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The Impact of Ungaran Toll Gate Development on the Land Use Change in Its Surrounding

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***Abstract* - The construction of toll gates and new road networks has an impact on changes in land use around it. The operation of section 1 of the Semarang - Solo Toll Road provides another alternative access to the road network between the City of Ungaran and the surrounding areas, namely, the City of Semarang and Bawen. This development increases the accessibility of Ungaran with the surrounding areas and has an impact on the surrounding land use. The Ungaran toll gate is located in the Kalirejo Village, so it has had an impact on the physical change of the agricultural land into economic and residential areas. Bawen has changes in surrounding land use both before and after the operation of toll gates. The objectives of this study are (1) to find out the impact of toll gate construction on changes in land use, (2) to understand the distribution and pattern of settlements and (3) to know the distribution and patterns of trade and services. The method of determining the number of samples used the formula of the Technical Guidelines for Collecting and Processing Spatial Mangrove Data from the Geospatial Information Agency from the total land use population in Sidomulyo and Kalirejo Villages. The calculation results obtained 91 number of samples, and samples were taken in areas that occurred changes in land use between 2011 and 2018. The method of analysis used is quantitative descriptive. Changes in land use that occurred after the completion of the Ungaran toll gate in 2015 were dominated by the changes in land use into fields, trade and services and settlements. Changes in land use that occurred in 2018 were dominated by land use into settlements, public, and trade and services. The conclusion obtained in this study is that the changes in land use in the period 2011 to 2018 as a result of the construction of the Ungaran toll gate have total areas of 63.21 ha. Changes in land use are dominated by land use into settlements, fields and trade and services.**

Keywords – Development; Land Use Change; Ungaran Toll Gate.

I. INTRODUCTION

Toll road facilities consist of several buildings that are needed in the context of toll collection activities, one of which is the toll gate. The toll gate is a transaction service place from several substations and other facilities. (Guidelines for Toll Facilities Building Planning, PT Jasa Marga Planning Division, 1999).

Based on Government Regulation Number 15 of 2005 concerning roads, the operation of toll roads is intended to: (1) realize the development equality and its results and balance in regional development by paying attention to justice, which can be achieved by fostering a road network whose funds come from the road users (2) improve the efficiency of distribution services to support increased economic growth, especially in regions that have high levels of development. According to the Toll Road Supervisory Agency, this consists of (1) Streamlining traffic in areas that have developed. (2) Improving service distribution of goods and services to support economic growth. (3) Improving equity in the development outcomes and justice. (4) Relieving the burden of Government funds through participation of the road users.

The Ungaran toll road is a part of the Semarang-Solo toll road which has a 72.64 km track which is one of a series of Trans Java Toll Roads. The construction of the Semarang-Solo Toll Road requires an investment cost of 6.1 trillion rupiah, the construction costs of 2.4 trillion rupiahs, and land acquisition costs of 800 billion rupiahs. Section I of Semarang (Tembalang)-Ungaran toll road construction which runs 16.3 km began in early 2009.

The construction of toll gates and new road networks have an impact on the changes in the surrounding land use. The operation of section 1 of the Semarang - Solo Toll Road provides an alternative access road network between the City of Semarang and its hinterland areas, Ungaran. Increasing the accessibility of the road from Semarang to Ungaran will have an absolute impact on surrounding land use. According to Soedarto in (Wicakssono, 2011: 29), in the short term, the development of changes in land use will be seen from the development of economic activity and population migration.

II. EXPERIMENTAL DETAILS

A. Research Background

The location of the study was carried out in the administrative area of East Ungaran District, Semarang Regency. The research focused on two sub-districts which have Ungaran toll gate access. The administrative area is Sidomulyo and Kalirejo Districts.

B. Research Population

The population in this study is all land use in the Ungaran toll gate access. Access to the Ungaran toll gate covers the administrative area of the Sidomulyo and Kalirejo Villages. This study aims to determine changes in land use in both villages.

