

MANAGING TRANSPORTATION CHALLENGES IN SELECTED SOUTHEAST ASIA COUNTRIES: COMPARISON OF POLICIES, FRAMEWORK AND COMPONENTS

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ABSTRACT

Urbanisation is often correlated with economic growth and expansion of countries, but previous studies show that it has caused environmental degradation in the countries. While many countries are striving to develop and aim to achieve sustainability, some countries are facing unmanageable issues related with urbanization. In Southeast Asia, Singapore as a developed country tends to have small emission of carbon while Indonesia and Malaysia as developing countries are the total opposite. This paper aims to discuss how Southeast Asia developed and developing countries manage the challenges of carbon emission that was caused by transport through policies and the implementation. Several countries are used as case studies: Malaysia, Indonesia and Singapore. This paper also summarizes and analyzes using Cashore and Howlett Method (2007) between these two groups of countries, given the implementation on managing the environmental issues of these countries are different. The method also calibrated with A-S-I approach, known as Avoid, Shift and Improve to analyse the implementations that can be used. Finally, this paper provides some alternatives for urban planners to develop resilient countries that



could benefit the well-being of the society and promote healthier countries. The findings of this study show that developed countries have better implementation of their policies through taxes, so that people would travel by public transport for shorter distances.

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INTRODUCTION

The industrial revolution in the 1970s has a deep impact towards urbanization. Migration of people, job creation, living conditions are some effects that were caused by urbanization, including environmental degradation. People are drawn to cities by the promise of jobs and affluence, among other causes, and are pushed to cities by dissatisfaction with rural life (Chawan, 2019). Kogi State, like the majority of other states in Nigeria, is urbanising as a result of the rural areas' "push" and the town's "pull" (Abalaka, 2018). Early urbanisation resulted in a concentration of manufacturing activities and industrial development. Industrialisation has been pushing rapid urbanisation since the 1970s (Rimmer and Dick, 2009). Zhang et al. (2017) mentioned, the first stage of urbanisation started when it reduces agricultural labour force as two-sector economy grows. Due to fundamental technology, industrial activities at this level use a lot of coal and gasoline. The process of rapid urbanisation is a significant contributor to air pollution, particularly in emerging countries (Mikayilov et al., 2017). Compared to low-energy agricultural production, a lot more carbon dioxide (CO₂) is released.

The relationship between urbanisation and the environment has been a subject of study since environmental degradation is strongly linked to human activity (Wang and Dong, 2019). Human activities are also correlated with urbanization since it is the actual activities in urban expansion. In this paper, the environmental issue that will be discussed is air pollution, specifically, on carbon emission by the transportation sector. Air pollution is caused by a wide variety of factors, including dust and excessive gases such as carbon dioxide or other vapours that cannot be effectively eliminated via natural

cycles such as the carbon or nitrogen cycles (Noordin, Abd Razak and Kwong, 2021). According to Muzakir, Yap and Malia (2021), the transport industry has consistently consumed over 40% of total energy in Malaysia during the last two decades, and even more in some years. The findings of the study also show that land transit dominates all modes of transport, and within land transport, private transportation is estimated to be the largest contributor of carbon emission.

According to Li and Lin (2015), the relationship between urbanisation and carbon emission shows that urbanisation increases CO₂ emissions in low-income countries, while it reduces energy consumption and decreases CO₂ emissions in middle-and high-income countries. According to the estimation results based on a study in Azerbaijan from 1990 until 2014, in the long run, energy consumption and urbanisation rose by 0.8 percent and road transport emissions increased by 2.7 percent, respectively. This shows that the emission from transportation due to urbanisation is quite high (Mikayilov et al., 2017).

Singapore is considered a developed country in Southeast Asia. It is believed that factors of environmental issues of developed countries are quite different than the environmental issues in developing countries. The increasing value of emission that China has created is due to industrial activities. This is the same with Singapore, the industrial activities mostly contributed to the carbon emission while transportation ranked in 3rd place. Figure 1 shows the emission profile of Singapore back in 2018.

