism sector. The author(s) can use another approach such as the cost of disaster with nominal values of damage (Kurniasari et al., 2019; Sharpley, 2005; Wang, 2009) and also the impacted people in one disaster (Pham et al., 2021; Wu et al., 2014). While there are two-types of impacted people namely the human loss and the mental or physical disabilities (Li et al., 2017; McGuire et al., 2018), this present research adopts the impacted people due to the limitation of data. The impacted people for disaster can reveal the intensity of natural disaster regardless the type of disaster, so this research eliminate the types of disaster in the impacted people.

Table 1: Variable References

Sr. No.	Variables (Unit Measurement)	Indicators	References
1	Hotel Occupancy Ratio (Percentage)	Tourism Performances	Farid Said et al. (2019); Hamzah et al. (2012); Rahmawati et al. (2019, 2019) Rindrasih (2018)
2	Human Loss (Unit)	Natural Disaster	(Barbhuiya & Chatterjee, 2020), (Li et al., 2017; McGuire et al., 2018)
3	Government Expenditure (IDR)	Government Spending	(Barbhuiya & Chatterjee, 2020; Liu et al., 2019; Muryani et al., 2020; Pham et al., 2021)
4	Transportation (IDR)	Infrastructure	(Farid Said et al., 2019; Sharpley, 2005; Wang, 2009)
5	GDRP (IDR)	Economic Performances	(Barbhuiya & Chatterjee, 2020; Lan et al., 2021)

The author(s) focus on Government Expenditure (Barbhuiya & Chatterjee, 2020; Liu et al., 2019; Muryani et al., 2020; Pham et al., 2021), Gross Domestic Regional Product (GDRP) (Barbhuiya & Chatterjee, 2020; Lan et al., 2021) and Transportation (Farid Said et al., 2019; Sharpley, 2005; Wang, 2009) as control variable for the present studies that The author(s) can called engineering resilience (Barbhuiya & Chatterjee, 2020) or resilience (Kim & Marcouiller, 2015). However, The author(s) can't ignore the importance rules of government for the present studies that includes

in the preparation and post-disaster activities. The control variables can show the level of resilience of each region if disaster occurs. The author(s) expect the higher government expenditure, GDRP and transportation ratio can lead lesser impact of natural disaster. The three control variables were collected from Nusa Tenggara Barat's Central Bureau of Statistics and Indonesia's Ministry of Finance. Table 1 shows the summary of references for each variable used for the present studies. Table 2 shows the descriptive summary of Data used for the present research.

Table 2: Descriptive Summary of Data

Sr. No.	Variables	Obs	Mean	Std. Dev	Min	Max
1	Hotel Room	110	1451	1592.996	56	5851
2	Government Expenditure	110	8.74e+09	4.91e+09	1.89e+08	2.60e+10
3	Disaster	110	55610.63	121463.9	0	626604
4	Transportation	110	127798.5	97484.56	19668	367685
5	GDRP	110	11411.28	6062.698	1448	25731

Model Specification

The author(s) noted that Nusa Tenggara Barat has 2 main islands namely Lombok Island and Sumbawa Island. Regardless the location, there is no big difference in economics, tourism, population, climate and political

conditions. First, the author(s) use panel regression methods to understand the effect of natural disaster on the tourism performances in Nusa Tenggara Barat. The author(s) include several control variables namely government expenditure, GRDP and transportation (All data converted to log natural). The panel regression models for the study expresses by equation 1.

$$\text{Hotel}_{it} = \beta_0 + \beta_1 \text{Gov}_{it} + \beta_2 \text{Dis}_{it} + \beta_3 \text{Trans}_{it} + \beta_3 \text{GDRP}_{it} + v_{it} \quad (1)$$

Where:

