International Journal of Civil Engineering and Infrastructure
Vol. 1, No. 1, March 2023

THE IMPACT OF ROAD NETWORK DEVELOPMENT ON AGRICULTURAL AND INDUSTRIAL LAND USE IN KARAWANG REGENCY

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Received December 02, 2022 | Accepted January 18, 2023

ABSTRACT

The efficient flow of goods and services serves as a keystone of economic development, essential for thriving market dynamics and total commercial efficiency. Far from being a mere conduit, transportation infrastructure takes on a foundational function, spurring industrial growth and having a significant impact on local economies. The crucial part that transportation networks play in advancing trade across sectors serves as evidence of the symbiotic relationship between transportation and economic development. The goal of the research is to determine how the development of the Jakarta - Cikampek toll road has affected the land use shifting from the agricultural to industrial sectors, which has a significant impact on Karawang regency's economic growth. Then create the mathematical model that enables information about the value of the agriculture sector's GDRP (Gross Domestic Regional Product) based on the influence of the value of the industrial sector's GDRP to be served.

Keywords: *transportation, road network, land use, agriculture, industry*

1. PRELIMINARY

The supply of the required infrastructure is necessary for the optimal operation and sustained growth of economic undertakings, with the effective distribution of goods and services across a geographic area being of utmost importance. This fundamental principle emphasizes the crucial part that efficient distribution of goods and services plays in establishing strong market dynamics, balancing supply-demand equations, and fostering an atmosphere that is conducive to commercial efficacy.

By building and expanding public facilities to provide basic needs for housing, education, shopping centers, and recreation areas, urban growth stimulates the growth of economic activities. Despite this goal, land use management is one of the most widely used strategies to boost local economies. When economic activities are supported by suitable infrastructure, including the transport of goods and services over the entire region, they perform and grow properly.

The transportation system develops as an essential element in the complex picture of economic development, its significance going beyond that of mere connective tissue. Instead, it takes on the function of essentiality, serving as the critical axis around which certain industries spin while also acting as a transformative force for the larger economic trajectory of defined areas. This claim has its foundation in the complex web of connections that transportation fosters, both metaphorically and practically,

acting as a conduit for the spread of ideas, innovations, and human capital in addition to the physical movement of goods.

Without a doubt, there is a strong connection between transportation and industrial expansion, with transportation networks acting as the circulatory system that drives commerce's essential elements across a wide range of industries. Whatever the sector, from industry to agriculture and services, the efficient flow of resources made possible by a strong transportation infrastructure creates a well-choreographed rhythm that emphasizes economic vitality.

In Jakarta, several toll roads have already been erected, and an outer ring road connecting several locations is being built. One of the heavily inhabited areas and the main thoroughfare connecting Jakarta to the Bekasi region is the Jakarta - Cikampek Toll Road.

Given the large volume of traffic that passes through the Jakarta - Cikampek toll road each year, among other toll roads, and the fact that it links Jakarta to the urbanized region known as Karawang Regency, this area would be the primary subject of research.

The management of land use presents a confluence of opportunities and obstacles, even though it is essential to supporting complete development. This project has conflicts and tensions, as may be seen from a careful analysis. A loss in environmental sustainability can be sparked by an imbalance in the distribution of land uses, as stated by Beinet and Nijkamp (1998). This emphasizes the delicate balance needed when dividing up land for different uses.

However, it is important to emphasize that good land use implementation can benefit local stakeholders and citizens when it is complemented by a well-designed infrastructure network. For instance, toll roads serve as an example of this type of infrastructure because they can change the physical environment by improving connection, cutting down on travel times, and increasing accessibility.

A dual character becomes clear in this complex system of land use management. On the one hand, it is necessary to protect the environment through wise land use, making sure that environmentally sensitive areas are conserved, and that urban sprawl is controlled. On the other hand, there is a chance for strategic land use planning to energize industrial development, improve trade dynamics, and accelerate economic growth. Due to this duality, a thorough analysis is required to understand both the possible conflicts and the synergies that can result from wise land use management.