EMISSIONS PROFILE (2018)

Total emissions: ~52MtCO₂e

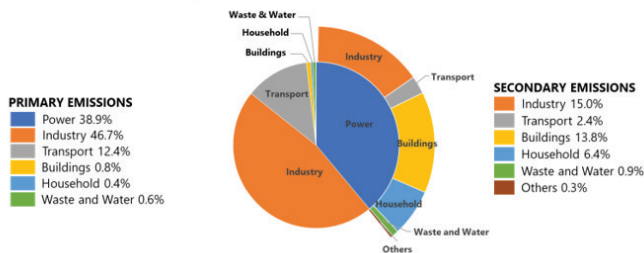


Figure 1. Emission Profile of Singapore

Source: National Climate Change, Singapore

However, Singapore ranked as 126th of 142 countries in terms of carbon emission per dollar GDP, as stated by the International Energy Agency (IEA) in 2018. On the other hand, Singapore ranks in the top 20 countries in terms of emissions intensity, according to the source in 2018.

Malaysia is used as one of the case studies for developing countries in Southeast Asia. In 2018, Malaysia’s carbon emission increased with 250.3 million tonnes while in 2017, Malaysia emitted 241.6 million tonnes (BP Statistical Review, 2019). The research also stated that the main source was from energy consumption, followed by transportation and then waste. Meanwhile, in Indonesia, it was recorded to be the world’s fourth largest emitter of greenhouse gases and ranked as 16th biggest economy in Southeast Asia (Dunne, 2019). The main contributor towards the emission of carbon in Indonesia was land use. It then reached a very high emission rate because of the fires that happened in 2006. Meanwhile, transportation sector was ranked at 4th place.

However, according to NAMA (2021), the transportation industry has become the largest contributor of carbon emission in Indonesia.

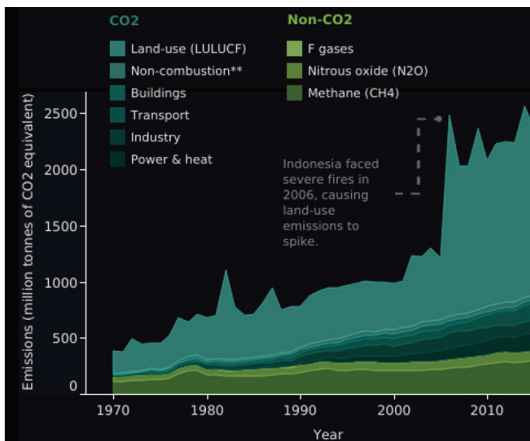


Figure 2. GHG Emissions in Indonesia

Source: Dunne, 2019

There are several differences of factors of environmental issues in these two groups of countries, and the implementation of policies in these countries are believed to be different. This paper aims to study the different ways these countries manage the challenges of air pollution that was caused

by transportation through policies and implementation. The analysis of this study will be using Cashore and Howlett (2003) model in analysing the policies related to managing the carbon emission by transportation. At the end of this study, the comparison of policies and implementation of the policies by these three countries will be discussed.

Section 2 discusses the related policies and implementation to mitigate carbon emission. In section 3, methodology and analysis is being conducted to study the policies of each city or country by using Cashore and Howlett (2003) model and calibrate it with the factors or issues, while section 4 will be the discussion on the analysis. Finally, section 5 is the conclusion of this study.

LITERATURE REVIEW

According to Lord (2020), comprehending the historical context of urbanisation policy and development is the first step in analysing the urbanisation process of a country. The study also highlighted four challenges of urbanisation in Southeast Asia but different countries, mainly in Cambodia and Vietnam; uncontrolled urban development, increasing fiscal deficits in public infrastructure, expanding resource usage and countries' impact to climate change and urban dwellers' liveability is deteriorating, and their exposure to environmental toxins is increasing. Surprisingly, the findings of a previous study by Zhang, Yu and Chen (2016), suggest that urban primacy also has a significant impact on carbon emissions. For Southeast Asia countries, Brunei Darussalam was the highest contributor with 16.645 metric tons per capita as mentioned by the World Bank.

Five indicators have been identified to analyse the cause of carbon emission between three countries: (1) population, (2) GDP growth, (3) rate of urbanisation, (4) carbon dioxide per capita and (5) fuel prices. The selection of these indicators is based on the factors of contribution towards the emissions and those data has been gathered from multiple secondary sources.

Table 1. The Comparison of Indicators for Each Country.

