Jejak Vol 15 (2) (2022): 368-388 DOI: https://doi.org/10.15294/jejak.v15i2.36728

JEJAK

Journal of Economics and Policy

http://journal.unnes.ac.id/nju/index.php/jejak

# Analysis of Economic Vulnerability to Disaster Threats in Batu City

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**Permalink/DOI:** https://doi.org/10.15294/jejak.v15i2.36728

Received: May 2022; Accepted: July 2022; Published: September 2022

## Abstract

*Geographically, Indonesia is located on three of the world's main tectonic plates and has 127 active volcanoes, making it highly vulnerable to natural disasters. In addition to natural disasters, Indonesia is also facing the Covid-19 disaster, which has greatly affected the tourism sector. Batu City is one of the leading tourism areas. Because Batu City is prone to disasters, this will certainly have an impact on the economy of the people of Batu City. Therefore, this study aims to analyze economic vulnerability due to disasters and the role of institutions in dealing with them. This research is a case study that uses a quantitative and qualitative approach, using the results of respondent interviews, ArcMap 10.3, ILWIS software, and MACTOR. The results obtained are that the disasters that have the most severe impact on the economic vulnerability of Batu City are droughts and earthquakes. In addition, other results also show that the role of institutions has not been good enough in creating institutional strategies in Batu City. Based on the modeling results using MACTOR, it is known that the disaster management efforts carried out by the tourism object and the Regional Apparatus Organization (OPD) agree and support the implementation of these efforts.*

**Key words** : disaster-resilient tourism area, disaster vulnerability index, economic vulnerability, tourism sector

**How to Cite:** Suprapto, F., Juanda, B., Rustiadi, E., & Munibah, K. (2022). Analysis of Economic Vulnerability to Disaster Threats in Batu City. JEJAK, 15(2), 368-388. doi:https://doi.org/10.15294/jejak.v15i2.36728

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p-ISSN 1979-715X
e-ISSN 2460-5123

## INTRODUCTION

Indonesia is the most severely affected country by the Covid-19 pandemic compared to other Southeast Asian countries. This is reflected in the highest number of daily cases since Indonesia's first Covid-19 case was detected in March 2020. This can be shown in Figure 1, where Covid-19 cases -19 Indonesia continue to increase and cause a large mortality rate (UN OCHA, 2021). The Covid-19 outbreak has caused all sectors of the economy to deteriorate. One of the sectors most affected by the Covid-19 pandemic is the tourism sector because the number of Indonesian tourists has decreased since 2020. Unemployment in the tourism sector has also increased, resulting in a drastic decline in national income. This is due to restrictions on mobility to reduce the spread of the Covid-19 virus (Sharma et al., 2021).

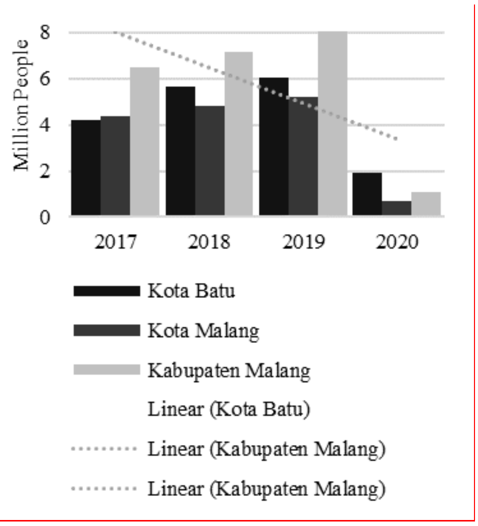



**Figure 1.** Number Of Visitors To Tourism Objects And Souvenirs Of Greater Malang In 2017 – 2020

The tourism sector is a sector that contributes significantly to the indonesian economy. This significant contribution is evidenced by the high number of tourists visiting indonesia. As is known, Indonesia is the country with the fourth-largest number of tourists in Southeast Asia in 2019 (ASEAN secretariat, 2020). One of the provinces that makes the tourism sector the mainstay of driving economic growth is East Java Province. The visit of foreign and domestic tourists to this province has an excellent opportunity to encourage the advancement of the hospitality industry, restaurants, and various other economic sectors (BPS East Java Province, 2020). The tourism sector also contributed to East Java's GDP by up to 60% in 2019 (jatimpos, 2021). One area that has a potential tourism sector in East Java is greater Malang (natalia, 2018).

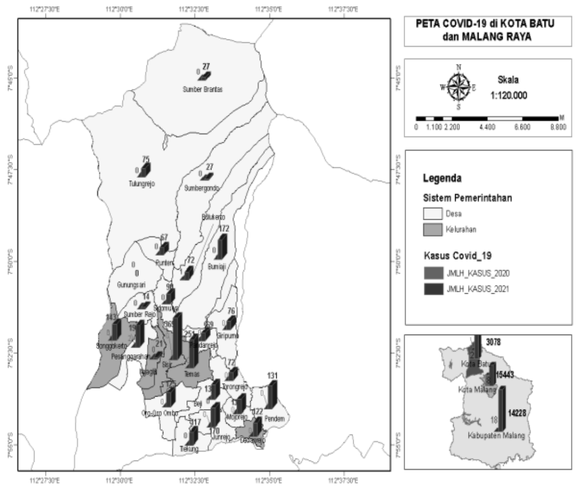
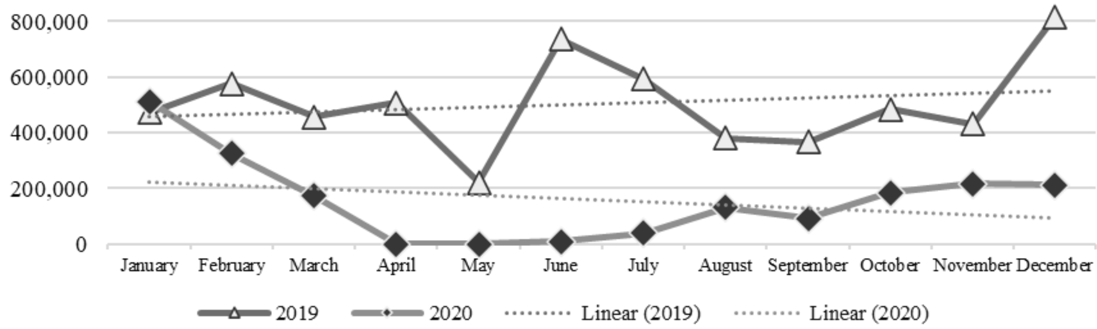



**Figure 2.** Map of Greater Malang Covid-19 Distribution in March – April 2020 and September - October 2021

However, due to the outbreak of the Covid-19 pandemic, the number of tourists experienced a significant decline in 2020. This was due to restrictions on community mobility to reduce the spread of the Covid-19 pandemic. Batu City is an area with high-risk status for the spread of Covid-19. The indications of the Covid-19 outbreak that spread almost evenly in all villages/ sub-districts from 2020 to 2021 are the evidence. However, this city has the highest number of tourists in Greater Malang. During the Covid-19 pandemic. This shows that Batu City has a higher tourism attraction. Batu City has 92 tourist attractions divided into 24 tourist villages/sub-districts, eight tourist areas, and 60 tourist objects, so it has a high tourist attraction. This city should be suspected of having the potential to have better tourism resilience during the Covid-19 pandemic compared to other districts/ cities in the Greater Malang area.

Batu City is also a leading tourist area in the Greater Malang area, East Java (Ministry of Tourism and Creative Economy of the Republic of Indonesia, 2012). This city is also the most aggressive in tourism development than other cities/ regencies in the Greater Malang area (Ismail et al., 2017). In 2019 Batu City won Indonesia's Attractiveness Award 2019, thanks to the government's success in providing the best public services and tourism.




*Source:* BNPB, 2020 (data processed)

**Figure 3.** Number of Batu City Tourists in 2019 and 2020 (Before and After the Covid-19 Pandemic)

Figure 3 shows that Batu City tourists peaked during the student holiday period in June and December 2019. This number decreased drastically in 2020 due to restrictions on community mobility. The lowest number of tourists reached more than 700 people in April 2020, while this number increased again in the following months. This shows that the Batu City tourism sector is recovering from the Covid-19 pandemic. One of the factors that led to this recovery is Batu City's resilience to disasters.

Batu City is a disaster-prone area with a Disaster Risk Index (IRB) with a moderate category (BNPB 2021a). This city is also a resilient area to natural disasters and the Covid-19 disaster, as reflected in most Batu City villages/ sub-districts, designated as disaster-resilient areas by the local government. This status shows that Batu City is also one of the disaster-resilient tourism areas, suspected of having a good disaster risk management system. However, it is necessary to strengthen disaster management in the tourism sector to become a disaster-resilient area. This effort needs to be made to maintain and increase the value of the Batu City tourism sector so that it can become a disaster-resilient tourism area. Therefore, this study aims to strengthen the disaster risk management system in supporting Batu City as a disaster-resilient tourism area, which can be a role model for disaster risk management in other tourism areas in Indonesia.

## METHOD

The tools used in this research are software with ArcMap 10.3 and ILWIS software. The materials used in this study are primary and secondary data listed in the following table.

The method used to analyze disaster vulnerability is a combination of ILWIS and GIS. Integrated Land and Water Information System (ILWIS) is a data processing software based on Geographic Information System (GIS). A geographic information system (GIS) is used to analyze the risk of natural disaster threats spatially through a spatial approach based on the type of natural disaster to be studied. GIS can be used to identify suitable land and inventory resources in land suitability analysis.

