STUDY ON RELATIONSHIP BETWEEN URBANIZATION CITY INDEX AND COVID-19 SPREAD

FINAL PROJECT REPORT

A Report submitted in fulfillment of the requirement for the award of the degree of Bachelor in Department of Industrial Engineering, Faculty of Engineering.

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UNIVERSITAS ANDALAS

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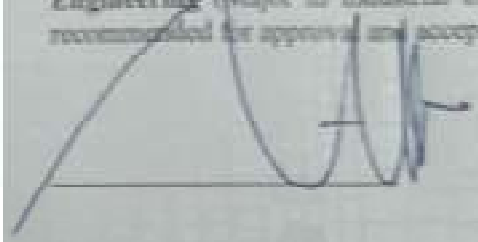

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ABSTRACT

The urbanization process occurs continuously. The urbanization index is supported by economic, social, environmental and government conditions. Today the world is shocked by a pandemic called COVID-19. The spread of COVID-19 cases is also supported by the existence of big cities. Where is the big city that is the center of economic and government activity. Then the busy city activities also affect the urbanization conditions of the city. In the last few months, COVID-19 has spread to 213 countries and 3 territories. In other words, the existence of urbanization in an area can be a factor that supports the spread of COVID-19. This study aims to examine the effect of a city's urbanization index on the spread of COVID-19. This study focuses on 34 cities in Indonesia with hypothesis testing using the SEM-PLS method and SMARTPLS application assistance. Data processing using the Structural Equation Modeling (SEM) method consists of 5 steps, namely designing a structural model, designing a measurement model, making a path diagram (path diagram), evaluating the SEM-PLS model and conducting hypothesis testing. The results showed that there were 28 research indicators consisting of 5 economic indicators, 8 social indicators, 11 environmental indicators, 3 government indicators and 1 COVID-19 spread indicator. Convergent validity is done by eliminating indicators with values below 0.5. There are 17 indicators that have been eliminated, leaving 11 indicators. Discriminant validity was done by eliminating X1B and X3B. Cronbach alpha and composite reliability in the study were above 0.7. The value of R-Square in this study is 0.968 percent. This explains the influence of economic, social, environmental and government variables at 96.8 percent. Economic, social and environmental organizational factors have a t-statistic value more than 1.96 and a p-value less than 0.05. Meanwhile, the government factor has a t-statistic value less than 1.96 and a p-value more then 0.05. There is an influence on the urbanization index of a city on the spread of COVID-19. Where economic, social, environmental variables have a significant effect on the spread of COVID-19, and government variables do not have a significant effect on the spread of COVID-19.

Keywords: COVID-19, Urbanization Index, SEM-PLS

ABSTRAK

Proses urbanisasi terjadi secara terus menerus. Indeks urbanisasi didukung oleh keadaan ekonomi, sosial, lingkungan serta pemerintahan. Dewasa ini dunia diguncangkan oleh pandemi yang disebut COVID-19. Penyebaran kasus COVID 19 juga disokong oleh keberadaan kota besar. Dimana kota besar yang menjadi pusat kegiatan ekonomi dan pemerintahan. Kemudian aktivitas kota yang sibuk juga mempengaruhi kondisi urbanisasi dari kota tersebut. Dalam waktu beberapa bulan terakhir COVID-19 menyebar ke 213 negara dan 2 daerah teritori. Dengan kata lain keberadaan urbanisasi pada suatu daerah dapat menjadi factor yang menunjang penyebaran COVID-19. Penelitian ini bertujuan untuk menguji pengaruh indeks urbanisasi suatu kota terhadap penyebaran COVID-19. Penelitian ini fokus pada 34 kota di Indonesia dengan pengujian hipotesis menggunakan metode SEM-PLS dan bantuan aplikasi SMARTPLS. Pengolahan data dengan menggunakan metode Structural Equation Modeling (SEM) terdiri dari 5 langkah yaitu merancang model struktural, merancang model pengukuran, membuat diagram jalur (diagram path), melakukan evaluasi model SEM-PLS dan melakukan pengujian hipotesis. Hasil penelitian menunjukkan bahwa terdapat 28 indikator penelitian yang terdiri dari 5 indikator ekonomi, 8 indikator sosial, 11 indikator lingkungan, 3 indikator pemerintah dan 1 indikator COVID-19. Validitas konvergen dilakukan dengan menghilangkan indikator dengan nilai dibawah 0,5. Ada 17 indikator yang sudah dieliminasi, menyisakan 11 indikator. Validitas diskriminan dilakukan dengan menghilangkan X1B dan X3B. Cronbach alpha dan composite reliability dalam studi di atas 0,7. Nilai R Square pada penelitian ini sebesar 0,968 persen. Hal ini menjelaskan pengaruh variabel ekonomi, sosial, lingkungan, dan pemerintahan sebesar 96,8 persen. Faktor organisasi ekonomi, sosial dan lingkungan memiliki nilai t-statistik besar dari 1,96 dan p-value kecil dari 0,05. Sedangkan faktor pemerintah memiliki nilai t-statistik kecil dari 1,96 dan p-value besar dari 0,05. Terdapat pengaruh indeks urbanisasi suatu kota terhadap penyebaran COVID-19. Dimana variabel ekonomi, sosial, lingkungan berpengaruh signifikan terhadap penyebaran COVID-19, dan variabel pemerintah tidak berpengaruh signifikan terhadap penyebaran COVID-19.

Kata Kunci: COVID-19*, Indeks Urbanisasi,* SEM-PLS

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CHAPTER I
INTRODUCTION

This chapter describes the background of research, problem statement, research objectives, research scopes, and outline of the report.

1.1 Background of Research

Urbanization is a phenomenon of increasing population in urban areas in line with the level of welfare and economic development of the population in a country (Tjiptoherijanto, 1999). Both developed and developing countries are experiencing urbanization. Urbanization is not only seen as a population phenomenon, but more than that urbanization must be seen as a political, social, cultural and economic phenomenon. The movement of population from rural areas to cities is one of the factors that affect the level of urbanization of an urban area.

Urbanization and urban population growth in Indonesia have been increasing especially since the 1970s when Indonesia initiated a more structured national development program. In 1920 the proportion of the population living in urban areas was only around 5.8 percent of the total population. **Figure 1.1** shows the growth rate of Indonesia's population from 1971 to 2017. Based on the Inter-Census Population Survey 2015, it is estimated that Indonesia's urban population has reached 135.61 million people or representing around 55.2% of Indonesia's total population experiencing a process of urbanization and rapid urban population growth (Mardiansjah, 2019).

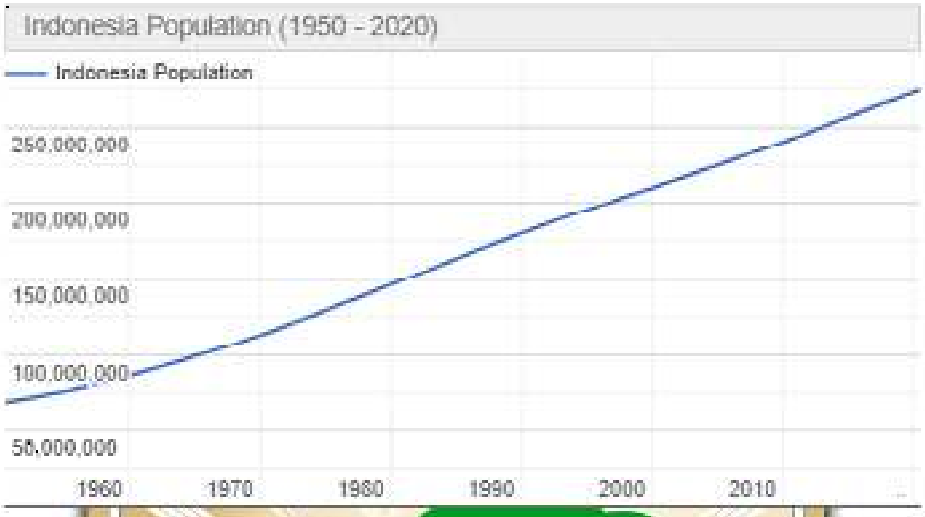

Figure 1.1 Population Growth in Indonesia
(Source: https://www.worldometers.com/)

One of the factors driving the urbanization process is the economic condition of an area. The economic conditions referred to are such as job opportunities, investment levels. These conditions make residents come to the city. Economic growth in Indonesia is centered in cities. More people live in urban areas than in rural areas with a proportion of 55% in 2018. Previously in 1950 only 30% of the population lived in urban areas and it is projected that 68% of the population will occupy urban areas in 2050. The World Bank estimates that in 2025, 68% Indonesian residents will live in cities as a result of uneven development. The greater the difference between regional growth rates, the higher the rate of urbanization (Setiawan, 2014).

Research conducted by Rafael Molinaro (2020) explains that the urban urbanization index is determined by several variables. Molinaro determines the variables that determine the urbanization index of the city, namely economic, social, environmental and governmental. Another study ranks several cities in the world based on their urbanization index. According to Arcandis, there are 3 variables that make up the urbanization city index are people, planet dan profit. The three variables have the same substances but have different benchmarks from the variables defined by Rafael Molinaro. From the urbanization research, it can

be concluded that a prosperous city and a good economy will attract residents to come from villages to cities.

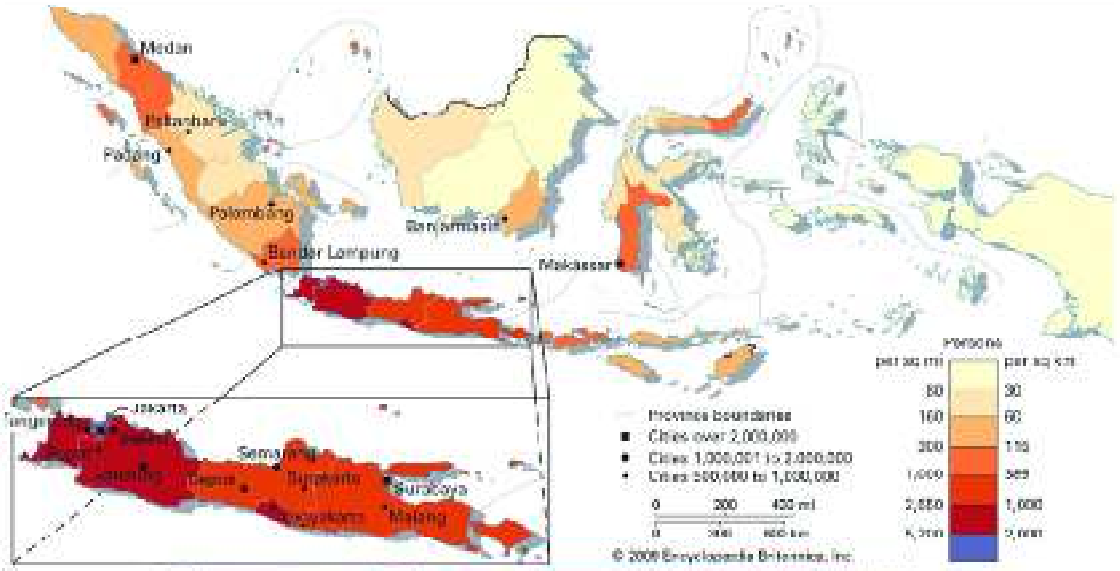

Figure 1.2 Population Density Distribution Map in Indonesia (Source: https://www.google.com/)

The urbanization process that occurs from time to time will cause population density. In Indonesia, the population density can be seen in **Figure 1.2**, where in 2018 the island of Java was the island with the highest density. The high population density in an area has various impacts. One of them has an impact on the health aspects of an area. This will increase the risk factors for spreading a disease, especially those that can spread through air, aerosols and contact, such as COVID-19.

COVID 19 is a disease caused by a virus in the same group as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) which attacks the respiratory tract of animals and humans. COVID-19 is easier to escape than the SARS virus. However, SARS was more deadly than COVID-19. The transmission of COVID-19 occurs through droplets exiting the infected body. Common symptoms experienced by people with COVID-19 are sneezing and coughing. COVID 19 is a virus that can move rapidly through fluids that leave the infected body (Yang, 6:29)

COVID-19 first appeared in Wuhan, China on November 17, 2019. COVID-19 emerged at the end of 2019 and spread rapidly throughout the world. COVID-19 has spread to 213 countries and 2 regions in as few months. The total number of confirmed cases of COVID-19 was 13,849,922 cases, died 589,828 cases, and recovered 8,249,155 (Worldmeter, 2020). The COVID-19 spread is slowly moving to various regions around Wuhan, Until January 30, 2020, WHO has declared a world emergency status. Countries on other continents are also infected with COVID-19. As of March, COVID-19 has spread throughout the world, including Indonesia. Indonesia is one of the countries in the world that has experienced the impact of COVID-19. This pandemic has caused anxiety and fear for all Indonesian people because it can be transmitted easily through humans.

