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Entrepreneurial Development in the Indonesian Economy: Spatial Heterogeneity Analysis of E-Commerce Implementation Determinants by MSMEs During the COVID-19 Pandemic

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Abstract

Information and Communication Technology (ICT) cannot be separated from society during the current COVID-19 pandemic. Whole activities are forced to distance themselves, so they have to rely on the existence of the internet, including economic activities through e-commerce. In Indonesia, many internet users become an opportunity for small entrepreneurs, namely Micro, Small, and Medium Enterprises (MSME), to implement e-commerce. ICT development in Indonesia also still shows inequality, especially between Indonesia's West and East Region. This condition indicates the diversity of characteristics in each region to the level of e-commerce application. This study aims to identify local spatial effects and factors that influence the percentage of MSMEs implementing e-commerce in each province in Indonesia in 2020 using Geographically Weighted Regression (GWR). The result shows spatial heterogeneity in the model of MSMEs implementing e-commerce percentage. Six regional groups have similar characteristics based on independent variables that significantly affect the MSMEs implementing e-commerce percentage. In most WRI and ERI areas, the MSMEs implementing e-commerce percentage is significantly influenced by the percentage of households that make purchases via the internet. GER of tertiary education growth has a significant effect on whole of the WRI areas. In contrast, the number of confirmed cases of COVID-19 has a significant effect on most of the ERI areas. Hence, the government needs to pay attention to characteristics of each region for encouraging the development of e-commerce for MSME players in Indonesia, especially after the COVID-19 pandemic.

Keywords: E-commerce, Entrepreneur, MSME, Spatial Analysis, GWR, COVID-19, Indonesia

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1. Introduction

COVID-19 pandemic that hit the world at the beginning of 2020 caused the world economy to experience shocks. The existence of a pandemic has stopped all activities and forced activities to be carried out remotely. Starting from the first case in Indonesia on March 2nd until the end of 2020, the Ministry of Health recorded 743,198 confirmed COVID-19 cases. The three provinces with the highest cases are DKI Jakarta, East Java, and West Java. Those provinces are areas with dense economic activity, and all three are in the Western Region of Indonesia.

The government then issued a regulation through the Minister of Health Regulation Number 9 of 2020 concerning Guidelines for Large-Scale Social Restrictions in the Context of Accelerating the Handling of COVID-19. As a result, many businesses, especially small-scale businesses, have been affected by this pandemic. This causes the development of Information and Communication Technology (ICT) to be indispensable in various aspects of life. Activities must be carried out remotely, so they rely on the presence of the internet in them, including economic activities. Sell and purchase transactions carried out using an internet platform are known as e-commerce. The presence of e-commerce has grown rapidly, especially since the pandemic, because transactions have become easier and safer remotely.

Based on a survey conducted by the Association of Indonesian Internet Service Providers, internet users in Indonesia in 2019 were 171 million and ranked 5th in the world. In 2020, internet users in Indonesia continued to grow, reaching almost 200 million, which is 197 million. This means that around 73 percent of the population in Indonesia has used the internet since the pandemic hit. A large number of internet users in Indonesia, which is followed by the widespread culture of online shopping, is a great opportunity for business actors to develop their businesses, especially Micro, Small, and Medium Enterprises (MSMEs).

The Ministry of Cooperatives and MSMEs recorded that the average contribution of GDP by MSMEs in Indonesia for 2015–2019 period (before the pandemic) exceeded half of the total GDP, which was 60.57 percent per year. As for the workforce, the largest absorption on average is absorbed by MSMEs at 97 percent. MSMEs have a fairly influential role in the Indonesian economy. Therefore, it must be utilized as well as possible to improve the national economy and increase the competitiveness of entrepreneurs in Indonesia.

Statistics Indonesia (BPS) noted that the decline in income due to the occurrence of COVID-19 in the third quarter of 2020 was still more experienced by Micro and Small Enterprises than Medium and Big Enterprises, which was 67.77 percent. Product marketing/sales is also the most common obstacle experienced by all business scales. This fact shows that small business actors are required to find strategies in order to survive so that they are able to run the wheels of the national economy. The existence of COVID-19 pandemic requires business actors to be able to immediately adapt to changes in community activities that are completely limited. Research conducted by Pasaribu et al (2021) reveals that the vulnerability of COVID-19 does not pay attention to the closeness of the area only. Population interactions between regions also play a more important role, namely the relevant socio-demographic and economic aspects. Furthermore, Gao et al (2020) revealed that the existence of a pandemic was able to create a new habit of society, that is adopting e-commerce. Therefore, e-commerce adoption is a strategy that can be carried out by business actors in selling (Hardilawati, 2020), especially small entrepreneurs such as MSMEs.

In general, the development of ICT in Indonesia can be divided into the Western Region of Indonesia (WRI) and the Eastern Region of Indonesia (ERI). Figure 1 shows a comparison of the growth of the ICT Development Index (ICT-DI) in WRI and ERI before the pandemic (2019) and during the pandemic (2020). The

pandemic conditions had an impact on the growth of ICT-DI in some areas in WRI and ERI in 2020 (blue). These areas include the Provinces of West Sumatra (13), Riau (14), South Sumatra (16), and Bali (51). This indicates that there are still areas where ICT-DI growth is increasing due to the need for internet from activities carried out remotely. On the other hand, there are areas where the growth of ICT-DI actually slows down and is below the national value (yellow). The regions are North Sumatra (12), Central Java (33), and East Java (35). When compared between WRI and ERI at the national level, several regions with growth in IP-ICT is still below the national value (gray colour). The regions are Provinces of Riau Islands (21), DKI Jakarta (31), West Java (32), S.R. Yogyakarta (34), and Banten (36).

The growth of ICT-DI in all provinces of Indonesia has increased during the pandemic in 2020. Unfortunately, the progress of ICT to date is still not evenly distributed between regions in Indonesia. From Figure 1, it can be seen that there are differences in the distribution of ICT-DI growth distribution, which tend to be more diverse in ERI compared to WRI. According to Abrar (2019), this can trigger a digital divide. This gap will lead to differences in the level of technology utilization in each region, which will ultimately result in different economic benefits (in this case the use of e-commerce) (Fuady, 2018).