Regarding this, the current analysis narrows its attention to the Jakarta - Cikampek toll road, acting as a microcosm of the larger land use interaction. As it passes through a lively area with a mix of commercial, industrial, and agricultural operations, this roadway embodies the transformative power of well-conceived infrastructure.

The Jakarta-Cikampek toll road, which is part of the Java North Coast transportation networks and plays a key role in economic development and distribution, is utilized as a case study. This toll road has frequently experienced traffic jams and load overloads. Karawang Regency was recognized as a rice producer prior to the completion of the Jakarta-Cikampek toll road. After the toll road is operational, it becomes the location for factories on both the right and left sides of the road.

There is a shift in land usage from agricultural to industrial. Locals are likewise transitioning from farmers to factory workers.

The transition from agricultural to industrial land use represents a significant transformation in both the landscape and the socioeconomic dynamics of the region. Historically founded in agriculture, cultures around the world have been shifting to industrialization since the 18th-century industrial revolution, propelled by the appeal of economic expansion. This change frequently results in larger profitability, considerable contributions to a region's

GDP, and the promise of greater economic stability in comparison to the typically volatile agricultural sector. However, it also causes considerable lifestyle changes, with farmers adapting to new jobs as factory workers, signaling a shift from agricultural-cycle-based traditions.

Simultaneously, this transformation poses environmental concerns, as verdant fields may give way to pollutant-emitting factories, thereby causing long-term ecological changes. Industrialization demands substantial infrastructural development, and while industries may offer higher pay, they can also generate socioeconomic inequities. As a result, while industrialisation can bring prosperity and modernization, such transformations must be approached with an emphasis on equitable development as well as cultural and environmental preservation.

According to the facts shown above, the industrial sector has transformed, and the agricultural sector has changed even more productively. However, it is unclear whether this optimism is accompanied by a negative impact and result.

The research uses a multiple regression method to comprehensively disentangle the complex relationships between the variables of industrial development and agricultural landscapes within the jurisdiction of Karawang Regency.

The following concerns are considered as this study explores the significance of land use management in Karawang Regency along the toll road corridors. Firstly, areas near toll roads are developing quickly, exceeding expectations, and creating an imbalance between traffic demand and road capacity. Along the network of roads, this situation has led to accidents and traffic congestion. Secondly, modifications to the land use pattern along the network of roads. The shift in the use of space from productive or technically irrigated agricultural areas into settlement, industrial, and urban areas serve as evidence for this.

2. LITERATURE REVIEW

Transportation

Transportation is critical in distributing goods and commodities across huge terrain. Essentially, it is the mechanism by which production commodities are carried from one location to another, and the efficiency of this process has a significant impact on a nation's economic viability. The goal of transportation is to carry these items in large quantities while maintaining safety, efficiency, and punctuality. The operation's underlying success is dependent on the availability of reliable transportation facilities.

Transportation technology developments have eased the process of carrying both commodities and people. Goods can now be delivered to the correct location and time. This punctuality and precision raise the value of the goods, owing to lower transportation costs, which leads to more competitive pricing (Morlok, 1995). In principle, the more efficient the transportation system, the better the economy.

Consider the toll road in Government Act No. 8/1990 to demonstrate the necessity of infrastructure in transportation. Toll highways are positioned as catalysts for regional development under this law. They are built with the goal of promoting equal development across regions, ensuring that both urban and rural communities' flourish. Furthermore, toll roads aim to improve distribution service efficiency, directly supporting and propelling economic growth. They act as key routes for products distribution to towns and industrial areas.

The alignment of transportation infrastructure, such as toll highways, and urban areas, on the other hand, is not necessarily seamless. Several urban regions encounter difficulties in gaining access to these toll highways. The imbalance between the construction of road networks and the rise of towns next to these highways is frequently at the base of the problem. Environmental disturbances and other

external elements in the vicinity of the highways can potentially degrade distribution quality.

