



Strategy to Actualize Green Campuses Through Sustainable Transportation

Amin Pujiati^{1✉}, Prasetyo Ari Bowo², Reza Nadya Isabella Putri³

Universitas Negeri Semarang

Article Info

History of Article
Received January 2021
Accepted March 2021
Published May 2021

Keywords:
Green Campus,
Sustainable
Transportation,
Analytical Hierachy,
Process (AHP)

Abstract

The green campus program is an effort made by the Indonesian government to overcome environmental problems that occur due to pollution, one of which is the Surakarta City Government. By involving tertiary institutions, it is hoped that it will be able to become a concrete example of the realization of greening for the surrounding community to help create a green and environmentally friendly city. The high level of pollution that occurs is certainly accompanied by the high use of motorized vehicles. The purpose of this research is to determine the priority order of strategies that must be carried out to realize a green campus through sustainable transportation at Universitas Sebelas Maret. The method used in this research is descriptive qualitative. The data used are primary data. The analytical tool used is the Analytical Hierarchy Process (AHP) which is used to determine the priority order of strategies in realizing a green campus through sustainable transportation at Universitas Sebelas Maret. The results showed that the order of priority strategies in realizing a green campus through sustainable transportation is improving the quality of the environment, developing facilities and infrastructure and university policies. Based on these priorities, there must be collaboration that is also carried out by the academic community in order to realize this green campus. In addition, all strategic plans that have been prepared must be carried out accordingly.

INTRODUCTION

The environment is something that is around humans and is a reciprocal relationship. One of the environmental problems that always attracts the world's attention is the increasing one. In the last 200 years, humans have produced carbon dioxide more than double because of the combustion system of fossil fuels such as coal, oil and natural gas. This massive arson began in the 18th century, when the world entered the industrial revolution. This is of course a serious problem for all countries that have businesses and activities related to natural resources, including Indonesia.

The Indonesian government plans to reduce 29% of greenhouse gas emissions by 2030 through land and forestry management, energy development and management and waste management. In addition, efforts that have been made by the Government are building green cities or green cities through the Ministry of Public Works and Public Housing (PUPR) by encouraging local governments to develop eight attributes of Program Pengembangan Kota Hijau or P2KH. A green city or city is a city that is well planned, characterized by being environmentally friendly and utilizing natural resources in a balanced manner so as to create welfare for its inhabitants.

In addition to the green city concept, the Government of Indonesia also includes universities to contribute to reducing global impacts by implementing the green campus concept. A green campus is defined as a campus with an environmental perspective, which integrates environmental science into the management policies and activities of the higher education's Tri Dharma (Buana et al., 2018). Indonesia has a green campus standard that is recognized by both state and foreign universities, namely Universitas Indonesia (UI) Greenmetric. The implementation of green campus makes many campus managements overwhelmed by the level of pollution created by transportation for the entire academic community every day. This is because the entire academic community, be it students, lecturers and educators, continue to

carry out activities from morning to evening on campus using private vehicles. To overcome this, the government has designed a green transportation concept that aims to reduce pollution levels, especially in the campus area.

The concept of Green Transportation or green transportation is a concept used so that the mode of transportation can be more environmentally friendly and reduce the greenhouse effect. According to research conducted by Wimala, et al (2018), Several improvement strategies that can be carried out at Itenas in the construction of a green campus are to increase understanding of the importance of sustainable transportation in reducing environmental impacts due to the daily activities of the campus community, providing sustainable transportation facilities and infrastructure, providing real examples in daily activities on campus, and supporting programs research programs or knowledge sharing. The impact of sustainable transportation cannot be separated from urban growth and the development process (Beyzatlar et al., 2014; Meersman et al., 2017; Özokcu et al., 2017; Saidi et al., 2018; Tong et al., 2018).