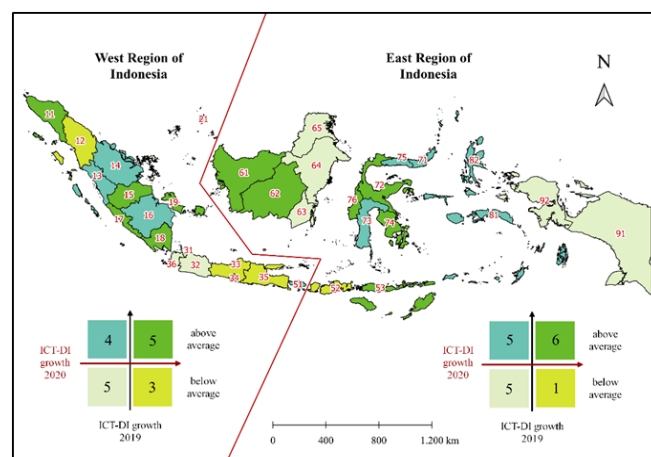


Figure 1- Distribution of provincial ICT-DI growth map in Indonesia in 2019–2020, Source: BPS - Statistics Indonesia, data processed by authors

Awais & Samin (2012) revealed that the existence of e-commerce, especially in developing countries, can increase output and provide a competitive advantage. This shows that e-commerce is able to make businesses enter new markets easily and become more effective and efficient. Susanty (2020) revealed that SME players have even begun to realize that e-commerce is able to expand the sales scale which is getting bigger. In terms of implementation, e-commerce also increases effectiveness from production costs to marketing and customer relations.

Suwarni et al. (2017) and Avriyanti (2020) studies show that there are still many considerations in adopting e-commerce by MSMEs. This consideration is seen from their weaknesses, such as the lack of mastery of technology, low availability of internet infrastructure, and the understanding of e-commerce by MSME actors, causing business actors to be reluctant to optimize e-commerce use in their business. However, the COVID-19 pandemic has made demands for the use of technology in marketing to become the new norm in businesses facing the COVID-19 pandemic (Kurniasih & Akbar, 2021).

The diversity of technological developments and many factors of consideration in each region in Indonesia leads to the uneven e-commerce application by MSME actors in Indonesia. This is reinforced by Zhang et al's (2017) statement, which generally reveals that e-commerce development follows certain rules to describe a strong diversity of characteristics in each region. Indonesia is a very large area and is in the form of an archipelago so the socio-economic characteristics between regions will tend to be different, especially WRI and ERI. The COVID-19 pandemic has widened the gap between the two regions. Pasaribu et al. (2020) revealed that the level of vulnerability to COVID-19 significantly affects socio-economic characteristics in an area and its surroundings, especially when viewed based on two large regions in Indonesia, namely WRI and ERI.

Analysis of economic phenomena involving spatial aspects in these two regions is unfortunately still rarely studied in Indonesia. Therefore, this study will analyze more deeply by looking at the phenomenon of regional characteristics based on the factors that influence the implementation of e-commerce in WRI and ERI. By grouping the analysis based on WRI and ERI, the influence of the implementation of e-commerce in each of these areas, both in WRI and ERI, and a general comparison of the two areas can be studied.

Based on the background that has been explained, this research has some purposes firstly to obtain an overview of the distribution of MSMEs that implemented e-commerce before the COVID-19 pandemic (2019) and during the pandemic (2020) in WRI and ERI; second, to identify spatial heterogeneity in the percentage of MSMEs implementing e-commerce in Indonesia in 2020; third, identify the factors that influence the percentage of MSMEs implementing e-commerce in Indonesia in 2020 globally and locally; and fourth, grouping regions that have the same characteristics as the percentage of MSMEs implementing e-commerce in Indonesia in 2020.

2. Literature Review

MSMEs and E-Commerce

The development of the internet is increasingly advanced today. It is even marked by the internet of things that facilitates all human activities and encourages an increase in the quantity and quality of their activities in every aspect of life. This internet development is also inseparable from the flow of globalization. Todaro & Smith (2012) revealed that globalization describes the development, trade, and international political economy, especially in the economic process where the world economy is becoming more integrated, leading to a global economy.

As previously mentioned in the background, MSMEs have a fairly influential role in the Indonesian economy. Not only in terms of GDP, but also in terms of employment. In order to be able to continuously develop, MSME actors are required to be able to adapt to the changes that occur. The development of the internet has also become a stepping stone for business actors to increase competitiveness and expand the market. MSMEs, as the business unit that dominates economic activity in many countries, have the opportunity to expand their trade through e-commerce.

E-commerce has become a platform for conducting online trade which is increasingly liked by people. E-commerce is a trading activity (purchase, sale, distribution, and marketing) of goods and/or services using electronic systems such as computers, internet, and other electronic networks. The existence of e-commerce has a very large impact, especially in terms of physical costs such as marketing and store costs. The shift in internet-based trading modes has been predicted since the end of the 20th century when buying and selling activities are carried out electronically (electronic commerce), thereby reducing the need for physical stores and providing

significant opportunities for new entrepreneurs to develop (Hammond, 1996; Burke, 1997). Nemat (2011) and Gupta (2014) state that there are five types of e-commerce that are generally used based on the actors and interactions that occur in them, namely Business-to-Business (B2B), Business-to-Consumer (B2C), Consumer-to-Consumer (C2C), Consumer-to-Business (C2B), and Government-to-Citizen (G2C).

The renewal of the transaction mode through e-commerce creates various concepts in describing the shift or progress of business actors in implementing this buying and selling system. MSMEs have a huge opportunity to implement e-commerce in their business. Although there are various potentials and benefits provided, there are still factors to consider in implementing e-commerce as a form of technology adoption in their business.

TOE+I Framework

Tornatzky et al. (1990) create a framework that describes the process of an organization in developing technological innovations to adapt them based on the dimensions that influence them. This framework is called the TOE model framework, namely Technology-Organization-Environment. Furthermore, this model was developed by Ghobakhloo & Tang (2013) because the previous TOE model did not pay attention to individual aspects/dimensions (Individual). The following is an explanation of each dimension.

1) Technology

Technology dimension refers to factors related to technology, both internal and external, that are relevant to the company. The technology in question is a technology owned by the company, or technology that is available but has not been or is not used by the company. The result of research by Rahayu & Day (2015) shows that the available infrastructure as an illustration of an organization's readiness to apply technology has a significant effect on the success of e-commerce. In this study, ICT infrastructure was approached by the presence of the internet, namely the percentage of the region with excellent internet signals (4G).