Managing urban transportation difficulties needs smart planning. Governments can link transportation operations with social goals by properly regulating road traffic in metropolitan areas. Collaboration between the public and commercial sectors can pave the way for infrastructure projects such as motorways. These motorways can make product and freight transportation more efficient. However, it is critical to maintain a harmonious balance between communities, industrial regions, and other commercial zones while building these paths (Oglesby and Hicks, 1982).

The construction of highways and other major transportation infrastructure usually alters the landscape of the regions through which they pass. Once rural or underdeveloped, these locations see tremendous expansion and transformation into hubs of manufacturing, service, and habitation. Such advances not only benefit the places they affect, but also contribute significantly to national and regional economic development.

Transportation and Economic Growth

The complicated relationship between transportation and economic growth cannot be overstated. The transportation industry is an economy's lifeblood, ensuring the dynamic movement and interchange of activity across places. This link, facilitated by transportation infrastructure, becomes the cornerstone that holds various economic zones together.

The importance of this link has been shown by historical research in regional science. Specifically, the evolution, expansion, and concentration of economic activity in a given region are heavily influenced by its connectivity to markets and the resulting locational benefits (Bryan et al., 2007). In other words, the more networked a location is, the more favorable it is to economic growth.

The structures and facilities that support a healthy economy are the fundamental building blocks. Roads, bridges, ports, and airports, for example, serve as important organs, facilitating the exchange of commodities, services, and information. The extent and quality of infrastructure in a region can be a direct predictor of its level of development and economic health. National Economic Activity Centres, for example, bustling commercial areas where marketplaces, retail centers, and restaurants converge, invariably have a solid supporting infrastructure network.

The fundamental engine fueling the expansion of industries and the economy of a region is a smooth, efficient, and comprehensive transportation system. It supports the smooth circulation of goods and services produced by various industries by connecting upstream manufacturing facilities with downstream markets. The system's arteries, roads, railways, and ports, connect core economic hotspots to periphery regions, assuring a continual flow of economic advantages.

As an economic region grows, so does the demand for its infrastructure, particularly roadways. As more goods and services are moved, road traffic is becoming more congested. This expansion always implies further expansion and refining of infrastructures to meet increased demand and maintain economic growth momentum.

An underestimated benefit of an efficient transportation system is the potential for cost savings. When transportation costs are kept low, the region benefits from economies of scale. Goods can be produced more cheaply, which has a direct impact on their pricing. This concept is critical to comprehending the dynamics of industrial site selection as well as broader economic activities. Transportation costs are factored into production costs. As a result, keeping transportation costs low correlates to reducing manufacturing costs, ensuring competitive pricing for products, and, as a result, increasing their market competitiveness (Nasution, 1996).

In brief, transportation is more than just a means of getting items from one place to another. It is a complex web that connects industries, generates economic activity, and ultimately affects regional growth trajectory. The interconnection provided by a strong transportation system is critical to regional economic growth.

Urban Development

According to Bertaud (2004), the intricate tapestry of urban development is delicately woven by the interplay of market dynamics, regulations, and primary infrastructure investments, constituting the fundamental foundations of urban spatial management systems. The emergence of this structure, albeit seemingly unintentional, frequently occurs as an unanticipated outcome of laws and regulations that were developed without adequate attention to spatial management considerations, as emphasized by Soetomo (2004). As an illustration, there are cities that face the issue of inadequate utilization of transportation infrastructure, whilst others possess well-functioning transportation systems, both of which necessitate the allocation of land resources. The adaptability of urban spatial management structures is shown in their ability to undergo changes, although these changes typically occur gradually. The presence of this innate trait greatly limits the range of feasible developmental routes.

As the proliferation of urban spatial management structures becomes more prevalent in big cities, their development tends to follow specific paths, making it difficult to easily restore areas that have been allocated for current projects. This highlights the necessity for urban planners to possess a comprehensive understanding of the potential opportunities and vulnerabilities associated with the existing spatial management patterns they are influencing.