According to 6 indicators of SNI, the land use classification used in this study is based on the provisions of land cover classification of SNI. The classification is as follows:

Table 1. 6 Indicators of National Standard of Indonesia

No.	Classification	Description
1.	Industrial, trade and office buildings	Covering man-made land in the form of buildings that are mainly used for industrial and trade and business activities.
2.	City residential buildings	The closure of man-made land is in the form of buildings which are mainly used for residential areas of the city
3.	Mixed gardens	Dry land (not rice fields) planted with annual crops (trees) combined with annual crops. Annual plants referred to here for example are fruit trees or other trees. While the annual plants in question are dry seasonal crops such as chili and cassava.
4.	Field / moor with palawija	Dry land (not rice fields) planted with non-rice annual crops but crops such as corn, soybeans, peanuts, and so on.
5.	Rice fields with rice continuously	Wet land in the form of rice fields planted with rice continuously, can be two or three times a year depending on rice varieties, without any rotation of planting with other plants.
6.	Yard	Coverage of vegetation in the form of trees and sometimes interspersed with annual plants located adjacent to or adjacent to settlements, which function as part of efforts to increase the comfort of housing, providers of fruit and other plant products, wood fuel, or become part of the aesthetics / beauty of the place stay.

C. Samples and Sampling Techniques

Samples are obtained from the results of interpretations of the images obtained from relevant sources. The image recording used as a sample is an image recording before the construction of the toll road gate and afterwards. The scope of land use change which was studied was limited to Sidomulyo and Kalirejo Village land uses, because these two urban villages began to show significant changes in land use after the operation of the Ungaran toll gate.

The sampling technique in this study used the stratified random sampling technique. According to Sugiyono (2007), this technique is used if the population or object has members / elements that are not homogeneous and have proportional strata. Hence, the sample in this study is the use of land from the interpretation of Quickbird and Bakosurtanal satellite imagery in 2002 which is in Sidomulyo and Kalirejo Villages.

Land use maps that have been interpreted overlay with maps cover the extent of the scope of land use change. Produce object areas of research studies. Based on the object area of the research study, the proportion of samples in each type of land use is proportionally distributed.

Determination of the number of sample points was adopted from the Technical Guidelines for Collecting and Processing Spatial Mangrove Data from the Geospatial Information Agency. The method of determining the number of samples considers the value of the scale and area of the map. The formula used in determining the number of samples is :

A = TSM + ((area (ha)) / 1500)
Attack:
A = Number of Samples
TSM = Minimum Sample Total
1500 = constants
A = 50 + (322,47Ha / 1500)
A = 50 + 0.215
A = 50,215
Minimum sample total = 50,215

The total sampling area of 322.47 ha did not meet the minimum requirements for determining the number of sample points referring to Congalton and Green (2008), where if the research area is less than 404,700 ha and the number of land cover classes is less than 12, the minimum number of samples taken is recommended. 50 polygon samples. In this study the samples used were 91 polygon samples.

D. Data Collection / Data Source Methods

The data used in this study can be divided into two (2), namely:

1. Primary Data

Primary data is data obtained directly from the area of study. In this study the primary data is obtained by:

1) Observation

In this study, observations were carried out directly (field observations and observations using remote estimation to map the sampling area in Sidomulyo and Kalirejo Subdistricts, which are located along the Ungaran toll gate access road.

2) Interview

The results of this interview will be combined with the secondary data, so that the results of holistic analysis of land use change in Sidomulyo and Kalirejo villages are found along the Ungaran toll gate access road.

2. Secondary Data

Secondary data is data obtained from the relevant agencies. The types of data needed in this study include:

Table 2. The Data Source

No.	Data	Source
1.	Ungaran Subdistrict in Figure	BPS of Semarang Regency
2.	Basic map of the Ungaran Timur District	BAPPEDA of Semarang Regency and KOTAKU
3.	2010 Quickbird Image of Semarang Regency	BAPPEDA of Semarang Regency
4.	RBI Map	BAPPEDA of Semarang Regency

The latest image of the researchers took from WorldView in May using SAS Planet applications that have been georeferenced, this is because there is no high-resolution image for the latest year. Referring to the research of Farah and Algarni (2014), the results of the accuracy of the image from Google Earth using RMSE (Root Mean Square Error) is 2.18 meters. The Farah and Algarni study area (2014) are the City of Riyadh in Saudi Arabia which has an elevation of around 600 meters above the sea level. The Ungaran area which only has an elevation of around 300 meters is assumed that the researchers can use World View-2 satellite imagery.