2) Organization

Organizational dimension refers to the factors within the company (internal), namely the characteristics and resources owned by the company or organization. The characteristics in question consist of organizational structure, managerial structure, scope, organizational size, financial capability, organizational culture, and so on. The results of the research by Suardana & Musmini (2020) show that access to capital and interest in using e-commerce have a significant influence on the performance of MSMEs. In this study, access to capital is approached by the growth of MSME credit.

3) Environment

The environmental dimension refers to the factors that surround the organization (external). These external conditions consist of intense competition between companies, industrial life cycles, the technology supporting infrastructure, government regulations, a series of production activities (value chain), economic and political stability, and so on. Research conducted by Marchidita et al. (2017) found that the large number of e-commerce users who carry out purchasing activities shows the convenience, trust, and loyalty of consumers in using e-commerce, thus influencing the decisions of business actors in implementing e-commerce. Another study conducted by Muslim (2020) shows that economic growth affects the percentage of businesses that use e-commerce. In this study, external factors will be seen through the percentage of the population who make purchases via the internet and the growth of GRDP in the trade sector. In addition, as previously explained, the existence of a pandemic requires business actors to use e-commerce. Therefore, cases of COVID-19 will also be included as an external factor.

4) Individual Dimension

Individual dimension relates to managerial and employee aspects as individuals' abilities and perceptions of perceived benefits. The individual characteristics in question include education level, ICT knowledge level, manager characteristics, and so on. Choshin & Ghaffari (2017) state that ICT capabilities and the development of awareness of e-commerce as individual factors have an important role in influencing e-commerce implementation decisions. The development of education in this study was approached by the growth of the Gross Enrollment Rate (GER) of tertiary education.

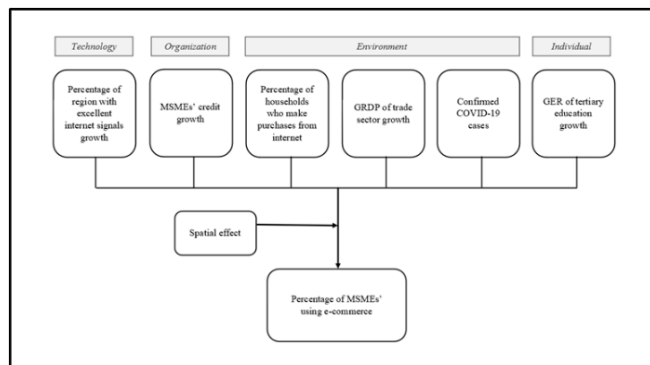


Figure 2- Research framework, Source: Authors

The TOE+I framework and the variable approach used in this study are shown in Figure 2. The existence of spatial effects was included in the study with the consideration that inter-regional diversity also has an influence on the percentage of MSMEs implementing e-commerce. This concept is a development of the TOE+I framework with reference to Zhang et al. (2017)'s statement that the development of e-commerce has a strong diversity of characteristics in each region based on certain rules.

Spatial Heterogeneity

Linear regression is said to be global regression because the resulting parameter estimates are single, i.e. only one and the same applies to all observed regions (Fotheringham et al., 2002). The existence of classical linear regression is able to provide a uniform picture of all observations studied. However, what if the observations under study actually have differences and the uniformity carried out through linear regression actually gives inaccurate analysis results?

One of the mistakes that occur when making decisions through the statistical model formed is the application of the model that is not necessarily suitable for all observations. An explanatory variable may be relevant in explaining observed characteristics in one area but may not be relevant in another. The difference in responses to the interaction of characteristics in each region is referred to as spatial heterogeneity (Caraka & Yasin, 2017).

Spatial heterogeneity can be seen in the difference in the variance of the same characteristics in each region. Spatial heterogeneity occurs due to errors in the use of the model in which all observations/regions are 'forced' to follow a single (global) model. Therefore, subjective statistics are needed, which in the spatial analysis are local or regional statistics, so that the results are not misleading and decision-making in each region is more precise. The Geographically Weighted Regression (GWR) model accommodates differences that cannot be done in linear regression so that the resulting statistics are able to describe the conditions of each region/observation more precisely.

3. Methodology

This study uses a locus throughout Indonesia with a unit of analysis at the provincial level, which is 34 observations. The classification of MSMEs used is based on the classification in Law Number 20 of 2008 concerning MSMEs classification based on total annual income. The data used is secondary cross-sectional data from official statistics in 2020. The data is sourced from Statistics Indonesia (BPS) and Central Bank of Indonesia.

The analytical method used consists of descriptive analysis and inferential analysis. Descriptive analysis was carried out by making a thematic map by bivariate choropleth map between the percentage of MSMEs implementing e-commerce in Indonesia and their respective independent variables. The aim is to see the tendency of the relationship of the percentage of MSMEs that implement e-commerce with each independent variable. According to Leonowicz (2006), this mapping was carried out in two variables to facilitate the analysis and visualization of geographical relationships. The interval class was divided into 5 groups using the natural break method.

Inferential analysis in this study aims to obtain the best model that is able to explain the percentage of MSMEs that implement e-commerce with factors that influence it significantly in each region. All hypothesis testing conducted in this study used a significance level (α) of 10 percent. The analysis stages in this study are broadly divided into two stages, consisting of global modelling using linear regression and local modeling using GWR (Geographically Weighted Regression).

Geographically Weighted Regression (GWR) is statistical modelling used on data that has spatial heterogeneity. GWR model is the development of a linear regression model, where the modelling considers the spatial aspects that reveal spatial variations in the relationships between variables (Mennis, 2006). The calculation of parameter estimates is carried out at specific points that are used as locations (called regression points) to show the spatial variability (Fotheringham et al., 2002). In the GWR model, the location points that are used as observations have a big influence in determining the estimation results because they use the distance between locations in the weighting.