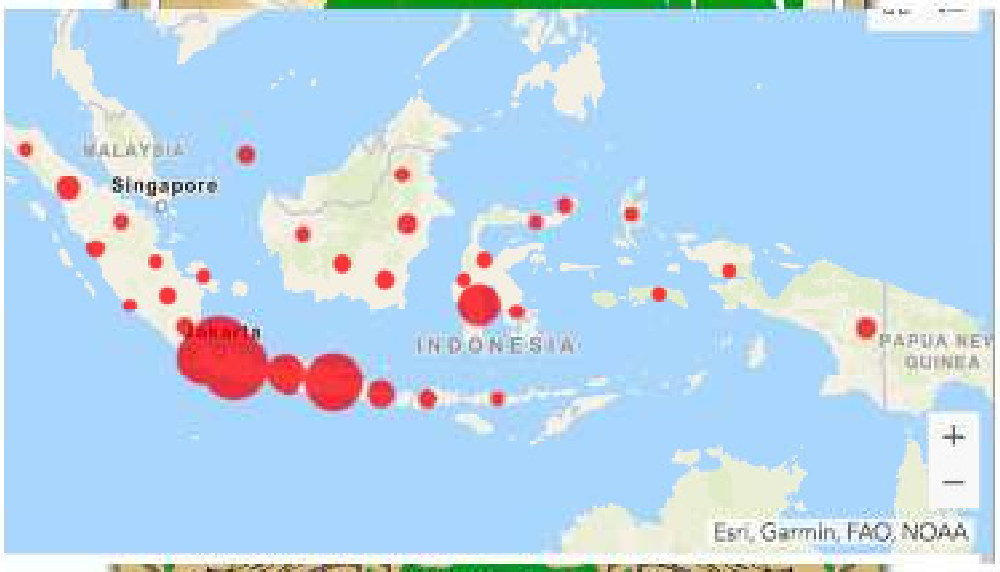

Figure 1.3 Map COVID-19 Spread in Indonesia
(Source: https://www.cnbcindonesia.com/, accessed on August 25, 2020)

The first and second cases of COVID-19 were announced by the Central Government on March 2, 2020 (Kompas, 2020). On August 27, 2020 the Satuan Tugas (SATGAS) handling COVID-19 reported 162,884 confirmed positive cases, 118,575 patients recovered, and 7,064 died. Map of the spread of COVID-19 can be seen in **Figure 1.3**. It can be seen that COVID-19 has spread in almost all regions of Indonesia. The table for the order of 10 cities with the urbanization index according to Arcaadis can be seen in **Table 1.1.**

Table 1.1 Urbanization Index and Total Cases COVID-19

No	City	Rank	Total Cases (23 December 2020)
1	Zurich	1	413.991
2	London	5	1.772.635
3	Munich	10	293.000
4	Amsterdam	11	121.333
5	Edinburgh	13	113.050
6	Madrid	20	377.921
7	Rome	22	150.223
8	New York	26	871.155
9	Sao Paulo	79	1.388.043
10	Jakarta	88	165.888

Based on the **Table 1.1**, it can be seen that cities that have a high urbanization index also have a large number of cases. the number of cases that occurred was more than 100,000 cases. Areas of transmission for COVID-19 around the world are densely populated areas. causes COVID-19 to spread easily. Busy city activities also affect the urbanization conditions in the city. In other words, urbanization in an area can be a contributing factor to the spread of COVID-19. Therefore, it is necessary to study the effect of the urbanization index of a city on the COVID-19 spread.

1.2 Problem Statement

The problem statement from this research is how is the relationship between urbanization index (economic, social, environmental and government) in a city with the COVID-19 spread.

1.3 Research Objective

The purpose of this study was to determine the effect of urbanization city index to COVID-19 spread.

1.4 Research Scope

This research is focused on 34 cities which are provincial capitals in Indonesia.

1.5 Outline of Report

The outlines of this research report are as follows:

CHAPTER I INTRODUCTION

This chapter consists of the background of the research, problem statement, objective of the research, scope of the problem, and outline of the report.

CHAPTER II LITERATURE REVIEW

This chapter presents the literature review related to the research consists of COVID-19, Urbanization, SMART-PLS, and Delphi Method.

CHAPTER III RESEARCH METHODOLOGY

This chapter describes the methodology consist of preliminary studies, literature studies, problem identification, research variable identification, conceptual framework, conducted hypothesis, data collecting, data processing, discussion, and conclusions.

CHAPTER IV DATA COLLECTING AND PROCESSING

This chapter consists of steps to do collecting and processing data by using SMARTPLS application. The steps of SMARTPLS consists of outer model testing, inner model testing, and hypothesis testing.

CHAPTER V DISCUSSION

This chapter presents the discussion in the model and the relation of the variable.

CHAPTER VI CONCLUSION

This chapter consists of conclusions and recommendations

CHAPTER II
LITERATURE REVIEW

The chapter describes the theories and preliminary studies boundary of the research.

2.1 Urbanization

One of the problems facing cities in developing countries is the rapid increase in urban population, as a result of births and especially by the large-scale population movement from rural to urban areas (urbanization). Urbanization is one of the factors triggering city development.

2.1.1 Definition of Urbanization

Urbanization is a world phenomenon. This is a process of relative growth in a country's urban population accompanied by a faster increase in the economic, political, and cultural interests of a city relative to rural areas. The term "urbanization" describes an increase in human habitation associated with an increase in energy consumption and per capita resources, and extensive landscape modification (McDonnell, 1990).

Urbanization is popularly defined as the movement of people from rural to urban areas. Urbanization is defined as the movement of people from rural to urban areas, but this understanding does not always correctly refer to contextual conditions (Tjiptoherijanto, 1999). The actual urbanization is the proportion of the population living in urban areas. Urban (urban area) is not the same as a city (city). What is meant by urban (urban) is an area or region that meets three requirements, namely a population density of 5000 people or more per square km, the number of households working in the agricultural sector is 25% or less and has 8 or more types of urban facilities. The increase in population living in urban areas can be

caused by several factors, namely natural growth that occurs in such areas, migration of people both from other cities and from rural areas, annexation, and reclassification.

Urbanization is not only seen as a population phenomenon but more than that, urbanization must be seen as a political, social, cultural, and economic phenomenon. From various studies show that the more advanced the economic level of a region, the higher the level of urbanization. Thus, urbanization is a natural phenomenon that is in line with economic development and the level of welfare of the population in an area. The thing that must be considered or avoided concerning urbanization is the existence of high or excessive population concentrations in an area, giving rise to what is called agglomeration or virtue (Tjiptoherijanto, 1999).

There are some perspectives of urbanization. First, in the case of demographics where urbanization is seen as a process that is demonstrated through changes in population in an area. This means that the process of urbanization is more emphasized on the aspect of the population in the sense of population explosion that occurs both in rural and urban areas that are considered to tend to exceed the carrying capacity of the region. The impact caused by an increase in population will certainly have its consequences for the need for housing facilities. Second, from the economic side. In this case, urbanization can be considered as a process of structural change in the economic field that can be observed in the difference of changes in the work of rural communities from the agricultural sector which then turns into non-racist workers in the city. Third, from the perspective of behavior that is more focused on the process of human adaptation to situations that experience changes both caused by technological developments and the consequences arising from the emergence of new developments in human life.

Fourth, from the aspect of sociology, in this case, urbanization is associated with changes in the lifestyle of villagers as a result of the influence of

urban society. And fifth from a geographical perspective. A gradual increase in the number of people living in urban areas and how each society adapts to this change. This specifically refers to the process of forming cities to become bigger because more people are starting to live and work in the area. In this case, urbanization is seen as a process of break out, diffusion of changes, and patterns according to time and place. Urbanization is triggered by differences in the growth or uneven break out of facilities from development, especially between rural and urban areas. As a result, urban areas become attractive magnets for urbanites to find work (Nuranap, 2013).

2.1.2 History of Urbanization

The human world has experienced three major changes in settlement patterns and organization, two of which are revolutionary. The first major revolution was the transition from hunting and fishing to agriculture, and it happened in the Neolithic Age. Previously, groups of hunters and gatherers living in houses settled in units and then in groups of dwellings, which were established to last longer than the season; and even today people can call that group "village". The beginning of these rural settlements, replacing the condition of no settlements at all, was associated with a relatively large population increase. Before that time, humans, as a whole, were at most only a few million; but with the adoption of sedentary agriculture, the human population soon reached tens of millions (United Nation, 2018).

The second major change - the transition from revolution - is what appears, even by modern standards, to be designated as a "city". It is now generally agreed that this development took place for the first time in the Mesopotamian region (now Iraq) soon after 3500 BC. The seeds of urban ideas are then gradually brought to other parts, especially to the Nile Valley (Egypt), the Indus Valley (Pakistan); and, subsequently, Hoang-ho Valley (China). This historical review, and in particular the latest historical trends, must recognize that cities have changed simultaneously in their quantitative and qualitative aspects

(United Nations, 2014). From the development of the earliest cities in Mesopotamia and Egypt to the 18th century, there was a balance between the majority of the population involved in subsistence agriculture in the rural context, and small population centers in cities where economic activity consisted mainly of trade in marketing and producing on a small scale. Due to primitive and relatively stagnant agricultural conditions during this period, the ratio of rural to urban populations remained at a fixed equilibrium. Also, a significant increase can be traced to Mughal India, where 15% of the population lived in urban centers during the 16-17 century, higher than in Europe at the time (Pablo, 2009).

Urbanization break out rapidly throughout the Western world and, since the 1950s, urbanization also began to take effect in Africa and Asia. At the turn of the 20th century, only 15% of the world's population lived in cities. In June 2016, Yale University published urbanization data from 3700 BC to 2000 AD, the data was used to make a video showing the development of cities in the world during that time period (United Nations, 2014). From a demographic point of view, the index urbanization is measured by the percentage of the population living in urban areas. In some cases, urbanization has a strong relationship with the level of economic development, where developed countries have higher rates of urbanization than developing countries. Weisman states that there are two dominant patterns of urbanization in the world. Urbanization on a regional scale. On a national scale, there is an increase in concentration and human production in one or several places in Indonesia in the form of large metropolitan agglomeration.

2.1.3 Factor of Urbanization

Factors affecting the probability of a person moving from a rural area to an urban area have been investigated literally in thousands of studies, and many useful generalizations have emerged. Factors that influence urbanization are as follows:

1. Changes in technology that are not balanced.
2. International economic relations. The concentration of exports in one sector and imports in another can weaken or promote. the internal structural transformation which usually results in urbanization.
3. Population growth rate. High natural rates, in this case, a faster natural rate of increase, albeit similar in rural and urban areas, will depress rural income more than urban areas and lead to accelerated urbanization.
4. Institutional arrangements that govern the relationships between factors of production. Likewise, the financial system makes capital formation easier in urban areas than in rural areas. In a more general sense, price and tax deviations that discriminate against rural areas are very broad and may encourage migration to urban areas.
5. Bias in government services Health and education expenditure in less developed countries is directed toward urban areas disproportionately with the size of the urban population, inertia, government policies regarding migration.

The main pull factors for migration from urban areas are the expectation of opportunities for increased income or better wages and the main driving factors for migration from rural areas are conditions in rural areas due to overpopulation and low agricultural productivity (Kaida, 1992). The strong and weak drivers of attraction of migration factors in Asian countries led to the rapid growth of the urban informal sector and resulted in the expansion of slums around big cities (Kaida, 1992).

Charles Wynne-Hammond in Budianto (2001) argues that there are 8 (eight) factors driving urbanization, namely:

1. Progress in agriculture. The existence of mechanization in the field of agriculture encourages 2 (two) things, namely firstly the withdrawal of some agricultural workers to the city to become industrial workers; second, the increase in agricultural output to ensure the needs of people who live from agriculture.

2. Industrialization, because industries are dependent on raw materials and sources of power, factories are established in their surrounding locations.
3. Market potential, where the development of light industry has given rise to cities offering themselves as markets for results being passed on to rural areas. The trade cities then attracted new workers from the countryside.
4. Increased service activities, in which industries and quarters grow and increase trade, living standards, and spur the emergence of economic and social organizations. Various types of services grow in urban areas
5. Progress of transportation; where the progress of communication is driving the advance of population mobility, especially from rural towns to nearby cities.
6. Social and cultural attraction; where many interesting things like recreation areas and others.
7. Educational progress.
8. Natural population growth.

2.1.4 Urban City

Urban cities are created and further developed by the process of urbanization. Urban areas are measured for various purposes, including analyzing population density and urban break out. Urban City (urban area) or building area, is a human settlement with high population density and built environment infrastructure. Urban areas are created through urbanization and are categorized based on urban morphology as cities, towns, cities, or towns. In urbanism, this term contrasts with rural areas such as villages and hamlets; in urban sociology or urban anthropology, in contrast to the natural environment.

The creation of the initial predecessors of urban areas during the urban revolution led to the creation of human civilization with modern urban planning, which together with other human activities such as exploitation of natural resources caused human impacts on the environment. "The agglomeration effect"

is on the list of the main consequences of increasing the level of company creation since then. This is caused by conditions created by greater levels of industrial activity in certain regions. However, a favorable environment for human resource development will also be produced simultaneously (Baten, 2003).

Urban City is simply defined, is urban life. Thus, the size of urbanity is usually different from non-urban life and is subject to the definition of the urban area. Urbanity characterizes the existence of conditions at a particular time point that is specific to urban areas or present in urban areas at a level that is much bigger or smaller than in non-urban areas. A focus on urbanity is important for public health assessments about prioritizing current needs and approaches (Ompad, 2007). Urbanization will create the development of cities and subsequently, the presence of big cities will lead to a more dynamic process of economic development and social transformation. The concept of a smart city (smart city) which is a big issue in big cities around the world encourages the active role and participation of the community in city management.

2.1.5 Urbanization City Index

Urbanization index is a number used to determine the level of urbanization of an area. the urbanization process in an area is influenced by the internal and external conditions of the region. This important influence is known as the sub-index. According to Arcandis (2016) the urbanization sub-index is people, planets, and profits. The three sub-indices have an important effect in determining the level of urbanization of a city. Arcandis Journal has ranked 100 random cities worldwide based on this sub-index. Most of the cities that are in the highest ranking are cities in developed countries, and are industrial cities. Table sub-index and indicator of Urbanization City Index by Arcandis can be seen in **Table 2.1.**

Based on Rafael Molinaro (2020) the Urbanization Index is a number that interprets the meaning of the progress of a city's development. The index can be determined by taking into account the economic, social, environmental and government conditions of a city. The interest of a city in increasing the urbanization index is influenced by the demands and needs of the city community.

