

UTILIZATION OF ARTIFICIAL INTELLIGENCE (AI) TO ANALYZE THE IMPACT OF COVID-19: EVIDENCE FROM MSME'S IN EAST JAVA

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ABSTRACT

The current state of the Covid pandemic certainly has an impact on MSMEs. As we can see and feel at this time, of course, the income of MSMEs is decreasing due to the covid pandemic. This is exacerbated by an increase in the price of raw materials which makes it more difficult for entrepreneurs. As data by Kadin, Malang Regency, East Java (Priyo, 2021) revealed that the condition of Micro, Small and Medium Enterprises (MSMEs) was getting worse during the Covid-19 pandemic. The reason is that people have difficulty getting business credit in banks. According to him, MSME actors have fallen because of business capital, market and consumer factors that make it difficult for them to get up. In addition, it is difficult for people to obtain business credit from banks. Of the 56 MSMEs that are members of the Malang Regency Kadin, only 8 MSMEs are approved by banks to obtain credit. Furthermore, MSMEs can survive by switching to other businesses and with assistance from the government. Based on these conditions, this research needs to be carried out to analyze more deeply what impacts are felt by MSMEs during the Covid pandemic. This is done further to be able to provide appropriate recommendations for determining MSME policies by the government.

Keywords: Artificial Intelligence (AI), COVID-19, Negative Sentiment, Positive Sentiment, MSME

INTRODUCTION

Research Background

This article examines the impact of Covid on MSMEs in Greater Malang with the use of Artificial Technology (AI) so that it can provide recommendations for MSMEs in Greater Malang in dealing with the Covid pandemic by using Artificial Technology (AI). Over the past decade, the use of media-based sentiment indicators has gained popularity among academics and market participants. Their basic appeal is that they can capture current trends in economic activity and financial markets but at a lower cost and timelier than survey-based indexes. The methodology used in the literature to construct these indicators: (1) Lexicon. The most common media-based indicators are based on a lexicon or dictionary—ie. Predefined word lists with associated sentiment scores. The basic method is the so-called "word bag" which ignores contextual characteristics and only measures the sentiment of a particular corpus of text based on the prevalence of negative versus positive words. Recent applications include: (Chen et al., 2018) focusing on financial market sentiment and (Björnlund et al., 2020) (Buckman et al., 2020) looking at economic sentiment. (2) Heuristic Rules. This approach attempts to overcome the main challenge of the bag-of-words method by using a simple rule to modify the sentiment scores of words—measured by the lexicon—based on how they appear in the text. A prominent example is the Valence Aware Dictionary and Sentiment Reasoner (VADER) which is a sentence-level sentiment classifier consisting of a lexicon and heuristic rules that explain the context in a sentence (Hutto & Gilbert, 2014). Typical rules deal with negation, punctuation, capitalization, modifiers (such as little, very), etc. Although this model is better at taking context into account, the rule-based scoring system cannot fully capture the complexity and composition or nuances of expression of a given text. To date, there are only a few applications in economics that use heuristic rules (Buckman et al., 2020).

In addition to these two indicators, there are other indicators such as machine learning with artificial intelligence (Artificial Intelligence). A more promising way to capture the complexities of natural languages is the use of machine learning (ML) techniques to build models that predict the sentiments of specific texts. This type of model is estimated on a training sample containing text and its mapping into a human-defined sentiment label. This way, they can automatically learn sentiment weights for words and entire sentences and learn how to combine them to measure the sentiment of a text. Their predictive performance, however, depends on the quality of the data. The most advanced ML models (especially deep learning) typically require large data sets to capture complex language features such as sentence structure and tend to function better for their training set domain. Because constructing these "labeled" text data is very expensive and the model difficult to interpret, ML is not as widely used in the economics and finance literature as lexicon-based methods. One of the newest apps is (Buckman et al., 2020) who compare the predictive performance of alternative ML-based models but ultimately rely on lexical techniques to construct indicators of economic sentiment given the rarity of their training sets. With these indicators, we can apply them in the business/economy world, for example, in SMEs.