Hotel_{it} : Hotel Occupancy Room

Gov_{it} : The Government Expenditure special for Tourism

Dis_{it} : Total Impacted people

Trans_{it} : Number of Registered Vehicle

GDRP_{it} : Gross Domestic Regional Product

Generally, panel data gives the more informative and complete information by combining time-series data and cross-section (Wooldridge, 2012). Thus, can reduce the probability of collinearity among variables, increase degrees of freedom and more efficient (Gujarati & Porter, 2009; Wooldridge, 2012). There are 3 types of panel data analysis, namely constant coefficients models, fixed effect models and random effects models. The three types can be used for data set depends on the data structure and characteristics. Meanwhile, the researcher needs to take note that the most suitable for the data set is the last, Random Effect Models (REM) that is also the same with previous paper (Barbhuiya & Chatterjee, 2020). The Random Effect Models (REM) is the panel regression analysis that is handle the ignorance or error term and assume that the intercept is random outcome variables. Also, the authors need to specify the individual characteristics that may or may not influence the predictor variables. The basic equation of Random Effect Models is represented by Equation 2.

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} + a_i + u_{it} \quad (2)$$

Under the Random Effect assumption, the is unobserved effect and uncorrelated independent variables (Wooldridge, 2012). However, according to Gujarati & Porter (2009) and Wooldridge (2012) the author need to use Random Effect Models if the key of explanatory variable is constant over

time. Second, the author(s) e noted that each regions responds differently when the disaster occurs, so the author(s) decided to use the region regions to get better point of view. Dummy variable for region is used in the second regression.

RESULT AND DISCUSSION

The Impact of Natural Disaster on Tourism Performance

First, the author(s) build the panel model to examine the relationship between natural disaster to the tourism performances. Table 3 shows the significant level for all independent are really high that is on 1% level of significant.

Table 3: Regression Result

Variables	Coef	Std. Error	z	p-Value
Gov Exp	0.7216808	.1385791	5.21	***0.000
Disaster	-0.0525182	.0183267	-2.87	***0.004
GDRP	-0.04089173	.1373933	-2.98	***0.003
Trans	0.5837695	.1739716	3.36	***0.001
Cons	-12.28917	2.994404	-4.10	***0.000

Note: The symbols *, ** and *** indicate that the result is significant at 10%, 5% and 1% levels, respectively.

First, the author(s) examine the result of the regression on natural disaster to hotel occupancy. The panel regression shows that the impact of natural disaster is statistically significant to the tourism performance in the 1% level of significant. This implies that as the natural disaster increase the level of tourism performances are lower. The negative

impact of natural disaster are also in-line with other research such as (Barbhuiya & Chatterjee, 2020; Kusumastuti et al., 2014; Parsons et al., 2016). The result also supported with Wibowo (2021) that natural disaster are statistically significant influence the number of inbound tourist in West Nusa Tenggara. The impact of natural disaster is severe in the region that is less prepared. According to Wahyuningtyas et al. (2020) the disaster mitigation in West Nusa Tenggara specially for tourism destination such as Senggigi beach are not sufficient and not well-integrated. However, due to the disaster self-awareness from the local citizen and the visitor, natural disaster has less fatality.

West Nusa Tenggara is small island that has very limited resource, such as water, dependence on neighboring regions and high transportation cost to entry (Kurniasari et al., 2019; Kurniawan et al., 2020). The engineering resilience factor are also significant with 1% level of significancy thus imply that the greater government expenditures and transportation might increase the tourism performances. Higher level of government expenditures can provide better tourism management assistance that will make tourist destination more attractive. In addition, the role of better transportation or infrastructure is to reach more remote and exotic tourist destination. This result is also strongly supported by (Barbhuiya & Chatterjee, 2020; Kusumastuti et al., 2014; Parsons et al., 2016). In the case of during or post disaster, government expenditure plays important rule in both

developing tourist destination, therefore, the government expenditure is the main key of resilience in the region. Transportation is the main media to transfer human, goods and services. The transportation rules in the developing tourism sector is to ease the tourist from one destination to other destinations (Mishra et al., 2020). The impact of good transportation has multiplier effect in economic growth, tourist sector, and many others.

The author(s) note that the GDRP have the negative coefficient respect to tourism this could implies that the increase of GDRP leads to lower tourism performances while the expected value is positive. The contribution of tourism sector to GRDP are relatively small and the growth of GDRP are increasing every year due to other sector performances namely mining and excavation (Islamy, 2019), so the regression result shows negative coefficient.