According to the Ministry of Environment and Forestry, the Directorate General of Pollution Control and Environmental Damage, the Provincial Air Pollution Control Directorate, in 2020, Central Java with the capital city of Semarang has an Indeks Standar Polusi Udara (ISPU) of 240, which falls under the unhealthy criteria. If this condition continues, it will have an impact on the quality of public health (Arvin et al., 2015; Israel-Schwarzlose et al., 2014; Liang et al., 2019; Qiu et al., 2019; Wang et al., 2019). This shows that there is a need for improvement in the development of green cities in Central Java, especially in indicators that affect air quality, such as transportation. In an effort to reduce the pollution rate, all districts / cities in Central Java are mobilized to build a green city, one of which is the city of Surakarta. In Wardana's research (2018), It is explained that in the Republic of Indonesia Law No.26 of 2007 concerning Spatial Planning, article 29 paragraphs 1 and 2 states that the proportion of

green open space in the city area is at least 30% of the total area of the city and the proportion of public green open space in the city area is at least 30%. at least 20% of the city area.

The Surakarta City Government formed a City Green Community in 2014 and included universities in the City of Surakarta to participate in the implementation of this green city through the green campus. In realizing this, the Surakarta City Government through the Dinas Lingkungan Hidup (DLH) has conducted a Socialization of P2KH. The parties who took part in the socialization activities were the academic community, be it students, lecturers and educators, with the hope that all academicians from universities in the city of Surakarta who will also be able to understand the goals and ways of implementing a green campus so that they can become an example for the community and environment around the campus. to pay more attention to the environment. With this directive,

several universities in Surakarta began to build green campuses, one of which was Universitas Sebelas Maret (UNS).

UNS is one of the public universities in the city of Surakarta that applies the green campus concept as seen in the Green Campus Rencana Pembangunan Strategis (Renstra) which has been adjusted to the Surakarta City Government planning in the development of the green city concept. Even in 2015, UNS was used as a model in implementing green campuses in Indonesia and was awarded as a pioneer environmentally friendly campus by the Ministry of Environment and Forestry. In the UI Greenmetric University Ranking, Universitas Sebelas Maretis also one of the universities that is always ranked in the top ten greenest campuses in Indonesia. The following is a table showing the ten universities that occupy the greenest position in Indonesia:

Table 1. Top 10 Ranking of Universities in Indonesia according to UI Greenetric 2019

Ranking	University	Score
1	Universitas Indonesia	8025
2	Institut Pertanian Bogor	7775
3	Universitas Gadjah Mada	7625
4	Universitas Diponegoro	7600
5	Insititus Teknologi Sepuluh November	7550
6	Universitas Negeri Semarang	7400
7	Universitas Sebelas Maret	7050
8	Universitas Islam Indonesia	6925
9	Universitas Telkom	6550
10	Universitas Padjajaran	6475

Source: (Universitas Indonesia, 2019)

Table 1 shows that Sebelas Maret University occupies the seventh position of the ten greenest campuses in Indonesia. In addition, UNS has also helped lay the foundations, values and implementation of sustainable development. Even as the main public university in the city of Surakarta, Universitas Sebelas Maret also supports the Go Green program of the city of Surakarta. With the campus environmental management activities that have been implemented, Universitas Sebelas Maret was able to maintain its position in the top ten of the UI Greenmetric Ranking University in Indonesia despite a decline from the previous rank in fifth.

In fact, based on data from the Universitas Sebelas Maret Greenmetric form, it is noted that the proportion of transportation modes is dominated by motorbikes, which is 85% compared to other transportation provided by the campus management, such as campus buses, bicycles and pedestrians.

Table 2 below shows the ranking obtained by Universitas Sebelas Maret in the last five years in terms of the percentage that has been adjusted to the UI Greenmetric University Ranking regulations.

Table 2. Ranking of Universitas Sebelas Maret (UNS) from 2015-2019 according to UI Greenmetric.