E. Data Collection Tools and Techniques

The data collected in this study are the primary and secondary data. The method of data collection is conducted by:

a. Observation method
b. Documentation method
c. Interview method

F. Data Analysis Method

1. Image interpretation
2. Descriptive Analysis

III. RESULTS AND DISCUSSION

A. Overview of the Public Facilities Object Research

Sidomulyo Village is one of Districts in Semarang Regency, Ungaran Timur District. The administrative boundary of Sidomulyo Village is in the north bordering the Susukan sub-district, on the east bordering the Kalirejo village, on the south bordering the Gedanganak sub-district and on the west bordering Ungaran Barat sub-district. The area of Sidomulyo Village is approximately 116.81 Ha. Sidomulyo Village has 5 RW and 29 RT.

B. Research Results

1. Changes in Land Use Before and After Construction of the Ungaran Toll Gate

Sidomulyo Village has 2 types of land use. Use of agricultural and non-agricultural lands. The use of agricultural land consists of rice fields with an area of 12.47 ha and non-rice fields with an area of 30.15 ha. The area of non-agricultural land use is 74.19 ha. The total area of land use in Sidomulyo Village is 116.81 Ha. Kalirejo Village has 2 types of land use, namely the use of agricultural and non-agricultural land. The use of agricultural land consists of rice fields with an area of 109.43 hectares and non-rice fields with an area of 227.87 hectares. The area of non-agricultural land use is 87.49 ha. The total area of land use in Sidomulyo Village is 424.78 Ha.

In 2011, in Sidomulyo Urban Village, the residential land use almost entirely followed the road network pattern, such as Jalan Letjend. Soeprapto, Jalan S. Parman and Jalan Brantas. In 2011, there were no visible settlements in clusters that were usually clustered.

The use of trade and service land in 2011 still follows the main road pattern, namely Ahmad Yani Street or Jalan Asmara where on the road, there is a center of community activities in the form of a mini square Ungaran and a center of economic activity even though there are not many trade lands and services.

The use of residential land in 2018, during four years after the operation of the Ungaran toll gate, there began to be clustered settlements in the form of clusters such as DAARA Residence, located in RW 04, Kelurahan Sidomulyo.

In 2018 at Sidomulyo Subdistrict, the development of trade and services still occurred even though the center of community activities in the form of a square moved to Kalirejo Subdistrict, and it did not stop trade and services in Sidomulyo Sub-District, even after the operation of the Ungaran toll gate, on the S. Parman street and MT Hariyono street.

In 2011, the Kalirejo Urban Village was only in the form of a typical rural dwelling which tended to cluster and followed the street, namely Jati Raya and at that time there were no settlements in the form of clusters.

The use of trade and service land in Kalirejo Village in 2011 can be said to be non-existent due to the absence of a center for community activities. At the same time, it became the economic center as happened in Sidomulyo Village.

In 2018, the Kalirejo Urban Village has begun to form settlements in the form of clusters, among others, the Ammaya, and My Home. This phenomenon occurred because four years after the operation of the Ungaran toll gate, the Kalirejo Urban Village became easier to access both from within and outside Ungaran City itself.

Trades and services in 2018 in the Kalirejo Urban Village have begun to emerge new points along Jati Raya Street and Flamboyan Street which are one of the main accesses to the Ungaran toll gate. Changes in land use between 2011 at the start of toll road construction are up to four years after completion of construction in 2018, there was a change in land use with a total area of 632,091.09 m2 (63.21 ha).

During this period, the biggest change in land use was dominated by the land use change into the settlements which had a percentage of 27.67% of the total land use change with an area of 174,870.71 m2

(17.49 Ha). Changes in land use to the widest settlement are found in Kalirejo Village, precisely in RW 01, Amaya cluster settlements and a part of the DARRA cluster with an area of 28,663.14 m2 (2.87 Ha) which is located in the southwest of the Ungaran toll gate. The changes in land use into fields are followed by a percentage of 18.24% of the total land use change with an area of 115,284.60 m2 (11.53 ha).