In general, the GWR model is written as follows (Fotheringham et al., 2002):

$$y_i = \beta_0(u_i, v_i) + \sum_{j=1}^k \beta_j(u_i, v_i) x_{ij} + \varepsilon_i \quad ; \quad i = 1, 2, \dots, n$$

| | |
|---------------------|--|
| y_i | : observed value of the dependent variable at the i -th observation location |
| x_{ij} | : observed value of the j -th independent variable at the i -th observation location |
| $\beta_0(u_i, v_i)$ | : intercept at the i -th observation location |
| (u_i, v_i) | : observation point (longitude, latitude) at the i -th observation location |
| $\beta_j(u_i, v_i)$ | : j -th independent variable parameter at the i -th observation location |
| k | : number of independent variables |
| ε_i | : error at the i -th observation location |

4. Results and Discussions

Overview of The Percentage of E-Commerce

MSMEs and the Factors Expected to Influence It

The percentage distribution of MSMEs that implement e-commerce is shown through a thematic map. As for each variable

that is thought to affect the percentage of MSMEs implementing e-commerce, it is shown through the bivariate choropleth map.

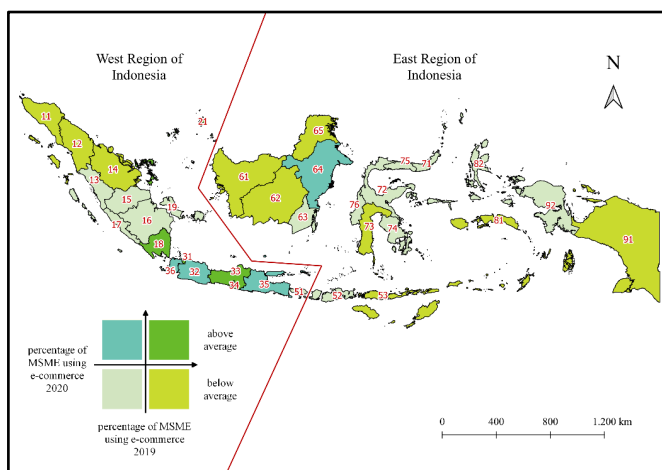


Figure 3- Distribution map of the percentage comparison of e-commerce MSMEs before and during the pandemic (2019–2020), Source: BPS - Statistics Indonesia, data processed by authors

Figure 3 shows the comparison distribution of the percentage of MSMEs implementing e-commerce in 2019 with 2020, before and during the pandemic in Indonesia. In general, it can be seen that most provinces in Indonesia are dominated by gray and yellow areas. In fact, in ERI, almost all of its territory is gray and yellow. This means that ERI is included in an area where the percentage of MSMEs that implement e-commerce is below the national value after the pandemic. East Kalimantan Province (64) is the only region in ERI with the percentage of e-commerce MSMEs that are above the national value during the pandemic.

In contrast to ERI, WRI actually has a percentage of e-commerce MSMEs that are generally above the national value during a pandemic. There are some areas that are coloured blue and green. In fact, several regions on the island of Java which in 2019 were below the national value, actually had a percentage of e-commerce MSMEs above the national value after the pandemic. This shows the difference in the development of e-commerce implementation by small business actors in WRI and ERI. The tendency of the spread of the four regional groups in Figure 3 above indicates diversity in the distribution of the percentage value of MSMEs that implement e-commerce both between regions in WRI and ERI.

In WRI, especially Java, the development of e-commerce as a form of economic strategy in running a business during the pandemic is going well. This can be seen in Figure 4(a), which shows that most areas in Java have a high percentage of e-commerce MSMEs, followed by MSME credit growth which tends to be high too (dark colour).

In contrast to conditions in most WRI areas, most areas in ERI actually have a low percentage of MSMEs in e-commerce, even though MSME credit growth is high. Hastuti et al. (2021) conducted a study on one of the SMEs in Kolaka Regency, Southeast Sulawesi. The result shows that the occurrence of COVID-19 accompanied by travel restrictions imposed by the government has limited business actors' mobility. This is because production and distribution activities are still carried out directly, so these activities are hampered. In addition, the decline in demand and market uncertainty due to the pandemic also hampered production activities. From Figure 4, it can also be seen that the greater the growth of MSME credit, the higher the percentage of MSMEs implementing e-commerce. This shows that during the 2020 pandemic, the existence of MSME credit is able to encourage business actors to utilize business capital through credit in developing their business through the use of e-commerce.

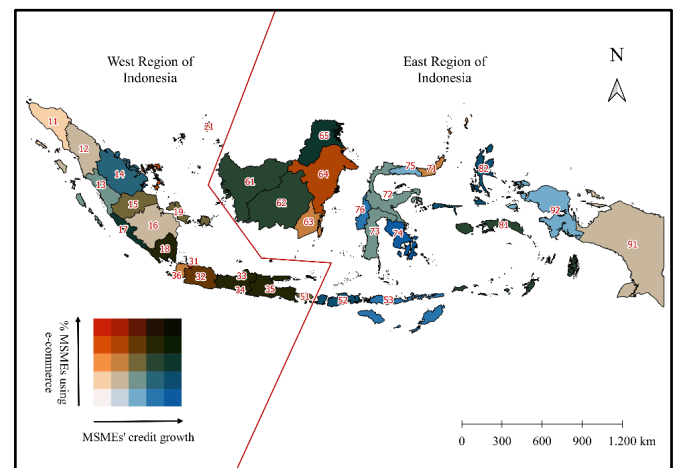


Figure 4- Distribution map of percentage of e-commerce MSMEs with MSMEs' credit growth in 2020, Source: BPS - Statistics Indonesia & Central Bank of Indonesia, data processed by authors

The utilization of e-commerce in a business also relies on the available internet infrastructure. Generally, WRI areas already have good internet infrastructure development. Based on Statistics Indonesia (BPS) data regarding the percentage of regions that have excellent internet signals, the average WRI area has a percentage of 78.26 percent, while the ERI region only has an average of 54.11 percent. This shows that the internet infrastructure is more advanced in the WRI areas compared to ERI. However, from the growth of infrastructure development point, the WRI areas have lower growth.