Year	Ranking	Indicators (%)					
		Arrangement and Infrastructure	Energy and Climate Change	Waste	Water	Transportation	Education and Research
2015	5	41%	57%	71%	65%	54%	41%
2016	5	58%	44%	64%	66%	64%	66%
2017	5	48%	63%	63%	48%	59%	51%
2018	7	60%	58%	58%	65%	67%	75%
2019	7	52%	69%	69%	85%	71%	79%

Source: (Universitas Indonesia, 2019)

This research is a qualitative descriptive study. The location used as a place in this research is Universitas Sebelas Maret in Surakarta. Primary data in this study were obtained through a questionnaire distributed to Keyperson. Meanwhile, secondary data in this study were obtained from government agencies such as the Surakarta City Environmental Service, or other related agencies such as Universitas Sebelas Maret and research that has been carried out which of course are related to the topics and themes in this study. The questionnaire design was made with clear questions, where these questions were to gather information from respondents about the conditions of the green campus and sustainable transportation at Universitas Universitas Sebelas Maret.

The keyperson in this study amounted to 13 people consisting of the Head of the Bureau of Finance and General Affairs, the Head of the Planning and Information Bureau, the Head of the Center for Environmental Research, Lecturers, Education Personnel and Students of Universitas Sebelas Maret. The researchers chose the keyperson in the table above because the green campus program through sustainable transportation is a program that requires collaboration by the entire academic community on campus. Thus, all selected keyperson are parties who are considered to have influence, understand and feel the impact of the development of a green campus through

sustainable transportation at Universitas Sebelas Maret.

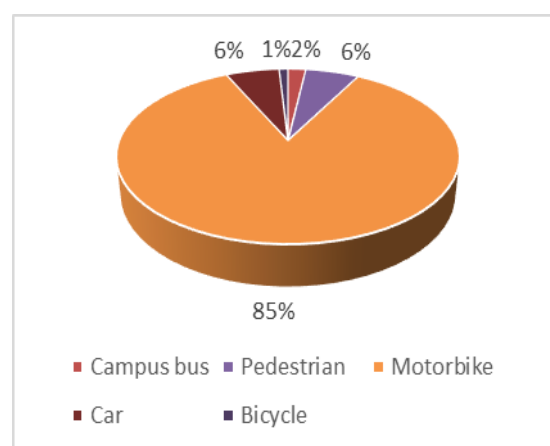


Figure. 1 Percentage Number of Vehicles that enter UNS /day.

Source: (Universitas Sebelas Maret, 2015)

RESULTS AND DISCUSSION

This study uses the Analytical Hierarchy Process (AHP) to formulate a priority strategy in realizing a green campus through sustainable transportation at Universitas Sebelas Maret. The following shows the results of the analytical hierarchy process using the expert choice 11 program. Based on the results of the data processing, it can be seen that the priority order of the criteria is from the most prioritized to the lowest weight value, as follows:

Table 3. Criteria for Achieving a Green Campus Through Sustainable Transportation.

No	Criterion	Value	Info.
1	Environmental Quality Improvement	0,407	<i>Inconsistency Ratio: 0</i>
2	Development of Facilities and Infrastructure	0,309	
3	University Policy	0,284	

Source: Processed primary data, 2020

Based on the picture above, it can be seen that the criteria that must be prioritized in realizing a green campus through sustainable transportation at Universitas Sebelas Maret are criteria for improving environmental quality with a weight value of 0.407. Then the second priority criterion is the development of facilities and infrastructure with a weight value of 0.309 and the third priority criterion is university policy with a weight value of 0.284. From the results of the calculation of the Analytical Hierarchy Process (AHP) with the expert choice 11 program, the inconsistency ratio is 0, which means that the answers given by Keyperson are consistent.