2.2. COVID-19

The latest viral coronavirus (SARS-CoV-2) and the disease called Coronavirus disease 2019 (COVID-19) beginning in 2020. The break out of COVID-19 is rapid and widebreak out because it can be transmitted through human-to-human contact. Coronavirus is a collection of viruses that can infect the respiratory system. In many cases, this virus only causes mild respiratory infections, such as flu. However, this virus can also cause severe respiratory infections, such as lung infections (pneumonia).

2.2.1. Definition of COVID-19

COVID-19 is an infectious disease caused by a newly discovered coronavirus. Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus2 (SARS-CoV-2). SARS-CoV-2 is a new type of coronavirus that has never been identified before in humans. The COVID-19 virus break outs mainly through droplets or coming out of the nose when an infected person coughs or sneezes (WHO, 2020). Initially, the disease was temporarily named as the 2019 novel coronavirus (2019-nCoV), then WHO announced a new name on February 11, 2020, namely Coronavirus Disease (COVID-19) caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) virus.

COVID-19 is a new type of Coronavirus which was later named SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2). This virus comes from the same family as the virus that causes SARS and MERS. Although

coming from the same family, SARS-CoV-2 is more infectious compared to SARS-CoV and MERS-CoV (CDC China, 2020).

2.2.2. History of COVID-19

The scientists first isolated the coronavirus in 1937 which caused infectious bronchitis in poultry. The first description of human coronavirus a family of viruses that now includes SARS-CoV-2, the cause of the current void-19 pandemic was published in The BMJ in 1965. The research, led by virologist David Tyrrell at the common cold Unit in Wiltshire, England, involved studying nasal washings from volunteers. The researchers found that they could grow several viruses associated with the common cold, but not all of them. One such sample referred to as B814, turned out to be what we now know as a coronavirus. The virus was then imaged for the first time by Juni Almeida, a virologist known as a pioneer of a new method of imaging and diagnosis of viral writing to Nature in 1968, describing their findings and naming the family coronavirus virus (WHO, 2020).

This virus comes from the same family as the virus that causes SARS and MERS. Although coming from the same family, SARS-CoV-2 is more infectious compared to SARS-CoV and MERS-CoV (CDC China, 2020). Based on the results of epidemiological investigations, the case was allegedly related to the Seafood Market in Wuhan. On January 7, 2020, the Chinese Government then announced that the cause of the case was a new type of Coronavirus which was later named SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2).

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by a new type of Coronavirus. This disease begins with the emergence of an unknown case of pneumonia in etiology in Wuhan, China at the end of December 20, 2019 (Li et al, 2020). On December 31, 2019, the WHO China Country Office reported a case of pneumonia of unknown etiology in Wuhan City, Hubei Province, China. The first outbreak of COVID-19 disease in Wuhan, China in

December 2019. (Worldmeter, 2020). On January 30, 2020, WHO designated the event as the World Health Anxiety (KKMMD) / Public Health Emergency of International Concern (PHEIC), and on March 11, 2020, WHO designated COVID-19 as a pandemic (WHO, 2020). Positive cases due to this virus have reached 2.7 million worldwide where the United States, Spain, and Italy occupy the top three ranks as the country with the highest cases in the world, leaving China was the initial break out of this virus (Worldmeter, 2020).

Thailand was the first country outside of China to report a COVID-19 case. After Thailand, the next countries to report the first case of COVID-19 were Japan and South Korea which then expanded to other countries. As of 30 June 2020, WHO reported 10,185,374 confirmed cases with 503,862 deaths worldwide (CFR 4.9%).The countries that reported the most confirmed cases were the United States, Brazil, Russia, India, and the United Kingdom. Meanwhile, the countries with the highest mortality rates are the United States, United Kingdom, Italy, France, and Spain (WHO, 2020). Indonesia reported its first COVID-19 case on March 2, 2020, and the number continues to grow today. On June 30, 2020, the Ministry of Health reported 56,385 COVID-19 cases confirmed with 2,875 deaths (CFR 5.1%) break out across 34 provinces (Source: Ministry of Health RI, 2020).

2.2.3. Break out of COVID-19

Coronavirus is a zoonosis (transmitted between animals and humans). Research says that SARS-CoV is transmitted from human (mongoose cats), MERS-CoV from human camels, and SARS-CoV-2 animals which are sources of COVID-19 transmission that are still unknown (Indonesian Ministry of Health, 2020). At present, the break out of SARS-CoV-2 from human to human is the main transmission source so that its break out becomes more aggressive. Transmission of SARS-CoV-2 from symptomatic patients occurs through drops that come out when coughing or sneezing (WHO, 2020).

This transmission occurs generally through droplets and contact with viruses then the virus can enter the open mucosa. An analysis attempts to measure transmission rates based on the incubation period, symptoms, and duration between symptoms and isolated patients. The analysis obtained the results of transmission from 1 patient to about 3 people around him, but the possibility of transmission in the incubation period causes the patient to contact people around longer so that the risk of contact from one patient may be greater (PDPI, 2020).

2.2.4. Risk Factor of COVID-19

Some other risk factors determined by the Centers for Disease Control and Prevention (CDC) are close contact, including living with a COVID-19 patient and a history of travel to the affected area. Being in one environment but not in close contact (within a 2-meter radius) is considered low risk. Comorbid hypertension and diabetes mellitus, male sex, and active smokers are risk factors for SARS-CoV-2 infection. Cancer patients and chronic liver disease are more susceptible to SARS-CoV-2 infection.

2.2.5. Sign and Symptoms of COVID-19

The symptoms experienced are usually mild and appear gradually. Some infected people don't show any symptoms and still feel healthy. The most common symptoms of COVID-19 are fever, fatigue, and dry cough. Some patients may experience aches and pains, nasal congestion, colds, headaches, conjunctivitis, sore throats, diarrhea, loss of smell, and smells or skin rashes (Kemenkes RI, 2020). Based on the Readiness Guidelines for Novel Coronavirus Infection (2019-nCov), January 2020, an operational definition is made: A person who has a fever (≥38° C) or has a history of fever accompanied by cough / runny nose / sore throat mild to severe pneumonia based on clinical symptoms and/or radiological features. For some people, the symptoms can be more severe and can cause pneumonia or difficulty breathing. Symptoms of COVID-19

generally appear within 2 days to 2 weeks after the patient is exposed to the Coronavirus.

An infected person can directly transmit it up to 48 hours before the symptom onset (presymptomatic) and up to 14 days after the symptom onset. A study by CDC (2020) reported that 12.6% showed presymptomatic transmission. It is important to know the presymptomatic period because it allows the virus to break out through droplets or contact with contaminated objects. Besides, there are asymptomatic cases in confirmation, although the risk of transmission is very low, there is still a small possibility of transmission. The incubation period for COVID-19 averages 5-6 days, with a range between 1 and 14 days but can reach 14 days. The highest risk of transmission is obtained in the first days of the disease due to the high concentration of the virus in the secretions.

2.2.6. Pandemic

The word "pandemic" comes from the Greek native pan which means a demonstration of "all" and "people", and this word is usually used to refer to the widebreak out epidemic of infectious diseases in all countries or one continent or more. at the same time (Porta, 2008). But the internationally accepted definition of a pandemic such as the one that appears in the Epidemiology Dictionary is direct and well-known: "epidemics that occur throughout the world, or in very large areas, cross international borders, and usually affect many people" (Harris, 2000).

2.2.7. Impact of Pandemic

Outbreaks of infectious diseases can easily cross borders to threaten economic and regional stability, as has been demonstrated by HIV, H1N1, H5N1, and SARS epidemics and pandemics (Verikios, etl, 2015). This also has an impact such as:

A. Health Effect

The disease of infectious diseases, including pandemics and outbreaks of infectious diseases that arise, has the potential to cause high morbidity and mortality in the world, and in fact, they can cause one-quarter to one-third of global deaths (Verikios et al., 2015). In some developing countries, both pandemics and infectious diseases have the potential to kill many people's claims, and the likelihood of death is in the range of 5 to 10 percent (Kern, 2016).

B. Economic Impact

The impact of economic losses can lead to economic instability. The Global Health Risk Framework for the Future (GHRF) estimates that each year the average outbreak of infectious diseases costs around 60 billion US dollars for world direct costs (Maurice, 2016). Pandemics have direct and long-term effects that can damage a country's economic life for years to come.

C. Social Impacts

The social impact of the pandemic is very severe, including very limited travel, and schools are closed, markets and sports are closed. All of this is a reality that is likely to emerge as a pandemic with high morbidity and mortality potential. With the rapid development in world aviation over the past two decades, the risk of a global pandemic has increased with increasing passenger traffic. With modern and efficient air travel, SARS, which originated in southern China, was quickly transmitted to more than 30 countries in early 2003 (Wong, 2007).

D. Security Impacts

Pandemic is no longer just the domain of public health and clinical medicine, but it is a social problem, a development problem, and a global security problem. The commission of the Global Health Risk Framework for the Future

(GHRF) published a book in early 2016 entitled "Neglected Global Security Dimensions - Framework for Tackling the Crisis of Infectious Diseases". The key statement sounds like that: "Pandemics destroy human life and livelihoods as do war, financial crisis. Therefore, the prevention and response of a pandemic must be treated as an important principle of national and global security - not just a health problem"(Kern 2016).

The break out and impact of the COVID-19 crisis provide a clear picture of how complexity in international relations begins with cities. Smart cities are intended to use urban technology and information technology to improve service efficiency. This allows city officials to interact directly with the community and the city's infrastructure. This is where smart city technology plays an important role. Technology that combines citizen reporting and artificial censorship (AI) will help governments formulate data-based decisions to address pandemics based on real situations on the ground. Transparent, fast, and accurate decisions can also provide certainty and calm to the community. Solutions through the smart city platform will help the government effectively reduce the break out of COVID-19 by utilizing AI-based data and sensors while helping to restore public confidence, which has declined since the COVID-19 case (Kurniawan, 2020). In the context of the COVID-19 pandemic, the strategy of building city resilience through a network of cities from various countries to exchange and produce practical examples of how cities with the challenges of rapid urbanization, and with conditions of the population at the level of middle to lower-income, can build cities that are resistant to various impacts, especially now facing the COVID-19 pandemic.

2.3 Partial Least Square (PLS)

Data analysis techniques using Structural Equation Modeling (SEM), conducted to explain thoroughly the relationship between variables in SEM research is a set of statistical techniques that allow testing a series of relationships

simultaneously. The relationship is built between one or several independent variables (Santoso, 2011).

2.3.1 Definition of Partial Least Square (PLS)

Structural Equation Modeling (SEM) is a statistical technique that can analyze the pattern of relationships between latent constructs and indicators, latent constructs with each other, and direct measurement errors. SEM enables analysis between several dependent variables and independent variables directly. SEM becomes a fairly powerful analytical technique because it considers interaction modeling, nonlinearity, correlated independent variables, measurement errors, correlated error terms, multiple latent independent variables in multiple where each is measured by many indicators, and one or two variables depending on latency which is also each measured by several indicators. (Hair et al, 2006).

Structural Equation Model (SEM) includes several statistical methodologies intended to estimate the network of causal relationships, defined according to theoretical models, connecting two or more latent complex concepts, each measured through several observable indicators (Kaplan, 2000). This PLS was first introduced in general by Herman Wold in 1974. According to Ghozali (2011), PLS is an alternative approach that shifted from the covariant-based SEM approach to variant-based. Covariant-based SEM generally tests causality or theory models, while PLS is more predictive. PLS is characterized as the most suitable technique in which the purpose of the research is a prediction or exploratory modeling. In general, covariance-based SEM is preferred when the research objective is confirmatory modeling. PLS is unsatisfactory as an explanation technique because it is low in power to filter out minor causal importance variables (Tobias, 1997).

2.3.2 SMARTPLS

PLS can be implemented as a regression model, predicting one or more dependents from a set of one or more independent; or it can be implemented as a path model, handling causal paths that connect predictors as well as paths that

connect predictors to response variables. PLS is implemented as a regression model by SPSS and by SAS PROC PLS. SMARTPLS is the most common implementation as a pathway model. On the response, PLS can link a set of independent variables to multiple dependent variables (responses). On the predictor side, PLS can handle many independent variables, even when predictors display multicollinearity (Garson, 2016).

The advantages of PLS include the ability to model many dependents as well as many independents, the ability to deal with multicollinearity among the independent, robustness in the face of data noise and data loss, and make latent independent variables directly based on cross-products involving response variables, thus making stronger predictions. The advantages of PLS include greater difficulty in interpreting the burden of independent latent variables (based on cross-product relationships with response variables, not based on analysis of common factors in covariance among independent manifests) and because the nature of the estimated break out is unknown, researchers cannot assess significance except through bootstrap induction (Garson, 2016).

Overall, a mixture of strengths and weaknesses means PLS is preferred as a prediction technique and not as an interpretive technique, except for exploratory analysis as the beginning of interpretive techniques such as multiple linear regression or covariance-based structural equation modeling. The Consistent PLS (PLSS) is proposed to correct reflective constructs' correlations to make estimation results consistent with a factor model. In SmartPLS v3, the developers have added: "Consistent PLS Algorithm" and "Consistent PLS Bootstrapping" to account for the correlations among reflective factors (Kwong, 2013).

2.3.3 PLS Algorithm

PLS is used to find the fundamental relationship between two matrices (X and Y), which is the latent variable approach to modeling the covariance structure in these two spaces. The PLS model will try to find the multidimensional direction in X space which explains the direction of the maximum multidimensional variance in Y space. PLS regression is very suitable when the predictor matrix has more variables than observations, and when there is multicollinearity between X values.