One notable aspect of urban expansion becomes apparent when analyzing large cities—a persistent pattern of development that does not correspond seamlessly with national policies. This phenomenon prompts reflection on the fundamental economic reasoning behind such expansion. It is worth noting that larger cities surpass smaller ones in terms of production, a phenomenon that can be attributed to their ability to provide efficient labor markets. According to Prud'homme (1995), the emergence of megacities as prominent labor markets was observed throughout the transition from the nineteenth to the twentieth century. Integrated labor markets emerge within the boundaries of a large urban area, designed to accommodate the specific skill levels required for various job positions.

The ability of an urban structure to effectively enable the movement of labor within a large metropolitan area is crucial for its proper functioning. Regardless of the location of one's family residence inside this region, the crucial factor to consider is the proximity to employment opportunities within an acceptable duration, preferably a commute of less than one hour.

The importance of indicators in the evaluation of urban spatial management structures cannot be overstated. Indicators play a crucial role in quantifying and assessing key aspects of spatial management, serving as benchmarks for critical appraisal. The employment of indicators is limited by the empirical nature of the analysis, but their deployment can be effectively combined with census data, land use plans, and satellite images.

In summary, the complex fabric of urban development is intricately intertwined with the multifaceted elements of market dynamics, regulatory structures, and investments in infrastructure. The urban spatial management systems that shape cities are influenced by several components, which frequently arise unintentionally because of policies that neglect spatial considerations. Despite their seemingly unintentional characteristics, these structures exhibit a degree of flexibility while advancing at a deliberate speed,

thereby determining the range of developmental options that are accessible.

The development of these architectural features within urban centers highlights the necessity for urban planners to comprehend their capabilities and constraints. Furthermore, the continued expansion of prominent urban centers, despite potential conflicts with national policies, can be due to their ability to offer highly efficient labor markets, a trend that is most pronounced in megacities. The phenomenon of urban expansion is inherently linked to the ability of an urban framework to enable the movement of labor between different metropolitan areas. Finally, the assessment of these structures necessitates the utilization of indicators that measure their essential attributes, notwithstanding the empirical nature of such evaluations.

The Dynamics of Urban Development

Modern urban development is a complicated and constantly shifting process. It is not just about constructing new structures or expanding cities. Instead, it goes further into the complexities of planning, decision-making, and community participation. As cities expand and grow, decision-making paradigms have shifted from top-down to a more inclusive and participatory approach. The modern perspective recognizes that cities belong to their citizens. Therefore, urban planning has shifted toward a paradigm of community empowerment.

As a result of this paradigm change, theories of planning and urban spatial design are no longer limited to infrastructure and aesthetics. They now strongly correlate with community development and empowerment philosophies. The goal of modern urban development is to ensure that urban environments are equal, inclusive, and represent the aspirations of their citizens.

Urbanization, a prominent factor in the modern era, is frequently associated with transformation or modernization. It serves as a crucible in which disparate materials collide, resulting in heterogeneity both within and outside of city limits. The urbanization diffusion model depicts this shift vividly. It depicts the transition from core urban hubs to periphery locations, encompassing a variety of dynamics such as economic shifts, investment trends, developmental regulations, and migratory patterns.

It is important to emphasize, however, that urbanization does not always take a straight or predictable path. Theoretical assumptions of the urbanization process frequently collide with the reality of unique obstacles, particularly in developing or third-world countries. One of the most visible issues is the shift from the second to the third stage of urbanization, which is characterized by the expansion of national cities. Currently, phenomena such as Urban Primacy and Mega Urban Phenomenon are common. These processes materialize as fast increasing metropolises, which, while delivering growth, also bring with them a slew of issues.

Similar ideas of urbanization and development can be seen in the notions of growth centers and growth poles. The transition from agrarian to non-agrarian settings, as well as the transformation from rural landscapes to busy urban centers, exemplify modernization. However, this modernity is selective. Not all industries or segments evolve at the same rate or in the same way. As a result, certain sectors, particularly the informal, emerge more prominently in these urban settings.