ILWIS was developed by the International Institute for Aerospace Survey and Earth Sciences, Netherlands (ITC, 2001). ILWIS is software that can enter data (input), manage data, and analyze data. ILWIS is currently widely used for mapping disaster areas and land use planning. The ad-vantage of ILWIS is that it can combine spatial and non-spatial data. The ILWIS tool pro-vides analytical facilities in a multi-criteria assessment method that can make it easier for researchers to tabulate spatial data and disaster attribute data. Multi-criteria analysis based on a spatial approach using ILWIS software opens opportunities to take advantage of various existing criteria for spatial analysis using problem scenario preparation, data standardization, weighting, and map-making. The weighting is done by the pairwise method (Analytical Hierarchy Process). Data collection is done by GIS analysis. Technical data processing using weighting classification through ILWIS software. One of the evaluation methods used in ILWIS is Spatial Multi-Criteria Evaluation (SMCE).

**Table 1.** Summary of Data and Data Sources in Research

| Data | Data Sources |
|---|---|
| Geology of Batu City tourism area | ESDM Geological Agency |
| DEM STRM 30 m | DEM STRM Data from CGIAR CSI (strm.csi.cgiar.org) |
| Citra Landsat 8 path 118/ row 65 | USGS (United Stated Geospatial Survey) on website earthexplorer.usgs.gov) |
| Soil type shapefile | Indonesian Geospatial Information Agency, FAO |
| Rainfall data | Rainfall capture station in Batu City from BMKG data |
| Land use | Land use map from the Geospatial Information Agency with a scale of 1:250.000 |
| Earthquake data | KRB (Disaster Prone Area) Batu City |
| Hotspots | Terra/Aqua MODIS satellites on the FIRMS website at the link https://earthdata.nasa.gov/data/near-real-time-data/firms/active fire-data) |
| RBI Map (Indonesian Landscape) | Page https://tanahair.indonesia.go.id |

The weighting method is a method in which each parameter is calculated with a dif-ferent weighting. The weights used are very dependent on the experiments or empirical experiences that have been carried out. One of the evaluation methods used in ILWIS is Spatial Multi-Criteria Evaluation (SMCE). SMCE is a form of AHP (Analytical Hierarchy Process). The ILWIS tool provides analytical facilities in a multi-criteria assessment method that can make it easier for researchers to tabulate spatial data and disaster attribute data. Multicriteria analysis based on a spatial approach using ILWIS software opens opportunities to take advantage of various existing criteria for spatial analysis using problem scenario preparation, data standardization, weighting, and map-making. The weighting is done by the pairwise method (Analytical Hierarchy Process). Data collection is done by GIS analysis. Technical data processing using classification weighting through ILWIS software.

Furthermore, the analysis of the influence of the threat of disaster vulnerability in the tourism area on the vulnerability of the local economy in Batu City in this study was conducted to find out what disasters affect the local economy to analyze Batu City's resilience in dealing with disasters and answer indications that Batu City can be a pilot area (role model) for disaster risk management in tourism areas. The analysis was carried out through a static panel analysis consisting of eighteen disaster conditions in the observation period from 2015 to 2020. The operational definition of each variable used in the panel data analysis is described in Table 2 below.

**Table 2.** Operational Definition of Variables in Static Panel Analysis

| Variable (Notation) | Definition |
|---|---|
| Economic Resilience Index (KE^(1)) | The variable of economic resilience is obtained from the calculation of the BNPB's economic vulnerability index (2012a), which is then inverted. The analysis of the economic vulnerability index is obtained based on the following formula.<br>$KE_i = (0,6 \times \text{Productive land score}_i) + (0,4 \times \text{GDRP score}_i)$,<br>where:<br>$\text{Productive land score}_i = \frac{\text{Productive land class } (RLP_i)}{\text{Maximum value of productive land class (Biggest } RLP_i \text{ in Batu City)}}$ (1)<br>and,<br>$\text{GDRP score}_i = \frac{\text{GDRP class } (RPP_i)}{\text{Maximum value of GDRP class (Biggest } RPP_i \text{ in Batu City)}}$ (2)<br>with,<br>$RLP_i = \frac{RLP_{kk}}{LLP_{kk}} \times LLP_i \;;\; RPP_i = \frac{RPP_{kk}}{L_{kk}} \times L_i$ (3)<br>Explanation:<br>$RLP_{kk}$, $LLP_{kk}$, $LPP_i$, $L_i$, $L_{kk}$ and $RPP_{kk}$ data obtained from the results of interviews with farmers in local villages and field observations of researchers.<br>The value of productive land is calculated using the economic land rent approach (Rustiadi, Saefulhakim, and Panuju; 2011) as follows.<br>$LR = Y(m - c) - Y.t.d$ (4)<br>Note:<br>LR = *land rent,* used as a representation of the value of productive land<br>Y = output per land unit<br>m = price per unit of output<br>c = production cost per unit of output<br>t = transportation cost per unit output per unit distance<br>d = distance from production site to city center |
| Night Room Filled (MKT) | Average night room used. This variable reflects the supply in the tourism sector. The data was obtained from the Batu City Tourism Office. |
| Number of Tourists (Tour) | Number of visitors to tourist attractions and souvenirs. This variable shows the demand in the tourism sector. Data obtained from BPS Batu City. |
| Earthquake Hazard Index (G) | The calculation of the earthquake susceptibility index is carried out by scoring and weighting some of the earthquake susceptibility variables used. The |

| Variable (Notation) | Definition |
|---|---|
| | primary reference, scoring technique, and weighting refer to the Regulation of the Minister of Public Works No. 21 of 2007 concerning Guidelines for Spatial Planning for Volcanic Eruption Prone Areas and Earthquake Prone Areas. |
| Flood Hazard Index (B) | The parameters used to map flood-prone areas in this study consisted of natural and human factors based on slope, geomorphology, rainfall, soil type, land cover, and river buffer. Furthermore, to obtain the zoning of the flood area in the research area, the weighting method (AHP) of the parameters has been processed using ILWIS software. |
| Drought Hazard Index (K) | Meteorological drought is obtained by the method of interpolation of drought values. The drought value was obtained by calculating the monthly rainfall value using the Standardized Precipitation Index (SPI). |
| Landslide Hazard Index (TL) | The parameters used to map landslide-prone areas in this study consisted of natural and human factors based on slope, geomorphology, rainfall, soil type, and land cover. Furthermore, to obtain the zoning of the landslide area in the research area, the weighting method of the parameters that have been processed using ILWIS software is carried out. The level of vulnerability of the landslide area is based on the cumulative score obtained from all parameters. |
| Land Fire Hazard Index (KB) | The study was conducted using secondary data related to environmental conditions causing fires, namely rainfall, land cover, and river buffers. The level of fire susceptibility in the research area is carried out by weighting the parameters that have been processed using ILWIS software. The level of vulnerability of the landslide area is based on the cumulative score obtained from all parameters. |
| Covid-19 Disaster Vulnerability Index (Cov) | The calculation of the Covid-19 vulnerability index is carried out by mapping the distribution of the population affected by Covid-19 in each village/ sub-district. Then interpolation is carried out according to the village office points and tourist spots to get the modeling and interpolation scoring of the spread of Covid. |
| Disaster Hazard Level Dummy (DTKB) | The Dummy of Disaster Vulnerability Level, obtained from the calculation of the composite index from the results of the analysis of the level of disaster vulnerability carried out in Goal 1 (Analyzing disaster threats in the Batu City Tourism Area, East Java), which consists of two categories of disasters, namely low, medium, and high, with variables dummy 0, 1, and 2, respectively. |

Next is the processing of research results using the MACTOR method. MACTOR's way of working is based on inter-actor influence by analyzing the relative strength between actors or stakeholders and exploring similarities and differences in various problems and goals to be achieved. In MACTOR, actors are defined as entities that determine the running of a system and regulate the mobilization of resources to influence outcomes either directly or indirectly. On the other hand, factors or issues are defined as variables, ideas, topics, problems, or things that trigger discussion. There are several variables linked between actors and factors, namely; (1) position, a variable that represents the actor's preference for the desired outcome. In other words, position indicates the direction in which the actor is able or willing to exert every effort to influence the issue. (2) Salience, is a priority that shows how important the realization of an outcome is to the overall achievement of the actor's goals. (3) Clout describes the "power" possessed by actors to directly influence an issue's outcome in various ways. And (4) Influence, is the power possessed by an actor to influence the behavior of other actors.

## RESULTS AND DISCUSSION

The development of the tourism sector indirectly affects local revenue (PAD) which will contribute to regional income (GRDP). The arrival of both local and foreign tourists also contributes to regional income (Adhikrisna, 2016). One city that is famous for its tourism existence is Batu City. Based on the analysis of the slope of the Batu City tourism area, rainfall, soil type, and land cover type, it was found that Batu City chose several disaster threats. There are 6 disaster threats that are prone to occur in Batu City, namely earthquakes, floods, droughts, landslides, and land fires. In addition, this research was carried out during the Covid-19 pandemic so that Covid-19 was also used as one of the disaster threat variables that affected tourism conditions in Batu City.

Based on the weighting of the six types of disaster vulnerability in each village and/ or sub-district in Batu City in the period 2015 to 2020, it was found that the village with the highest vulnerability was Pesanggrahan Village and the lowest vulnerability was in Tlekung Village. In addition, other villages with low vulnerability are the villages of Mojorejo, Oro-Oro Ombo, Beji, and Dadaprejo. The vulnerability classes are in the villages of Gunungsari, Pandanrejo, Sisir, Temas, Sidomulyo, Bulukerto, Pendem, Songgokerto, Sumber Brantas, Torongrejo, Bumiaji, Punten, Sumberejo. Furthermore, villages with high vulnerability are the villages of Tulungrejo, Sumbergondo, and Pesanggrahan. Furthermore, in the static panel analysis, it was found that the best model to explain the analysis of the influence of disaster threats in tourism areas on local economic vulnerability in Batu City is the fixed effect model (FEM). The selection of the best model follows the results of the model significance test as follows.