The current state of the Covid pandemic certainly has an impact on MSMEs. As we can see and feel at this time, of course, the income of MSMEs is definitely decreasing due to the covid pandemic. This is exacerbated by an increase in the price of raw materials which makes it more difficult for entrepreneurs. As data by Kadin, Malang Regency, East Java (Faruq, 2021) revealed that the condition of Micro, Small and Medium Enterprises (MSMEs) was getting worse during the Covid-19 pandemic. The reason

is that people have difficulty getting business credit in banks. According to him, MSME actors have fallen because of business capital, market, and consumer factors that make it difficult for them to rise. In addition, it is difficult for people to obtain business credit from banks. Of the 56 MSMEs that are members of the Malang Regency Kadin, only 8 MSMEs are approved by banks to obtain credit. Furthermore, MSMEs are able to survive by switching to other businesses and with assistance from the government. Based on these conditions, this research needs to be carried out to analyze more deeply what impacts are felt by MSMEs during the Covid pandemic. This is done further in order to be able to provide appropriate recommendations for determining MSME policies by the government.

Problem Statement

Based on the aforementioned, we state the following research questions:

Research question 1: How is the impact of Covid on MSMEs in Greater Malang by the use of Artificial Technology (AI)?

Research Question 2: What are the recommendations for MSMEs in Greater Malang in dealing with the Covid pandemic by using Artificial Technology (AI)?

LITERATURE REVIEW

Innovation in Technology

We need to do innovation in all aspects. As it is understood that innovation is usually related to novelty. Innovation is defined as an idea, practice or object that is considered new by an individual or other user unit. Innovation, namely: "as the ability to apply creativity in order to solve problems and opportunities to improve and enrich life". A company's ability to use new organizational forms and processes can increase its ability to seek new opportunities internally, such as technological advances, and externally, such as new markets or expanding markets. This is what produces entrepreneurial success. (Georgellis et al., 2000) say that an entrepreneurial business which is described by its capacity to plan ahead, its capacity to innovate and its willingness to take risks, will make it easier for it to innovate, and also to develop and grow successfully. Innovation is a key characteristic of an entrepreneurial business that affects business performance.

(Kurtulmuş & Warner, 2015) Innovation is very important for the following reasons:

- Technology changes rapidly as new products, processes and services come from competitors, and this drives entrepreneurial ventures to compete and succeed. What has to be done is to adapt to new technological innovations.
- The effect of environmental changes on product life cycles is getting shorter, which means that old products or services must be replaced with new ones quickly, and this can happen because there is creative thinking that leads to innovation.
- Today's consumers are smarter, classier and more demanding. They expect more in terms of quality, updates and price. Innovative skills are therefore needed to satisfy consumer needs while retaining them.
- With markets and technology changing so rapidly, it is easier to imitate a really good idea, and this requires using new and improved methods of product use, processes, and faster service.
- Innovation can lead to faster growth, increase market segments, and create a better corporate position.

With the Industrial Revolution Era 4.0, it will also have an impact on the business revolution. The revolution is to increase productivity, efficiency and customer service by combining internet and digital technology in conventional industries (Sundari, 2019). With the development of technology, it will certainly create opportunities for MSMEs and creative businesses to be able to develop. Other technological innovations such as information technology that includes supply and demand sides (Fathul Wahid, 2007). The supply side is concerned with the creation, production, and diffusion of innovations, while the demand side focuses on the adoption and application of innovations. Diffusion and adoption are intermediate between these two sides.

This information technology can facilitate the operations of a business in its business governance. As well as the use of the internet by SMEs such as:

- Online transactions/orders
- search for market information
- search for design information
- communication and collaboration with partners, suppliers/suppliers
- communication with consumers

Artificial Technology

(Ahmad, 2017) argued that Artificial Intelligence (AI) is a technique used to imitate the intelligence possessed by living and non-living things to solve a problem. In line with (Nasri, 2014) also stated that AI is a part of computer science that studies how to make machines (computers) can do work as well as what humans do and even better than what humans do. Humans are intelligent in solving problems because humans have reason, reason, knowledge and experience gained from learning. Likewise, so that machines can be intelligent like humans, there must be a provision of knowledge so that they have the ability to reason. In general, AI can be seen in diagram 1 below.