Another result of fast urbanization is the formation of "area cities" in suburban areas. These are sprawling that form on the outskirts of big cities, often spontaneously and unplanned. The consequences of such unrestrained expansion are numerous. Encroachments harm the ecosystem and agricultural fields. Congestion has become an everyday occurrence, particularly on key transit routes such as toll roads.

Furthermore, the modern urban development narrative is multidimensional.

It's a story about development, empowerment, challenges, and chances. While urbanization provides tremendous benefits, it also introduces a slew of problems that demand careful planning, community involvement, and environmentally sound methods.

Land Use and Transportation Interactions in Urban Development

Land use and transportation are two of the most important aspects of urban development. The link between transportation infrastructure and land use patterns has long been a focus of urban studies and policy. How cities use their property and how they permit movement inside their borders has far-reaching consequences for growth, sustainability, and citizens' quality of life.

One of the most important areas of research in this field is the concept of multi-purpose land use in conjunction with transportation services. This concept contends that land should not be confined to a single, static use; rather, it can be optimized for several purposes, aided further by efficient transportation systems. When these two factors work together, the effects on urban landscapes can be profound.

The National Cooperative Highway Research Program (NCHRP) published a study in 1998 that provided light on the mutually beneficial connection between road development and land use. Their ideas were critical in shaping our knowledge of how transportation projects shape and are shaped by their surroundings. In general, the NCHRP recognized three types of induced growth effects in transportation projects:

1. Planned Projects to Serve Specific Land Development
   These are transportation projects that are specifically designed to support specific land development plans. A new residential complex, for example, may entail the construction of a linked road or railway. The major goal of the transportation project is defined and customized to the objectives of a specific land use plan in this case.
2. Projects that Promote Complementary Functions
   Transportation improvements might sometimes unintentionally pave the path for auxiliary developments. For example, the creation of a new highway may result in the establishment of commercial hubs, shopping centers, or service stations along its path. These additional roles were not the primary goal of the transportation project, but they emerge because of the project's enhanced accessibility and opportunity.
3. Projects Influencing Intraregional Land Development Location Decisions
   Transportation infrastructure has a large impact on where developers choose to invest. The existence of a large transportation hub, such as a railway station or an airport, for example, may make neighboring land more appealing for commercial or residential development. Such projects can change the landscape of an entire region over time, shifting investment and altering the spatial distribution of urban expansion.

Recognizing these induced growth consequences is critical for policymakers. Policymakers can foresee the cascading effects of transportation developments and land use decisions with a more holistic understanding.

Furthermore, this information enables them to direct urban growth in a way that maximizes benefits while reducing any negative consequences.

As cities evolve, integrating multi-purpose land use with transportation services emerges as a critical strategy. It encourages sustainable expansion, maximizes resource utilization, and guarantees that urban places remain adaptable and responsive to their residents' changing demands. Governments may design wealthy, sustainable, and inclusive urban futures by enacting policies that encourage this integration.

The Importance of Transportation in Economic Dynamics and Industrial Location

The field of urban and economic growth is large and complex, and transportation is one of its most important foundations. The importance of transportation extends beyond simply getting from point A to point B; it has far-reaching ramifications for regional economic growth, industry placement choices, and even the sort of goods produced in a region.

Economic dynamics are naturally skewed in locations lacking efficient transportation networks or burdened by high transportation expenses. In the lack of external inputs or market access, such regions rely primarily on their indigenous resources. They favor utilizing their natural resources, resulting in a potentially limited-diversity economy. Without inexpensive and effective transportation, the potential for expansion and diversification is hampered.

In contrast, a place blessed with low transportation costs frequently experiences economic growth. Lower transportation costs imply that large-scale production is feasible. Goods and services may be produced more cheaply with lower logistical costs, which benefits both industry and consumers. As Nasution (1996) correctly pointed out, this not only provides a competitive price for items but also nurtures a market competitive edge.

When delving deeper into the complexities of industrial location considerations, transportation costs play a critical role. This is not a broad-brush concept. The nature of the commodities, particularly their weight and perishability, is important. When dealing with heavy raw materials, as Von Thunen proposed in 1966, it is economically beneficial to locate the production plant as close to the source of these commodities as possible.