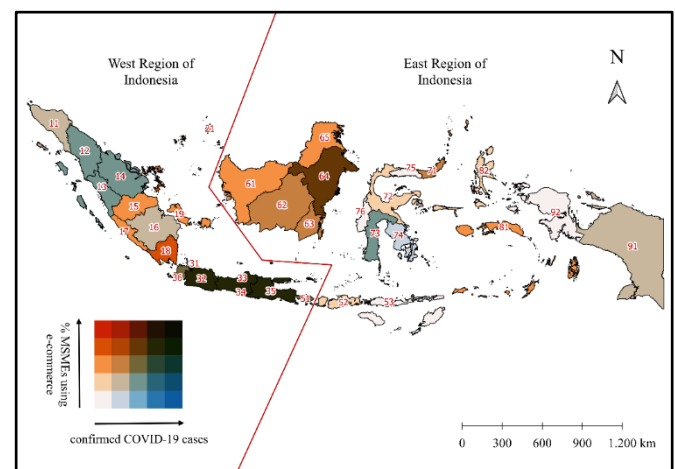


Figure 5- Distribution map of percentage of e-commerce MSMEs with % of the region with excellent internet signals growth in 2020

In Figure 5, most of the WRI regions have lower internet growth (orange colour) than the ERI regions (blue colour). In fact, most areas in the Western Region of Indonesia, especially Java Island, have good internet infrastructure development. The low growth of internet signal infrastructure in WRI compared to ERI is related to the national strategy made by the Ministry of Communication and Information regarding Merdeka Signal 2020. The Ministry of Communication and Informatics targets an even distribution of ICT infrastructure by building BTS capable of reaching 4G internet signals (LTE) in the 3T (underdeveloped) area. This can be an indication of low internet growth at WRI.

On the other hand, Papua Island and its surroundings in ERI have high growth of excellent internet signals, but the percentage of e-commerce MSMEs is actually low. Most of the ERI areas are areas where internet development still tends to lag behind. Even so, the obstacles in using the internet that have not been maximized, coupled

with the pandemic that has attacked important sectors in several regions in ERI have hampered the development of e-commerce. As in NTT Province, the COVID-19 pandemic made the tourism sector, which is the dominant sector, slump (Nugraha, 2021). Research conducted by Araujo (2021) found that many SMEs in the tourism sector in Kupang City were forced to close their businesses due to the pandemic.

In terms of utilizing existing internet technology, the basic obstacle lies in the number and quality of human resources. If seen through Figure 6, it can be seen that on the island of Java, areas with high GER of tertiary education growth also have a high percentage of e-commerce MSMEs. ERI, especially the Papua Island and surrounding areas, have high GER of tertiary education growth, but the percentage of e-commerce SMEs tends to be low. In WRI, especially Java Island, is still the target of students to continue their higher education there. Zubaidah et al (2016) examined the reasons why students migrated and studied at D.I. Yogyakarta; an area dubbed the Student City. The results show that 49.58 percent of students reasoned that Yogyakarta is a comfortable area as a place to study. Furthermore, some of these students finally decided to settle down and develop their potential there. As a result, the development of e-commerce that occurs will most likely occur in the area where they develop their potential.

Beforehand, the internet using in terms of business actors who implement it has been viewed. Then, in Figure 7 it can be seen the distribution of the percentage of e-commerce MSMEs using the internet for shopping by households. In WRI, it can be seen that all areas on the island of Java have a dark brown color, meaning that areas with a high percentage of households doing online shopping also have a high percentage of e-commerce MSMEs. However, Lampung Province which has a very low percentage of households making purchases via the internet is able to have a high percentage of e-commerce MSMEs. On the other hand, most of Eastern Indonesia's regions have a faded gray or blue color, meaning that areas with a low percentage of households doing online shopping also have a low percentage of e-commerce MSMEs.

The distribution in Figure 7 is able to give an indication that business actors will be more easily interested in utilizing e-commerce in their business if in their area there are many people who are internet literate in their economic activities. Moreover, since the COVID-19 pandemic, the rise of COVID-19 cases and the government's policies regarding social restrictions have limited public activities, including carrying out economic activities.

As can be seen in Figure 8, the area on the island of Java which is a densely populated area has a high rate of COVID-19 cases and also has a high percentage of e-commerce MSMEs. On the other hand, most ERI areas with a low confirmed rate of COVID-19 cases also have a low percentage of e-commerce MSMEs. This shows that the existence of a pandemic requires MSME actors to provide innovation in their business so that buying and selling activities continue, one of which is by utilizing online platforms in sales and marketing (Yuwana, 2020).

Limited economic activity due to the pandemic has caused the trade sector to be one of the sectors that were severely affected to a negative number. BPS - Statistics Indonesia (2021) shows that before the pandemic, namely in 2016–2019, the growth rate of the trade sector was always above other dominant sectors, namely the agricultural and manufacturing sectors. However, the pandemic caused the growth rate of the trade sector to be below the two sectors. As a result, traders (business actors) will look for various strategies to maintain their business in the midst of this pandemic that brought down the economy. In addition to reducing physical costs, the rapid technological era has made business people choose e-commerce as a way to get out of the economic downturn in this trading sector.

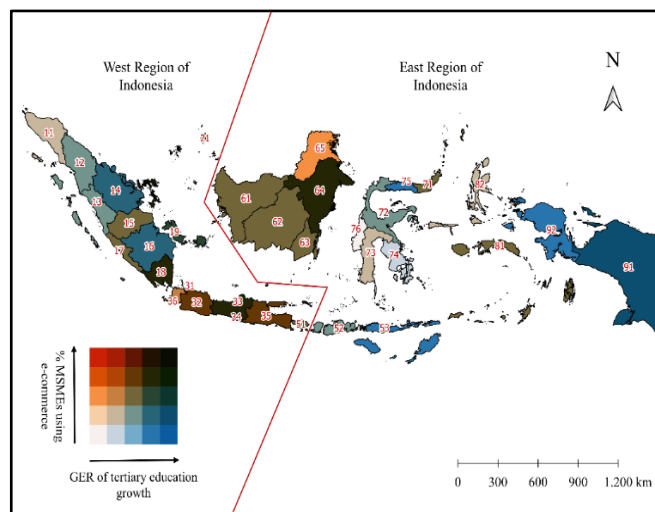


Figure 6- Distribution map of percentage of e-commerce MSMEs with GER of tertiary education growth in 2020

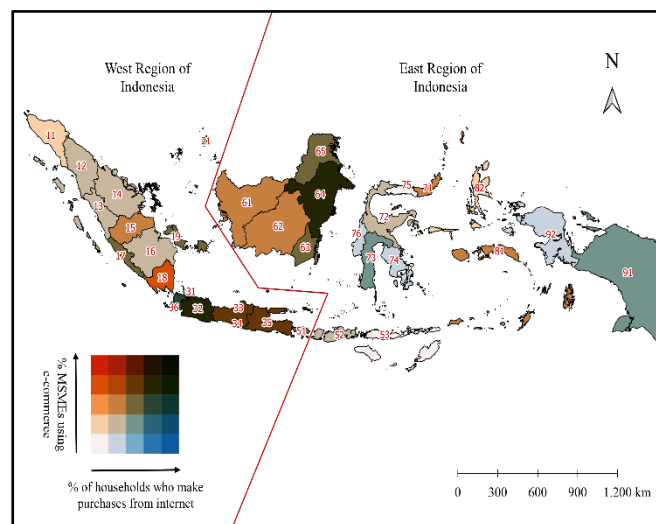


Figure 7- Distribution map of percentage of e-commerce MSMEs with percentage of household who make internet purchases in 2020