**Table 3.** Model Significance Test Results

| Test | Test Criteria | Chi-square Probability | Best Model |
|---|---|---|---|
| Chow | Ho: PLS<br>H1: FEM | 0,000000 < 0,05 | FEM |
| Breusch and Pagan Lagrangian multiplier | Ho: PLS<br>H1: REM | 0,00000 < 0,05 | REM |
| Hausman | Ho: REM<br>H1: FEM | 0,0496 < 0,05 | FEM |

The estimation results shown in Table 4 can be written in the following equation model. Presumed equations for observations in areas with low disaster susceptibility:

$$KE_{it} = 1{,}129367 - 0{,}00000000698MKT_{it} - 0{,}000000000369TOUR_{it} - 0{,}004925G_{it} - 0{,}2232989B_{it} - 0{,}1058048KB_{it} - 0{,}1279432K_{it} + 0{,}0027585TL_{it} + 0{,}00021COV_{it} + 0{,}0048134(0) + 0{,}173878(0)$$

$$KE_{it} = 1{,}129367 - 0{,}00000000698MKT_{it} - 0{,}000000000369TOUR_{it} - 0{,}004925G_{it} - 0{,}2232989B_{it} - 0{,}1058048KB_{it} - 0{,}1279432K_{it} + 0{,}0027585TL_{it} + 0{,}00021COV_{it}$$

Estimated equations for observations in areas with moderate disaster susceptibility:

$$KE_{it} = 1{,}129367 - 0{,}00000000698MKT_{it} - 0{,}000000000369TOUR_{it} - 0{,}004925G_{it} - 0{,}2232989B_{it} - 0{,}1058048KB_{it} - 0{,}1279432K_{it} + 0{,}0027585TL_{it} + 0{,}00021COV_{it} + 0{,}0048134(1) + 0{,}173878(1)$$

$$KE_{it} = 1{,}129367 - 0{,}00000000698MKT_{it} - 0{,}000000000369TOUR_{it} - 0{,}004925G_{it} - 0{,}2232989B_{it} - 0{,}1058048KB_{it} - 0{,}1279432K_{it} + 0{,}0027585TL_{it} + 0{,}00021COV_{it}$$

Presumed equations for observations in areas with high disaster susceptibility:

$KE_{it} = 1{,}129367 - 0{,}00000000698MKT_{it} - 0{,}000000000369TOUR_{it} - 0{,}004925G_{it} - 0{,}2232989B_{it} - 0{,}1058048KB_{it} - 0{,}1279432K_{it} + 0{,}0027585TL_{it} + 0{,}00021COV_{it} + 0{,}0048134(0) + 0{,}173878(1)$

The estimation results of the FEM model in this study are as follows.

**Table 4.** Model Estimation Results

| Independent Variable | Estimated Coefficient (p-value) |
|---|---|
| MKT | -0,00000 (0,352) |
| Tour | 0,00000 (0,941) |
| G | -0,004925 (0,044)** |
| B | -0,2232989 (0,396) |
| KB | -0,1058048 (0,508) |
| K | -0,1279432 (0,000)* |
| TL | 0,0027585 (0,984) |
| Cov | 0,00021 (0,204) |
| DTKB (Moderate) | 0,0048134 (0,828) |
| DTKB (High) | 0,0173878 (0,526) |
| _cons | 1,129367 (0,000)*** |

*Note: Numbers in brackets indicate p-value, *, **, significant at 1%, 5%.*

$KE_{it} = 1{,}303245 - 0{,}00000000698MKT_{it} - 0{,}000000000369TOUR_{it} - 0{,}004925G_{it} - 0{,}2232989B_{it} - 0{,}1058048KB_{it} - 0{,}1279432K_{it} + 0{,}0027585TL_{it} + 0{,}00021COV_{it}$

After finding the best model that can explain the analysis of the effect of disaster threats in tourism areas on local economic vulnerability in Batu City, it is necessary to evaluate the best model, which includes the autocorrelation test, heteroscedasticity test, normality test, and multicollinearity test. Juanda (2009), and Romli et al. (2016), stated that the evaluation of the best model was carried out to ensure that the model used met the criteria and was able to produce BLUE (Best Linear Unbiased Estimator) parameter estimates. The test results to evaluate the best model are as follows.

**Table 5.** Best Model Evaluation Results

| Test | Test Criteria | Probability Value | Conclusion |
|---|---|---|---|
| Modified Wald | Ho: variance of residual constant over time (homoscedastic)<br>H1: the variance of the residuals is not constant over time (heteroscedasticity) | 0,0000 < 0,05 | Reject Ho (variety of residuals is not constant over time (heteroscedastic)) |
| Breusch-Godfrey /Wooldridge | Ho: no autocorrelation<br>H1: there is autocorrelation | 0,0000 < 0,05 | Reject Ho (there is autocorrelation) |
| Shapiro-Wilk | Ho: population is normally distributed<br>H1: population is not normally distributed | 0,0000 < 0,05 | Reject Ho (population not normally distributed) -> for all variables in the study |

Table 5 briefly shows the results of the model's evaluation of the classical assumptions. The tests carried out include the Modified Wald test to test the variance of the residuals (heteroscedasticity) in the model, the Breusch-Godfrey/Wooldridge test to test the presence or absence of autocorrelation in the model residuals, and the Shapiro-Wilk test to test the normality of the population distribution in the model. The results of the Modified Wald test show a probability value of 0.0000, which is lower than the confident level of 0.05. This indicates that the residual variance of the model used is not constant over time or the model has heteroscedasticity problems. The results of the Breusch-Godfrey/ Wooldridge test conducted to test the presence or absence of a serial correlation on the model residuals (the relationship between residuals) obtained a probability value of 0.0000, which is lower than the significance level of 0.05. This shows that the model used has an autocorrelation problem. The evaluation of the next model using the Shapiro-Wilk test to determine the normality of the population distribution in the model produces a probability value of 0.0000, which is lower than the confident level of 0.05, indicating that the population is not normally distributed.

Based on the tests carried out to evaluate the best model used, it is known that the best model still violates the classical assumptions, as evidenced by the finding of heteroscedasticity, autocorrelation, and populations that are not normally distributed. To overcome this problem, it is necessary to use a robust standard error. The results of the resulting model estimation are as follows.

**Table 6.** Model Estimation Results

| Independent variable | Estimated coefficient (p-value) |
|---|---|
| MKT | -0,00000 (0,114) |
| Tour | 0,00000 (0,956) |
| G | -0,004925 (0,003)* |
| B | -0,2232989 (0,236) |
| KB | -0,1058048 (0,367) |
| K | -0,1279432 (0,000)* |
| TL | 0,0027585 (0,974) |
| Cov | 0,00021 (0,024)** |
| DTKB (Moderate) | 0,0048134 (0,830) |
| DTKB (High) | 0,0173878 (0,606) |
| _cons | 1,129367 (0,000)* |

*Note: Numbers in brackets indicate p-value, **, *, significant at 1%, 5%*

When compared with the results of the initial estimation of the FEM model before using the robust standard error, as shown in Table 6 above, it can be seen that the use of robust standard error to overcome the problem of violating classical assumptions in the form of heteroscedasticity, autocorrelation, and normality in the model causes changes in conclusions but does not cause changes in the findings. Change in the estimated coefficient. In the initial estimation results of the FEM model before using the robust standard error, it is known that there are only two independent variables that have been shown to significantly affect economic vulnerability, namely the earthquake vulnerability index variable and the drought vulnerability index. Meanwhile, in the model that uses the robust standard error, it is found that in addition to the earthquake and drought vulnerability index, there is a variable number of tourists and the Covid-19 disaster vulnerability index, which also has a significant effect on the economic vulnerability of Batu City.

The estimation results shown in table 6 can be written in the following equation model. Presumed equations for observations in areas with low disaster susceptibility:

$$KE_{it} = 1{,}129367 - 0{,}00000000698MKT_{it} - 0{,}000000000369TOUR_{it} - 0{,}004925G_{it} - 0{,}2232989B_{it} - 0{,}1058048KB_{it} - 0{,}1279432K_{it} + 0{,}0027585TL_{it} + 0{,}00021COV_{it} + 0{,}0048134(0) + 0{,}173878(0)$$

$$KE_{it} = = 1{,}129367 - 0{,}00000000698MKT_{it} - 0{,}000000000369TOUR_{it} - 0{,}004925G_{it} - 0{,}2232989B_{it} - 0{,}1058048KB_{it} - 0{,}1279432K_{it} + 0{,}0027585TL_{it} + 0{,}00021COV_{it}$$

Estimated equations for observations in areas with moderate disaster susceptibility:

$$KE_{it} = 1{,}129367 - 0{,}00000000698MKT_{it} - 0{,}000000000369TOUR_{it} - 0{,}004925G_{it} - 0{,}2232989B_{it} - 0{,}1058048KB_{it} - 0{,}1279432K_{it} + 0{,}0027585TL_{it} + 0{,}00021COV_{it} + 0{,}0048134(1) + 0{,}173878(0)$$

$KE_{it}$ = 1,1341804 – – 0,00000000698$MKT_{it}$ – 0,000000000369$TOUR_{it}$ – 0,004925$G_{it}$ – 0,2232989$B_{it}$ – 0,1058048$KB_{it}$ – 0,1279432$K_{it}$ + 0,0027585$TL_{it}$ + 0,00021$COV_{it}$

Presumed equations for observations in areas with high disaster susceptibility:

$KE_{it}$ = 1,129367 – 0,00000000698$MKT_{it}$ – 0,000000000369$TOUR_{it}$ – 0,004925$G_{it}$ – 0,2232989$B_{it}$ – 0,1058048$KB_{it}$ – 0,1279432$K_{it}$ + 0,0027585$TL_{it}$ + 0,00021$COV_{it}$ + 0,0048134(0) + 0,173878(1)

$KE_{it}$ = 1,303245 – 0,00000000698$MKT_{it}$ – 0,000000000369$TOUR_{it}$ – 0,004925$G_{it}$ – 0,2232989$B_{it}$ – 0,1058048$KB_{it}$ – 0,1279432$K_{it}$ + 0,0027585$TL_{it}$ + 0,00021$COV_{it}$

Based on the model estimation results in table 6, it is known that there are only three independent variables that have a significant effect on local economic vulnerability in Batu City, namely the earthquake vulnerability index variable, the drought threat index, and the Covid-19 disaster threat index. In contrast, the others were found to have no significant effect. This is because the three disasters (earthquake, drought, and Covid-19) are disasters that have a severe impact on the agricultural and tourism sectors in this city. Although the earthquake disaster does not have a high intensity of occurrence, the impact of an earthquake can significantly affect the agricultural sector and the economy due to the destructive power it causes. Then, the threat of drought will directly affect the agricultural sector. The three disasters greatly affected the main tourism business of most tourist attractions in Batu City. Meanwhile, the Covid-19 pandemic disaster impacted the implementation of regulations that disrupted tourism operations and activities in Batu City for some time.