Heading level	Unit	Year	Malaysia	Indonesia	Singapore
Population	Millions	2018	31.53	267.70	5.64
GDP Growth	%	2018	4.8	5.2	3.5
Rate of Urbanisation (Anually)	%	2015-2020	2.13	2.27	1.39
Carbon Dioxide Emission per Capita	Metric Tonnes	2018	7.60	2.18	8.40
Fuel Prices	USD	2018	0.45	0.48	1.56

Source: World Bank

Table 1 explains the indicators for each case study. Overall, most of the gathered data is from the year of 2018. Therefore, to ensure the relevance of the analysis on carbon emission, both of these data rely on the same year.

Analysing the cause of carbon emission is important because it does not occur only because of private transportation usage, in fact, it also involved industrial sector as well. In addition, the main highlight of this study is on the carbon emission by transportation sector. 87% of all carbon emissions created by humans come from the combustion of fossil fuels such as coal, natural gas, and oil, while the remaining is a result of forest clearance and other land use changes (9%), as well as certain industrial operations such as cement making (4%) (ECMWF, 2017).

In comparing the results of carbon emission between both developed and developing countries, it shows that developed countries are most likely to have a low amount of carbon emission affected by transportation despite having a higher amount of emission overall, compared to developing countries. Nevertheless, it is not surprising that Malaysia has a high number of carbon emission by transportation sector because it was expected that 30 Malaysian will have a new vehicle every year (LCCP, 2011).

As shown in Table 1, the emission of carbon does not increase as the growth rate of GDP and population increases. This phenomenon has been explained by Aye and Edoja (2017), whereby the findings of their study revealed that economic growth has a detrimental effect on CO2 emissions when the economy is in a low growth phase, but has a beneficial effect when the economy is in a high growth phase. Nonetheless, Figure 3 shows a different result in Singapore. The GHG increases as the GDP increases.

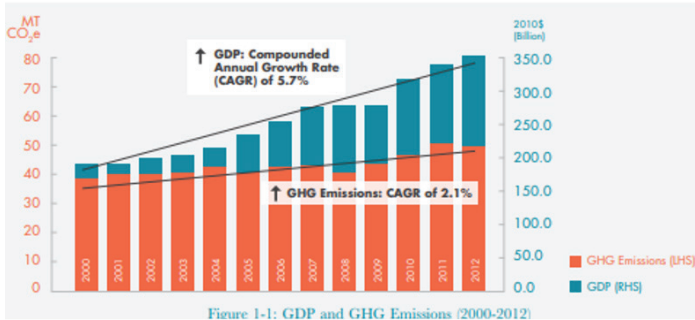


Figure 3. GHG and GDP of Singapore

Source: Singapore Climate Action Plan 2030

Policies and Efforts by Malaysia

Various plans and strategies were introduced to ensure good transportation planning in Malaysia. Firstly, National Transport Policy (2019-2030) highlighted 5 thrusts with many strategies. The policy does not only involve the integration of a good network of transportation, but also involves public and freight transport. With the launch of the Low-Carbon Mobility Blueprint and Action Plan, Malaysia aims to implement sustainable growth, particularly in the transportation sector (LCMB) (Yaacob et al., 2020).

The implementation of public transport in Kuala Lumpur and Penang by Prasarana Sdn. Bhd. is one of the initiatives for provision of public transport. The existence of Mass Rapid Transit (MRT) that connects several main cities and neighbourhood in Selangor and Kuala Lumpur is also an initiative towards seamless journey for people. MyRapid has significantly improved the public transport system, particularly in the Klang Valley and Penang, where public transport's model share climbed from 16% in 2010 to 20% in 2015 (Yaacob et al., 2020).

Policies and Efforts by Indonesia

Although Indonesia Long-Term Strategy for Low Carbon and Climate Resilience 2050 does not really focus on transportation like in Malaysia and Singapore, Indonesia has their own way in managing the carbon emission through energy sector which compliments with transportation. However,

there are still certain strategies implemented to face the challenges of climate change in Indonesia which is by implementing and planning a sustainable transportation. Indonesia's National Medium-Term National Development Plan (RPJMN) 2020-2024 has been structured to construct urban mass transportation. Ministry of Transport (MoT) Indonesia is committed to develop and provide better transportation. The government is also planning to conduct a feasibility study on Bus Rapid Transit (BRT) in five cities: Bandung, Batam, Pekanbaru, Makassar and Semarang (Rahman, 2020).