Based on calculations using the Analytical Hierarchy Process (AHP), it shows that the most prioritized criterion in realizing a green campus through sustainable transportation at Universitas Sebelas Maret is the criteria for environmental quality improvement with a weight value of 0.407 with an alternative being the priority, namely determining a car free day on campus reduce motor vehicle fumes. Then the second priority criterion is the development of facilities and infrastructure with a weight value of 0.309 with alternatives being the priority, namely the provision of comfortable and safe supporting facilities (shelters, shelters, benches, shade vegetation) and the criterion with the last priority is university policy with a weight value of 0.284. with an alternative that is a priority, namely using environmentally friendly modes of transportation around the campus. This is different from the results of research conducted

by Adzim (2019) regarding sustainable transportation development strategies in the city of Semarang, based on the results of this study, the criteria for developing facilities and infrastructure are the main priority criteria with a weight value of 0.413, and the second priority criterion is environmental quality improvement with a weight value of 0.327 and the third or final priority criterion is policy government with a weight value of 0.260. The results of these calculations can be used as the basis for realizing green campus through sustainable transportation at Universitas Sebelas Maret.

The main priority criteria in realizing a green campus through sustainable transportation at Universitas Sebelas Maret are criteria for improving environmental quality. Based on the results of data processing, it can be seen that the order of alternatives from the most prioritized to the one with the lowest weight value in the criteria for improving environmental quality in realizing a green campus through sustainable transportation at Universitas Sebelas Maret, is as follows:

Table 4. Criteria for Improving Environmental Quality in Achieving a Green Campus Through Sustainable Transportation.

No	Alt. Criterion	Value	Info.
1	C3	0,350	<i>Inconsistency Ratio: 0,01</i>
2	C2	0,250	
3	C1	0,223	
4	C4	0,177	

Source: Processed primary data, 2020.

Where C1 is transfer of private modes of transportation to modes of public transportation; C2 is arrangement of campus transportation circulation system; C3 is determination of car free days on campus to reduce motor vehicle fumes; and C4 is tree planting movement and environmental campaign on social media.

Based on the results of calculations from the Analytical Hierarchy Process (AHP) in the picture above, it shows that the most prioritized alternative is the determination of car free days

on campus to reduce motor vehicle fumes with a weight value of 0.350. Supported by the theory put forward by Brotodewo (2010) on Hidayati (2016) that environmental aspects in sustainable transportation are the use of resources in transportation activities that are balanced and environmental pollution due to the impact of minimal transportation. In addition, industrial development (construction of fossil fuel transportation facilities) in the vicinity of the environment can increase the impact of environmental quality degradation and the health of the surrounding community (Amin Pujiati et al., 2020).

Furthermore, the second priority alternative is the arrangement of the campus transportation circulation system with a weight value of 0.250. The third priority alternative is the transfer of private transportation modes to public transportation modes with a weight value of 0.223. As according to Tamin (Tamin, 2000), In an effort to achieve sustainable transportation there are basic principles that must be applied, one of which is sustainability in the environment, where according to him places that have little impact by the transportation system are places where people prefer to use public transportation or walk rather than private vehicles. Then the alternative that is the last priority is the tree planting movement and environmental campaigns on social media with a weight value of 0.177. The decline in air quality and the environment is caused by the use of motorized vehicles, reduced incentives for non-motorized vehicles, and a lack of green land (Labib et al., 2018).

As an attribute in green city development, one of the most important elements is the existence of green open space. Green open space is useful in reducing pollution, adding aesthetics and creating a comfortable microclimate. This can be created by expanding the garden land, green corridors and others. In tree planting, Universitas Sebelas Maret already has an agreement with the Kementerian Lingkungan Hidup dan Kehutanan (KLHK), in which the agreement contains the obligation for each new student to plant trees and care for 5 trees until

graduation. From these results, the value of the inconsistency ratio is 0.01, which means that the answer given by Keyperson is consistent.