The negative coefficients generated in the model estimation results for the earthquake vulnerability index and drought vulnerability index variables indicate a negative relationship between the independent variable economic vulnerability and these two variables. In contrast, the Covid-19 disaster vulnerability index coefficient positively affects economic vulnerability. However, in processing the data, it should be borne in mind that the variable of economic vulnerability used is the inverse of the calculation of economic vulnerability based on the index obtained through the formula from Perka BNPB No. 2 of 2012, so it can be explained that the relationship between disaster and economic vulnerability is positive, except for the effect of the Covid-19 disaster vulnerability index variable which was found to have a negative impact on economic vulnerability. The inversion of the economic vulnerability index calculation results based on the BNPB calculation formula is carried out to prove that Batu City is a city with tourism advantages that are resilient to disasters.

The coefficient of the earthquake vulnerability index variable is -0.004925, which means that if the earthquake vulnerability index increases by 1%, the economic vulnerability in Batu City will increase by 0.004925%. In contrast, the variable coefficient of the drought vulnerability index is -0.1279432. If the drought vulnerability index increases by 1%, it will cause economic vulnerability in Batu City to increase by 0.1279432%. The variable coefficient of the Covid-19 disaster vulnerability index of 0.00021 means that if the Covid-19 disaster vulnerability index increases by 1 percent, the economic vulnerability in Batu City will decrease by 0.00021 percent. Based on the estimation results, it can be concluded that the impact of the drought disaster on the economic vulnerability of Batu City is greater than the impact of the earthquake and Covid-19 disasters.

Most Batu City residents work in the agricultural/plantation sector and are supported by the existing tourism potential. Therefore, if an earthquake and drought occur, these sectors will be the most affected (BPBD Batu City, 2020). Many of the types of tourism offered by Batu

City are natural attractions that are strongly influenced by disaster conditions, especially earthquakes and droughts. Meanwhile, the Covid-19 disaster and the number of tourists visiting Batu City will further affect the tourism sector provided.

Another disaster that has had a significant impact on the economic vulnerability of Batu City is the Covid-19 pandemic. This is due to the primary source of income for the people of Batu City, which comes from agriculture, trade, and tourism. In the context of tourism, the Covid-19 pandemic was responded to by enforcing the Large-Scale Social Restrictions (PSBB) policy which had implications for the cessation of all tourism activities in Batu City, causing economic losses in the tourism sector. Implementing the PSBB, which has continued to be tightened since the increase in Covid-19 cases in Indonesia, has also exacerbated existing conditions. Tourist attractions that were still allowed to operate during the initial PSBB but with reduced visiting capacity were then forced to temporarily close their business locations due to the tightening of the Covid-19 handling policy. However, in this study, it was found that an increase in the Covid-19 disaster vulnerability index harmed the economic vulnerability of Batu City (an increase in the Covid-19 disaster vulnerability index resulted in a decrease in economic vulnerability). This is presumably because, in the midst of policies restricting human movement and prohibiting tourist sites from operating, it can improve the sustainability and environmental conditions of Batu City so that agricultural products owned by Batu City increase. As is well known, most agricultural products are obtained from horticultural crops and grains. Both types of plants are basic household goods, so sales transactions are still being carried out despite restrictions on mobility due to the Covid-19 pandemic. On average, Micro, Small, and Medium Enterprises (MSMEs) also carry out trading activities, whereas most MSMEs have gone digital. This allows MSMEs to reach a wider market share so that their source of income does not depend on sales transactions by tourists in Batu City. Thus, the increase in environmental capacity and quality due to the Covid-19 pandemic has led to the rise in the Covid-19 disaster vulnerability index, which affects the decline in the economic vulnerability of Batu City.

The results of the field research show that the average tourist attraction in Batu Tourism City is agro-tourism. This type of tourism is a series of tourism activities that utilize the potential of agriculture and plantations (natural panoramas) as tourist objects, including agricultural culture. The primary source of income for the community's economy is also largely derived from agricultural production activities, so agro-tourism is only done as a side job. Therefore, the tourism sector does not significantly affect most people's income. This is also reflected in the panel analysis, where the demand for tourism (reflected by the number of visitors) and tourism supply (reflected by the average hotel room nights stay) in Batu City have no significant effect on the economic vulnerability of the people Batu City in general.

Other disasters that do not significantly affect the economic vulnerability of the people of Batu City, in general, are also shown by the results of the panel analysis above. Flood disasters do not significantly impact the economic vulnerability of the people of Batu City, even though these disasters often occur in Batu City. These disasters frequently happen, as most the landslides are caused by floods.

The contours of the Batu City area, which has many hills, also contribute to increasing the risk of landslides and floods, especially when rainfall is high. These two disasters often occur, so the community and local government are accustomed to dealing with the impact of disasters (recovery), ranging from mutual cooperation to cleaning up facilities and infrastructure damaged by disasters to regulating road traffic. The farmers also cultivate crops on land that is prone to landslides and floods, so these two disasters are not significant in affecting the economic vulnerability of the people of Batu City in general.

Forest fires are also relatively common in Batu City. One of the leading causes is the land conversion into horticultural agricultural land. In addition, local people often burn garbage indiscriminately, so the fire often spreads to the forest, which is still quite a lot in the Batu City area. This disaster did not significantly affect the economic vulnerability of the people of Batu City in general due to the fast handling of forest fires by the government and local communities. This also causes the fire not to spread, so it does not interfere with agricultural and agro-tourism areas.

Analysis of the relationship between actors and the role of actors in the management and strategy of tourism disaster in Batu City was carried out using MACTOR analysis. The MACTOR analysis that will be carried out is divided into two: MACTOR analysis at the OPD level and tourist attraction managers. MACTOR analysis at the OPD level in the study was based on a questionnaire and the results of interviews with eleven local institutions, namely the Health Office (Dinkes); Meteorology, Climatology and Geophysics Agency (BMKG); National Land Agency (BPN); Department of Agriculture (Dintan); Tourism Office (Dinpar); Environmental Service (DLH), Regional Disaster Management Agency (BPBD); Regional Development Planning Agency (Bappeda); Junrejo District; Batu District; and Bumiaji District. Each institution plays a role in implementing the Batu City disaster strategy as a Tourism City, both pre-disaster, during the disaster, and post-disaster. The disasters analyzed also focus on six disasters, namely floods, landslides, droughts, land fires, earthquakes, and Covid-19.

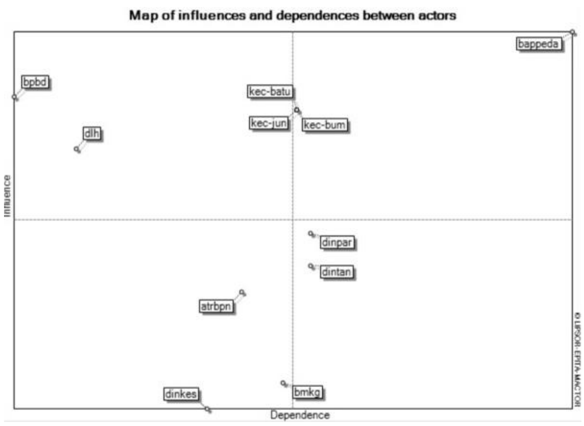



**Figure 4.** Map of Inter-Institutional (Actor) Roles in Disaster Strategy in Batu City Tourism Area

The MACTOR analysis results in Figure 4 show that the BPBD and DLH institutions are in quadrant I. This indicates that the programs/ activities carried out by the two institutions have a big influence on the strategy and handling of the Batu City disaster, both pre-disaster, during, and after the disaster. These two institutions also have a low dependence on other institutions in their disaster strategies, so both become critical drivers in implementing disaster strategies in Batu City. A total of four institutions are in quadrant II, namely Bappeda, Junrejo District, Batu District, and Bumiaji District. This shows that the four institutions highly influence the Batu City disaster strategy pre-disaster, during the disaster, and post-disaster. These four institutions also have a high dependence on other institutions, so the synergy of roles between institutions is very necessary so that these four institutions can carry out disaster strategies to the maximum.

A total of two institutions are in quadrant III, namely the Department of Tourism and the Department of Agriculture. These two institutions highly depend on other institutions but have a low influence on disaster strategies.

Institutions in quadrant III are greatly affected by institutions from other quadrants. A total of three institutions are in quadrant IV, namely the Health Office, BMKG, and BPN. These three institutions have low influence on disaster strategies and have low dependence on institutions in other quadrants. This shows that these three institutions do not significantly contribute to the disaster strategy in the Batu City Tourism Area.