On the other hand, Indonesia has several initiatives such as Green Infrastructure, Green Building and Green City Development. In Green City Development, Indonesia aims to achieve smart mobility. The Green City Development Program (P2KH) of the Ministry of Public Works and Public Housing in Indonesia is an endeavour by the Indonesian government to use GI principles in urban areas in a systematic and widespread manner (Mungkasa, 2020). The initiative to manage the environmental issues were also related to the political events as well. Many of Suharto's and his ever-expanding circle of business friends, drawn from the country's ethnic elite and Chinese-Indonesian allies, benefited directly from the country's policy decisions (Batubara, Kooy and Zwarteveen, 2018).

The purpose of low carbon city development is to minimise the city's overall carbon footprint by reducing or eliminating its reliance on fossil fuels energy without jeopardising its economic development potential (Das, 2019).

Policies and Efforts by Singapore

Singapore also has established Land Transport Masterplan 2040 and trying to implement Walk-Cycle-Ride modes of transport (NCCS, 2021). In the Masterplan, they aim to achieve Singapore to be 45-Minute City with 20-Minute Towns by 2040. Since 2013, the rail network has been expanded around 182km to 229km. With the "ring concept" that is implemented in Singapore, this is achievable by Singapore since they already have a good transportation system.

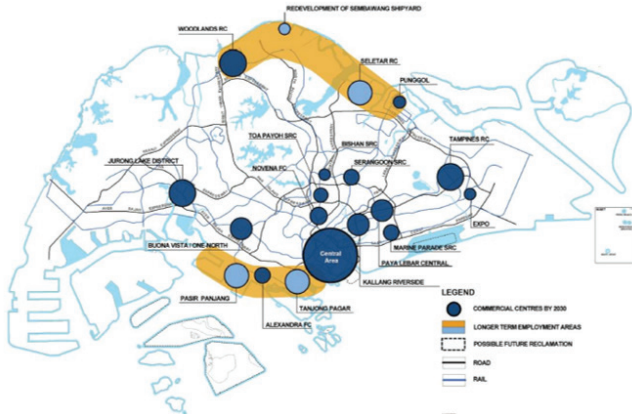


Figure 4. Centralisation of Singapore

Source: Ministry of National Development (January 2013)

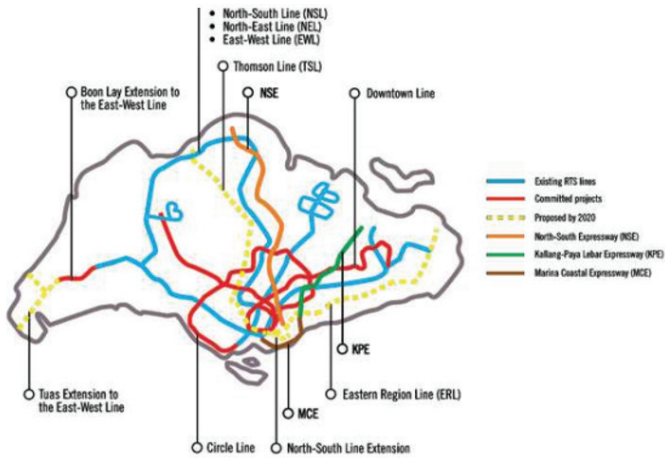


Figure 5. Rail Transport in Singapore

Source: Urban Redevelopment Authority (2012)

METHODOLOGY

Methods

This paper compares the carbon emissions from transportation in

selected countries, which are Singapore, Malaysia and Indonesia. The selection of these countries is based on classification of developing and developed countries. The criteria of developed country is measured by Gross Domestic Product (GDP) and Human Development Index (HDI). Therefore, Singapore is classified as a developed country while Malaysia and Indonesia as developing countries. The main reason for comparing these two groups of countries is to analyse the differences of the implementation of policies to mitigate carbon emission. According to ASEAN State of Climate Change Report (2021), Indonesia, Thailand, Malaysia, Vietnam, and the Philippines are ASEAN's largest emitters of CO₂ from fossil fuel burning. Meanwhile, Singapore is stated as the least contributor towards carbon emission. In addition, the implementation and policies by Malaysia and Indonesia could be different.