By connecting transportation to the broader area of distribution, Woodward (1980) summarized the core of transportation. The act of manufacturing is only one component of the puzzle that constitutes industrial operations. Producers are not only concerned with producing items, but also with ensuring that these goods reach consumers in a timely, efficient, and flawless manner. As a result, distribution systems become industries' lifelines, bridging the gap between production and consumption. Transportation isn't simply a cog in the machine in this distribution network; it's the engine that powers it.

Furthermore, the importance of transportation in influencing economic landscapes and industrial decisions cannot be emphasized. It's a complex combination of cost dynamics, site preferences, and logistical efficiencies, with ripple effects that influence the broader economic fabric of places.

3. RESEARCH METHODOLOGY

Research Approach

According to Saunders et al. (2012), a case study is a different research technique that tries to gather data directly from the intricacies of real-life occurrences and actual observations. It provides a comprehensive understanding based on actual, lived experiences by methodically investigating specific circumstances or phenomena. Bryman and Bell (2007) define case studies further by emphasizing their focus—often on specific situations inside organizations, particularly those undergoing transformative transformations or upheavals.

The case study technique was specifically chosen in the context of this research, with the Jakarta-Cikampek toll road serving as the principal subject of investigation. This method not only investigates a phenomena in its natural surroundings, but it also provides a unique opportunity to connect theoretical ideas with real-world occurrences. The use of such a technique in research can yield extraordinary depth and nuanced insight, as Saunders et al. (2012) note. They also stated that, while case

studies are often qualitative, adopting a holistic viewpoint by integrating quantitative data inputs might enrich the study and provide a more rounded understanding of the issue.

Case studies, like any research methodologies, have their own set of obstacles and issues. Lanthier (2002) emphasized a crucial caveat: the conclusions of one case study may not be applicable to others. This limitation is due to the inherent uniqueness of each case, as well as the various situations, stakeholders, and a plethora of other elements that might impact outcomes. Furthermore, data analysis in case studies might be very interpretive. The conclusions reached from the same collection of data may range dramatically depending on the researcher's perspective, experiences, and prejudices, potentially leading to various, even opposing, interpretations.

In conclusion, while case studies provide in-depth, complete insights into specific real-life circumstances, integrating theory and practice, researchers must approach them with an understanding of their limitations and the potential for interpretation variations.

Data Availability

The research employs quantitative research methodologies by obtaining information mostly from secondary sources. Quantitative data, according to Saunders et al. (2012), is a research technique that processes and analyses numerical information acquired directly from raw data. The decision to use a quantitative method in this study derives from the requirement to alter and assess this raw numerical data using linear regression techniques, with the goal of obtaining comprehensive results from these computations.

The following data are required for this study:

- Gross Domestic Regional Product (GDRP): The research studies the GDRP from Karawang regency during a 12-year period, from 2000 to 2012.
- Agricultural Sector: Examining agricultural indicators can provide insights into changes in rural productivity as well as the possible effects of urbanization and infrastructural development on agrarian economies.
- Industrial Sector: Investigating the industrial sector can reveal growth trends, contributing variables, and the potential implications of transportation and urban planning on industry dynamics.

Data Analysis Perspective

According to Saunders et al. (2012), quantitative data analysis needs a few numerical operations. This method converts raw numerical values into meaningful insights, interpretations, and outcomes. Given the study's emphasis on raw numerical statistics and use of numerous regression algorithms, a quantitative research strategy is unquestionably appropriate.

This study's base combines urban design concepts with transportation paradigms. While this study may appear to be innovative, similar approaches have been used in numerous previous studies. To begin the research process, relevant concerns must first be identified. Recognizing and defining these challenges ensures that the subsequent research methodologies are in sync with the overall goals. Furthermore, this first step necessitates a thorough comprehension of existing theories and knowledge, ensuring that the research remains grounded and relevant within its academic and practical contexts.