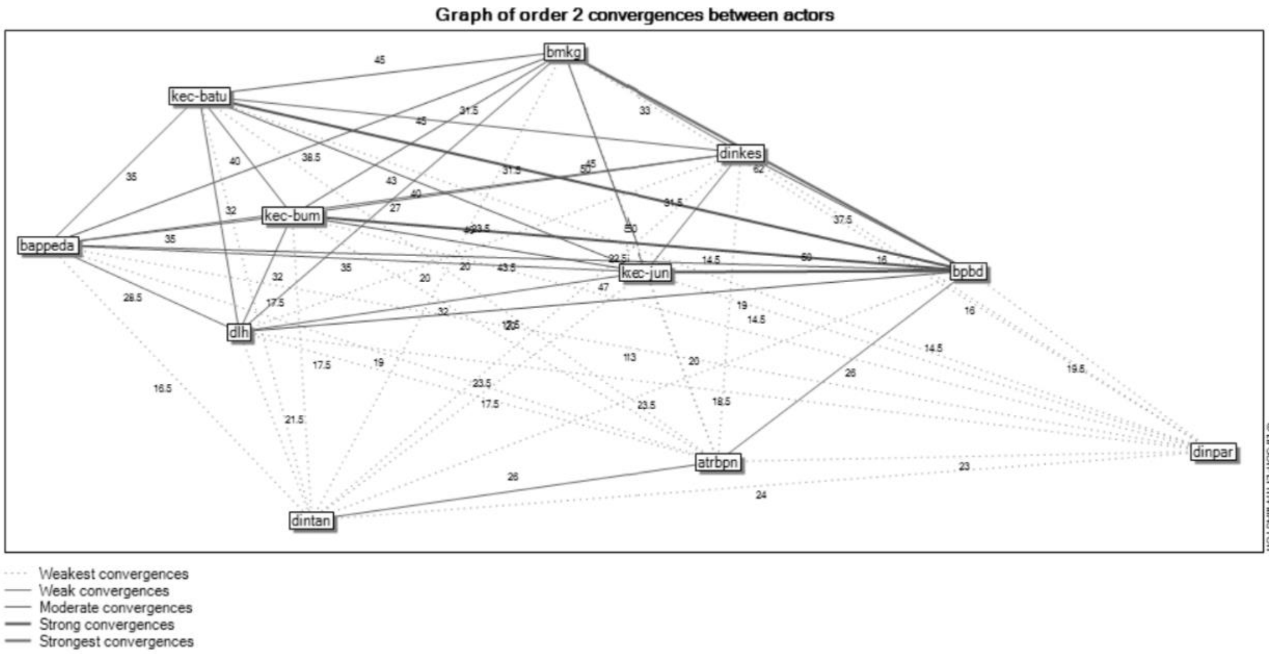



**Figure 5.** Map of Inter-Institutional Convergence (Actor), which plays a role in Disaster Strategy in Batu City Tourism Area

The convergence map between institutions in Figure 5 shows the similarity of roles between institutions that have the potential to work together in implementing a goal, namely disaster management in Batu Tourism City. In addition, it was also shown that regional institutions with high potential for cooperation in the Batu City disaster strategy are BPBD and BMKG. This is caused by disasters that generally occur due to changes in the earth's meteorological, climatological, and geophysical conditions. Therefore, as an institution that handles disasters, BPBD requires information and intensive cooperation with the BMKG. Other regional institutions with strong potential for collaboration in disaster strategies are Junrejo District, Bumiaji District, Batu District, Bappeda, and DLH. These five institutions have strong potential to cooperate with other regional institutions in implementing disaster strategies. This shows that the risk of conflict between regional institutions is relatively low.

The divergence map between institutions in Figure 6 shows the different roles between institutions in carrying out disaster management in Batu City, so the potential for conflicts of interest is more significant. It is also shown that BPBD with the Tourism Office and BPBD with the Agriculture Service has an extreme degree of divergence. This indicates that the relationship between BPBD and the Tourism Office and Agriculture Office has a great potential for conflict to occur in disaster strategies. This is due to the disaster management efforts carried out by BPBD (e.g., disaster evacuation, etc.) disrupting projects or missions owned by the Tourism Office and the Agriculture Office. These projects include increasing the number of tourist visitors and agricultural land productivity. Other institutions that have potential conflicts with the Tourism Office in carrying out their role in realizing a disaster-resistant Batu Tourism City are Junrejo District, Bumiaji District, Batu District, and BMKG. This is because each sub-district wants to preserve the environment of its area. Hence, a tourism area that does not pay attention to environmental aspects is not in line with the objectives of regional institutions at the sub-district level.

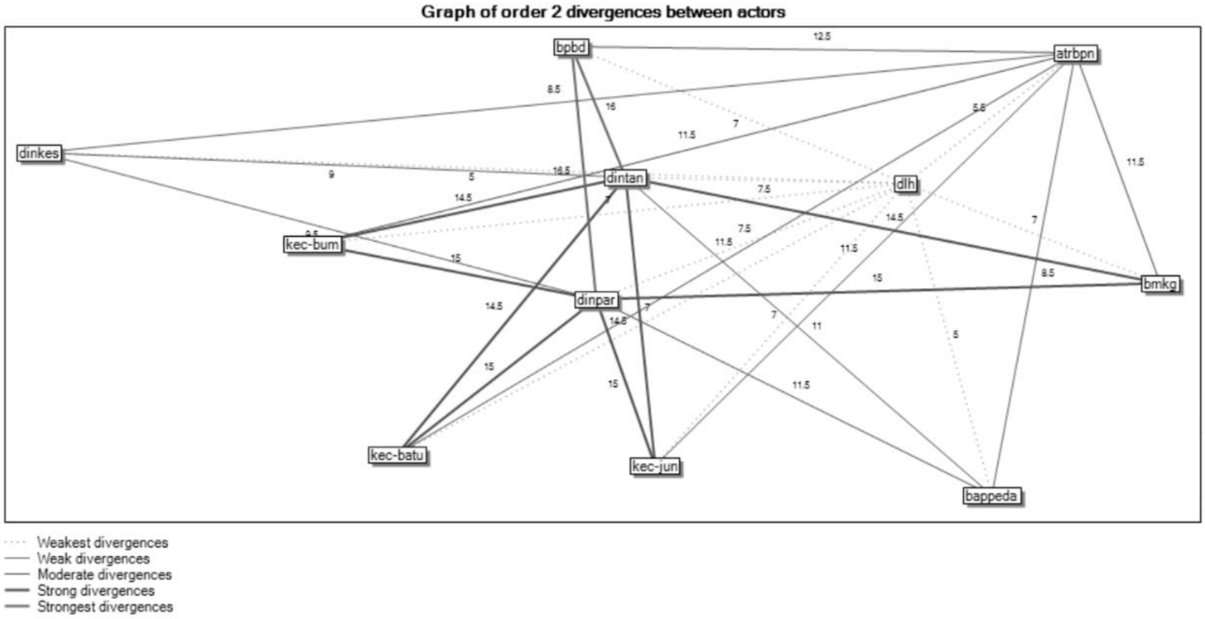



**Figure 6.** Map of Inter-Institutional Divergence (Actor) which plays a role in Disaster Strategy in Batu City Tourism Area

| 3MAO | pra-covid | sat-cov | pas-cov | pra-banjir | sat-banjir | pas-banjir | pra-gempa | sat-gempa | pas-gempa | pra-longs | sat-longs | pas-longs | pra-bakar | sat-bakar | pas-bakar | pra-kering | sat-kering | pas-kering | Mobilisation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| bappeda | 2.1 | 3.1 | 2.1 | 3.1 | 2.1 | 2.1 | 0.0 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 0.0 | 2.1 | 2.1 | 0.0 | 2.1 | 1.0 | 32.4 |
| bmkg | 0.8 | 0.8 | 0.8 | 3.1 | 1.6 | 3.1 | 3.1 | 3.1 | 3.1 | 2.3 | 3.1 | 2.3 | 3.1 | 3.1 | 3.1 | 3.1 | 2.3 | 3.1 | 45.2 |
| atrbpn | 1.8 | 1.8 | 0.9 | 2.7 | -2.7 | 2.7 | 0.0 | -1.8 | 1.8 | 0.0 | -1.8 | 1.8 | 0.0 | -1.8 | 1.8 | 0.0 | 0.0 | 1.8 | 25.0 |
| dinkes | 1.6 | 3.2 | 3.2 | 0.0 | 1.6 | 1.6 | 0.0 | 1.6 | 2.4 | 0.0 | 1.6 | 2.4 | 0.0 | 1.6 | 2.4 | 0.0 | 0.0 | 0.8 | 23.7 |
| dintan | 0.9 | 1.8 | 1.8 | 0.9 | -1.8 | 0.9 | 0.0 | -1.8 | 1.8 | 0.0 | -2.7 | 1.8 | 0.0 | -2.7 | 1.8 | 0.0 | -1.8 | 0.9 | 23.4 |
| bpbd | 3.8 | 5.0 | 2.5 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 3.8 | 5.0 | 5.0 | 3.8 | 5.0 | 5.0 | 3.8 | 5.0 | 5.0 | 82.7 |
| dlh | 1.1 | 2.3 | 1.1 | 3.4 | 3.4 | 3.4 | 2.3 | -3.4 | 2.3 | 4.6 | -3.4 | 2.3 | 2.3 | 3.4 | 2.3 | 2.3 | 2.3 | 2.3 | 48.2 |
| dinpar | 0.9 | 2.8 | 0.9 | 0.0 | -1.9 | 0.9 | 0.0 | -2.8 | 0.9 | 0.0 | -2.8 | 0.9 | 0.0 | -2.8 | 0.9 | 0.0 | -1.9 | 0.9 | 21.8 |
| kec-batu | 3.2 | 4.3 | 2.2 | 2.2 | 3.2 | 2.2 | 1.1 | 4.3 | 2.2 | 1.1 | 4.3 | 2.2 | 0.0 | 3.2 | 2.2 | 0.0 | 3.2 | 2.2 | 43.3 |
| kec-jun | 3.2 | 4.3 | 2.2 | 2.2 | 3.2 | 2.2 | 1.1 | 4.3 | 2.2 | 1.1 | 4.3 | 2.2 | 0.0 | 3.2 | 2.2 | 0.0 | 3.2 | 2.2 | 43.3 |
| kec-bum | 3.2 | 4.3 | 2.2 | 2.2 | 3.2 | 2.2 | 1.1 | 4.3 | 2.2 | 1.1 | 4.3 | 2.2 | 0.0 | 3.2 | 2.2 | 0.0 | 3.2 | 2.2 | 43.3 |
| Number of agreements | 22.7 | 33.8 | 19.8 | 24.8 | 23.4 | 26.3 | 13.7 | 24.8 | 25.9 | 16.0 | 24.8 | 25.1 | 9.2 | 25.0 | 25.9 | 9.2 | 21.5 | 22.4 | |
| Number of disagreements | 0.0 | 0.0 | 0.0 | 0.0 | -6.4 | 0.0 | 0.0 | -9.9 | 0.0 | 0.0 | -10.8 | 0.0 | 0.0 | -7.3 | 0.0 | 0.0 | -3.7 | 0.0 | |
| Degree of mobilisation | 22.7 | 33.8 | 19.8 | 24.8 | 29.8 | 26.3 | 13.7 | 34.7 | 25.9 | 16.0 | 35.6 | 25.1 | 9.2 | 32.3 | 25.9 | 9.2 | 25.2 | 22.4 | |