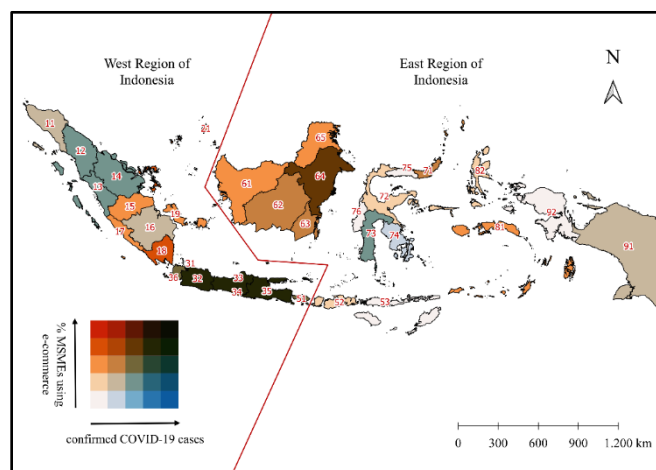


Figure 8- Distribution map of percentage of e-commerce MSMEs confirmed COVID-19 cases in 2020

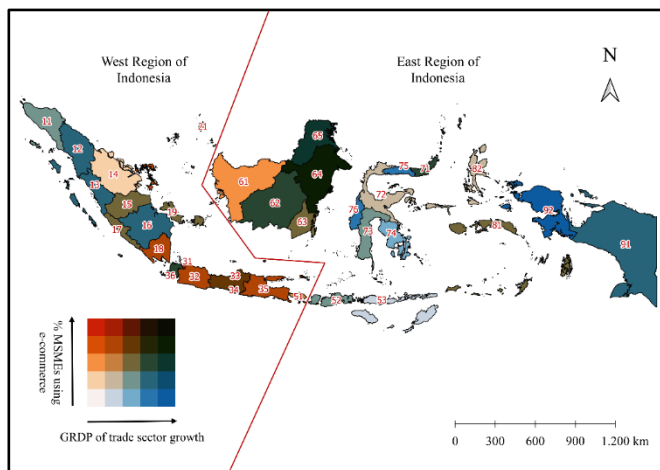


Figure 9- Distribution map of percentage of e-commerce MSMEs with GRDP of trade sector growth in 2020

Figure 9 shows that most areas with high GRDP declines in the trade sector also have a high percentage of e-commerce MSMEs (blue colour), and vice versa. However, several provinces in Java and Kalimantan have low GRDP declines in the trade sector and have a high percentage of e-commerce MSMEs.

Formation of GWR Model and Hypothesis Testing

Before the appropriate spatial modelling is carried out, firstly need to carry out hypothesis testing to see the spatial effects that exist in the model, namely spatial dependencies and heterogeneity. From Figure 10, it can be seen that Moran's I value is 0.506. This indicates that there is a spatial dependency that is not too strong.

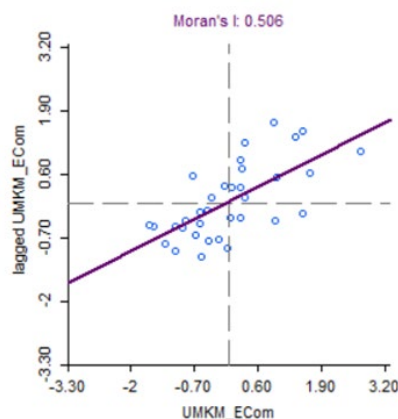


Figure 10- Moran's scatterplot

It can be seen in Figure 6 that the areas that have significant spatial dependencies are in the Eastern Indonesia region in almost all of Maluku and Sulawesi Islands. These areas are included in the *Low-Low* cluster, which means that areas with a low percentage value of e-commerce MSMEs are surrounded by low percentage values as well. On the other hand, a significant area in the WRI area is in the Province of DKI Jakarta and its surroundings. These areas are included in the *High-High* cluster, which means that areas with a high percentage value of e-commerce MSMEs are surrounded by high percentage values as well.

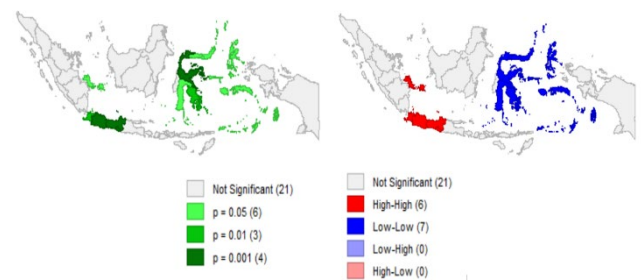


Figure 11- Significance map and cluster map

Table 1 shows the results of testing the spatial effects on the model used. Based on the results in Table 1, the statistics obtained from the *Moran's I* spatial autocorrelation test are 0.5059. The *p-value* generated in the test is also smaller than (0.10) so it can be concluded that there is spatial autocorrelation in the data on the percentage of MSMEs that implement e-commerce.

Table 1- Spatial effect testing result

| Test statistics | Value | Sig. |
|----------------------|---------|--------|
| (1) | (2) | (3) |
| <i>Moran's I</i> | 0.5059 | 0.0010 |
| <i>Breusch-Pagan</i> | 21.0198 | 0.0018 |

Furthermore, the results of the Breusch-Pagan statistical test resulted in a value of 21.0198 with a p-value of 0.0018. The resulting p-value is smaller than (0.10) so it can be concluded that there is spatial heterogeneity in the data. In other words, the error variance generated by the linear regression model is not homogeneous. From the two results of the spatial effect test, it can be concluded that in each region, the influence given by each independent variable is different on the results of the dependent variable, namely the percentage of MSMEs that implement e-commerce.