4. DATA ANALYSIS

Linier Regression Outcome

Toll road development is frequently a catalyst for broader changes within an area, particularly in terms of land-use patterns and the mobility behaviors of its residents.

Such infrastructure initiatives not only improve transportation but also have an economic, social, and spatial impact on the surrounding area.

The Gross Domestic Regional Product (GDRP) is a useful indicator for assessing an area's economic progress. Changes in the GDRP over time can provide insight into the real-world economic impact of infrastructure developments such as toll highways. Agriculture and industry (excluding the oil and gas sectors) were the key sectors examined in this study to track these consequences. These industries were chosen because they frequently demonstrate the most direct and immediate ramifications of infrastructure advancements, such as altered land-use patterns for agriculture or improved logistics and transportation networks for industry.

The research used the Statistical Package for the Social Sciences (SPSS) software to ensure a thorough examination of the available secondary data. SPSS is a well-known statistical analysis application that provides rigorous approaches for interpreting and comprehending complex statistics. The findings of this application are then delineated in the following parts, with the goal of painting a full picture of the impact of toll road development on regional economic indicators.

Agriculture and Industrial Correlation

The first step is generating the correlation between agricultural sector and industrial sector based on the linear regression model below:

$$Y = a + bX$$

Denotation:

Y = agricultural variable

X = industrial variable

The input for the calculation is the GDRP number of agricultural and industrial within the time frame. Agriculture is a dependent factor, but the industrial sector is independent. The calculation's goal is to determine whether the development of industry has an impact on the development of agriculture.

The research used hypothesis that suit with condition and analysis such are:

H0 = The independent variable has no effect on the dependent variable, implying that industrial sector development does not correspond with agricultural sector development.

Ha = Dependent variable has any impact on the dependent variable, implying that industrial sector development corresponds with agricultural sector development.

Tabel 1: Coefficients of Agriculture as dependent variable

Model	Unstandardized Coef.		Std. Coef.	t	Sig.
	B	Std. Error	Beta		
1 (constant)	1146456,255	42047,047		27,266	0
INDUSTRY	0,082	0,005	0,978	15,483	0

It is denoted that the value of t in the table 4.7 is 15.483, which is called as t calculation. In order, to take a decision of the early hypothesis, t calculation should be compared with the value of t table such as described below:

- If –t table < t calculation < t table, then H0 is accepted.
- If t calculation < - t table or t calculation > t table than, H0 is rejected.

Based on SPSS result the outputs are generated below:

- t calculation = 15.483
- significance level = 0.05
- degree of freedom= number of samples – number of variables = 13 – 2 = 11
- t table (1/2 0.05 ; 11) = 2.201

The result shows that t calculation > t table than H0 is rejected, which means that the development of industrial sector significantly correlated to the development of agriculture sector.

The regression coefficient resulted in the following model:

$$Y = a + bX$$
$$Y = 1146456.255 + 0.082X$$

In a regression analysis, the coefficient (b) indicates the slope of the line and offers critical information about the nature of the relationship between the dependent variable (Y) and the independent variable (X). In terms of its mathematical role, it particularly depicts the average change in the dependent variable (Y) for a one-unit change in the independent variable (X).

Consider (b) as a measure of the sensitivity or responsiveness of (Y) to changes in (X). If (b) were negative, it would indicate that if (X) increased, so would (Y), and vice versa. However, because (b) is positive in this instance, it suggests a direct relationship between (X) and (Y). This means that for every unit increase in (X), the magnitude of (Y) will rise by the magnitude of (b).

Consider a rising slope on a graph, where the upward incline represents the positive association between the two variables. The higher the incline (or slope), the greater the influence of changes in (X) on (Y). In practice, this could be interpreted as follows: for every additional mile of road created (X), a region's economic output may grow by a specific amount (Y). The value of (b) determines the exact amount of that increment.

Thus, a positive value of (b) not only indicates a direct relationship, but also provides an empirical basis for predicting how (Y) would behave in response to changes in (X), which is useful in forecasting and policy-making situations.