Changes in land use into the widest field are found in Sidomulyo Village, precisely in RW 05 Bukit Tegalepek with an area of 43,640.38 m2 (4.36 Ha) which is to the west of the Ungaran toll gate. The change in land use into trades and services is the largest change in the land use number three with a percentage of 17.50% of the total land use change with an area of 110,626.49 m2 (11.06 Ha). The widest change in trade and service of the land use is found in Kalirejo Village, precisely in RW 01 on the east along M.T. Hariyono road accesses to an area of 21,806.29 m2 (2.18 Ha) which is located in the north of the Ungaran toll gate.

2. Distribution and Pattern of Change in Land Use Built After the Construction of Ungaran Toll Gate

a. Changes in land use become the settlements in Sidomulyo Village

Changes in land use into settlements between 2011 and 2018 in Sidomulyo Sub-District are scattered in all existing RWs. The use of RW 01 Sidomulyo residential land in 2011 with a pattern extending to Asmara Street has a total area of 56,096.08 m2 (5.61 Ha). The commencement of the operation of the Ungaran toll gate is resulted in a change in residential land use that turned into the trade and service sector, so that the settlement area was reduced to 44,956.83 m2 (4.50 Ha). These changes can be interpreted in the period of 8 years, that the change in settlements into the trade and services sector occurred at 19.79%. Changes to the settlements into the trade and services sector are quite significant, especially those along the collector's access to the Ungaran toll gate, both Ahmad Yani Street (Asmara) and S Parman Street.

The use of RW 02 Sidomulyo residential land in 2011 which patterned along the road has an overall area of 194,673.46 m2 (19.47 hectares). The commencement of the operation of the Ungaran toll gate has resulted in an increase in the residential land use covering an area that has turned into a trade and service sector, so that the settlement area has decreased to 102,995.68 m2 (10.30 Ha). These changes can be interpreted in the period of 8 years, the change in settlements into the trade and services sector occurred at 47.10%. Changes to settlements into the trade and service sectors occur, especially those along the collector's access to the Ungaran toll gate in the RW, namely, Letjend. Soeprapto Street.

The use of residential land in RW 03 Sidomulyo which in 2011, had clustered patterns had a total area of 66,136.73 m2 (6.61 Ha). In 2018, four years after its operation the Ungaran RW 03 Sidomulyo toll gate experienced additional settlements of 9,384.45 m2 (0.94 Ha). The increase in the area can be interpreted in the period of 8 years, there are additional settlements of 14.22%. The increase in the size of the land use in these settlements is located behind the Office of Agriculture and Fisheries and Ungaran Regency.

The use of residential land RW 04 Sidomulyo, which in 2011, had a cluster type pattern, had a total area of 55,032.92 m2 (5.50 Ha). In 2018, four years after the operation of the Ungaran RW 04 Sidomulyo, toll gate experienced additional settlements covering 66,134.95 m2 (6.61 Ha). The increase in area can be interpreted in the period of 8 years, there is a massive addition of the settlement area of 120.18% while at the same time, becoming the largest increase in settlements. The increase in residential land use of that size occurs because both the DARRA cluster and a part of the Amaya cluster were previously paddy fields that are now located near the collector's access to the Ungaran toll gate at the RW, namely, M.T. Hariyono Street which is also the location of the new settlement closest to the Ungaran toll gate compared to other new settlements.

The use of residential land in RW 05 Sidomulyo which in 2011, has a pattern that extends the following road has a total area of 90,013.65 m2 (9.00 Ha). In 2018, four years after the operation of the Ungaran RW 05 Sidomulyo toll gate, there were additional settlements covering 32,563.02 m2 (3.26 Ha). The increase in area can be interpreted in the period of 8 years, there are additional settlements of 36, 22%. The expansion of the land use of the settlement is located near the collector's access to the Ungaran toll gate at the RW, namely, S. Parman Street.

b. Changes in land use become settlements in Kalirejo Village

Changes in land use into the settlements between 2011 and 2018 in the Kalirejo Village are scattered throughout the existing RWs. The use of residential land in RW 01 Kalirejo, which in a clustered pattern in 2011 had a total area of 131,747.87 m2 (13.17 ha). In 2018, four years after its operation the Ungaran RW 01 Kalirejo toll gate expanded by 9,335.09 m2 (0.93 Ha). The increasing area can be interpreted in the period of 8 years, there is an additional area of 7.06%. The area's increase in the residential land use is located in a portion of the Amaya cluster located in Kalirejo Village.