Effect of Natural Disaster for Tourist Performances for Each Region

Next, move to the regional effect of natural disaster to tourism performances that is shown in Table 4. The author(s) noted that there are several regions that the channel of natural disaster for tourism performances are not statistically significant namely East Lombok, Sumbawa, Dompu and West Sumbawa.

Table 4: Effect of Natural Disaster for Tourism Performances for Each Region

Region	Coef.	Std. Err	z	P-Value
West Lombok	1.097896	.2993329	3.67	***0.000
Central Lombok	.6832436	.3523029	1.94	**0.052
East Lombok	-.3093019	.3781983	-0.82	0.413
Sumbawa	.393186	.2744407	1.43	0.152
Dompu	-.0437949	.2254241	-0.19	0.846
Bima	-1.198239	.244092	-4.91	***0.000
West Sumbawa	.5325797	.3485948	1.53	0.127
North Lombok	1.760197	.2298836	7.66	***0.000
Mataram	1.71439	.3827775	4.48	***0.000
Bima	0			

Note: The symbols *, ** and *** indicate that the result is significant at 10%, 5% and 1% levels, respectively.

The lack of infrastructure support in West Nusa Tenggara affects the level of tourism attractiveness in the regions (Fig. 1). Both international and domestic visitor are attracted to the main destination in Lombok Island. Besides, currently the focus of Indonesian government is improving the tourism environment in Mandalika (Lombok Island) to attract more investment and to boast the tourism sector in the end. Also the author(s) note that the existing agglomeration in tourism due to the Mandalika SEZ, that first is designed for developing marine tourism potentials and consist of following tourist

destination such as Kuta Beach, Seger Beach, Tanjung Aan and traditional villages (Rahmafitria et al., 2019).

Meanwhile, in Sumbawa Island that confirm are not statistically significant (Table 4), the tourism potential are available namely Moyo Island, Bedil Island, Bungin Island, Ai Beling Waterfall, Tering Batu area, Liang Petang Cave, Mamak and Batu Bulan Dam Area and Istana Dalam Area (Arisanti, 2019). Moreover, the role of Sumbawa oil that originally produced and well-known from Sumbawa is another tourism potential on traditional health tourism

(Hakim et al., 2020). Unfortunately, the potential cannot be maximized due to the lack of infrastructure support for tourism performance for example the hotel availability

limited only for non-star hotel and lack of transportation in these regions.

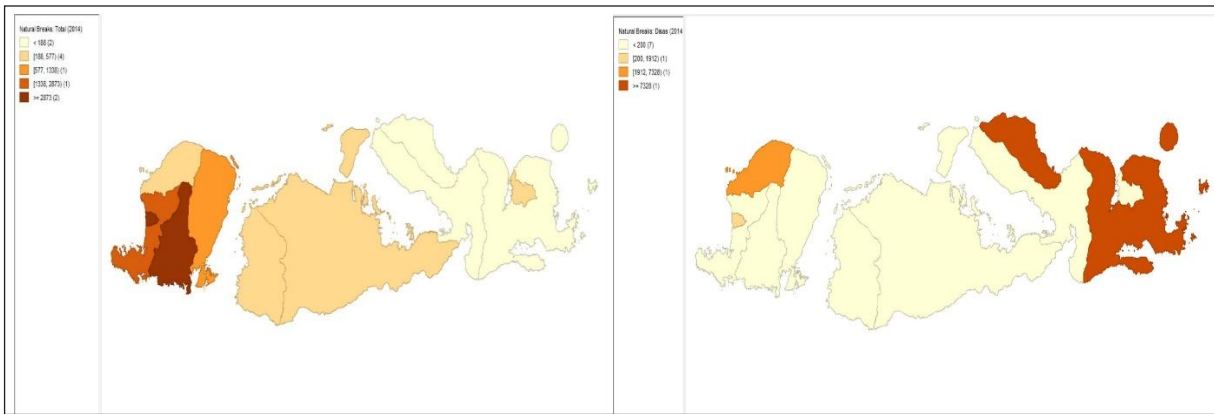


Fig. 1: Natural Break of Visitor (Left) and Natural Disaster (Disaster)

On the right side of Fig. 1 shows the natural breaks of natural disaster. Natural disaster is the exogenous factor that effect negatively to economic growth and tourism performances (Table 4). The data shows that Bima has the highest impacted

people and follows by North Lombok in the second place. According to BNPB Indonesia, these 2 regions are mainly affected by drought, flood and earthquake almost every year.