**Figure 7.** Weighted Value Matrix of Regional Institutional (Actor) Positions (3MAO)

The 3MAO matrix in Figure 7 provides an overview of the most active actors in achieving the objectives of implementing a disaster strategy, both pre-disaster, during the disaster, and post-disaster. In the matrix above, it can be shown that regional institutions that have the highest mobilization in carrying out disaster strategies in Batu City are BPBD, which is reflected in the mobility score of 82.7. This shows that BPBD has a high disaster management program, so it is expected that the impact of the program on disaster mitigation and handling is also high. Other regional institutions with high mobility in the Batu City disaster strategy are DLH and BMKG, with mobility degrees of 48.2 and 45.2, respectively. This shows that the DLH and BMKG institutions have many roles and programs in implementing disaster strategies in Batu City.

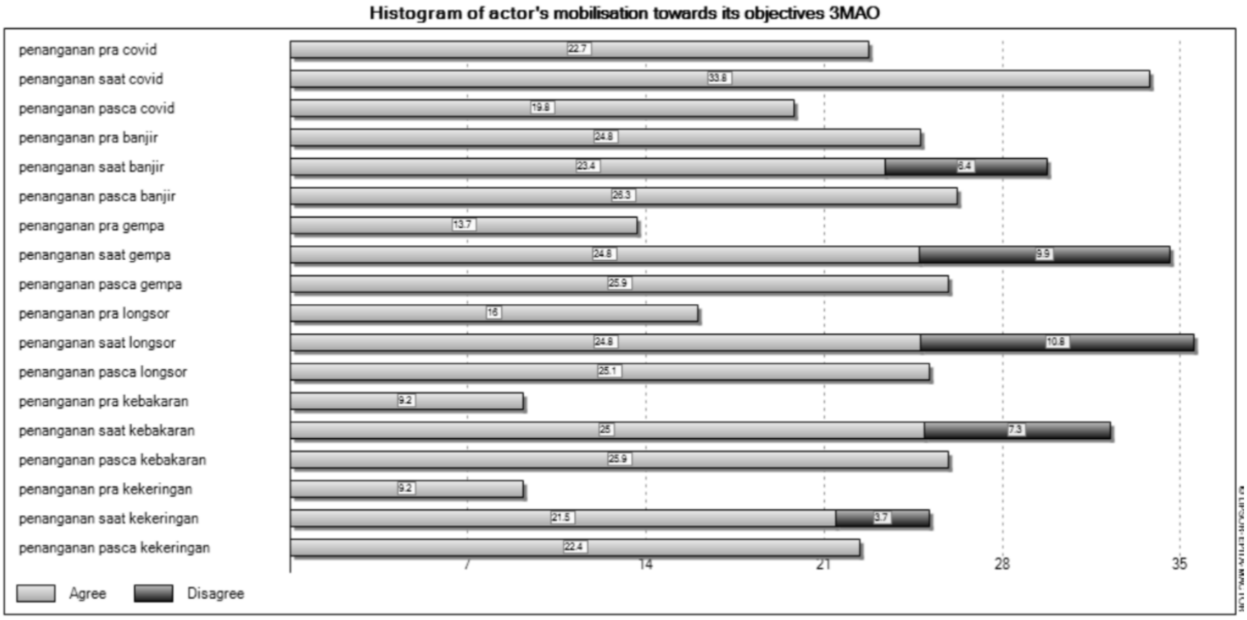



**Figure 8.** Histogram of Achievement of Batu City Regional Institutional Goals for Disaster Management Efforts

The 3MAO matrix can also be visualized in a histogram as shown in Figure 8, the achievement of regional institutional goals for disaster management efforts above. The histogram shows the degree of mobility and agreement (pro) of all regional institutions studied in general in implementing each disaster strategy. Efforts to handle the pre-Covid-19 disaster, during the Covid-19 disaster, post-Covid-19 disaster, pre-flood disaster, post-flood disaster, pre-earthquake disaster, post-earthquake disaster, pre-landslide disaster, post-landslide disaster, pre-disaster forest fire disaster, post forest fire disaster, pre-drought disaster, and post-drought disaster indicate that all regional institutions in Batu City agree (pro) and support the implementation of these disaster efforts. Meanwhile, several regional institutions do not agree (contra) to carry out disaster management during floods, earthquakes, landslides, forest fires, and droughts. This can be caused by regional institutions that feel they are not authorized to carry out disaster management efforts, such as disaster evacuation.

Furthermore, this study also analyzed the role of inter-agency (actors) in the form of 29 tourist objects in dealing with disaster problems related to tourism that is carried out in Batu Tourism City. This analysis uses MACTOR to see actors' roles and interrelationships in the Batu City disaster aspects. The study was carried out based on the results of direct observations and interviews and filling out a written questionnaire from 29 tourist objects. To MACTOR analysis on OPD, each institution (tourist object) plays a role in the disaster strategy of Batu City as a Tourism City, both in pre-disaster, during the disaster, and post-disaster conditions. The disasters analyzed also focus on six disasters, namely the Covid-19 disaster, forest fires, droughts, earthquakes, floods, and landslides.

MACTOR analysis results in Figure 9 show that as many as seven tourist objects are in quadrant II. The seven attractions are Jatim Park 1, Jatim Park 2, Jatim Park 3, Museum Angkut, Predator Fun Park, Eco Green Park, and Batu Night Spectacular (BNS). This shows that the seven attractions highly influence the Batu City disaster strategy, both pre-disaster, during, and post-disaster. These seven tourist objects also have a high dependence on other institutions, so the synergy of roles between institutions (tourism objects) is necessary to carry out disaster strategies to the maximum. The high synergy and influence between the seven attractions are because they are in one business group, the Jatim Park Group. Therefore, it was found that there was uniformity of policies applied to the seven tourist objects.

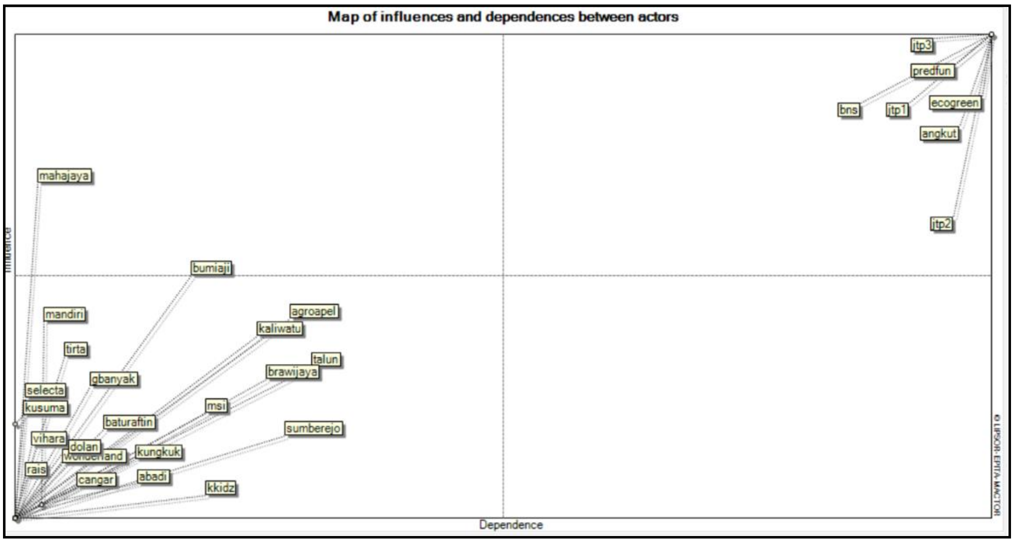



**Figure 9.** Interagency Map of Tourism Objects (actors) who play a role in Disaster Strategy in Batu City Tourism Area

Meanwhile, 22 tourist objects were found in quadrant IV. It can be interpreted that the 22 tourism objects have a low influence on disaster strategies and have low dependence on institutions in other quadrants. It can be concluded that these three institutions did not make a significant contribution to the disaster strategy in the Batu City Tourism Area. This is presumably because the 22 tourism objects do not synergize with one another in implementing their tourism business. Another factor is that Batu City has no directive or standard rule regarding this matter.