Cashore and Howlett’s elements of policy is used to understand the policies and alternatives made by each country in order to manage the environmental issues, specifically carbon emissions. This method is used to determine on how to perform forward-looking policy design, including the identification of policy mixed effects, and how to measure policy change (Cashore, 2020). Previously, Bakker et al. (2017) used this method to present a comparative analysis on low-carbon transport policies in four ASEAN countries; Indonesia, Philippines, Thailand and Vietnam. In this paper, the analysis will be done using the same method but the main goals, indicators and case studies are different.

Table 2 Elements of Policy that was Introduced to Measure Policy Changes and Effects

	Elements of Policy		
	Policy Level		
	High Level Abstraction (Policy Orientation)	Operationalisation (Program)	On the Ground Specification (Measures)

Policy Content	Policy Ends (Aims)	Goals	Objectives	Settings
		What general type of ideas governing policy development?	What does policy aimed to address?	What are the specific “on the ground” requirements of the policy?
	Policy Means (Tools)	Instrument Logic	Tools	Calibration
		What general norms guide policy implementation preferences?	What types of instruments are utilised?	What are the specific ways in which the instrument is applied?

Source: Cashore and Howlett (2007)

In addition, A-S-I approach is used to promote alternative mobility solutions and to develop sustainable transport. This approach consists of three approaches: Avoid/Reduce, Shift/Maintain and Improve. For Avoid/Reduce, we focus on the things that are needed to improve the transportation system. Meanwhile, Shift/Maintain refers to trip efficiency of the transportation. For instance, transportation shift towards any environmentally friendly modes such as public transport or cycling. Lastly, Improve focuses on vehicle efficiency such as less fuel consumption or energy efficiency.

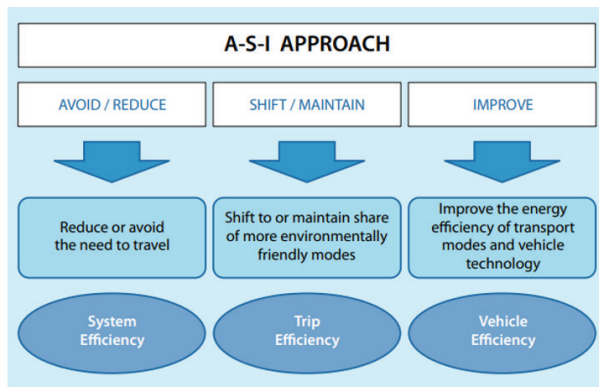


Figure 6 A-S-I Approach for Analysis

Source: Transport Policy Advisory Services, Federal Ministry for Economic Cooperation and Development, Germany

The methodology that was introduced by Cashore and Howlett in 2003 has been improved year by year until 2020. This method can be used for comparative analysis specifically on policies since it is precisely considered on the strategies and implementation of each policy. In this

paper, we compare two groups: developing and developed countries in Southeast Asia. By using this method, we could clearly see the differences of each country's efforts and implementation in managing the challenges in environmental issues.

DISCUSSION

In order to determine the effectiveness of policies and strategies, we firstly identified the actual challenges of urbanization in environmental degradation of these countries. Each of these three countries are facing different challenges. Limited land space is one of the challenges that Singapore is facing (Cook, 2016). With the growing population each year, limited spaces are one of their concerns. However, addressing the expanding road network would not be the best solution because it will only lead to other environmental issues.

Meanwhile, in Malaysia, there are various challenges on reducing carbon, mainly in transportation. First and foremost, Malaysia is adopting the loan car scheme. There are many schemes that banking sectors offer to Malaysians to encourage people to buy cars of their own choice. The consequences of this matter will finally lead to high number of car ownership. Malaysia focuses on automotive industry and it is the third largest in Southeast Asia (Malaysia Automotive Institute, 2017). In the 1980s the National Car Project, Proton, was launched and it was the start of the development of this industry. Until now, many types of vehicles have been produced by Proton and Perodua. Secondly, the oil and gas sector is one of the main contributors towards the national GDP. Therefore, it is very challenging for Malaysia to adapt green transportation such as the electric vehicle. Another challenge is, fuel price in Malaysia is the cheapest compared to the other two countries. The Malaysian Government subsidizes a huge amount to ensure Malaysians get a cheaper price for petrol. These three benefits are actually the real challenges in adapting green transportation. Promoting green transportation itself only could not achieve sustainable mobility.