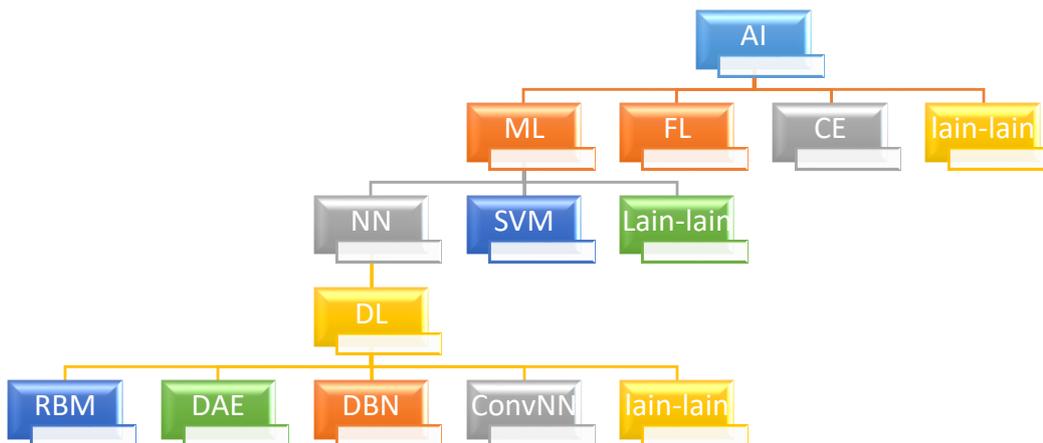


Chart 1. Artificial Intelligence Diagram

Based on the chart, there are 3 methods of applying artificial intelligence, including:

1. Fuzzy Logic (FL). This technique is used by machines to adapt how living things adjust to conditions by giving decisions that are not rigid 0 or 1. So that a fuzzy logic system is generated that is not rigid. One of the applications of this fuzzy logic is for the train braking system in Japan.
2. Evolutionary Computing (EC). This approach uses an evolutionary scheme that uses a large number of individuals and provides a test to select the best individuals to raise the next generation. This selection is used to find a solution to a problem. Examples of this approach are Genetic Algorithms which use the idea of mutation and interbreeding, Particle Swarm Optimization (PSO) which imitates groups of animals such as birds and fish in search of prey, Simulated Annealing which imitates how metal is forged, and many more.
3. Machine Learning (ML) or machine learning is the most popular technique because it is widely used to replace or imitate human behavior to solve problems. As the name implies, ML tries to imitate how humans or intelligent creatures learn and generalize.

Artificial intelligence has advantages such as:

1. More permanent. Natural intelligence can change because of human forgetfulness. Artificial intelligence does not change as long as computer systems & programs do not change it.
2. Easier to duplicate & spread. Transferring human knowledge from 1 person to another is a very long process & expertise can never be completely duplicated. So if knowledge resides in a computer system, the knowledge can be copied from that computer & can be transferred easily to another computer.
3. Cheaper. Providing computer services will be easier & cheaper than bringing someone to do a number of jobs in a very long period of time. It is consistent because artificial intelligence is part of computer technology while natural intelligence is constantly changing.
4. Can be documented. Decisions made by computers can be easily documented by tracking every activity of the system. Natural intelligence is very difficult to reproduce.
5. How to work faster
6. Better results

The main scope of artificial intelligence includes:

1. Expert system (expert system): a computer as a means to store the knowledge of experts so that computers have the expertise to solve problems by imitating the expertise of experts.
2. Natural language processing: users can communicate with computers using everyday language, for example English, Indonesian, Javanese, etc.
3. Speech recognition: humans can communicate with computers using voice.
4. Robotics and Sensor Systems
5. Computer vision: interpreting images or visible objects through a computer
6. Intelligent computer-aided instruction: the computer can be used as a tutor who can train and teach.
7. Game play.