From the results of interviews, it was also found that in the tourism business, only a few tourist objects prioritized disaster strategies and Work Operational Standards (SOPs), including Batu Rafting, Coban Talun, Coban Rais, Kaliwatu Rafting, and Cangar Hot Springs. In contrast, the rest did not prioritize strategy and disaster SOPs because the location of tourism businesses is not prone to disasters. Tourist objects that do not prioritize disaster strategies and SOPs assess the disasters studied in the study as never occurring (or only happening once or twice) and do not affect tourist sites in running their tourism businesses, so they are only limited to preparing preventive SOPs, current SOPs, and post-disaster SOPs and received disaster training from the Batu City BPBD. Meanwhile, disasters related to Covid-19, under the rules and protocols imposed by the government (central and regional), become a disaster that is the focus of all tourist attractions. Most tourist attractions experienced impacts on a scale ranging from not large (only affecting the operating hours of tourist sites but not causing a reduction in employees) to large scale (causing tourist sites to temporarily close, causing employee reductions, but not causing casualties).

The convergence map between institutions above shows the similarity of roles between institutions that have the potential to work together in carrying out a goal, namely disaster management, especially those related to the tourism sector in Batu Tourism City.

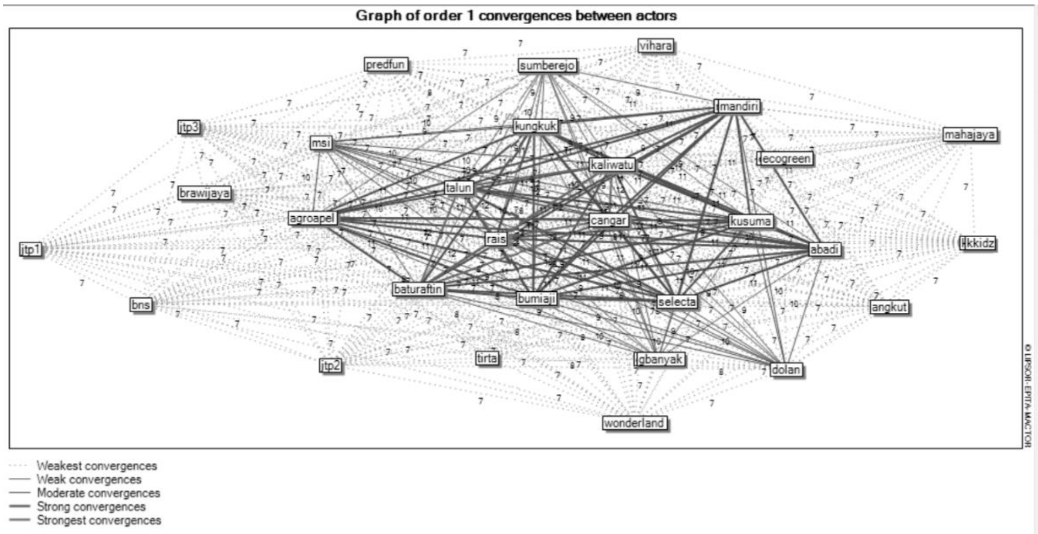



**Figure 10.** Map of Interagency Convergence of Tourism Objects (actors) who play a role in Disaster Strategy in Batu City Tourism Areas

Figure 10 shows that tourism objects with high potential for cooperation in disaster strategies, especially those related to the tourism sector in Batu City, are Batu Rafting, Coban Talun, Coban Rais, Kaliwatu Rafting, and Cangar's Hot Springs. This is because the five tourist objects are objects that utilize nature in carrying out their tourism businesses, which are more vulnerable and need to be alert to possible disasters. The five attractions also have similarities in the tourism business they run, namely the Brantas River tourism, which is known to have a strong current so that it allows cooperation in formulating, developing, and implementing disaster SOPs related to its tourism business.

| 3DAA | tirta | gbanyak | sumberejo | rais | cangar | selecta | bumiaji | talun | abadi | mandiri | kungkuk | vihara | mahajaya | brawijaya | baturaftin | msi | kaliwatu | agroapel | jtp1 | jtp2 | jtp3 | wonderland | angkut | bns | ecogreen | kkidz | dolan | predfun | kusuma |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| tirta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| gbanyak | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| sumberejo | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| rais | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| cangar | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| selecta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| bumiaji | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| talun | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| abadi | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| mandiri | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| kungkuk | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| vihara | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| mahajaya | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| brawijaya | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| baturaftin | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| msi | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| kaliwatu | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| agroapel | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| jtp1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| jtp2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| jtp3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| wonderland | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| angkut | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| bns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ecogreen | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| kkidz | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| dolan | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| predfun | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| kusuma | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Number of divergences | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Degree of divergence (%) | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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**Figure 11.** Value of Inter-Institutional Divergence of Tourism Objects (Actors) who play a role in Disaster Strategy in Batu City Tourism Areas

The table of divergence values between institutions in Figure 11 above shows that all tourism objects studied in this study do not have the potential for a conflict of interest in implementing their respective strategies and disaster management in Batu Tourism City. This is presumably because, in implementing the disaster strategy related to the tourism business carried out by the 29 tourist objects, they do not influence or are independent of one another. The focus and scope of the disaster strategy SOPs owned by the 29 tourism objects are currently only limited to the location of their respective tourism businesses.

| 3MAO | Pra-Cov-19 | Sat-Cov-19 | Pas-Cov-19 | Pra-bakar | Sat-bakar | Pas-bakar | Pra-kering | Sat-kering | Pas-kering | Pra-gempa | Sat-gempa | Pas-gempa | Pra-banjir | Sat-banjir | Pas-banjir | Pra-longso | Sat-longso | Pas-longso | Mobilisation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| tirta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| gbanyak | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| sumberejo | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| rais | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| cangar | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| selecta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| bumiaji | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| talun | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| abadi | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| mandiri | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| kungkuk | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| vihara | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| mahajaya | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| brawijaya | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| baturaftin | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| msi | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| kaliwatu | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| agroapel | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| jtp1 | 0.0 | 11.6 | 7.8 | 3.9 | 3.9 | 3.9 | 0.0 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 |
| jtp2 | 0.0 | 11.6 | 7.8 | 3.9 | 3.9 | 3.9 | 0.0 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 |
| jtp3 | 0.0 | 11.6 | 7.8 | 3.9 | 3.9 | 3.9 | 0.0 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 |
| wonderland | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| angkut | 0.0 | 11.6 | 7.8 | 3.9 | 3.9 | 3.9 | 0.0 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 |
| bns | 0.0 | 11.6 | 7.8 | 3.9 | 3.9 | 3.9 | 0.0 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 |
| ecogreen | 0.0 | 11.6 | 7.8 | 3.9 | 3.9 | 3.9 | 0.0 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 |
| kkidz | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| dolan | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| predfun | 0.0 | 11.6 | 7.8 | 3.9 | 3.9 | 3.9 | 0.0 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 |
| kusuma | 0.0 | 5.5 | 3.7 | 1.8 | 1.8 | 1.8 | 0.0 | 1.8 | 0.0 | 1.8 | 0.0 | 0.0 | 1.8 | 0.0 | 0.0 | 1.8 | 1.8 | 1.8 | 25.7 |
| Number of agreements | 0.0 | 87.0 | 58.0 | 29.0 | 29.0 | 29.0 | 0.0 | 1.8 | 0.0 | 29.0 | 0.0 | 0.0 | 29.0 | 0.0 | 0.0 | 1.8 | 1.8 | 1.8 | |
| Number of disagreements | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Degree of mobilisation | 0.0 | 87.0 | 58.0 | 29.0 | 29.0 | 29.0 | 0.0 | 1.8 | 0.0 | 29.0 | 0.0 | 0.0 | 29.0 | 0.0 | 0.0 | 1.8 | 1.8 | 1.8 | |



**Figure 12.** Matrix of Weighted Values for Positions of Tourist Attractions (Actors) (3MAO)

The 3MAO matrix in Figure 12 provides an overview of the most active actors in achieving the objectives of implementing a disaster strategy, both pre-disaster, during the disaster, and post-disaster. In the matrix above, it can be shown that the attractions that have the highest mobilization in carrying out disaster strategies are tourist objects that are included in the Jatim Park Group, which include Jatim Park 1, Jatim Park 2, Jatim Park 3, Predator Fun Park, Museum Angkut, Batu Night Spectacular (BNS), and Eco Green Park. The active role in achieving the objectives of implementing disaster strategies, both pre-disaster, during the disaster, and post-disaster, from the seven tourism objects, is reflected by a mobility score of 38.8. This shows that the seven attractions in the Jatim Park Group have a high disaster management program, so it is expected that the impact of the program on disaster mitigation and handling is also high. Another tourist attraction institution with high mobility in disaster strategies in its tourism business is Kusuma Agrowisata, with a mobility degree of 25.7. This shows that the Kusuma Agrowisata tourism object has quite a lot of roles and programs in implementing disaster strategies related to the tourism business being carried out.