The steps in the PLS-SEM algorithm, as explained by Henseler, Ringle, & Sarstedt (2015), are summarized below:

1. Before applying the PLS algorithm, the measured indicator variables are normalized to have an average of 0 and a standard deviation of 1. In this context, normalized means standard. PLS requires a score of standardized latent variables, and because the latent variables in PLS are linear combinations of indicator variables, indicator variables need to be standardized. The consequence is that the coefficient of the measurement pathway (outer model) and structural (inner model) varies from 0 to plus or minus 1, with the path closest to absolute 1 being the strongest.
2. In the first stage of the PLS algorithm, the measured indicator variables are used to score the components X and Y. To do this, an iterative process is used, repeatedly through four steps:

I. The latent variable score is given an initial estimate based on the score of the indicator with the same weight.

II. Initial weighting is assigned to the structural path (in) which connects latent variables using a path weighting scheme based on regression, to maximize the R-squared of each endogenous latent variable. That is, the component score as predicted in the given iteration is used to calculate the weight of the structural trajectory. Put the third way, using regression, successive iterations adjust the structural weights to maximize the strength of the relationship between pairs of scores X and Y respectively

by maximizing the covariance of each score- X with variable Y. This maximizes the variance explained by the dependent component.

III. Structural weights (in) are used to adjust the estimation of latent variable scores.

IV. Measurement weights (outside) that connect latent variables to indicator variables are estimated to be different, depending on whether the model is reflective or formative. For ordinary reflective models, with arrows from the latent variable to the indicator variable, the weight of the measurement path is based on the covariance between the estimated latent variable and the indicator variable. If the model is formative, with the arrow switching from the indicator to the latent variable, the weight of the measurement path is based on the regression of the latent variable on the indicator.

The overall result of the PLS algorithm is that component X is used to predict the component Y score, and the predicted component Y score is used to predict the actual value of the measured Y variable. This strategy means that while the original variable X may be multi-collinear, the X component used to predict Y will be orthogonal. Also, the variable X might have missing values, but there will be a score calculated for each case in each component X. Finally, because only a few components (often two or three) will be used in the prediction, the PLS coefficient can be calculated even when there may be more there are more original X variables than observations (although the results are more reliable in more cases) (Wijaya, 2016).

2.3.4 Soft System Methodology SSM

Soft System Methodology was introduced by Peter Checkland in 1999. Martin et al. (2008) stated that SSM was developed to deal with management problems arising from human activity systems, such as conflicts. Furthermore, it is stated that SSM is a problem-solving framework (framework) designed specifically for situations where the nature of the problem is difficult to define.

Checkland and Poulter (2006) state that, soft system methodology is implemented through seven stages. The seven stages of soft system methodology according to Checkland and Poulter (2006), namely:

1. Description of the problem, namely starting to recognize the problem that is happening.
2. Describing the problem situation into a rich picture diagram, namely sketching the real problem situation into a large rich picture diagram (helicopter view).
3. Defining the keywords (root definitions), which is to collect keywords that must be defined as a textual and concise business process path. From this Root Definition, it is mapped into CATWOE- elements (Client, Actor, Transformation, World view, owner, environment).
4. Creating a system model based on root definitions.
5. Comparing the model with the real situation.
6. Make changes/adjustments.
7. Make repairs/solutions for the recommended system.

The benefits of using SSM according to Delbridge (2008) are

1. Increase the holistic understanding of the parties being explored on the case at hand;
2. The use of SSM allows the learning process to be shared with all parties involved;
3. The process of innovation in solving problems can be explored together to give birth to many alternative solutions.

Currently, Soft Systems Methodology (SSM) is not only SSM classic, whose implementation consists of seven stages according to the theory presented by Checkland. However, SSM itself is a methodology that is used to deal with unstructured problems and continuously changes dynamically by using a variety of analysis tools or tools that can be used, so that it can find a balance between elements.

2.3.5 Delphi Method

The definition is a group process that involves the interaction between the researcher and a group of experts on a particular topic; usually through the help of a questionnaire. This method is used to gain consensus on future projections/trends using a systematic information gathering process. This method is useful when the opinions and judgments of experts and practitioners are needed in solving problems. This will be very useful when the experts cannot be present at the same time.

The advantages of the Delphi Method:

1. The existing problem cannot be solved using empirical analysis methods but rather a collective subjective assessment.
2. It takes several people to contribute to providing an assessment of complex problems that represent different backgrounds and experiences.
3. More people are needed to be able to interact face to face.
4. Do not allow time and money for regular meetings.
5. The process of group communication in this method can increase the efficiency of the meeting.
6. Differences of opinion between individuals are strong so that the communication process requires rules of the game and is carried out anonymously.
7. The heterogeneity of the participants must be ensured to ensure the validity of the result, this is to avoid domination by certain parties in the panel (known as the bandwagon effect).

2.4 Preliminary Studies

There are preliminary research that related to this research. Variable and Indicator of preliminary research can be seen in **Table 2.1.**

Table 2.1 Variables and Indicators Used in Preliminary Research

No	Title	Variable	Indicator
1	SUSTAINABLE CITIES INDEX 2015 (Arcandis, 2015)	People	Transport Infrastructure
			Health
			Education
			Income Inequality
			Work-life balance
			The dependency ratio
			Green Spaces within cities
		Planet	City energy consumption and renewable energy share
			Recycling rates
			Greenhouse gas emissions
			Natural catastrophe risk
			Drinking water
			Sanitation
			and air pollution.
		Profit	Business perspective
			combining measures of transport infrastructure (rail, air, other public transport and commuting time)
			Ease of doing business
			The city's importance in global economic networks
			Property and living costs
			GDP per capita
			Energy efficiency.

Table 2.1 Variables and Indicators Used in Preliminary Research (Continue)

No	Title	Variable	Indicator
2	STUDY OF IMPACT OF URBANIZATION AND RAPID URBAN EXPANSION IN JAVA AND JABODETABEK MEGACITY, INDONESIA (Andrea Emma Pravitasari, 2015)	Populat ion density	-
		Number of population	-
		Literacy rate (%)	-
		Average of per capita expenditure (Rp. 000)	-
		Entropy index1	index for measuring diversity of regional income/GDP
		Theil index2	index for measuring regional disparity using GDP/income per capita
		Scalogram index3	index for measuring urban development level by considering number of+G1:G30

Table 2.1 Variables and Indicators Used in Preliminary Research (Continue)

No	Title	Variable	Indicator
3	DEFINIING THE QUALITY OF URBAN LIFE (Eva Psatha, 2015)	Physical health	Energy and Fatique
			Pain and discomfort
			Sleep and rest
		Psychological	Bodily image and appearance
			Negative Feelings
			Positive Feelings
			Self Estem
			Thinking, learning, memory and concentration
		Level Independence	Mobility
			Activities of daily living
			Dependence on medical substances and medical aids
		Social Relations	Personal relationship
			social support
			sexual activity
		Environment	Financial resources
			Freedom, physical safety and security
			Health and social care: accessibility and quality
			Home environment
			Opportunities for acquiring new information and skills
			Participation in and opportunities for recreation/leisure
			Physical environment (pollution/noise/traffic/climate) transport
		Spirituality	Religion
			Personal Beliefs

Table 2.1 Variables and Indicators Used in Preliminary Research (Continue)

No	Title	Variable	Indicator
4	URBAN DEVELOPMENT INDEX, A COMPARISON BETWEEN THE CITY OF TIO DE JANEIRO AND FOUR OTHER GLOBAL CITIES (Rafael Molinaro, 2020)	economic indicator (EI)	GDP
			International companies
			Foreign direct investment
			Urban competitiveness
			Innovation
			Research and Development
		social indicator (SI)	Smart city
			Patents
			Education
			Universities
			Health
			Connectivity
			Immigration
			Freedom
			Socioeconomic Dependence
			Unemployment
		environment indicator (EnI)	Environmental impact
			Sustainability
			Urban density
			Urban mobility
			Quality of life
			Cost of living
			Residency
			Safety
		governmendi cator (GI)	Government Effectiveness
			Electronic Governance
			Tourism
			Urban planning and resilience
			Corruption
			Taxes
			Inflation
			Social
			equality

Table 2.1 Variables and Indicators Used in Preliminary Research (Continue)

No	Title	Variable	Indicator
5	A REVIEW OF VARIABLES OF URBAN STREET CONNECTIVITY FOR SPATIAL CONNECTION (WSNW Mohamad, 2014)	Link	Control Value
			Depth
			Intergration Clustering
			Coeficient
		Accessibility	Steps
			Depth
		Least Angle	Route Strategy
			Memorized
			Strategy
		Centrality	Degree
			Closeness
			betweeness
			Straightness
			Information

CHAPTER III
RESEARCH METHODOLOGY

The research methodology contains the stages carried out during the research process. The research methodology aims to find solutions to solving problems.

3.1 Preliminary Study

A preliminary study was conducted to find out concretely the conditions in the field and to know more clearly about the source of the data to be used in research. In this study, Preliminary studies that applied are literature studies. A literature study is done by studying theories related to research. A literature study is a useful stage to determine references that are relevant to the problems that occur. References that are sought can be in the form of theories or conclusions from previous studies. Theories are summarized related to urbanization, the urbanization level, pandemic, COVID-19, and COVID-19 spread. This literature study can support research and as a basis for discussion of the object under study.

3.2 Problem Identification

Problem identification is carried out to find problems related to the spread of COVID-19 factors. Problem identification was obtained from journals relating to COVID-19 as well as information from various sources on the internet. Pattern movement of people in the Java Island during COVID-19. The form of Javanese island communities made significant inter-regional movements during the February-April period (Shihab, 2:34). Therefore, statistical testing using SEM-PLS method is needed related to the effect of urbanization city index on the COVID-19 Spread.

3.3 Research Variables Identification

Variables are everything that is determined by researchers to be studied in order to obtain information that can then be concluded from that information (Sugiyono, 2010). The research variable is the nature or value of people and attributes, factors, and treatment of objects or activities that have certain variants that have been determined by researchers to be studied, and then conclusions can be drawn (Hermawan, 2019). The following is a research variable about the effect of urbanization on the spread of COVID-19. This step is done to identify the availability of data and indicators of each variable. These variables are identified based on preliminary research that has been reviewed.

3.3.1 Variable Urbanization City Index

The urbanization level in a city is an important variable in research. These variables are determined based on preliminary studies that have been conducted. The urbanization level has several sub-variables, namely economic, social, environment, and government. These four sub-variables are determined by several indicators on each sub variable. The variable urbanization were adapted from the journal Arcandis and the Journal of Rafael Molinora. These variables have been adjusted to the availability of data and the suitability of the data to conditions in Indonesia. The availability checked in bps website and ministry website.

3.3.2 Variable Spread of COVID-29

The variable of the spread of COVID-19 is the dependent variable in research. The covid-19 distribution variable is a very important variable to examine its relationship with the urbanization index. The following variables are collected from the official website which lists the number of COVID-19 cases.

3.4 Conceptual Framework

A conceptual framework is a unified framework of thought in order to find scientific answers to problems in research that explain about variables, the relationship between variables theoretically related to the results of previous studies whose truth can be empirically tested (Iskandar, 2008). The conceptual framework is built based on predetermined research variables. conceptual framework shows the indicators of each variable as well as the relationship between variables. These indicators are in accordance with the indicators identified in the previous step.

3.5 Methods Selection

Method selection was made to define the method of analysis suitable in research. This research uses the method Structural Equation Modeling - Partial Least Square (SEM - PLS). SEM- PLS as an appropriate analytical tool is used to test a series of relationships that are difficult to measure simultaneously. Structural Equation Modeling - Partial Least Square (SEM - PLS) is a multivariate analysis technique that combines factor analysis and regression analysis (correlation) which aims to examine the relationship between variables in a model, be it between indicators and their constructs, or the relationship between constructs. In research there are economic, social, environmental, governance and spread of COVID-19 variables. This variable cannot be measured directly so the researcher must use secondary data. If we use analysis regression, then each of these variables is assumed to be measured directly so we use the average or total score of the items. However, this method ignores measurement errors. SEM - PLS can complete the analysis with one time estimate where the other is solved by some equations regression.

3.6 Research Hypothesis

The hypothesis is a temporary answer to a research problem whose truth must be tested empirically (Nazir, 2009). Making hypotheses in research aims to be used as a reference in determining the next stage to make conclusions about the research to be conducted. The following are hypotheses in the research to be conducted:

1. Ho: Economic variables affect COVID-19 spread.
   Ha: Economic variable does not affect COVID-19 spread.
2. Ho: Social variable affects COVID-19 spread.
   Ha: Social variable does not affect COVID-19 spread.
3. Ho: Environmental variables affect COVID-19 spread.
   Ha: Environmental variable does not affect COVID-19 spread.
4. Ho: Government variables affect COVID-19 spread.
   Ha: Government variable does not affect COVID-19 spread.

3.7 Data Collection

The data collection stage in this research is to utilize data that is distributed on the internet. Data is collected by visiting official sites that provide data. The data used in this research is secondary data. Secondary data is data that is not obtained indirectly. The data needed in this study is in the form of the cities index and COVID-19 development data. The procedure of collecting and retrieving research data is carried out from the stage of determining the required data to visiting the official website that provides data. The official website consists of Badan Pusat Statistik (BPS), Bank Indonesia (BI), and also the ministry website. Data collection in this study was conducted to be used in the data processing.

3.8 Data Processing

Data processing in this study uses the Structural Equation Modeling-Partial Least Square method. Structural Equation Modeling (SEM) is a multivariate analysis technique that has been developed to cover the limitations of the previous analysis model that has been used in statistical research. The SEM method has better analytical skills compared to regression analysis and multiple paths because SEM can analyze variables or models to the deepest level. Partial Least Square (PLS) is an alternative model for Structural Equation Modeling (SEM). PLS aims to overcome limitations on the SEM method (Nur Meilita et al, 2006). SEM-PLS is an alternative technique in SEM analysis where the data used do not have to be multivariate in a normal spread. In SEM-PLS the value of latent variables can be estimated according to the linear combination of manifest variables related to a latent variable and treated to replace the manifest variable (Alodya et al, 2017). According to Nikmatus Sholiha and Mutiah (2015), the SEM-PLS Method consists of several steps as follows:

1. Designing structural models

   At this stage designing a structural model that describes the relationship between latent variables based on a substantive theory

2. Designing a measurement model

   At this stage designing a part of the SEM model that describes the relationship between latent variables or between exogenous variables and endogenous variables.