MSMEs (Small MEDIUM MICRO ENTERPRISES)

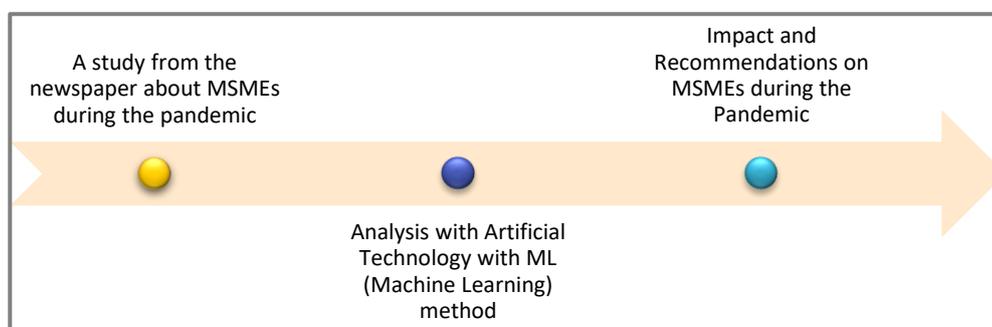
In general, SMEs or commonly known as small and medium enterprises is a term that refers to a type of business that is founded by a private person and has a net worth of at most Rp. 200,000,000.00 (not including land and buildings). If based on the applicable law (Law Number 20 of 2008), the definition of Micro, Small and Medium Enterprises (MSMEs) is:

1. Micro-enterprises are productive businesses owned by individuals and/or individual business entities that meet the criteria for micro-enterprises as regulated in this law.
2. Small business is a productive economic business that stands alone, which is carried out by individuals or business entities that are not subsidiaries or branches of companies that are owned, controlled, or become a part either directly or indirectly of a medium or large business that fulfills small business criteria as referred to in this law.
3. What is meant by small and medium enterprises are business activities with a scale of activity that is not too large, management is still very simple, the available capital is limited, the market reached is also not wide. Medium-sized businesses are productive economic businesses that stand alone, which are carried out by individuals or business entities that are not subsidiaries or branches of companies that are owned, controlled, or become a part either directly or indirectly with small businesses or large businesses with total net assets or annual sales proceeds as regulated in this law. The business world is micro-enterprises, small-scale businesses, medium-sized businesses, and large businesses that carry out economic activities in Kudus and are domiciled in Kudus.
4. Another word for business actor is entrepreneur (entrepreneurship). In simple terms, entrepreneurship can be defined as an entrepreneur who is able to see opportunities by seeking funds and other resources needed to work on these opportunities, dares to take risks related to the implementation of the business he is engaged in, and runs the business with a growth and expansion plan.

RESEARCH METHODOLOGY

In this proposal, we use the ML approach to build an economic sentiment indicator based on newspapers. Specifically, we use a transfer learning model in ML called BERT (Bidirectional Encoder Representations from Transformers) developed at Google by (Devlin et al., 2018). BERT is an ML model that has been trained to capture the meaning of a sentence based on context. BERT can then be trained for specific tasks such as predicting the sentiment of a text based on the training text (a newspaper article that has been annotated with a sentiment) entered into the BERT. Because BERT is trained to understand the meaning of a sentence based on context, the main advantage of our approach relative to standard lexicon-based sentiment indicators is that it can capture the structure and rich language context of a text to predict its sentiment.

In simple terms, the research activities carried out are as shown in the image below.