The second priority criterion in realizing a green campus through sustainable transportation at Universitas Sebelas Maret is the criteria for developing facilities and infrastructure. Based on the results of data processing, it can be seen that the order of alternatives from the most prioritized to the one with the lowest weight value in the criteria for developing facilities and infrastructure in realizing sustainable transportation at Universitas Sebelas Maret, is as follows:

Table 5. Criteria for the Development of Facilities and Infrastructure in Realizing a Green Campus through Sustainable Transportation.

No	Alt. Criterion	Value	Info.
1	B4	0,360	<i>Inconsistency Ratio: 0,0088</i>
2	B3	0,244	
3	B1	0,212	
4	B2	0,184	

Source: Processed primary data, 2020.

Where B1 is development of pedestrian and bicycle paths; B2 is Provision of parking points facilities; B3 is provision of mass public transportation/campus buses that are comfortable and affordable; and B4 is provision of comfortable and safe supporting facilities (bus stops, shelters, benches, shade vegetation).

Based on the results of calculations from the Analytical Hierarchy Process (AHP) in the picture above, it shows that the alternative that is most prioritized on the criteria for developing facilities and infrastructure in realizing a green campus through sustainable transportation at Universitas Sebelas Maret is the provision of comfortable and safe supporting facilities (bus stops, shelters, benches, shade vegetation) with a weight value of 0.360. As in Prihanto's research (2014), The existence of this vegetation is scattered along the campus corridors which give direct and indirect influence to road users. And

supported by Tamin (2000) said that one of the basic principles in the effort to achieve sustainable transportation is health and safety, where travel will be safer if it is carried out in places that provide public transport facilities, pedestrians and cyclists. The second priority alternative is the provision of mass public transportation/campus buses that are comfortable and affordable with a weight value of 0.244. According to Litman (2019) the various transportation planning objectives supporting the sustainable goal are the diversity of the transportation system, so that transportation service users can choose the type of mode, location and price options, especially those that are affordable, healthy, efficient and accommodate the non-drivers of transportation who want to be used. The third priority alternative is the development of pedestrian and bicycle paths with a weight value of 0.212. According to Wimala (2018) said that the provision of supporting facilities and infrastructure for bicycle users and pedestrians such as lockers for storing personal items, bicycle parking lots, and shower / shower facilities for pedestrians and bicycle users, providing bicycle rental to the campus community, and providing an area specifically for pedestrians who are protected from rain and heat. And the alternative which is the last priority is the provision of parking points with a weight value of 0.184. In Artisna, et al (2018), said that the arrangement of the parking area aims to minimize the use of land for parking and create a neat and comfortable parking environment as an indication of an environmentally friendly campus is the creation of a comfortable environment which will certainly make users comfortable in the Kampus area as an academic center. From these calculations, the value of the inconsistency ratio is 0.0088, which means that the answer given by Keyperson in this study is consistent.

University policy criteria are criteria that are prioritized third or most recently in realizing a green campus through sustainable transportation at Universitas Sebelas Maret. According to research conducted by Amba (2015), university policies and regulations are

important indicators because they are related to the planning of the layout of buildings, roads, open spaces and other policies and regulations related to the environment. Based on the results of data processing it can be seen the sequence of alternatives from the most prioritized to the lowest weighted value in the university policy criteria in realizing sustainable transportation at Universitas Sebelas Maret, as follows:

Table 6. University Policy Criteria in Achieving a Green Campus Through Sustainable Transportation.

No	Alt. Criterion	Value	Info.
1	A1	0,336	<i>Inconsistency Ratio: 0,01</i>
2	A2	0,264	
3	A3	0,244	
4	A4	0,157	

Source: Processed primary data, 2020

Where A1 is using environmentally friendly modes of transportation around campus; A2 is walking or cycling in doing activities in the campus environment; A3 is SOP for quality internal campus transportation management procedures; and A4 is increasing the number of researches related to sustainable transportation.