In the formation of the GWR model, the spatial weights must be calculated first. Therefore, it is necessary to determine the distance function and the optimum bandwidth that will be used in the calculation of the spatial weighing. The type of bandwidth used is fixed bandwidth, where the bandwidth used in all areas is the same. Fixed bandwidth makes distance as the limit of the considered area around it into the calculation of the model in that area. The optimum bandwidth value obtained using the CV method is 23,904 degrees, or equal to 2,661.0411 km (1 degree equal to 111,322 km). This means that the distance of the region that is considered to be able to affect the observed area is less than 2,661,0411 km.

Table 2- Kernel weight comparison result

| Weight function | AIC | SSR | R ² |
|------------------------|----------|----------|----------------|
| (1) | (2) | (3) | (4) |
| <i>Bisquare</i> kernel | 186.1472 | 219.5743 | 0.8511 |
| <i>Gaussian</i> kernel | 188.9875 | 265.0203 | 0.8202 |

There are several distance functions that can be used to form spatial weights in the GWR model. Weight functions that are commonly used are the *Gaussian* kernel and the *Bisquare* kernel. Based on the results in Table 2, it is known that the *Bisquare* kernel function is better than the *Gaussian* kernel. This can be seen from

the result that AIC and SSR values are much smaller. On the other hand, the resulting R^2 values are much larger. The value of R^2 in the *Bisquare* kernel is 0.8511. This means from the GWR model formed, the variation in the percentage of MSMEs that implement e-commerce can be explained by the independent variable used in this study of 85.11 percent on average.

Table 3- Result of ANOVA testing for GWR model

| Model | Sum of squares | df | Mean square | F | Sig. |
|------------------|----------------|--------|-------------|--------|--------|
| GWR improvement | 255,308 | 6.975 | 36.602 | 3.3380 | 0.0451 |
| GWR residuals | 219,574 | 20.025 | 10.965 | | |
| Global residuals | 474,883 | 27 | | | |

Furthermore, the ANOVA test was carried out based on the GWR modeling output in the GWR4 program. Based on the results in Table 3, the *F*-value is 3.3380 with a *p*-value of 0.0451. The number of *p*-value is smaller than (0.10), so the null hypothesis is rejected. So, it can be concluded that there are parameters that have a significant spatial effect so that the estimates produced by the GWR model are better than the linear regression model on the data studied.

To see which variables have a significant local effect, local parameter variations are tested. Based on the results in Table 4, it can be seen that all independent variables have a negative difference of criterion value. This means that there is spatial heterogeneity in each of the independent variables. The growth of MSME credit, the percentage of the region with excellent internet signals, residents who make purchases via the internet have the same influence in all regions, GER of tertiary education, growth of GRDP in the trade sector, and confirmed cases of COVID-19 have different effects between regions. to the percentage of MSMEs that implement e-commerce.

Table 4- Result of local parameter variations

| Variable | Difference of criterion |
|--|-------------------------|
| (1) | (2) |
| Intercept | -25.0492 |
| MSMEs' credit growth (X1) | -3.6183 |
| Percentage of region with excellent internet signals growth (X2) | -1.1344 |
| Percentage of households who make purchases from internet (X3) | -0.6632 |
| GER of tertiary education growth (X4) | -11.0107 |
| GRDP of trade sector growth (X5) | -1.3506 |
| Confirmed COVID-19 cases (X6) | -0.8226 |

Comparison of WRI and ERI Regions Based on Similarity in Determinant Characteristics of the Percentage of MSMEs Implementing E-Commerce

From the results of testing local spatial parameters on the GWR model formed, there are 6 regional groups and the distribution is shown in Figure 7. The formed regional groups have similar characteristics based on independent variables that are significant to the percentage of e-commerce MSMEs in each province. Based on these groupings, it can be seen that, in general, almost all regions in Indonesia have similar characteristics. The most significant variable is the percentage of households that make purchases from the

internet. This shows that the use of the internet by external parties (society) has a significant influence in almost all regions of Indonesia. Especially when the COVID-19 pandemic hits, people's demands to fulfil their daily needs in limited activities made them use the internet to buy their needs. Furthermore, e-commerce users are increasing and then able to show their loyalty by using e-commerce. This is in line with the statement of Marchidita et al. (2017) where, in the end, the number of people who make purchases via the internet is able to influence the decisions of business actors in implementing e-commerce. Hamad et al. (2018) also reveal that the competitive forces that increase the pressure on the e-commerce market have a significant influence both directly and indirectly on the performance of trading through e-commerce.

The most significant variable forward is the GER of tertiary education growth variable, which has a significant effect on 82.35 percent of Indonesia's territory. This shows that in most regions in Indonesia, the percentage of e-commerce MSMEs is significantly influenced by the quality of individual aspects of education, especially higher education. The utilization of e-commerce as a form of technological progress requires the role and expertise of users (business actors) in its implementation. This is in line with Helaluddin's (2019) statement which reveals that universities are the front line in dealing with changes in the field of education so they are required to be literate on existing changes, including technology. Other similar studies were also conducted by Rahayu & Day (2015) and Choshin & Ghaffari (2017) which state that ICT capabilities and the development of awareness of e-commerce as individual factors have an important role in influencing decisions to implement e-commerce by SMEs.

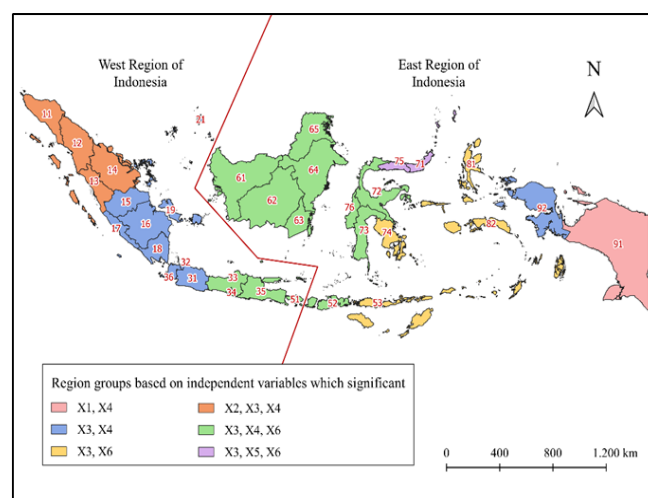


Figure 12- Region group distribution map based on significant independent variables, Source: BPS - Statistics Indonesia & Central Bank of Indonesia, data processed by authors