Picture 1. Research Framework

In this study using the ML (Machine Learning) method. Machine Learning (ML) is an approach in AI that is widely used to replace or imitate human behavior to solve problems or perform automation. As the name implies, ML tries to imitate how humans or intelligent creatures learn and generalize. There are at least two main applications in ML namely, classification and prediction. The hallmark of ML is the existence of a training, learning, or training process. Therefore, ML requires data to be learned which is known as training data. Classification is a method in ML that is used by machines to sort or classify objects based on certain characteristics as humans try to distinguish objects from one another. While prediction or regression is used by the machine to guess the output of an input data based on the data that has been studied in training. The most popular ML methods are Decision Making System, Support Vector Machine (SVM) and Neural Network.

In the research to be conducted, the researcher acts as an instrument as well as data collector, so that in conducting research, the researcher will go directly to the research subject. This research was conducted in MSMEs located in Malang Raya. The type of data used by the researcher is secondary data in the form of MSME news during the pandemic in newspapers, totaling 153 news from 3 newspapers in Malang Raya and Batu starting from March 2020 - August 2021. The data collection method that will be used by researchers in this study are as follows.

1. The research phase and data collection through surveys, including in this step include literature studies related to artificial intelligence and MSMEs as well as collecting data on news (news) from newspapers both printed and electronic about the impact of covid-19 on MSME businesses in the City Poor
2. The analysis stage, the data is AI using the ML (Machine Learning) method
3. The reporting stage includes reporting activities from the analysis of the method.

RESULTS AND FINDINGS

In our research we use the lexicon or dictionary—i.e.. Predefined word lists with associated sentiment scores. The basic method is the so-called "word bag" which ignores contextual characteristics and only measures the sentiment of a particular corpus of text based on the prevalence of negative versus positive words. We use a dictionary of economic words and positive, negative, and uncertainty words from Loughran and McDonald's (2011) economic sentiment lexicon. We use the lexicon, after being translated into Indonesian, to count the number of economic words that have positive, negative, and uncertainty sentiments from each news that we get from newspapers in Malang Raya (Radar Malang, Surya, and Malang Pos). The results of research related to the impact of Covid-19 on MSMEs with the application of AI carried out in Greater Malang can be seen in graph 1 and table 1 below.

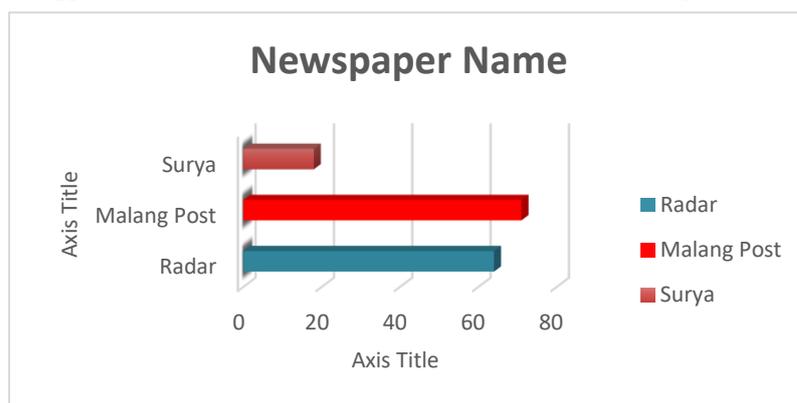


Chart 1. Newspaper Name

Based on graph 1, this research uses three names of newspapers, namely Malang post (71) Radar (64) and Surya (13).

Table 1. Number of words in the news

Indicators	Number	Percentage (%)
Number of positive economic words		
1 - 10 words	124	81,05
11 - 20 words	23	15,03
21 - 30 words	5	3,27
more than 31 words	1	0,65
		100,00
Number of negative economic words		
1 - 10 words	94	61,44
11 - 20 words	39	25,49
21 - 30 words	12	7,84
31- 40 words	6	3,92
more than 41 words	2	1,31
		100,00
Number of uncertainty words		
1 - 5 words	119	77,78
6 - 10 words	26	16,99
more than 11 words	8	5,23
		100,00

Based on table 1 above, the emergence of positive words from the news is at most 81.05% and the emergence of negative words is 61.44%, namely 1-10 words in the published news. As for the words that are not sure as much as 77.78% appear 1-5 words.