3. Make a path diagram (path diagram)

   Next is to make a diagram that connects the exogenous variables (independent) and endogenous variables (dependent).

4. Perform an SEM-PLS model evaluation

   There are two SEM-PLS model evaluations, they are structural model evaluation and measurement model. Evaluation of structural models in SEM-PLS is carried out by doing the R-squared (R2) test and a significant test through estimation of the path coefficient. While the evaluation of the measurement model consists of three stages, namely the

convergent validity test, discriminant validity test, and composite reliability test.

5. Conduct hypothesis testing

   Hypothesis testing consists of a t-test, mediation test, and coefficient of determination test.

3.8 Discussion

Discussions are an explanation of data processing that do according to the research objective. Every hypothesis was tested will be discussed to know how urbanization affects to COVID-19 spread.

3.9 Conclusion

The conclusion contains conclusions on the achievement of research objectives that have been done and recommendations for further research. The research flowchart can be seen in **Figure 3.2.**

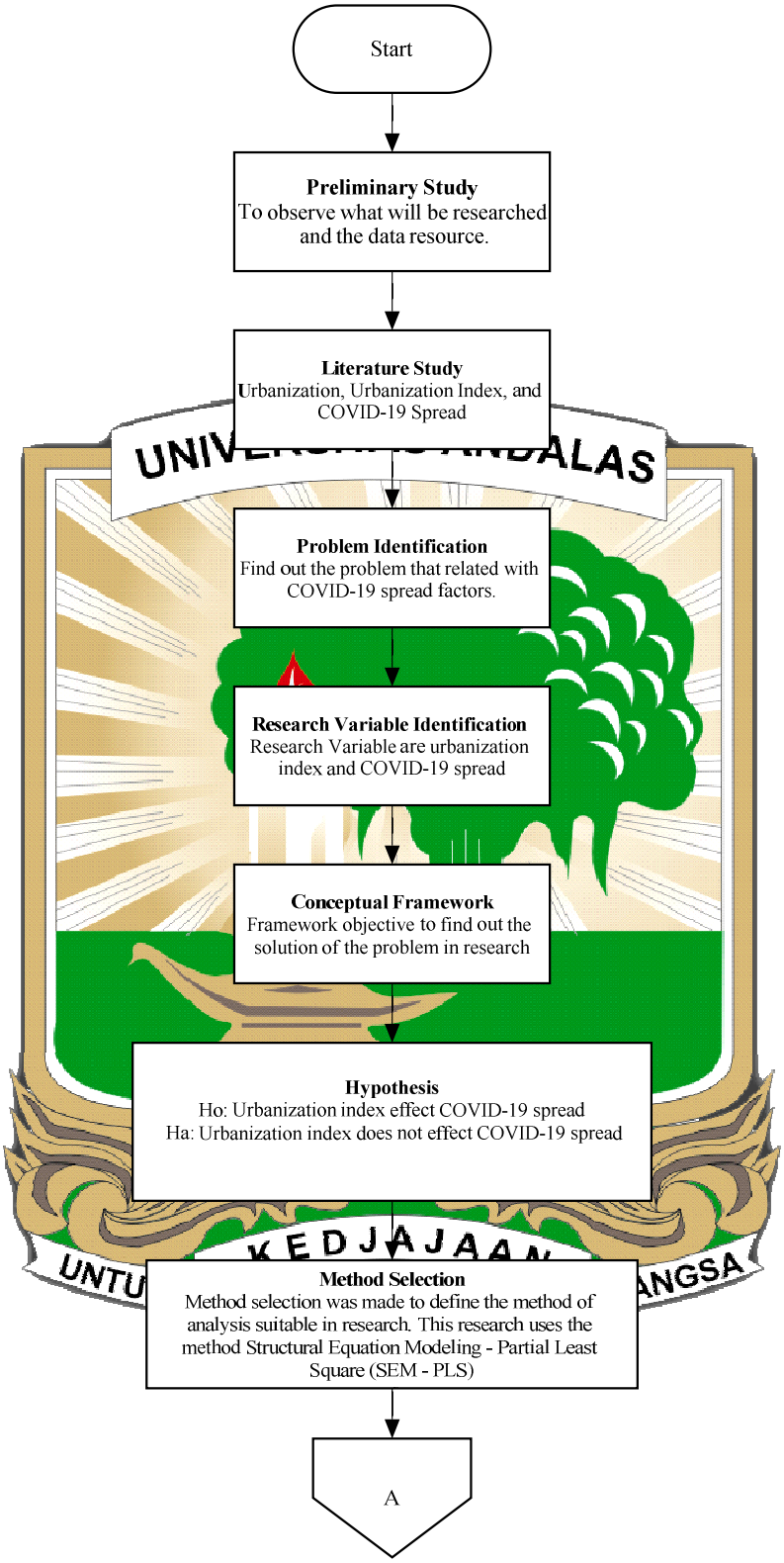

Figure 3.1 Research Flowchart

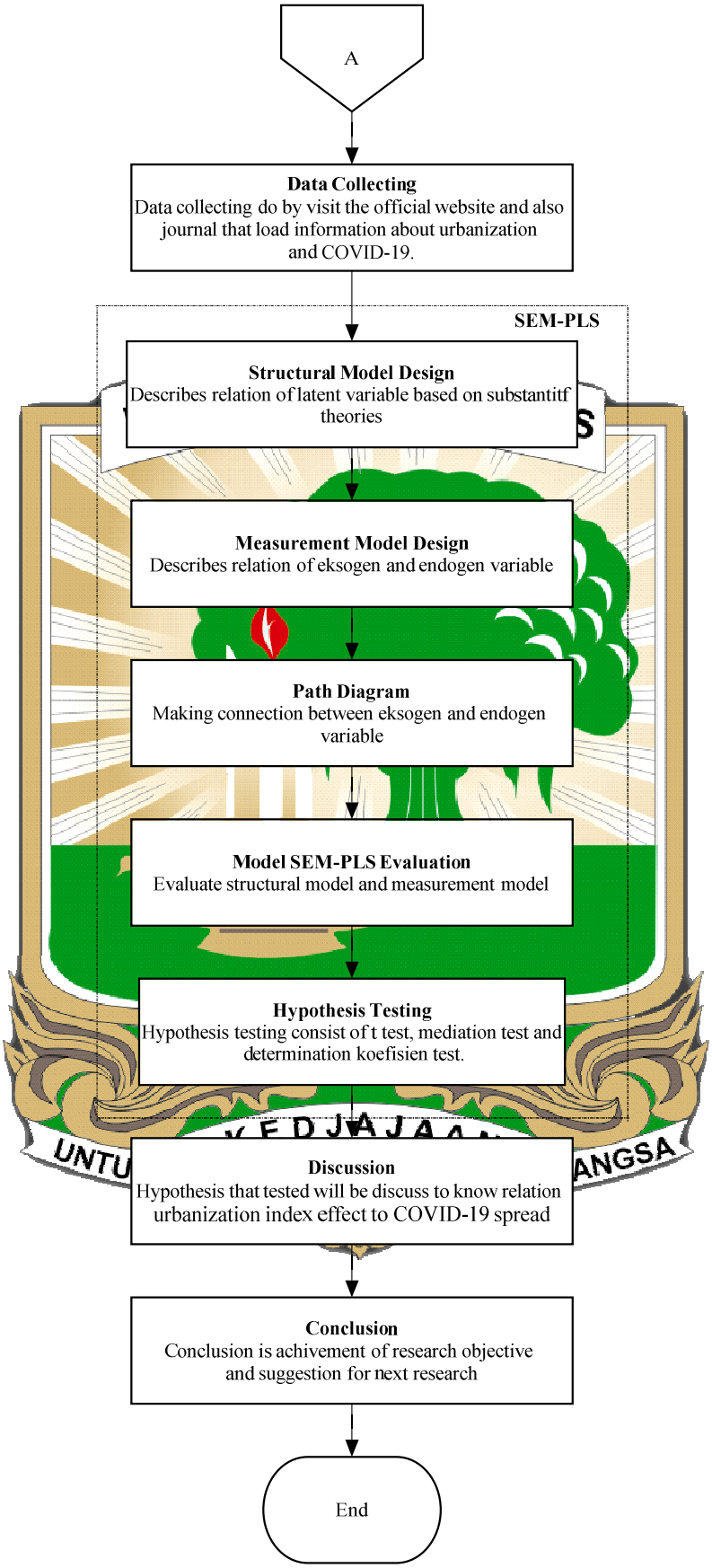

Figure 3.2 Research Flowchart (continue)

CHAPTER IV
DATA COLLECTION AND PROCESSING

4.1 Data Collection

Data collection is carried out by visiting official websites and journals that contain information related to urbanization and COVID-19. Based on the data that has been collected, there are two main variables in the study, namely the urbanization city index variable and the COVID-19 spread variable. The urbanization index variable is defined by 4 sub-variables, namely economic, social, environmental, and governmental. The sub-variables are obtained by adapting the variables from several preliminary studies which can be seen in **Table 2.1.** The next step is examine the resource data. Variables that do not have enough data are eliminated.

4.1.1 Variables Validation

Variables are collected from several sources. Therefore, these variables need to be validated by several experts. There were 4 experts in this study namely. Ir. Insannul Kamil, M.Eng., Ph.D, IPM, ASEAN Eng, Prof. Dr. Ir Alizar Hasan, MSIE.,M.Eng, Prof. Dr. Ir. Rika Ampuh Hadiguna, IPM, and Prof. Vera Surtia Bachtiar, S.T., M.Sc., Ph.D. Validation technique which is done by Recapitulation of interview results can be seen in **Table 4.1.** The processing of the results of the interview is done by calculating the Guttman scale. Where the Guttman scale consists of two choices. In this study, the interview question options were effect and does not effect. A value of 0 is given for does no effect and a value of 1 is for effect.

Tabel 4.1 Recapitulation of Interview Results

Variable	Indicator	Ir. Insannul Kamil, M.Eng., Ph.D, IPM, ASEAN Eng	Prof. Dr. Ir Alizar Hasan, MSIE.,M.Eng	Prof. Dr. Ir. Rika Ampuh Hadiguna, IPM	Prof. Vera Surtia Bachtiar, S.T.,M.Sc, Ph.D.
Economy	GDP	1	1	0	1
	International Companies	1	1	1	1
	Foreign Direct Investment	1	1	0	1
	Innovation	1	0	0	1
	Ease of Doing Business	1	1	1	1
Social	Immigration	1	1	1	1
	Unemployment	1	1	0	1
	Universities	1	1	1	1
	Connectivity	1	1	0	1
	Health	1	1	1	1
	Socioeconomic Dependence	1	1	0	1
	Education	1	1	1	1
	The Dependency Ratio	1	1	0	1

Tabel 4.1 Recapitulation of Interview Results (Continue)

Variable	Indicator	Ir. Insannul Kamil, M.Eng., Ph.D, IPM, ASEAN Eng	Prof. Dr. Ir Alizar Hasan, MSIE.,M. Eng	Prof. Dr. Ir. Rika Ampuh Hadiguna, IPM	Prof. Vera Surtia Bachtiar, S.T.,M.Sc , Ph.D.
Environmental	Environmental Impact	1	0	0	0
	Urban Density	1	1	1	1
	Property and Living Cost	1	1	1	1
	Residency	1	1	1	1
	Safety	1	0	0	0
	City Energy Consumption	1	0	0	0
	Recycling Rates	1	1	0	1
	Natural Catastrophe Risk	1	1	0	1
	Drinking Water	1	1	1	0
	Sanitation	1	1	1	1
	Air Pollution	1	1	1	1
Government	Tourism	1	1	1	1
	Inflation	1	0	0	0
	Social Equality	1	1	1	1

The processing of the results of the interview is done by calculating the Guttman scale. Where the Guttman scale consists of two choices. In this study, the interview question options were effect and does not effect. A value of 0 is given for does no effect and a value of 1 is for effect. The following is the calculation from the interview results:

1. Determine the limit of acceptance of the indicator.

   The total "Effect" answers divided by the total questions to all respondents. Where the total answers to the effect are 85 and the total questions are 112. Then the indicator acceptance limit is 75.89.

2. Calculating the percentage of answers to the effect on each indicator.
3. Eliminate indicators that do not meet the requirements.

The results of the calculations can be seen in **Table 4.2**. The results of the calculation are in the form of 5 research variables consisting of 14 indicators. The next step is to determine the endogenous and exogenous variables.

Tabel 4.2 Calculation Results

Variable	Indicator	Effect	Does Not Effect	Percentage Effect	Term	Result
Economy	GDP	3	1	75	75,89	x
	International Companies	4	1	100	75,89	√
	Foreign Direct Investment	3	1	75	75,89	x
	Innovation	2	1	50	75,89	x
	Ease of Doing Business	4	1	100	75,89	√
Social	Immigration	4	1	100	75,89	√
	Unemployment	3	1	75	75,89	x
	Universities	4	1	100	75,89	√
	Connectivity	3	1	75	75,89	x
	Health	4	1	100	75,89	√
	Socioeconomic Dependence	3	1	75	75,89	x
	Education	4	1	100	75,89	√
	The Dependency Ratio	3	1	75	75,89	x
Environmental	Environmental Impact	1	1	25	75,89	x
	Urban Density	4	1	100	75,89	√
	Property and Living Cost	4	1	100	75,89	√
	Residency	4	1	100	75,89	√
	Safety	1	1	25	75,89	x
	City Energy Consumption	1	1	25	75,89	x
	Recycling Rates	3	1	75	75,89	x
	Natural Catastrophe Risk	3	1	75	75,89	x
	Drinking Water	3	1	75	75,89	x
	Sanitation	4	1	100	75,89	√
	Air Pollution	4	1	100	75,89	√
Government	Tourism	4	1	100	75,89	√
	Inflation	1	1	25	75,89	x
	Social Equality	4	1	100	75,89	√

4.1.2 Exogenous Variables

The exogenous variable in this study is the urbanization variable. The urbanization variable has sub-variables, namely; Economics (X1), Social (X2), Environment (X3), and Governance (X4).

a. Economic Variable (X1)

Economic variables are variables related to the economic conditions of a city or region. The following indicators are needed to assess the economic condition of a region.