Based on the results of calculations from the Analytical Hierarchy Process (AHP) in the picture above, it shows that the most prioritized alternative to university policy criteria in realizing a green campus through sustainable transportation at Universitas Sebelas Maret is to use environmentally friendly transportation modes around the campus with a weight value of 0.336. As according to the Organization Of Economic Transportation and the National Round Table On The Environment And the Economy (OECD, 1996 dan NRTEE, 1996) dalam Brotodewo, N (2010), defines sustainable transportation based on three aspects, one of which is the environmental aspect, according to which transportation does not endanger public health and the ecosystem and provides a means of mobility by utilizing renewable resources or in other words transportation that does not pollute

water, air and land and avoids use. redundant resources.

The second priority alternative is walking and / or cycling in carrying out activities in the campus environment with a weight value of 0.264. Basically, Universitas Sebelas Maret has provided a solution by prohibiting using motorized vehicles but it is only implemented once a month on the first Friday of the week, so it is not yet effective in reducing emissions due to motorized vehicles.

The third priority alternative is the SOP for quality procedures for campus internal transportation management with a weight value of 0.244. And the last priority alternative is to increase the number of researches related to sustainable transportation with a weight value of 0.157. In line with Amba (2015), that campus research is important because it is related to planning, implementing and controlling a systematic, effective and efficient environment. The increase in the number of researches related to sustainable transportation must also be accompanied by the implementation of policies carried out in accordance with the research that has been carried out. The value of the inconsistency ratio in this calculation is 0.01, which means that the answer given by Keyperson is consistent.

In realizing a green campus through sustainable transportation at Universitas Sebelas Maret in this study, three criteria were used which then became twelve sub-criteria or alternatives. Based on the calculation, an alternative sequence is obtained, including the following:

Table 7. Alternatives in Realizing a Green Campus through Sustainable Transportation.

No	Alt. Criterion	Value	Info.
1	C3	0,142	<i>Inconsistency Ratio: 0,01</i>
2	B4	0,108	
3	C2	0,102	
4	A1	0,099	
5	C1	0,091	
6	A2	0,078	
7	B3	0,073	

No	Alt. Criterion	Value	Info.
8	A3	0,072	
9	C4	0,072	
10	B1	0,063	
11	B2	0,055	
12	A4	0,046	

Source: Processed primary data, 2020.

Where C3 is determination of car free days on campus to reduce motor vehicle fumes; B4 is provision of comfortable and safe supporting facilities (bus stops, shelters, benches, shade vegetation); C2 is arrangement of campus transportation circulation system; A1 is using environmentally friendly modes of transportation around campus; C1 is transfer of private modes of transportation to modes of public transportation; A2 is walking or cycling in doing activities in the campus environment; B3 is provision of mass public transportation / campus buses that are comfortable and affordable; A3 is SOP for quality internal campus transportation management procedures; C4 is tree planting movement and environmental campaign on social media; B1 is development of pedestrian and bicycle paths; B2 is provision of parking points facilities; and A4 is increasing the number of researches related to sustainable transportation.

Based on the results of calculations from the Analytical Hierarchy Process (AHP) in the picture above, it shows that the most prioritized alternative in the strategy of realizing a green campus through sustainable transportation at Universitas Sebelas Maret is the establishment of a car free day on campus to reduce motor vehicle fumes with a weight value of 0.142. The second priority alternative is the provision of comfortable and safe supporting facilities (bus stops, shelters, benches, shade vegetation) with a weight value of 0.108. The alternative with the third priority is the arrangement of the campus circulation system with a value weight of 0.102. The alternative with the fourth priority is to use environmentally friendly modes of transportation around the campus with a weighting value of 0.099. Furthermore, the fifth priority alternative is the transfer of private

transportation modes to public transportation modes with a value weight of 0.091. The sixth priority alternative is walking and / or cycling in carrying out activities on campus with a weighting value of 0.078. The alternative with the seventh priority is the provision of mass public transportation/campus buses that are comfortable and affordable with a weighting value of 0.073.