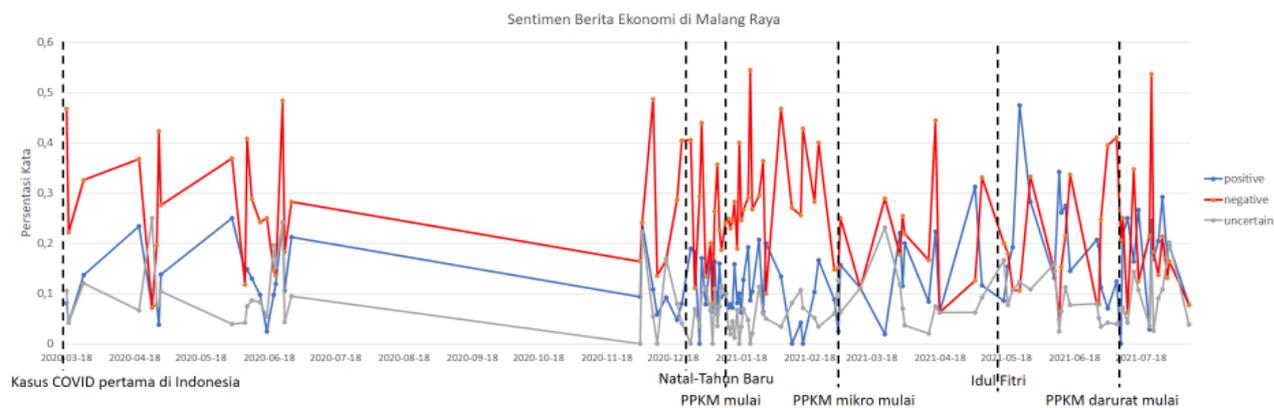


Chart 2. Economic Sentiment in Greater Malang using AI

Based on graph 2, it can be understood that the sentiment seen can be grouped into six phases, namely phase 1 when the Covid-19 case first appeared in Indonesia, phase 2, namely during the New Year's Eve 2020, phase 3, namely when PPKM began, phase 4 when the start of micro PPKM, phase 5 when there is Eid al-Fitr and phase 6 when there is an emergency PPKM. Nearly 50% of negative words appeared in the news published in phase 1 when the first Covid-19 case appeared, even though the negative sentiment decreased until nearing phase 2 before Christmas and New Year. Also for the highest negative sentiment (more than 50%) when the PPKM and emergency PPKM started. For positive sentiments (positive words) that appear in the news the most during phase 3, namely when there is Eid al-Fitr (almost 50%). As for uncertain at most, only 25% in June 2020, November 2020 and March 2021.

DISCUSSIONS

From the number of words, the researcher calculates the percentage of the number of positive, negative, and uncertainty words in each news and reports the average of these percentages in the news every day during the COVID-19 period in Indonesia, starting from the first case in Indonesia (March 2, 2020, to July 2021). From the average percentage of news sentiment, we see that the average news has negative sentiment throughout the COVID-19 period, and becomes more negative as PPKM starts (PPKM, micro PPKM, and emergency PPKM). However, there were times when the economic news turned positive, namely in May 2021 (along with Eid al-Fitr). However, along with the increasing number of COVID-19 cases in Indonesia and the start of Emergency PPKM, economic news in Malang Raya has turned negative again.