Table 4.3 Economic Variable and Indicator

Variable	Indicator	Description
Economic	International Companies	Number of Headquarters of The World's 500 Largest Companies By Market Value
	Ease of Doing Business	Ease of Doing Business in Region

b. Social Variable (X2)

Social variables are variables related to the human condition and culture of a city or region. The following indicators are needed to assess the economic condition of a region.

Table 4.4 Social Variable and Indicator

Variable	Indicator	Description
Social	Immigration	Number of people entering and leaving an area
	Universities	University Ranking Best Placed National Ranking
	Health	Value In National Health
	Education	The Ratio Of Public Spending On Education

c. Environmental Variable (X3)

Environmental variables are variables related to environmental, natural, and ecosystem conditions of a city or region. The following indicators are needed to assess the economic condition of a region.

Table 4.5 Environmental Variable and Indicator

Variable	Indicator	Description
Environmental	Urban Density	The population density in inhabitants per km2
	Property and Living Cost	National Ranking on Cost of Living
	Residency	Accessibility to the housing by the National Index
	Sanitation	Sanitation Index
	Air Pollution	Comparing Clean and Polluted

d. Variable Goverment (X4)

Social variables are variables related to the human condition and culture of a city or region. The following indicators are needed to assess the economic condition of a region.

Table 4.6 Government Variable and Indicator

Variable	Indicator	Description
Government	Tourism	Number of international visitors per year
	Social Equality	Income inequality level

4.1.3 Endogenous Variables

The endogenous variable in this study is the variable of the spread of COVID-19. COVID-19 data collection was carried out on March 4, 2020. The indicator for measuring COVID-19 is the number of cases that have occurred in a city. The number of COVID-19 cases can be seen in **Appendix A.**

4.1.4 Conceptual Framework

Conceptual framework is needed to see the basic model of research. Conceptual framework shows the relationship between variables. In this study, there are 5 variables consisting of 4 exogenous variables and 1 endogenous variable. The relationship between these variables can be seen in **Figure 4.1**.

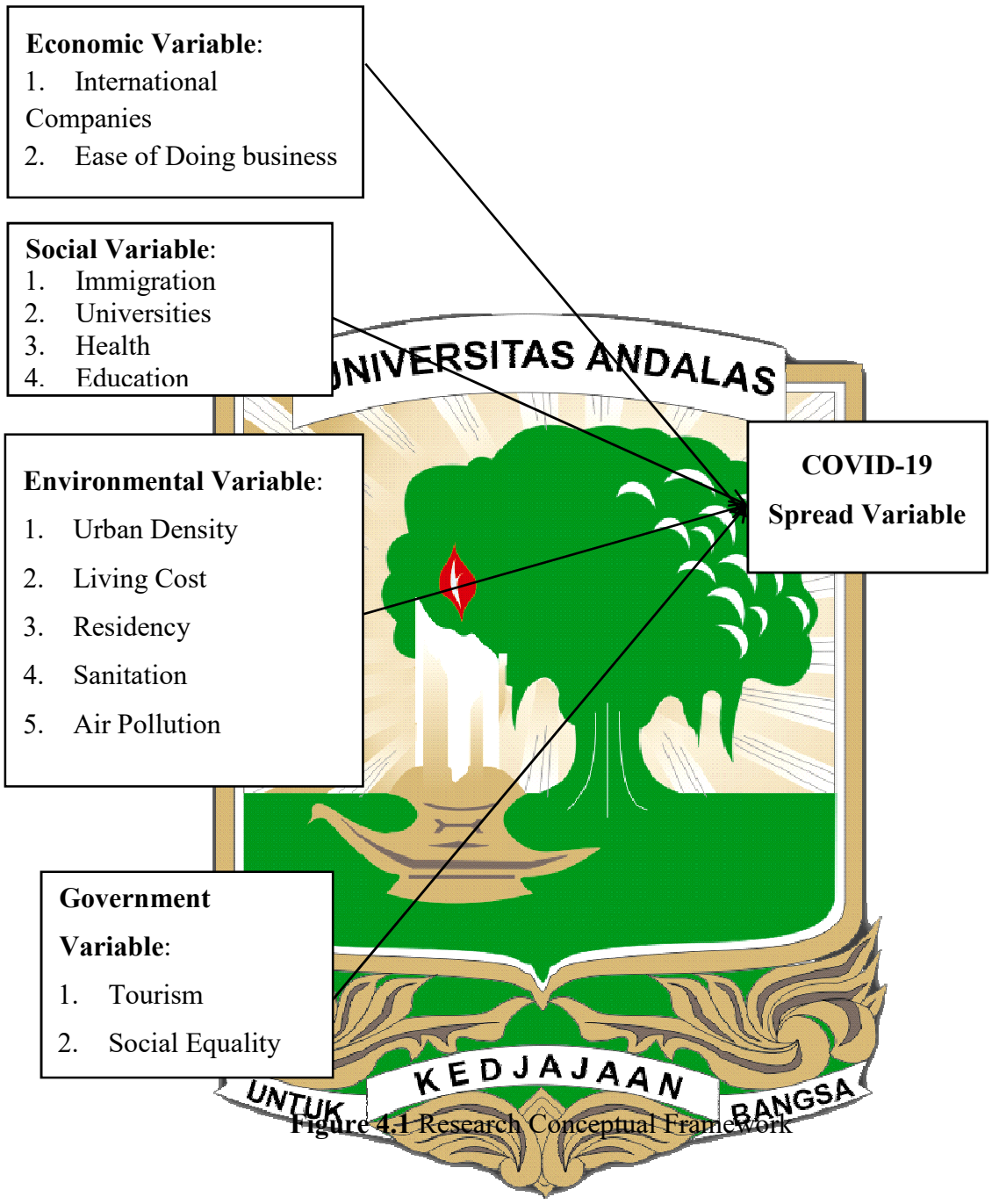

Figure 4.1 Research Conceptual Framework

Some factors influence the city's urbanization index. The factor is an indicator that is useful as a measure of the urbanization index . In sub variable economic there are 2 indicators, social has 4 indicators, environmental has 5 indicators, and government there are 2 indicators. In the conceptual framework, there is an arrow stating the relationship between the index urbanization and the COVID-19 spread. The effect of the urbanization index to the COVID-19 spread is a hypothesis in the study.

4.2 Data Processing

The data that has been collected is processed using the SMARTPLS 3.0 application. The processed data consists of five variables, namely: economic, social, environmental, and government. The variables and indicators used can be seen in **Appendix A**. Data processing uses the structural equation modeling (SEM) method which consists of several stages, namely the outer model test, inner model test, and hypothesis testing.

4.2.1 Evaluation of the Measurement Model (Outer Model)

Validity and reliability tests are known by testing the measurement model. In this study, the validity test was carried out to determine whether the measuring instrument used had met the requirements to be continued as research or not.

4.2.1.1 Convergent Validity

Outer Model shows how the manifest variable represents the latent variable to measure. Convergent validity is measured using the outer loading parameter of the latent variable with its indicator. Ghozali (2006) explains that for the early-stage research, the outer loading measurement scale of 0.5 to 0.6 is considered sufficient. However, in this study, an outer loading limit of 0.50 was used. **Figure** shows the initial model between variables using the SMARTPLS 3 application.

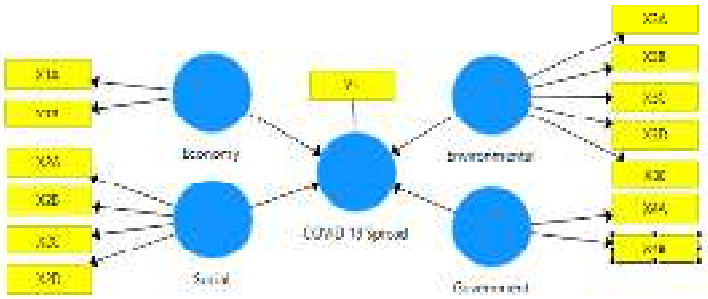

Figure 4.2 Relationship Model Between Variables

Figure 4.2 is the initial SEM-PLS model which shows that there are 14 indicators of all variables. There are 2 indicators included in economic variables, 4 indicators included in social variables, 5 indicators included in environmental variables, 2 indicators included in government variables, and 1 indicator included in independent variables. To be able to see in more detail the value of the loading factor , **Table 4.7** presents the exogenous construct data of economic variables.

Table 4.7 Loading Factor Economic Variables

Indicator	Loading Factor
Companies (X1A)	0.927
EoD Business (X1B)	0.644

It can be seen in **Table 4.7** shows all the loading factor values for the economic variables above 0.5, then no indicator is removed from the model and has a good level of validity. To be able to see in more detail the value of loading factor data for exogenous constructs of social variables can be seen in **Table 4.8.**

Table 4.8 Loading Factor Social Variables

Indicator	Loading Factor
Immigration (X2A)	0.847
Universities (X2B)	0.928
Health (X2C)	0.326
Education (X2D)	-0.190

Table 4.8 shows that there are 2 loading factor values for social variables below 0.5, namely the education and health indicator. Then this indicators are removed from the model, which means that these indicators have a bad level of validity. The remaining indicators of social variables after the convergent validity test can be seen in **Table 4.9**.

Table 4.9 Indicators Remaining After Convergent Validity Test

Indicator	Loading Factor
Immigration (X2A)	0.871
Universities (X2B)	0.965

Table 4.9 shows the remaining indicators of social variables after the convergent validity test because these indicators have a loading factor value above 0.5. So, these indicators have a good level of validity. To be able to see in more detail the loading factor value of exogenous construct data for environmental variables can be seen in **Table 4.10**.

Table 4.10 Loading Factor Environmental Variables

Indicator	Loading Factor
a	0.890
Property and Living Cost (X3B)	0.651
Residency (X3C)	-0.183
Sanitation (X3D)	0.483
Air Pollution (X3E)	0.014

Table 4.10 shows that there are three loading factor values for environmental variables below 0.5, namely the residency, sanitation and air pollution. Then the three indicators are excluded from the model because these indicators have a bad level of validity. The remaining indicators of environmental variables after the convergent validity test can be seen in **Table 4.11.**

Table 4.11 Indicators Remaining After Convergent Validity Test

Indicator	Loading Factor
Urban Density (X3A)	0.934
Property and Living Cost (X3B)	0.638

Table 4.11 shows the remaining indicators of environmental variables after the convergent validity test because these indicators have a loading factor value above 0.5. So, these indicators have a good level of validity. To be able to see in more detail the value of loading factor data for the exogenous constructs of government variables can be seen in **Table 4.12**.

Table 4.12 Loading Factor Government Variables

Indicator	Loading Factor
Tourism (X4A)	0,917
Social Equality (X4B)	-0,311

Table 4.12 shows that there is a loading factor values for environmental variables below 0.5, namely social equality indicators. Then this indicators is excluded from the model because these indicators have a bad level of validity. The remaining indicators of environmental variables after the convergent validity test can be seen in Table 4.13.

Table 4.13 Indicators Remaining After Convergent Validity Test

Indicator	Loading Factor
Tourism (X4A)	1.000

Table 4.13 shows the remaining indicators of environmental variables after the convergent validity test because these indicators have a loading factor value above 0.5. So, these indicators have a good level of validity. To be able to see in more detail the loading factor value of the endogenous construct data for the COVID-19 Spread variable can be seen in **Table 4.14**.

Table 4.14 Loading Factor COVID-19 Spread

Indicator	Loading Factor
Total Cases (Y1)	1.000

Table 4.14 shows all the loading factor values for the COVID-19 Spread above 0.5, then no indicator is removed from the model and has a good level of validity. The remaining indicators after the convergent validity test can be seen in **Table 4.15.**

Table 4.15 The Remaining Indicators after the Convergent Validity Test

Indicator	Loading Factor
Companies (X1A)	0,927
Investment (X1B)	0,644
EoD Business (X2A)	0,871
Health (X2B)	0,965
Socioeconomic Dependence (X3A)	0,934
Urban Density (X3B)	0,638
Property and Living Cost (X4A)	1.000
Total Cases (Y)	1.000

Table 4.16 Eliminated Variables at Convergent Validity

Indicator	Loading Factor
Health (X2C)	0.326
Education (X2D)	-0.190
Residency (X3C)	-0.183
Sanitation (X3D)	0.483
Air Pollution (X3E)	0.014
Social Equality (X4B)	-0.311

Table 4.15 shows indicators that have a latent variable loading factor value with sufficient indicator because the loading factor value of these indicators is above 0.5. The indicators that are removed in the convergent validity test can be seen in **Table 4.16** which shows that these indicators have no level of validity. Furthermore, the convergent validity test is carried out again after removing several indicators.

Figure 4.3 Model After Modification

From the results of data processing with SEM PLS, which can be seen in **Figure 4.3**, shows that all indicators have a loading value greater than 0,50. This has a high level of validity, so it meets convergent validity.