The use of residential land RW 02 Kalirejo which in 2011, patterned along the road has a total area of 91,657.29 m2 (9.17 ha). In 2018, four years after the operation of the Ungaran RW 02 Kalirejo toll gate experienced additional settlements covering 1,311.62 m2 (0.13 Ha). The increase in area can be interpreted in the period of 8 years, there is an additional area of settlements of only 1.42%. The increase in the area of the residential land use is due to the very limited

availability of space for the new settlements to be built in RW 02.

The use of residential land in RW 03 Kalirejo, which in 2011 patterned along the road has an overall area of 84,754.41 m2 (8.48 Ha). The commencement of the operation of the Ungaran toll gate resulted in a change in residential land use that turned into the trade and service sector, so that the settlement area was reduced to 78,739.27 m2 (7.87 Ha). These changes can be interpreted in the period of 8 years, the change in settlements into the trade and services sector occurred at 7.08%. Changes to the settlements into the trade and service sectors occur, especially those that are along with the collector's access to the Ungaran toll gate, namely Flamboyan Street.

The use of residential land RW 04 Kalirejo which in 2011, had a clustered pattern had a total area of 69,223.92 m2 (6.92 Ha). In 2018, four years after the operation of the Ungaran RW 02 Kalirejo toll gate, there were additional settlements covering 38,073.92 m2 (3.81 Ha). The increase in area can be interpreted in the period of 8 years there is an additional area of settlements of 55.06%. The increase in the area of residential land use occurs because there is still a large amount of space available to build new settlements of cluster types in RW 04.

c. Changes in Land Use Become Trade and Services in Sidomulyo Village

Changes in land use to trade and services between 2011 and 2018 in Sidomulyo Sub-District are scattered in all existing RWs. The use of RW 01 Sidomulyo trade and service land already exists even before 2011 which has a total area of 20,307.70 m2 (2.03 Ha) which is along Ahmad Yani Street, because at that time, it was the center of attraction (where events were held) specifically or yearly) and the activities of the surrounding community and the City of Ungaran are in the Mini Square in front of the Regent's official residence. The commencement of the operation of the Ungaran toll gate has resulted in changes in residential land use turning into the trade and services sector, resulting in the trade and service sector being 50,354.28m2 (5.04 Ha da). These changes can be interpreted in the span of 8 years, the broad trade and service sector grew by 59.72%. The growth of the trade and services sector is quite significant, especially those along the collector's access to the Ungaran toll gate, both Ahmad Yani Street (Asmara) and S Parman Street. The stake holder's decision to move the center of community activities from Alun-alun Mini to Bung Karno Square as a new place located in a different district was still able to encourage the expansion of the trade sector and services in the form of cafe food businesses, mini markets, stalls eat, then mobile phone counters, and public facilities for refueling stations.

RW 02 Sidomulyo did not have extensive use of trade land and services in 2011, it is only limited to roadside stalls that were relatively small in size. In 2018, four years after its operation the RW 02 Sidomulyo Ungaran toll gate underwent a change in residential land use that turned into a trade and service sector, so that the trade in services became 10,821.49 m2 (1.08 Ha) due to the phenomenon of RW 02 in the form of food stalls, souvenir shops located along the collector's access to the Ungaran toll gate, namely Letjend. Soeprapto Street.

RW 03 Sidomulyo did not have extensive use of trade land and services in 2011, it is only limited to roadside stalls that were relatively small in size. In 2018, four years after the operation of the Ungaran toll gate in RW 03 Sidomulyo the trade and service sector began to emerge in the form of food stalls, freight forwarding and screen printing and printing services, which had an insignificant area of only 8080.00 m2 (0.81 ha) due to the limitations of the strategic space that has been used as office spaces and public facilities even though it is located near the collector's access to the Ungaran toll gate, Jalan Ungaran - Mranggen.