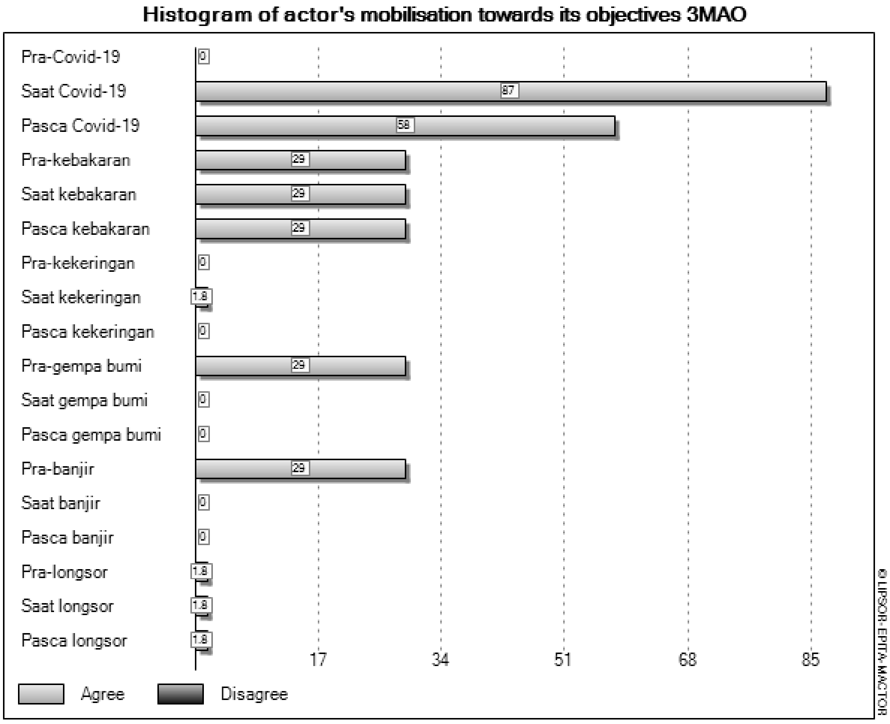


**Figure 13.** Histogram of Achievement of Batu City Tourism Objects on Disaster Management Efforts

The 3MAO matrix is then visualized into a histogram as shown in Figure 13, the achievement of regional institutions' goals for disaster management efforts above. The histogram shows the degree of mobility and agreement (pro) of all regional institutions studied in general in implementing each disaster strategy. Efforts to handle the pre-Covid-19 disaster, during the Covid-19 disaster, post-Covid-19 disaster, pre-flood disaster, post-flood disaster, pre-earthquake disaster, post-earthquake disaster, pre-landslide disaster, post-landslide disaster, pre-disaster forest fires, post-forest fires, pre-drought, and post-drought disasters indicate that all of the studied tourism objects (29 attractions) agree (pro) and support the implementation of these disaster efforts. Meanwhile, several regional institutions do not agree (contra) to carry out disaster management during floods, earthquakes, landslides, forest fires, and droughts.

## CONCLUSION

The weighting results of 6 disasters show that the village with the highest vulnerabil-ity is Pesanggrahan Village, and the lowest vulnerability is Tlekung Village. In addition, other villages with low vulnerability are the villages of Mojorejo, Oro-Oro Ombo, Beji, and Dadaprejo. The vulnerability classes are in the villages of Gunungsari, Pandanrejo, Sisir, Temas, Sidomulyo, Bulukerto, Pendem, Songgokerto, Sumber Brantas, Torongrejo, Bumi-aji, Punten, Sumberejo. Furthermore, villages with high vulnerability are the villages of Tulungrejo, Sumbergondo, and Pesanggrahan. Furthermore, with the distribution of dis-aster vulnerability, the static panel analysis found that three of the six disasters observed in the study proved to have a significant influence on the local economic vulnerability of Batu City. The index variable represents the three threats to disaster vulnerability the threat of earthquake vulnerability, the index for the threat of vulnerability to drought, and the index for vulnerability to the Covid-19 disaster.

The institutional capacity observed in this study is about the toughness and readiness of the strategies and efforts of actors who have an essential role in the development of Batu City as a tourism area that would resilient to disasters. Based on the results of modelling using MACTOR, it is known that the disaster management efforts carried out by the tourism objects studied (29 tourist objects), and the OPD (11 OPD) agreed (pro) and supported the implementation of the disaster efforts. Disaster management work programs carried out by OPD and tourist attractions strongly influence the strategy and disaster management of Batu City, both pre-disaster, during the disaster, and post-disaster. This show low dependence on other institutions in their disaster strategy, thus becoming a key driver in disaster management. The implementation of the disaster strategy in Batu City is owned by BPBD, DLH, and the Jatim Park Group. The different roles between institutions in carrying out disaster management in Batu City give rise to more significant conflicts of interest between BPBD and the Tourism Office, as well as BPBD and the Agriculture Office. This shows that the relationship between the BPBD agency with the Tourism Office and the Agriculture Office has great potential for conflict in disaster strategies.

Meanwhile, on the tourism object side, there is no divergence or potential for conflict. This is presumably because in implementing the disaster strategy related to the tourism business carried out by the 29 tourist objects, they do not influence or are independent of one another. The focus and scope of the disaster strategy SOPs owned by the 29 tourism objects are currently only limited to the location of their respective tourism businesses.

## REFERENCES

Arianpour, M., Jamali, A. (2015). Flood Hazard Zonation Using Spatial Multi-Criteria Evaluation (SMCE) In GIS (Case Study: Omidieh-Khuzestan). *European Online Journal Of Natural And Social Science, 4*, 39-49.

ASEAN Secretariat. (2020). *ASEAN Statistical Yearbook 2020*. ASEAN, Editor: Jakarta.

Batu City Government. (2019). *The Medium Term Regional Development Plan (RPJMD) Of Batu City For 2017-2022*. https://www.batukota.go.id/

BNBP. (2012). *Vulnerability Calculation Methodology BNPB Regulation Number 02 Of 2012*. https://inarisk.bnpb.go.id/metodologi

BNPB. (2021a). *Indonesia Disaster Risk Index 2020*. Indonesian National Board For Disaster Management: Jakarta.

BPS East Java Province. (2020). *Tourism Statistics Of East Java Province 2019*. https://jatim.bps.go.id/

Bunruamkaew, K., Murayam Y. (2011). Site Suitability Evaluation For Ecotourism Using GIS & AHP: A Case Study of Surat Thani Province, Thailand. *Procedia: Social and Behavioral Sciences, 21*, 269-278.

Dai, F., Lee C., Zhang X. (2001). GIS-Based Geoenvironmental Evaluation For Urban Landuse Planning. *Journal Of Engineering Geologi, 61,* 257-271.

Firdaus, H., Sukojo, B. (2015). Mapping Of Landslide Prone Areas With Remote Sensing Methods And Spatial Based Operations. *Geoscientific Journal, 1,* 25-34.

Ismail, M., Mawardi, M., Iqbal, M. (2017). Analysis Of The Socio-Economic Impact Of Batu City Tourism Development For

The Surrounding Area (Study In Karangploso District, Malang Regency). *J Adm Bisnis, 51*(1), 1–7.

Jatim Pos. (2021). *A Year Of Covid, This Is The Contribution Of East Java Tourism To GRDP*. https://www.jatimpos.co/

Jayanthi, J., Raj, T., Gandhi, M. (2016). Identification Of Landslide-Prone Areas Us-Ing Remote Sensing Techniques In Sillahallawatershed, Nilgiris District, Tamilnadu, India. *International Journal Of Engineering And Technology, 3*, 1947-1952.

Juanda, B. (2009). *Econometrics Modeling And Estimation*. IPB Press: Bogor.

Kumar, M., Murthy, C., Seshasai, M., Roy, P. (2009). On The Use Of Standardized Precipitation Index (SPI) For Drought Intensity Assessment. *Meteorological Applications: A Journal Of Forecasting, Practical Applications, Training Tech-Niques And Modelling, 16*, 381-389.

Lillesand, T., Kiefer, R., Chipman, J. (2004). *Remote Sensing And Image Interpretation: Fifth Edition*. John Wiley & Sons: New York.

Livada, I., & Assimakopoulos, V. (2007). Spatial And Temporal Analysis Of Drought In Greece Using The Standardized Precipitation Index (SPI). *Theoretical And Applied Climatology, 89*, 143-153.

Ministry Of Tourism And Creative Economy Of The Republic Of Indonesia. (2012). *Menparekraf Supports The Development Of Greater Malang And Batu Tourism City*. https://kemenparekraf.go.id/

Natalia, M. (2018). The Influence Of The Tourism Sector On Community Welfare In Greater Malang. *J Ilm Mhs FEB Univ Brawijaya, 6*(2).

Nefeslioglu, H., Sezer, E., Gokceoglu, C., Bozkir, A., Duman, T. (2009). Landslide Susceptibility Mapping Of A Landslide-Prone Area By Data Mining. *Mathematicl Problems In Engineering, 2010*, 1-15.

Pambudi, N., Jalilinasrabady, S. (2018). Sustainability Of Geothermal Power Plant Combined With Thermodynamic And Silica Scaling Model. *Geothermics, 71*, 108-117.

Romli, M., Hutagaol, M., Priyarsono, D. (2016). Structural Transformation: Factors And Their Impact On Income Disparities In Madura. *Journal Of Economics And Development Policy Bogor Agricultural University, 5*, 25-44.

Sharma, G., Thomas, A., Paul, J. (2021). Reviving Tourism Industry Post-COVID-19: A Resilience-Based Framework. *Tour Manag Perspec, 37*, 100786. https://doi:10.1016/j.tmp.2020.100786.

Turkes, M., Tatli, S. (2009). Use Of The Standardized Precipitation Index (SPI) And Modified SPI For Shaping The Drought Probabilities Over Turkey. *International Journal Of Climatology, 29*, 2270-2282.

UN OCHA. (2021). *Action Plan On Covid-19 And Natural Disaster Responses*. https://reliefweb.int/report/indonesia/action-plan-covid-19-and-natural-disaster-responses-january-june-2021

World Health Organization. (2021). *Coronavirus Disease (COVID-19) Pandemic*. https://www.who.int/emergencies/diseases/novel-coronavirus-2019