4.2.1.2 Discriminant Validity

Discriminant validity is the cross-loading value which is useful to see whether the construct has adequate discrimination by comparing the loading value of the intended construct, where the intended construct must be greater than the cross-loading value of other constructs. The value of cross-loading technology variables in each construct can be seen in **Table 4.17.**

Table 4.17 Value of Discriminant Validity

	COVID-19 SPREAD	Economic	Social	Environmental	Government
Y1	1,000	0.865	0.462	0.899	0.128
X1A	0.941	0,927	0.302	0.923	0.154
X1B	0.273	0.644	0.374	0.266	0.320
X2A	0.203	0.186	0.871	0.161	-0,062
X2B	0.554	0.459	0.965	0.470	0.030
X3A	0.954	0.928	0.352	0,934	0.170
X3B	0.328	0.249	0.272	0.638	0,079
X4A	0.128	0.250	-0.00	0.168	1.000

The estimated value of cross-loading is shown in **Table 4.17**. It shows that there are some constructs with lower indicators than other constructs with indicators, namely the X1A and X3A indicators. Therefore, indicators X1A and X3A are removed from the model because they do not have sufficient discriminant. The X1A indicator is International Companies. The X3A indicator is urban density. Then the item was removed and the discriminant validity was re-tested again.

4.2.1.3 Discriminant Validity After Modification

After the elimination of indicators that did not pass the first stage of the discriminant validity test, the second stage of the discriminant validity test was carried out. The results of the discriminant validity of the research model by looking at the cross-loading value can be seen in **Table 4.18.**

Table 4.18 The Discriminant Validity Value Research Model

	COVID-19 SPREAD	Economic	Social	Environmental	Government
Y1	1.000	0.273	0.432	0.328	0.128
X1B	0.273	1.000	0.374	0.266	0.330
X2A	0.202	0.184	0.961	0.162	0.063
X2B	0.554	0.459	0.944	0.170	0.030
X3B	0.328	0.749	0.272	1.000	0.079
X4A	0.128	0.250	-0.030	0.168	1.000

Based on the results of the cross-loading estimation in **Table 4.18.** it can be seen that all latent constructs or variables already have good discriminant validity, where the indicators in the construct indicator block are better than other block indicators. The model after the display of several indicators can be seen in **Figure 4.4.**

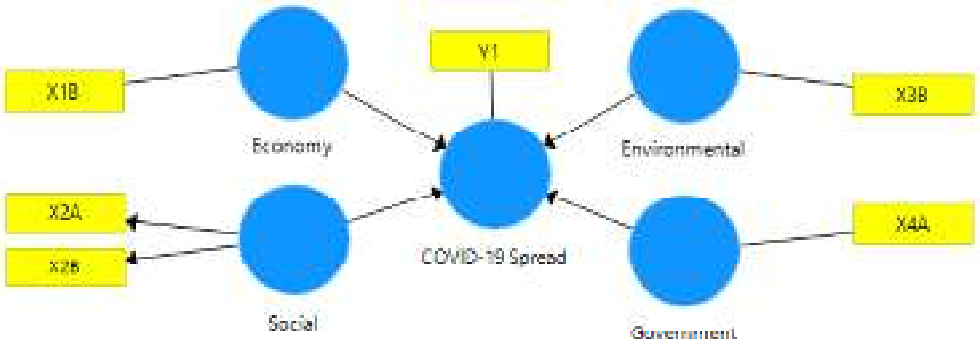

Figure 4.4 PLS-SEM Model After Discriminant Validity Test

It can be seen in **Figure 4.4** that it can be concluded that the manifest variable in this study has correctly explained the latent variable and proved the indicator is valid.

4.2.1.4 Reliability Test

The next step is to test the construct reliability as measured by two criteria, namely composite reliability and Cronbach alpha from the indicator block that measures the construct. Cronbach alpha is a measure of reliability that has values ranging from zero to one. Composite reliability is to measure the reliability value of a construct. The construct is declared reliable if the composite reliability and Cronbach alpha values are above 0.70. The results of the composite reliability index and Cronbach's alpha can be seen in **Table 4.19.**

Table 4.19 Composite Reliability Results

	Cronbach's Alpha	Composite Reliability
COVID-19 SPREAD	0.754	0.779
ECONOMIC	1.000	1.000
SOCIAL	1.000	1.000
ENVIRONMENTAL	0.831	0.921
GOVERNMENT	1.000	1.000

The results of the composite reliability and Cronbach's alpha output for the construct of readiness in COVID-19 spread, economy, social, environmental, and government are all above 0.70. So, it can be concluded that the construct has good reliability.

4.2.2 Evaluation of the Structural Model (Inner Model)

The structural model was evaluated using the R-square for the dependent construct, the t-test, and the significance of the structural path parameter coefficients.

4.2.2.1 R-Square (R2)

The structural model was evaluated by looking at the R2 results for endogenous variables. Following are the results of R2 which can be seen in **Table 4.20.**

Table 4.20 R-Square results

	R Square	R Square Adjusted
COVID-19 Spread	0.906	0.892

Table 4.20 shows that the value of R2 COVID-19 Spread is 0.906, which indicates that the R2 value is strong, where this value indicates that economic, social, environmental, and government variables affect the COVID-19 Spread variable by 90.6 percent, and the rest is influenced by other variables outside the variables in this study.

4.2.2.2 Significant Test (Bootstraping)

A hypothesis is accepted or rejected can be done by paying attention to the significance value between constructs, p-values , and t-statistics. This method of estimating measurement and standard error is no longer calculated using statistical assumptions but is based on empirical observations. Based on the bootstrapping calculations in this study, the hypothesis is accepted if the significance value is greater than 1.96 (t table significance 5% = 1.96) and or the p-value is smaller than 0.05, then Ha is accepted and Ho is rejected and so vice versa. The bootstrapping results can be seen in **Table 4.21.**

Table 4.21 Bootstrapping Results

	Original Sample (O)	*Sample Mean* (M)	*Standard Deviation* (STDEV)	T Statistics (| O / STDEV |)	P Values	Total Effect
ECONOMIC -> COVID-19 SPREAD	0,267	0,12	0,141	1,895	**0,059**	0.199
SOCIAL -> COVID-19 SPREAD	0,687	0,714	0,155	4,436	**0.000**	0.220
ENVIRONMENTAL -> COVID-19 SPREAD	0,295	0,247	0,151	1,954	**0.051**	0.085
GOVERNMENT -> COVID-19 SPREAD	0,115	0,091	0,106	1,083	**0,280**	0.511

Table 4.21 shows the results of bootstrapping in this study, the following is an explanation for determining whether the hypothesis is accepted or rejected:

a. Ho: Economic variables affect COVID-19 spread.
Ha: Economic variable does not affect COVID-19 spread.

1. If P-values >0.05 then Ho is rejected and Ha is accepted
2. Result: hypothesis testing shows a P-value of 0.059
3. Conclusion:
Based on the above calculations, it can be concluded that Ha is accepted and stated that the economic variables does not affect the COVID-19 spread.

b. Ho: Social variable affects COVID-19 spread.
Ha: Social variable not COVID-19 spread.

1. If P-values <0.05 then Ho is rejected and Ha is accepted
2. Result: hypothesis testing showed a P-value of 0.00
3. Conclusion:
Based on the above calculations, it can be concluded that Ho is accepted and declared a variable Social affect the COVID-19 spread

c. Ho: Environmental variables affect COVID-19 spread.

Ha: Environmental variable does not affect COVID-19 spread.

1. If P-values <0.05 then Ha is rejected and Ho is accepted
2. Result: hypothesis testing showed a P-value of 0.051
3. Conclusion:

Based on the above calculations, it can be concluded that Ha is accepted and declared a variable Environmental does not affect the COVID-19 spread.

d. Ho: Government variables affect COVID-19 spread.

Ha: Government variable does not affect COVID-19 spread.

1. If P-values <0.05 then Ha is rejected and Ho is accepted
2. Result: hypothesis testing showed a P-value of 0.280
3. Conclusion:

Based on the above calculations, it can be concluded that Ha is accepted and declared a variable Government does not affect the COVID-19 spread.

A recapitulation of the results of the research hypothesis test can be seen in **Table 4.22.**

Table 4.22 Recapitulation of Hypothesis Test Results

	Hypothesis	Information
H1	There is an economic influence on COVID-19 spread	Rejected
H2	There is a social influence on COVID-19 spread	Accepted
H3	There is an environmental influence on COVID-19 spread	Rejected
H4	There is government influence on COVID-19 spread	Rejected

CHAPTER V
DISCUSSION

5.1 SEM Model - PLS (Structural Equation Modeling - Partial Least Square)

SEM - PLS (Structural Equation Modeling - Partial Least Square) is a method used to analyze the relationship between variables. Initial model testing is done by testing the outer and inner models. The outer test consists of a validity test and reliability test. The validity test consists of convergent validity and discriminant validity. **Figure 4.5** is the initial model in research and also shows 14 indicators of all variables. There are 2 indicators included in economic variables, 4 indicators included in social variables, 5 indicators included in environmental variables, 2 indicators included in government variables, and 1 indicator included in independent variables. **Figure 4.6** is the second model after modification in the convergent validity test. The indicator that is removed in the convergent validity test means that it has a low degree of accuracy of the research measuring instrument. Furthermore, the analysis was continued on the discriminant validity test.

Discriminant validity was done by paying attention to the value of cross-loading. This value is useful for determining whether the construct has sufficient discriminant. Discriminant validity is done by comparing the loading value of the intended construct with the loading value of other variables. The value of the intended construct must be greater than the loading value of other constructs. The indicators are removed in the discriminant validity test validity namely X1A, and X3A through one validity discriminant test which aims to see whether all constructs or latent variables already have good discriminant validity, where the indicators in the construct indicator block are better than other block indicators. **Figure 4.4** illustrates the SEM-PLS model after discriminant validity

which also proves the indicator is valid. After all, indicators are declared valid, the next step is to test the construct reliability.

The reliability test is carried out to see the consistency of a series of measurements or a series of measuring instruments. The construct reliability test is measured by two criteria, namely composite reliability and Cronbach alpha. Composite reliability does measure the real value of the reliability of a construct. Cronbach's alpha is a reliability measure that has a value ranging from zero to one. The value of composite reliability and Cronbach alpha have to above 0,70. After the model that has been tested is valid and reliable, the next step is to test the structural model.

Testing the structural model using the R square, t-test, and the significance of the structural path parameter coefficients. R square for endogenous constructs is the coefficient of determination in endogenous constructs. **Table 4.20** shows that economic, social, environmental, and government variables have an effect on the COVID-19 Spread variable by 90,6 percent, and the rest is influenced by other variables outside the variables in this study. The next test is to analyze how the influence of economic, social, environmental, and government variables on the COVID-19 Spread, it is necessary to do a significance test (bootstrapping) to pay attention to the significance value between constructs, p-values , and t-statistics to see where a hypothesis is accepted or rejected.

5.2 The Effect of Economic Variables on the COVID-19 Spread

The economic variable is one of the dimensions that builds the urbanization index in a city. Based on literature and previous research. Economic variables can be measured based on five indicators, namely GDP, investment, innovation, international company and ease of doing business. However, at the expert validation stage three of the five indicators of economic variables are eliminated. So that in this study the indicators used are international companies and the ease of doing business. At the discriminant validity stage, which can be

seen in **Table 4.17**, it shows that the international company indicator was eliminated. Therefore, a single benchmark for economic variables is the level of ease of doing business in a city. In **Table 4.22**, it can be seen that economic variables do not have a significant effect on the spread of COVID-19. This is because the t-statistic value is smaller than 1.96 and the p-value is bigger than 0.05. So that the first hypothesis is rejected and the alternative hypothesis is accepted. This shows that the perception that economic factors influence the spread of COVID-19 is not proven.

5.3 The Effect of Social Variables on the COVID-19 Spread

Social variable is the second dimension that builds the urbanization index in a city. Based on literature and previous research. Social variables can be measured based on 8 indicators, namely immigration, unemployment, the number of universities, health telecommunications, socio-economic inequality, education, and level of dependence. However, at the expert validation stage four of the eight indicators of social variables are eliminated. So that in this study the indicators used are immigration, university, education and health level. In the convergent validity test, which can be seen in **Table 4.8**, it shows that the indicators of education and health are eliminated. Therefore, the social variables measure immigration and the number of quality universities. In **Table 4.22**, it can be seen that social variables have a significant effect on the spread of COVID-19. This is because the t-statistic value is greater than 1.96 and the p-value is smaller than 0.05. So that the second hypothesis is accepted and the alternative hypothesis is rejected. This shows that the perception that social factors influence the spread of COVID-19 is proven. The immigration indicator causes a population movement from rural to urban. The existence of a quality university increases the interest of the population to move to the city. This can facilitate the spread of COVID-19.

5.4 The Effect of Environmental Variables on the COVID-19 Spread

Environmental variable is the third dimension that builds the urbanization index in a city. Based on literature and previous research. Environmental variables

can be measured based on 11 indicators which can be seen in **Table 4.1.** However, at the expert validation stage 6 of the 11 indicators of economic variables were eliminated. So that in this study the indicators used are population density, cost of living, recency, sanitation and consumption of drinking water. At the convergent validity stage, which can be seen in **Table 4.10**, it shows that indicators of recency, sanitation and drinking water consumption are eliminated. Meanwhile, at the discriminant validity stage, which can be seen in **Table 4.17**, the population density indicator is eliminated. Therefore, the single yardstick for environmental variables is the cost of living. In **Table 4.22**, it can be seen that environmental variables have no significant effect on the spread of COVID-19. This is because the t-statistic value is smaller than 1.96 and the p-value is bigger than 0.05. So that the third hypothesis is rejected and the alternative hypothesis is accepted. This suggests that the perception that environmental factors influence the spread of COVID-19 is not proven.