The dominating groups are areas with MSMEs that implement e-commerce significantly influenced by the percentage of the population who make purchases via the internet, GER of tertiary education growth, and confirmed cases of COVID-19. This regional group is found in both regions, both WRI and ERI. 69.23 percent of the territory of this domination group is in Eastern Indonesia. In Figure 12, it can be seen that the regions in WRI have similar characteristics. This similarity can be seen from the percentage of e-commerce MSMEs which are significantly influenced by the percentage of households doing online shopping and the GER of tertiary education growth. That is, if the implementation of e-commerce is to be increased in the WRI area, then the policy or matter to be regulated must be related to the use of the internet in household shopping or the development of higher education. In the northern area of Sumatra Island, the orange area can also be applied to policies or matters relating to the development of 4G internet

signal infrastructure. This is in line with the results of research by Rahayu & Day (2015) on SMEs in Indonesia which shows that the availability of infrastructure as an illustration of an organization's readiness to apply technology has a significant influence on the success of e-commerce. However, it will be less effective if the policy is applied to the green area of Java. Instead, control over the spread of the COVID-19 virus can be implemented in these areas.

In WRI, the percentage of e-commerce MSMEs in these areas is also influenced by the percentage of the households who make purchases from internet and GER of tertiary education growth. However, it was not significantly affected by confirmed cases of COVID-19. It can be seen that these regional groups are located in DKI Jakarta Province and its surroundings. The development of e-commerce in some of these areas was seen even before the COVID-19 pandemic. Research conducted by Simanjuntak (2020) shows that the widespread use of e-commerce by MSMEs in DKI Jakarta has occurred because of special attention from the government through assistance from the Ministry of Trade since 2017. This can provide an illustration of why the COVID-19 confirmation case does not significantly affect the development of e-commerce by MSMEs in the region.

In contrast to WRI which tend to have similar characteristics, regions in ERI have characteristics that tend to be more heterogeneous than WRIs. In Papua Province, e-commerce implementation by MSMEs could be increased by carrying out policies relating to MSME credit and higher education. The existence of the influence of the growth of MSME credit supports the results of research conducted by Shemi (2013) and Chen & Zhang (2015). The problem of credit as access to capital occurs in the majority of SMEs, especially in developing countries, and has a significant effect on the performance of MSMEs. Not with MSME credit, the policies that can be applied in West Papua Province are precisely those regarding the level of households who make purchases from the internet. Beside those two regions, although the regional groups tend to be heterogeneous, there are few similarities that are shared by other regions in ERI. Apart from the dominance variable, namely the percentage of households doing online shopping, the percentage of e-commerce MSMEs is also significantly influenced by the number of confirmed cases of COVID-19. This means that the implementation of social restrictions in areas in ERI other than Papua Province and West Papua has a significant effect on the level of implementation of e-commerce among MSMEs. This result is in line with the statements of Sardjono et al. (2020) and Indartha et al (2021) who revealed that the COVID-19 pandemic accompanied by the government's policy of restricting social activities from a socio-economic perspective had changed people's shopping behaviour from conventional (offline) to online. In the end, business actors who do not implement e-commerce will experience a setback in their business compared to business actors who implement e-commerce (Lestari et al., 2021).

Unfortunately, the GER of tertiary education growth does not significantly affect most areas in ERI. This has been indicated on the bivariate choropleth map, where there is no pattern formed between the GER of tertiary education growth and the percentage of MSMEs that implement e-commerce. That is, the evidence collected based on the distribution on the bivariate choropleth map used is insufficient to show a significant trend of relationship.

5. Conclusions And Policy Implication

The distribution pattern of e-commerce implemented percentage by MSMEs comparison before and during the COVID-19 pandemic shows that there are differences in developments between WRI and ERI. It can be seen that the distribution in the WRI area is more heterogeneous than in the ERI. The four types of regions based on the growth of MSMEs that implement e-commerce

percentage shift are as a whole, found in WRI. In ERI, most of the regions have a proportion of e-commerce MSMEs below the national value during the 2020 pandemic.

Based on testing the spatial effect on the percentage of MSMEs implementing e-commerce, it was found that there is a weak spatial autocorrelation. DKI Jakarta and surrounding areas are included in the High-High cluster, while most areas on the islands of Sulawesi and Maluku are included in the Low-Low cluster. Furthermore, it was also found that there was spatial heterogeneity during the 2020 pandemic in the percentage of MSMEs implementing e-commerce. That is, the model of the factors that are thought to affect the percentage of e-commerce MSMEs has a different influence in each region. Variables of MSME credit growth, the percentage growth of region with an excellent internet signal, GER of tertiary education growth, GRDP in the trade sector growth, and confirmed cases of COVID-19 have a significant influence and varied locally in Indonesia.

There are 6 region groups formed based on similar characteristics from independent variables that were significant to the percentage of MSMEs implementing e-commerce. The formed regional groups have similar characteristics based on independent variables that are significant to the percentage of e-commerce MSMEs in each province. This similarity can be seen from a significant variable in almost all parts of Indonesia, namely the percentage of households that make purchases via the internet. Apart from the dominance variable, the growth of GER of tertiary education is also a significant variable in all regions in WRI. Slightly different from WRI, apart from significant variables in the two regions, the percentage of e-commerce MSMEs is also significantly influenced by the number of confirmed cases of COVID-19 in ERI.

In encouraging the development of e-commerce for MSME players in Indonesia, especially after the COVID-19 pandemic, the government needs to pay attention to the characteristics of the area it wants to target. Especially the existence of these areas in the Western or Eastern Regions of Indonesia. For both WRI and ERI, this can be done by developing a platform for MSMEs to sell their products online. Apart from the use of online shopping by households, it can be done to increase the level of higher education participation through the provision of scholarships for students, especially in the economic field or digital entrepreneurship workshops among students at WRI. On the other hand, in the ERI region, social control or restrictions can be carried out to prevent the spread of a pandemic that has a significant effect on the development of e-commerce MSMEs there.

The existence of a pandemic does not make the Indonesian economy slump continuously, the development of the digital economy is able to make the Indonesian people are required to survive and develop through technological developments. In the end, MSME actors as entrepreneurs and drivers of the economy are competing with situations that are all changing in a short time. The goal, of course, is to rise from the adversity that hit the pandemic, as well as reduce the inequality that occurs between WRI and ERI.

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