Indonesia is very well known for its traffic congestion. Congestion is closely tied to motorization and the widespread use of automobiles, both of

which have raised the demand for transportation infrastructure (Rodríguez, 2020). The traffic congestion is not only generated from private vehicles, but by the industrial sector as well. The quantity of vehicles on the road is obviously surpassing the length of the road. When limited road capacity is paired with excessive trip demand, severe congestion will develop (Muhammad Farda and Lubis, 2018). The number of car ownership increases in Indonesia and one of the factors is the income (Ruslan et al., 2020). Car ownership in Indonesia also increases year by year which also poses a challenge in managing carbon emission.

Table 3 Analysis by using A-S-I Method together with Cashore and Howlett (2007) Model Italic Sentences in Mechanism: Additional approaches that can be considered to reduce the carbon emission in transportation

Policy Components	Malaysia	Indonesia	Singapore
Policies/ Framework	Low Carbon Cities Framework & Assessment System (LCCF)	INDONESIA Long-Term Strategy for Low Carbon and Climate Resilience 2050	Singapore Climate Action Plan Land Transport Masterplan 2040
Goals	Aimed to reduce all carbon footprint in Malaysia	To contribute to the global goal and to national development objectives while balancing carbon reduction, economic growth, social fairness, and climate resilience development	Reduce emissions intensity by 36 per cent below 2005 levels by 2030 and stabilise emissions with the aim of peaking around 2030
Objectives	<ul style="list-style-type: none"> •Decreasing growth of energy consumption while enhancing economic development; •Facilitating growth of the green technology industry and enhancing its contribution to the national economy; •Increasing national capability and capacity for innovation in green technology development and enhancing Malaysia's green technology competitiveness in the global arena; •Ensuring sustainable development and conserving the environment for future generations; and •Enhancing public education and awareness of green technology and encouraging its widespread use. 	<ul style="list-style-type: none"> •Aligning the climate goals and targets with national, sub-national and international objectives including SDGs; •Engaging non-party stakeholders (NPS), •Enhancing opportunities for innovation, and •Enabling communities to earn benefits of early actions 	<ul style="list-style-type: none"> •Improving energy efficiency •reduce carbon emissions from power generation •Develop and demonstrate cutting-edge low carbon technologies

<p>Settings (target)</p>	<p>Main elements to cater the issue in carbon footprint: <ul style="list-style-type: none"> •Urban transport: shift the transportation mode, improve green infrastructure, promote clean vehicles and improve traffic management </p>	<p>•Energy sector: substitution of fossil fuel by renewable in power generation and transport, electrification of end use in building and in transportation</p>	<p>•Switching to cleaner fuels such as natural gas can decrease carbon emissions from heating processes by about 25% <ul style="list-style-type: none"> •Increase the use of public transport as a share of overall transport during morning peak hours from 66 per cent in 2015 to 75 per cent by 2030. By 2050, the aim is to further increase this share to 85% </p>
<p>Instrument Logic (strategies)</p>	<p>•Urban transport: Achieve a 10% to 40% reduction in the number of daily commuters from using private vehicles to public transport, and lower each passenger's per capita carbon footprint, ensure smooth flow of traffic throughout the development.</p>	<p>•Strengthening policy and regulation</p>	<p>•Transport: Achieve 75 per cent use of public transport by 2030, encourage cycling and walking, improve vehicle fuel efficiency</p>
<p>Mechanism (A-S-I)</p>	<p>•Avoid: Improve the transportation system, walkability and traffic management, improve infrastructure such as traffic lights, improve traffic engineering for efficient speeds, create a better policy for traffic <ul style="list-style-type: none"> •Shift: Provide dedicated lanes for walking and cycling •Improve: Convert government vehicles to low carbon vehicles •Avoid: Improve dedicated lanes to avoid people travelling with private vehicle •Shift: Enhance lanes for walking and cycling by practicing safety and comfort attributes •Improve: Policies and implementation through price of fuel and taxes for car loan and purchase </p>	<p>•Avoid: Travel distance of constrained transport (home-to-work/school) is around 40 km (in Jakarta) <ul style="list-style-type: none"> •Shift: Develop more efficient transport system (promote mass public transport), electrification of vehicles and other equipment at end-users (residential and commercial) with decarbonized electricity •Improve: Implementation of efficiency measures, decarbonization of power using large renewable and coal with CCS/CCUS, and biofuel use in transport •Avoid: Improvise the land use planning to promote shorter distance travelling •Shift: Enhance lanes for walking and cycling by practicing safety and comfort attributes •Improve: Improve energy efficiency of transportation mode by switching fuel use to green transportation </p>	<p>•Avoid: Enhance the walkability around neighbourhood by implementing "20-minute Town" and "45-minute City" <ul style="list-style-type: none"> •Shift: Promoting "Walk-Cycle-Ride" by •Improve: Improving bus route to increase the speed and frequency for shorter distance </p>