5.5 The Effect of Government Variables on the COVID-19 Spread

The government variable is one of the dimensions that builds the urbanization index in a city. Based on literature and previous research. Government variables can be measured based on three indicators, namely tourists, inflation and income inequality. However, in the validation stage with experts, the inflation indicator is eliminated. So that in this study the indicators used are tourists and income inequality. **Table 4.12** shows that the income inequality indicator is eliminated. Therefore, a single measure of the economic variable is the level of tourist arrivals in a city. In **Table 4.22** it can be seen that government variables have no significant effect on the spread of COVID-19. This is because the t-statistic value is smaller than 1.96 and the p-value is bigger than 0.05. So that the fourth hypothesis is rejected and the alternative hypothesis is accepted. This shows that the perception that government factors influence the spread of COVID-19 is not proven.

CHAPTER VI
CONCLUSION

6.1 Conclusions

There are some conclusions that can be drawn, namely:

1. This study has succeeded in determining 4 variables that can be used as an index of urbanization in a city, namely economic, social, environmental and governmental.
2. Economic variables do not have a significant influence on the spread of COVID-19, with a significance value 19,9 %.
3. Social variables have a significant influence on the number of spread of COVID-19, with a significance value 51,1 %.
4. Environmental variables do not have a significant influence on the spread of COVID-19, with a significance value 22,0%
5. Government variables do not have a significant effect on the number of COVID-19 spread, with a significance value 8,5%.
6. In general, this study shows that the urbanization city index do not has contributed to the spread of COVID-19.

6.2 Recommendations

Some recommendations need to be considered for future research, namely:

1. Future researchers should use primary data in determining the level of urbanization.
2. Future researchers should use several statistical applications so that the research results can be compared.
3. This research is expected to become a reference for related parties such as the Health Office, Regional Disaster Management Agency, and

Regional Governments throughout Indonesia. This research should be considered in taking steps to tackle a pandemic.

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APPENDIX

APPENDIX A

Raw Data SMARTPLS

APPENDIX A.1 Economic Varable Value

No	Province	Capital City	International Companies (unit)	Ease of doing business (%)
1	Aceh	Banda Aceh	0	0,46
2	Sumatera Utara	Medan	0	-0,96
3	Sumatera Barat	Padang	0	-1,41
4	Riau	Pekanbaru	0	0,3
5	Jambi	Jambi	0	1,2
6	Sumatera Selatan	Palembang	0	-1,09
7	Bengkulu	Bengkulu	0	-1,58
8	Lampung	Bandar Lampung	0	0,54
9	Kepulauan Bangka Belitung	Pangkal Pinang	0	-1,21
10	Kepulauan Riau	Tanjung Pinang	0	-1,05
11	DKI Jakarta	Jakarta	7	1,33
12	Jawa Barat	Bandung	1	1,72
13	Jawa Tengah	Semarang	0	1,33
14	DI Yogyakarta	Yogyakarta	0	1,06
15	Jawa Timur	Surabaya	0	1,8
16	Banten	Serang	0	0,37
17	Bali	Denpasar	0	0,63

APPENDIX A.1 Economic Varable Value (Continue)

No	Province	Capital City	International Companies (unit)	Ease of doing business (%)
18	Nusa Tenggara Barat	Mataram	0	0,41
19	Nusa Tenggara Timur	Kupang	0	-1,16
20	Kalimantan Barat	Pontianak	0	-0,64
21	Kalimantan Tengah	Palangka raya	0	-0,05
22	Kalimantan Timur	Samarinda	0	1,02
23	Kalimantan Selatan	Banjarmasin	0	0,82
24	Kalimantan Utara	Tanjung Selor	0	-1,5
25	Sulawesi Utara	Manado	0	-0,47
26	Sulawesi Tengah	Palu	0	0,92
27	Sulawesi Selatan	Makassar	0	-1,09
28	Sulawesi Tenggara	Kendari	0	0,46
29	Gorontalo	Gorontalo	0	0,66
30	Sulawesi Barat	Mamuju	0	-0,25
31	Maluku	Ambon	0	0
32	Maluku Utara	sofifi	0	0,56
33	Papua	Jayapura	0	-0,66
34	Papua Barat	Monokwari	0	-1,21

APPENDIX A.2 Social Varable Value

No	Province	Capital City	Immigration	Universities	Health	Education
1	Aceh	Banda Aceh	-47921	15	24,8	119,84
2	Sumatera Utara	Medan	-1687229	38	37,4	122,32
3	Sumatera Barat	Padang	-790807	15	26	123,63
4	Riau	Pekanbaru	1561521	10	41,1	128,94
5	Jambi	Jambi	513165	5	22,2	118,29
6	Sumatera Selatan	Palembang	228475	16	28,6	109,65
7	Bengkulu	Bengkulu	226204	5	31,7	145,87
8	Lampung	Bandar Lampung	621533	12	14,1	119,21
9	Kepulauan Bangka Belitung	Pangkal Pinang	86604	1	34,5	113,88
10	Kepulauan Riau	Tanjung Pinang	781060	7	42,7	91,49
11	DKI Jakarta	Jakarta	946183	57	33,2	108,29
12	Jawa Barat	Bandung	2613413	55	24,4	109,49
13	Jawa Tengah	Semarang	-5536153	51	18,8	98,47
14	DI Yogyakarta	Yogyakarta	-340459	26	27	96,79
15	Jawa Timur	Surabaya	-2897540	96	24,6	103,47
16	Banten	Serang	1911799	20	22,4	109,75
17	Bali	Denpasar	163809	14	32,6	96,96

APPENDIX A.2 Social Varable Value (Continue)

No	Province	Capital City	Immigration	Universities	Health	Education
18	Nusa Tenggara Barat	Mataram	-87441	15	12,1	92,93
19	Nusa Tenggara Timur	Kupang	-77104	14	7,5	107,66
20	Kalimantan Barat	Pontianak	108068	5	28,1	117,96
21	Kalimantan Tengah	Palangka raya	421875	6	23,5	86,02
22	Kalimantan Timur	Samarinda	207031	10	43,6	131,15
23	Kalimantan Selatan	Banjarmasin	975490	6	28,1	120,37
24	Kalimantan Utara	Tanjung Selor	146182	1	0	140,52
25	Sulawesi Utara	Manado	-7408	11	36	118,85
26	Sulawesi Tengah	Palu	343686	8	16,2	102,35
27	Sulawesi Selatan	Makassar	-1069520	23	17,6	122
28	Sulawesi Tenggara	Kendari	251685	8	19,2	108,75
29	Gorontalo	Gorontalo	-39444	5	25,8	106,72
30	Sulawesi Barat	Mamuju	66640	3	17,9	97,73
31	Maluku	Ambon	-80578	4	10,7	106,09
32	Maluku Utara	sofifi	44949	7	21,7	120,42
33	Papua	Jayapura	220392	7	24	92,76
34	Papua Barat	Monokwari	402395	5	33,8	92,82

APPENDIX A.3 Environmental Varable Value

No	Province	Capital City	Urban density	Property and living cost (Rp/bulan)	Residency	Sanitation (%)	Air Pollution (AQI)
1	Aceh	Banda Aceh	93	6.169.359	57,41	73,16	12
2	Sumatera Utara	Medan	200	5.015.549	64,65	79,59	51
3	Sumatera Barat	Padang	130	4.752.304	51,42	63,98	34
4	Riau	Pekanbaru	80	5.808.376	62,94	80,04	52,8
5	Jambi	Jambi	74	4.[illegible]854	54,78	75,6	30
6	Sumatera Selatan	Palembang	92	5.360.422	52,24	74,67	86
7	Bengkulu	Bengkulu	100	4.584.590	41,73	75,91	28
8	Lampung	Bandar Lampung	244	4.606.636	52	79,22	17
9	Kepulauan Bangka Belitung	Pangkal Pinang	91	4.999.659	26,16	90,32	38
10	Kepulauan Riau	Tanjung Pinang	267	5.721.444	44,09	89,13	42
11	DKI Jakarta	Jakarta	15 900	7.500.726	34,25	92,89	49
12	Jawa Barat	Bandung	1 394	5.630.382	49,29	69,64	40
13	Jawa Tengah	Semarang	1 058	4.829.461	64,69	80,29	40
14	DI Yogyakarta	Yogyakarta	1 227	4.803.345	81,61	94,67	20
15	Jawa Timur	Surabaya	831	6.059.488	65,61	78,78	45
16	Banten	Serang	1 338	4.951.204	56,92	81,01	16
17	Bali	Denpasar	750	5.336.103	77,24	94,59	12

APPENDIX A.3 Table Environmental Varable Value (Continue)

No	Province	Capital City	Urban density	Property and living cost (Rp/bulan)	Residency	Sanitation (%)	Air Pollution (AQI)
18	Nusa Tenggara Barat	Mataram	273	4.274.526	56,35	80,02	30
19	Nusa Tenggara Timur	Kupang	112	4.785.043	32,08	64,55	37
20	Kalimantan Barat	Pontianak	34	5.263.192	53,52	72,08	49,7
21	Kalimantan Tengah	Palangka raya	18	5.221.136	47,9	69,23	28
22	Kalimantan Timur	Samarinda	110	5.668.102	65,55	89,27	46
23	Kalimantan Selatan	Banjarmasin	29	4.819.850	46,73	76,56	15
24	Kalimantan Utara	Tanjung Selor	10	-	60,76	77,2	42
25	Sulawesi Utara	Manado	181	5.045.867	64,61	82,36	43
26	Sulawesi Tengah	Palu	49	4.792.614	56,65	71,95	13
27	Sulawesi Selatan	Makassar	189	5.774.957	60,93	87,8	19
28	Sulawesi Tenggara	Kendari	71	5.081.044	59,82	79,75	17
29	Gorontalo	Gorontalo	107	4.406.566	62,26	74,57	21
30	Sulawesi Barat	Mamuju	82	4.808.421	47,23	73,39	21
31	Maluku	Ambon	38	5.633.018	51,75	70	17
32	Maluku Utara	sofifi	39	-	59,03	72,52	21
33	Papua	Jayapura	9	6.939.057	26,19	38,27	41
34	Papua Barat	Monokwari	11	6.269.296	52,22	76,39	5

APPENDIX A.4 Government Varable Value

No	Province	Capital City	Tourism	Social Equality
1	Aceh	Banda Aceh	0.02	9,84
2	Sumatera Utara	Medan	1.11	8,73
3	Sumatera Barat	Padang	0.56	4,97
4	Riau	Pekanbaru	0.67	6,12
5	Jambi	Jambi	1.19	10,41
6	Sumatera Selatan	Palembang	0.08	12,16
7	Bengkulu	Bengkulu	0.53	14,77
8	Lampung	Bandar Lampung	0.58	9,02
9	Kepulauan Bangka Belitung	Pangkal Pinang	0.34	3,06
10	Kepulauan Riau	Tanjung Pinang	0.26	5,42
11	DKI Jakarta	Jakarta	0.25	4,53
12	Jawa Barat	Bandung	0.14	7,14
13	Jawa Tengah	Semarang	0.06	10,09
14	DI Yogyakarta	Yogyakarta	0.06	11,53
15	Jawa Timur	Surabaya	0.1	7,89
16	Banten	Serang	0.1	5,03
17	Bali	Denpasar	0.19	3,33

APPENDIX A.4 Government Varable Value (Continue)

No	Province	Capital City	Tourism	Social Equality
18	Nusa Tenggara Barat	Mataram	0.4	14,9
19	Nusa Tenggara Timur	Kupang	0.18	8,64
20	Kalimantan Barat	Pontianak	0.36	4,69
21	Kalimantan Tengah	Palangka raya	0.34	4,62
22	Kalimantan Timur	Samarinda	0.1	4,45
23	Kalimantan Selatan	Banjarmasin	1,08	3,61
24	Kalimantan Utara	Tanjung Selor	0.26	5,06
25	Sulawesi Utara	Manado	0.01	5,22
26	Sulawesi Tengah	Palu	0.95	8,76
27	Sulawesi Selatan	Makassar	0.02	4,49
28	Sulawesi Tenggara	Kendari	0.12	7,14
29	Gorontalo	Gorontalo	0.42	3,97
30	Sulawesi Barat	Mamuju	0.17	9,59
31	Maluku	Ambon	0.53	6,23
32	Maluku Utara	sofifi	0.21	4,53
33	Papua	Jayapura	0.09	4,47
34	Papua Barat	Monokwari	0.82	5,85

APPENDIX A.5 Total Cases of COVID-19

No	Province	Capital City	Total Cases	No	Province	Capital City	Total Cases
1	Aceh	Banda Aceh	630	18	Nusa Tenggara Barat	Mataram	2146
2	Sumatera Utara	Medan	4323	19	Nusa Tenggara Timur	Kupang	3
3	Sumatera Barat	Padang	1365	20	Kalimantan Barat	Pontianak	170
4	Riau	Pekanbaru	891	21	Kalimantan Tengah	Palangka raya	964
5	Jambi	Jambi	60	22	Kalimantan Timur	Samarinda	198
6	Sumatera Selatan	Palembang	2658	23	Kalimantan Selatan	Banjarmasin	2946
7	Bengkulu	Bengkulu	278	24	Kalimantan Utara	Tanjung Selor	945
8	Lampung	Bandar Lampung	171	25	Sulawesi Utara	Manado	1788
9	Kepulauan Bangka Belitung	Pangkal Pinang	80	26	Sulawesi Tengah	Palu	61
10	Kepulauan Riau	Tanjung Pinang	174	27	Sulawesi Selatan	Makassar	7020
11	DKI Jakarta	Jakarta	50106	28	Sulawesi Tenggara	Kendari	669
12	Jawa Barat	Bandung	818	29	Gorontalo	Gorontalo	2182
13	Jawa Tengah	Semarang	6322	30	Sulawesi Barat	Mamuju	166
14	DI Yogyakarta	Yogyakarta	107	31	Maluku	Ambon	1570
15	Jawa Timur	Surabaya	13118	32	Maluku Utara	sofifi	1900
16	Banten	Serang	89	33	Papua	Jayapura	1887
17	Bali	Denpasar	1759	34	Papua Barat	Manokwari	62