Then there are two alternatives with the eighth priority level, namely the SOP for quality procedures for campus internal transportation management with weight values and tree planting movements and environmental campaigns on social media with the same weighting value, namely 0.072. The ninth priority alternative is the development of pedestrian and bicycle paths with a weighting value of 0.063. The tenth priority alternative is the provision of parking points with a value weight of 0.055 and an alternative with the last priority is to increase the number of researches related to sustainable transportation with a value weight of 0.046. From these calculations, the value of the inconsistency ratio is 0.01, which means that the answers given by Keyperson in this study are consistent.

CONCLUSION

In realizing a green campus through sustainable transportation at Universitas Sebelas Maret, there are several strategies that must be implemented. Based on the calculation of the Analytical Hierarchy Process (AHP), the most prioritized criterion is environmental quality improvement. The second priority criterion is the development of facilities and infrastructure. Furthermore, the criterion that becomes the last priority is university policy. Then, for the prioritized alternative order is the determination of a car free day on campus to reduce motor vehicle fumes, the provision of comfortable and safe supporting facilities (bus stops, shelters, benches, shade vegetation), arrangement of campus transportation circulation arrangements, using environmentally friendly modes of transportation. around the campus, the transfer of private transportation modes to public

transportation modes, walking or cycling in carrying out activities within the campus environment, providing mass public transport / campus buses that are comfortable and affordable, SOP quality procedures for campus internal transportation management, tree planting movements and environmental campaigns on social media, development of pedestrian and bicycle paths, providing parking points and increasing the number of research related to sustainable transportation.

REFERENCES

- Adzim, F. (2019). [*Analisis Gap dan Strategi Pengembangan Transportasi Berkelanjutan di Kota Semarang*]. Universitas Negeri Semarang.
- Amba, M. (2015). [*Desain Strategi Pengelolaan Green Campus Pada Universitas Pattimura*]. *Jurnal Arika*, 83–90.
- Artisna, S. A., Iswandi, U., & Chandra, D. (2018). [*Penerapan Konsep Kampus Ramah Lingkungan (Green Campus) dalam Tinjauan Deep Ecology DI Universitas Negeri Padang*]. *Jurnal Buana*, 2(5), 300–311.
- Arvin, M. B., Pradhan, R. P., & Norman, N. R. (2015). Transportation intensity, urbanization, economic growth, and CO₂ emissions in the G-20 countries. *Utilities Policy*, 35, 50–66. doi: 10.1016/j.jup.2015.07.003.
- Beyzatlar, M. A., Karacal, M., & Yetkiner, H. (2014). Granger-causality between transportation and GDP: A panel data approach. *Transportation Research Part A: Policy and Practice*, 63, 43–55. doi: 10.1016/j.tr.2014.03.001.
- Brotodewo, N. (2010). [*Penilaian Indikator Transportasi Berkelanjutan pada Kawasan Metropolitan di Indonesia*]. *Jurnal Perencanaan Wilayah Dan Kota*, 21(3), 165–182.
- Buana, R. P., Wimala, M., & Evelina, R. (2018). [*Pengembangan Indikator Peran Serta Pihak Manajemen Perguruan Tinggi dalam Penerapan Konsep Green Campus*]. *Jurnal Teknik Sipil*, 4(2), 82–93.
- Hidayati, I. Y., & Febriharjati, S. (2016). [*Pengembangan Transportasi Berkelanjutan di Kota Semarang. Riptek*], 10, 43–56.
- Israel-Schwarzlose, A. A., Mjelde, J. W., Dudensing, R. M., Jin, Y., Cherrington, L. K., & Chen, J. (2014). Willingness to pay for public transportation options for improving the quality of life of the rural elderly. *Transportation Research Part A: Policy and Practice*, 61(2014), 1–14. doi: 10.1016/j.tr.2013.12.009.
- Labib, S. M., Neemab, M. N., & Rahaman., Z. (2018). Carbon dioxide emission and bio-capacity indexing for transportation activities: A