From the results of data analysis, information was obtained that the average news showed negative sentiment occurred during the initial period of the emergence of the covid 19 outbreak until the period of implementation of PPKM (Enforce Office Activity Restrictions) both micro PPKM and emergency PPKM. In this condition, the news content in Malang Raya newspaper generally has negative sentiment. The negative sentiment in the media shows how bad the impact of the Covid-19 pandemic is in Malang, especially for MSMEs. Based on the description from the Ministry of Finance, MSMEs are one of the 4 sectors that have been hit hard by the Covid-19 pandemic. MSMEs are the sector that is really most affected by the Covid-19 pandemic (OECD, 2020). An explanation from the Organization for Economic Co-Operation and Development (OECD), explains that almost half of MSMEs in Indonesia are predicted to be bankrupt by the end of 2020 (OECD, 2020). This was also emphasized by the Malang Regency Cooperatives and Micro Business Office that of the 686 MSMEs in Malang Regency affected by the Covid-19 pandemic, they experienced various problems, including: decreased sales (44%); capital problems (27%); obstruction of product distribution (12%); difficulty in obtaining raw materials (9%) and production problems (8%), sales turnover decreased to 77.6%, decreased assets reached 42.7% and experienced a reduction in the number of workers up to 46.1% (Kementerian Koperasi dan Kecil dan Menengah, 2020).

The increasingly uncertain economic situation due to COVID-19 seems to have a negative impact on people's lives. The bad impact and the unfavorable situation made the media coverage negative. Negative sentiment in the mass media continues during the covid period. The long duration of negative sentiment as seen in graph 2 is due to the fact that during this phase the Covid-19 cases in Malang Raya were increasing. The increase in COVID-19 cases has made the government increasingly tighten the rules for entering the Greater Malang area, through the implementation of PPKM (Enforce Office Activity Restrictions). The impact of the implementation of this policy causes people to tend to spend more to fulfill basic needs rather than other needs. This is in accordance with what was expressed by (Hertina et al., 2021) that the Covid-19 pandemic condition causes people to spend their income to meet basic needs. This situation then has an impact on the reduced income of MSME actors in Malangraya. This decrease in the income of MSME actors is caused by a decrease in people's purchasing power which ultimately reduces the sales proceeds

from MSME actors. The decline in people's purchasing power, which experienced a decline, ultimately reduced the sales results of MSME actors.

This is in line with the results of a survey from the Indonesian Business Development Services Association (ABDSI, 2020) that the COVID-19 pandemic has caused MSMEs to experience a decline in sales. From the survey, it can be seen that around 36.7% of MSME actors do not get sales, there are approximately 26% MSMEs experiencing a decline in sales, and around 60% of MSMEs are experiencing difficulties in the availability of raw materials and credit payments (ABDSI, 2020). This is also confirmed by data from the Ministry of Cooperatives and SMEs that the Covid-19 pandemic has had an impact in the form of decreased sales and disruption of the supply of raw materials to around 98% of micro businesses (approximately 63 million micro businesses), 783 thousand small businesses, 60 thousand medium and medium enterprises. 5 thousands of big businesses (Putra, 2020). This opinion is reinforced by (Shafi et al., 2020) in their research stating that when the condition of cases of patients infected with Covid 19 is increasing, it will have an impact on the global economy, for example the occurrence of an economic slowdown shown by decline in global foreign direct investment by 5% - 15%, problems in the supply chain, declining purchasing power of the people, declining sales and profits of MSME actors.

At the time of Christmas and New Year (phase 2) and before Idul Fitri (May 2021) media sentiment turned slightly positive, this was because at the celebration of the big day there was an increase in public consumption in December 2020 and May 2021 compared to previous month. This increase in public consumption, of course, has a positive impact on MSME actors and will contribute to good economic growth as well. The increase in public consumption makes MSME actors try to meet consumer needs, because with these efforts MSME actors will continue to survive and grow during this pandemic. This is in accordance with what was expressed by (Suryawardana, 2020) that MSME actors must be able to meet consumer needs if MSMEs want to survive during the pandemic and continue to grow (W. Adda et al., 2020).

CONCLUSION AND RECOMMENDATIONS

Based on the results of data processing using Artificial Intelligence (AI) it was concluded that negative sentiment from the media provided information that the COVID-19 pandemic had a bad impact on MSMEs in Malang, for example, decreased sales, decreased income, decreased turnover, etc. shows that during a pandemic, MSMEs can still increase their business. What has been done by MSMEs to survive in the face of this pandemic is to change sales strategies by online and online marketing strategies. MSME actors rely more on online business operations.

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