5. DISCUSSION AND CONCLUSION

The data analysis findings provide critical insights into the patterns of land usage in the Karawang region. It is clear, that the industrial sector is the dominant engine affecting land-use changes, especially after the construction of the Jakarta-Cikampek toll road. This trend reflects a larger global pattern in which regions experience a transformation from agrarian to industrial economies, which can have a significant impact on their economic destiny.

The data implies a trade-off: converting fertile agricultural regions, which have historically produced significant economic value, into industrial zones has the potential to boost industrial expansion. This, however, comes with its own set of difficulties. While industries can provide quick economic growth, unregulated industrialization can pose environmental dangers and disrupt the local ecosystem's balance. Furthermore, replacing agricultural areas might have an influence on food security and farmers' livelihoods in the region.

The increased coefficient value of the industrial sector, as indicated by SPSS computations, acts as a policymaker indicator. Recognizing the industrial sector as a dominating influencer following the development of the toll road suggests that its expansion can be exploited for maximum economic gains if handled efficiently. However, it also serves as a cautionary tale: focusing solely on one industry without adequate scrutiny might have long-term ramifications.

As a result, the government's participation becomes critical. Following such discoveries, government agencies should invest in extensive research before making land-use decisions, ensuring that they are supported by empirical facts and are in the best long-term interests of the region. The goal should not only be short-term economic gains, but also long-term growth that is compatible with the environment and societal needs.

Furthermore, comprehensive land-use planning by municipal governments is critical. It should not only meet the needs of industrial growth, but also assure the survival of other key sectors such as agriculture, trade, and real estate. A balanced approach that connects these sectors, particularly through effective transportation networks and infrastructure, might result in holistic development. Such a

strategy assures that, although the region benefits from the toll road and industrial growth, it is protected from potential traps and negative effects in the future. Properly managed land use, with foresight and adaptation, is the foundation for any region's future prosperity and sustainability.

REFERENCES

[1] Alonso, W. (1964) Location and Land Use: Toward a General Theory of Land Rent. Massachusetts: Harvard University Press.

[2] Beinet, E. and Nijkamp, P. (1998) Multicriteria Analysis for Land-Use Management. Dordrecht: Kluwer Academic Publishers.

[3] Bryan, J., Weisbrod, G. E., and Martland, C. D. (2007) Rail Freight Solutions to Roadwway Congestion – Final Report and Guidebook. Washington: National Cooperative Highway Research Program

[4] Carnemar, C., Biderman J., Bovet, D. (1976) The Economic Analysis of Rural Road Projects. Washington DC: World Bank

[5] Fujita, M. (1989) Urban Economic Theory: Land Use and City Size. England: Cambridge University Press.

[6] Hermanides, G., and Nijkamp, P. (1998) 'Multicriteria Evaluation of Sustainable Agricultural Land Use: A Case Study of Lesvos', Muticritera Analysis for Land Use Management, 9, pp. 61 – 78.

[7] Indonesia. Department of Public Works (2009) Program Percepatan Pembangunan Jalan Tol. Jakarta: Department of Public Works.

[8] Indonesia. Department of Settlement and Regional Infrastructure (2002) Tol Road Investment Opportunity in Indonesia. Jakarta: Department of Settlement and Regional Infrastructure.

[9] Morlok, E. (1995) Pengantar Teknik Perencanaan Transportasi. Jakarta: Erlangga.

[10] Nurmandi, A. (2006) Manajemen Perkotaan: Aktor, Organisasi, Pengelolaan Daerah Perkotaan dan Metropolitan di Indonesia. Jakarta: Sinergi

[11] Tamin, O.Z., Russ, B.F. (1997) Penerapan Konsep Interaksi Tata Guna Lahan-Sistem Transportasi dan Perencanaan Sistem Jaringan Transportasi. Perencanaan dan Manajemen Transportasi: Vol. 8. Bandung: ITB Press.

[12] Woodward, F.H. (1980) Managing the Transport Service Function. London: Gower Press