- methodological development in determining the sustainability of vehicular transportation systems. *Journal of Environmental Management*, 223, 57–73.
- Liang, L., Wang, Z., & Li, J. (2019). The effect of urbanization on environmental pollution in rapidly developing urban agglomerations. *Journal of Cleaner Production*, 237, 117649. doi: 10.1016/j.jclepro.2019.117649.
- Litman, T. (2019). *Developing Indicators for Sustainable and Livable Transport Planning*. Victoria, Canada: Victoria Transport Policy Institute.
- Meersman, H., & Nazemzadeh, M. (2017). The contribution of transport infrastructure to economic activity: The case of Belgium. *Case Studies on Transport Policy*, 5(2), 316–324. doi: 10.1016/j.cstp.2017.03.009.
- Özokcu, S., & Özdemir, Ö. (2017). Economic growth, energy, and environmental Kuznets curve. *Renewable and Sustainable Energy Reviews*, 72(April 2016), 639–647. doi: 10.1016/j.rser.2017.01.059.
- Prihanto, T. (2014). [*Pengembangan Sistem Transportasi Hijau Kampus Universitas Negeri Semarang Sebagai Pendukung Mobilitas Civitas Akademika*]. *Jurnal Teknik Sipil Dan Perencanaan*, 16(2), 169–182.
- Pujiati, A., Nihayah, D. M., Adzim, F., & Nikensari, S. I. (2020). Implementation Of Sustainable Transportation Using Gap Analysis: Case Study Of Semarang City. *Journal Of Critical Reviews*, 7, 47–54.
- Pujiati, Amin, & Imron, M. (2020). The Effect of Industrial Existence on the Environment and Socio-Economy. *Economics Development Analysis Journal*, 9(1), 12–22. doi: 10.15294/edaj.v9i1.37261.
- Qiu, G., Song, R., & He, S. (2019). The aggravation of urban air quality deterioration due to urbanization, transportation and economic development – Panel models with marginal effect analyses across China. *Science of the Total Environment*, 651, 1114–1125. doi: 10.1016/j.scitotenv.2018.09.219.
- Saidi, S., Shahbaz, M., & Akhtar, P. (2018). The long-run relationships between transport energy consumption, transport infrastructure, and economic growth in MENA countries. *Transportation Research Part A: Policy and Practice*, 111(October 2017), 78–95. doi: 10.1016/j.tra.2018.03.013.
- Tamin, O. Z. (2000). [*Perencanaan & Permodelan Transportasi*]. Bandung: Institut Teknologi Bandung.
- Tong, T., & Yu, T. E. (2018). Transportation and economic growth in China: A heterogeneous panel cointegration and causality analysis. *Journal of Transport Geography*, 73(October), 120–130. doi: 10.1016/j.jtrangeo.2018.10.016.
- Universitas Indonesia. (2019). *UI Green Metric: World University Rankings*. Jakarta: Universitas Indonesia.
- Universitas Sebelas Maret. (2015). [*Publikasi Penggalan Data Dalam Rangka UI Greenmetric*]. Surakarta: Universitas Sebelas Maret.
- Wang, Z., Cui, C., & Peng, S. (2019). How do urbanization and consumption patterns affect carbon emissions in China? A decomposition analysis. *Journal of Cleaner Production*, 211, 1201–1208. doi: 10.1016/j.jclepro.2018.11.272
- Wardana, A. A. (2018). [*Aspek Hukum Partisipasi Masyarakat dalam Kebijakan Penyelenggaraan Penataan Ruang*]. *Law Review*, 18(1), 72–89.
- Wimala, M., Iqbal, M., & Maulana, A. (2018). [*Penilaian Usaha Ke Arah Transportasi Berkelanjutan Berdasarkan STARS v.2.1 Di Institut Teknologi Nasional*]. *Jurnal HPJI*, 4(2), 105–116.