Calibrations (examples)	<ul style="list-style-type: none"> •Urban transport: Public Transport Policy Development Plans, implementing TOD, provide vehicles with low carbon emission as feeder transport, create pedestrian and cycling shortcut to encourage people walking 	<ul style="list-style-type: none"> •Investment in renewable energy 	<ul style="list-style-type: none"> •Low-emission cars are given incentives, while high-emission cars incur a penalty in the form of a registration surcharge
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Source: By the author

The best practice for these three countries would be different based on their own challenges. Overall, Singapore is a good example in managing the challenges. They take the challenges seriously and make it possible by using it as an opportunity for them to increase the walkability among the people. “45-minutes City”, “20-minute Town” and “Walk-Cycle-Ride” in Land Transport Masterplan 2040 is achievable for them because their transportation system is much efficient. In addition, since their spaces are limited, it is convenient for people to walk and switch transportation mode. In this case, Malaysia and Indonesia could learn from Singapore in managing a compact city like Kuala Lumpur and Jakarta. To have a better transportation for the whole country is not easy. Therefore, by focusing on a small-scale area is much more convenient to start with.

Secondly, the number of car ownership in Malaysia and Indonesia is another contributor towards carbon emission. Japan is one of the countries that produce vehicles in the automotive industry. However, that does not make Japan’s car ownership high. By implementing expensive several taxes and parking fees (Meister, 2021), the people are more likely to use public transport, although the price of their car is cheap. Meanwhile, in Singapore, the people need to have Certificate of Entitlement (CoE) to purchase a car. The CoE is only valid for 10 years and the people need to renew it every 10 years. The rules to have a car in Singapore is also dependent on the year of production of the car, which must be below 10 years old. This is because older vehicles tend to emit more carbon. In addition, the traffic flow in Singapore is being controlled by a recognition system that link to the people. It is believed that Singapore is the first country to implement this method.

In the case of car ownership in Malaysia and Indonesia, these two countries can adopt Japan and Singapore’s initiatives to reduce the number of vehicles. Another way to manage these challenges is by increasing

the taxes as well as improving the public transport as well. Japan and Singapore success is also related to the good provision of public transport. By maintaining the low price of vehicle, increasing the taxes or parking fees as well as improving the public transport services could be the best way for both people and economy. This initiative could encourage people to use public transport at shorter distance, but people still can use private vehicle to travel at a longer distance.

CONCLUSION

Urbanisation has been affected globally by industrial activities until the present. GHG emission has been discussed in depth by numerous authors. Many countries have created policies and plans to manage the emissions. This paper highlighted how three Southeast Asia countries; Malaysia, Indonesia and Singapore manage the carbon emissions that was caused by transportation through policies that they have created. By going through several data on carbon emissions, these countries have different causes of emissions.

Each country has set their own goals and objectives through their own policies. By using the method that was introduced by Cashore and Howlett (2007) to compare related policies, we could see the differences of these policies, including the content itself. This is because the challenges and issues itself are quite different from one country to the other. Last but not least, by applying the A-S-I method an analysis of the different initiatives taken by each country could be made. Comparing the policies and initiatives of each country is one of the ways to evaluate which is the best approach to improve the transportation sector.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

All authors contributed to the design of the research, the questionnaire, and the write-up. The on-line survey, data cleaning and tabulation was undertaken by researcher. All authors have read and approved the final manuscript.

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