The use of RW 04 Sidomulyo trade land which in 2011 has not seen the use of services that are quite extensive, only limited to roadside stalls that are relatively small in size. In 2018, four years after the operation of the RW 04 Sidomulyo, Ungaran toll gate began the trade and service sector began to emerge with an area of 11,650.40 m2 (1.17 Ha). The emergence of trade and service sectors in the form of shophouses in RW 04 was triggered by the existence of the new settlements in the Amaya cluster. Changes in the trade and service sectors are not only in the form of shop houses, but there are several food and cafe places located along M.T. Hariyono Street.

d. Changes in Land Use Become Trade and Services in Kalirejo Village

Changes in land use to trade and services between 2011 and 2018 in the Kalirejo Village are not scattered in all RWs which are only in locations where there are many human activities.

The use of RW 02 Kalirejo trading land, which in 2011 has not seen as a wide use of services, is only limited to the roadside stalls that are relatively small in size. In 2018, four years after the operation of the Ungaran RW 02 Kalirejo toll gate, the trade and services sector began to emerge with an area of 10,711.99 m2 (1.07 Ha). The emergence of the trade and service sector in the form of food stalls in RW 02 was triggered by the presence of a center and a new center of activity in Bung Karno Square which replaced the role of the Mini Square. Changes in the trade sector and services are along Jati Raya Street (Ungaran - Mranggen).

The use of RW 03 Kalirejo trading land, which in 2011, has not seen a wide use of services, is only limited to roadside stalls that are relatively small in size. In 2018, four years after the operation of the Ungaran RW 03 Kalirejo toll gate began the trade and service sector began to emerge with an insignificant

area of only 8080.00 m2 (0.81 Ha). The emergence of the trade sector and services in the form of food stalls in RW 03 was triggered by the presence of crowds and new activity centers that replaced the role of Mini Square. Changes in the trade and service sectors are along the Flamboyan Street.

IV. CONCLUSION

The conclusions that can be drawn from this study are as follows:

Starting the operation of the Ungaran toll gate provides an alternative access road network between Semarang City, such as Tembalang and Ungaran City. The increase in accessibility from Semarang to the City of Ungaran in plain view has an impact on land use, especially those around the toll gate and access to the Ungaran toll gate itself. The increase can be seen from the increasing area of the new land use in both Sidomulyo and Kalirejo Villages.

Land use in 2011 prior to the operation of toll gates was dominated by three land uses, namely mixed gardens of 27.03%, settlements of 23.23%, rice fields of 15.93% while land use of trade and services was only 0.73% of the total use land that year. In 2015, one year after the operation of the Ungaran toll gate began, there was a change in land use of 53.48 ha which was dominated by three land uses of 22.73%, trade and services of 20.58% and the settlements of 16.88% of the total extensive changes in land use. In 2018, there was a change in the use of 9.73 ha of land to the residential land use. The overall change in land use in the period of 2011 to 2018 is an area of 63.21 ha.

Changes in land use in the Kalirejo Villages between 2011 and 2018 indirectly indicate an increase and a reduction in land use area. The most extensive use of land that has been reduced is the use of mixed garden land with a reduced area of 151,471.08 m2 (15.15 Ha), and then followed by the use of vacant land which for a period of eight years has decreased by 136,931.70 m2 (13.69 hectares), and the use of land is reduced by an area of 110,796.18 m2 (11.08 hectares).

The commencement of the operation of the Ungaran toll gate encourages property developers to build new residential areas including in the research areas including Bali Terrace, Graha Imperial, Griya Bukit Jati Asri, Griya Kelapa Gading, My Home, DARRA and the Amaya as a manifestation of increasing demand for residential areas, that are new with increasing economic activity and population

The operation of the Ungaran toll gate resulted in the surrounding area experiencing changes in land use, such as what happened to paddy fields around the toll gate changed into Bung Karno Square and the new settlements such as the DARRA and Amaya clusters. Settlements that are located along the main access and collectors' access to the Ungaran toll gate are transformed into trade and service sectors in the form of mini markets, trade kiosks, food stalls, food stalls, cafes and shop houses. Increasing accessibility is also the reason for the new Semarang District Samsat Service Office in Ungaran City to be more accessible to people outside of Ungaran City.

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