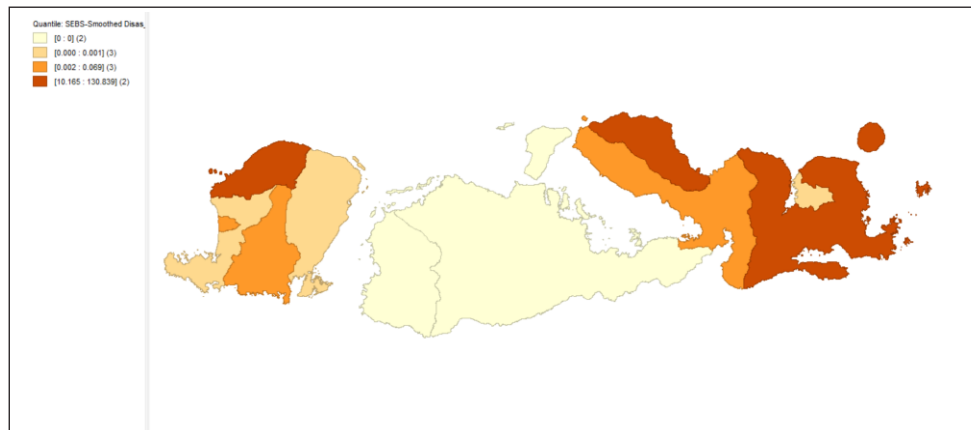


Fig. 2: The Relationship between Natural Disaster and Tourism Performances

To support the regression result on Table 4, the author creates map to examine the relationship between natural disaster and tourism performances on West Nusa Tenggara (Fig. 2). Bima Regency has the highest natural disaster respectively comparing to the other regions, but unfortunately the Bima Regency has low tourism performances, as result as, the tourism performances in Bima Regency affected by natural disaster. Second, the effect of Natural Disaster in North Lombok impacted in tourism performance not only in North Lombok, but also the neighboring area such as Mataram, East Lombok, Central Lombok dan West Lombok.

CONCLUSION

The aim of this paper is to explain the effect of natural disaster on tourism performances across different region in West Nusa Tenggara Barat. By using panel data for 10 regions and cities from 2008 – 2019, the author(s) built a Random Effect Models, and include several control variables as resilience engineering factor. The result of the present research indicates that natural disaster has negative impact on tourism performance. Conversely, transportation and government expenditure have positive impact on tourism

performances. Visitors are more likely to visit region that has less natural disaster and supported by good transportation and high government expenditure. Thus result, indicates that by increasing the disaster mitigation and increase engineering resilience namely government expenditure and transportation can positively impact tourism performances. Furthermore, the existing of tourism-based culture-social activities in West Nusa Tenggara, can be utilize and manage by both of central and regional government, so, it can increase the unique and selling point of tourism sector in West Nusa Tenggara. Unfortunately, the GDRP as one of the engineering resiliencies in this study shows negative relationship with the hotel occupancy rate, while there is no empirical research in West Nusa Tenggara regarding tourism's performance that can capture the relationship between GDRP and hotel occupancy rate.

In this research the author(s) use hotel occupancy room for proxy of tourism performances, due to the limitation of data this has constrained the analysis to some extent. Our hypothesis if using money used by tourist or tourist expenditure is more relatable for tourism performances and it will enrich the result with deeper analysis. Using tourist expenditure also can capture the multiplier effect for each region and the author(s) can see the spillover effect across sector. Even though the study successfully sees the negative impact of natural disaster on tourism performances in West Nusa Tenggara and the importance of engineering resilience, the author(s) did not accommodate the existing mitigation level of each region. While great number of studies using primary data shows that mitigation level is statistically significant to make less impact of natural disaster. To sum up, future studies should be focus on mitigation level and using tourist expenditure as one of the proxies for tourism performances.

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