Article

Low-Carbon Transport Policy in ASEAN Countries: A Comparative Analysis

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Abstract: Emerging countries in Southeast Asia are facing considerable challenges in addressing rising motorisation and its negative impact on air quality, traffic, energy security, liveability, and greenhouse gas emissions. Indeed, even as initial policies to address these issues are being agreed and implemented, current trends are incompatible with sustainable development and long-term climate change targets. This paper presents a comparative analysis of the approach and status of sustainable, low-carbon transport policy in ASEAN countries and identifies differences and similarities, with the aim of helping assessment of feasibility of future policies and informing future studies on policy innovations and cross-country learning. The methodology is based on the taxonomy of policy components developed by Howlett and Cashore, and our data on comprehensive country studies for Indonesia, the Philippines, Thailand and Vietnam and interviews. We find that each country has a specific set of goals, objectives and targets that support sustainable transport, and, directly or indirectly, climate change mitigation. In terms of specific instruments and calibrations, which we analyse based on the Avoid-Shift-Improve approach, there are notable differences between the countries, for example in fuel economy policy.

Keywords: transport policy; ASEAN countries; low-carbon transport; comparative analysis; climate change mitigation

1. Introduction

The member countries of the Association of Southeast Asian Nations (ASEAN) are experiencing robust economic growth in recent years. This growth has resulted in a rapid increase in the demand for motorised transportation. Southeast Asian countries already face serious problems including congestion, fossil fuel consumption, air pollution and road crashes, whilst significantly contributing to the ever increasing global greenhouse gas (GHG) emissions, notably CO_2 and black carbon, as transport accounts for approximately one-quarter of regional final energy consumption (OECD/IEA, 2013). This picture is likely to get worse with vehicle registrations still increasing by over 10% annually in many countries (Clean Air Asia, 2012) and demand for transport in ASEAN projected to increase by 60% from 2013 to 2040 in a business-as-usual scenario (OECD/IEA, 2015). Many of the

ASEAN countries are facing challenges in providing timely sustainable transport solutions to keep up with the rapid increase in transport demand and motorisation rates.

In the extant literature, analysis on how transport policy in ASEAN countries is responding to the challenge of climate change mitigation is limited. However, a growing body of research analyses transport systems in Southeast Asia as well as policy options, and various researchers compare countries in the region on different aspects of transport. Akimura (2015) does so for cities while Nguyen et al. (2013) analyses motorcycle accessibility. Khuat (2007) characterises cities and countries according to their transport system development, particularly related to the extent to which these are 'motorcycle dependent'. Van et al. (2014), on citizen preferences and attitudes towards travel modes, shows that in Indonesia, the Philippines, Thailand and Vietnam, the car scores higher on 'affective' and 'social orderliness' values compared to China and Japan. Moreover, research is available on the characteristics and trends of urban transport systems (e.g. Morichi and Acharya 2013) in megacities. In the policy field, Barter (2012) discusses parking management, Silitonga et al. (2011) fuel economy policies for Singapore, Indonesia, Malaysia, Philippines, Thailand and Vietnam, and Mofijur et al. (2015) biofuel policies in eight ASEAN countries. Furthermore, ITPS (2014) develops business-as-usual and low-carbon scenarios for all 10 ASEAN member countries for the transport sector in 2050. Barter (1999) discusses transport policy choices in Asia-Pacific countries, and concludes that a crucial issue explaining differences in motorisation and success of public transport is the "decision of whether or not to restrain private vehicle ownership and use" (Barter, 1999; p. ii).

There is not much analysis of the /approaches and processes of policymaking related to sustainable, low-carbon transport (except for a few single cases, e.g. Uabharadorn (2013)). In analysing peer-reviewed literature on transport policy, Marsden and Reardon (forthcoming) found that only 13% of papers consider specific aspects of the policy cycle, fewer than 10% of papers engage with debates about policy aims and that two-thirds of papers did not engage with real-world policies examples or policy makers and focussed on quantitative ex-ante analysis of potential policy options alone.

This research article presents a comparative analysis of the approach and status of sustainable, low-carbon transport policy in ASEAN countries and identifies differences and similarities, with the aim of helping assessment of feasibility of future policies and informing future studies on policy innovations and cross-country learning.

The countries studied here are Indonesia, the Philippines, Thailand and Vietnam, the four most populous in the ASEAN region. They face similar challenges including rapid motorisation and low or declining public transport modal share, however are different in other aspects such as economic development and cultural orientation. Low-carbon transport policies are considered to be those that result in lower GHG emissions in the sector than would happen in absence of implementation of such policies. Passenger transport is the primary focus of this paper. As for freight and logistics, policies in this subsector are generally much less developed and therefore data on policy development are limited.

Section 2 outlines the conceptual framework and Section 3 the methodology and an overview of key indicators for the transport system in the four countries. Section 4 gives an overview of policy components based on the methodology developed in Section 2 and 3. Section 5 discusses and the results after which conclusions are drawn in Section 6.

2. Theoretical framework for low-carbon transport policy analysis

In his seminal work on policy development as a process of social learning, Hall (1993) decomposed policy into three distinct elements or variables: the overarching goals that guide policy in a particular field, the techniques or policy instruments used to attain those goals, and the precise settings of these instruments (p. 278). These components can change at different speeds, with change in settings, instruments and goals referred to as first, second and third-order change respectively. Building on Hall, Howlett and Cashore (2009) developed a more elaborate taxonomy of policy components. At the level of ends and aims, they distinguish the goals, which are the ultimate ends and general ideas policy development is trying to achieve, objectives, which operationalise the goals

into formal policy aims, and settings, the more specific requirements in the policies or measures. At the level of policy means and tools, the components are divided into the instrument logic, which are the general norms that guide the choice of the mechanisms or specific instruments, and the calibrations, which are the specific ways the instruments are used.

In transport policy analysis, this taxonomy has been used in multiple articles. In their analysis of transport policy change in the United Kingdom, Marsden et al. (2012) observe changes in calibrations and the types of instruments being deployed to respond to the need to address climate change, however paradigmatic change has not taken place. Bache et al. (2014) argue that climate change mitigation policy can be seen as a meta-policy in relation to transport policy. They found the impact of climate change objective on transport policy 'symbolic' for the UK, in other words, having a minor impact on the ground. In addition, the aforementioned study of Marsden and Reardon (forthcoming; 9) found that "the majority (60 papers) focused on the 'means or tools' components of policy; the instrument logics, mechanisms and calibrations, with only four focused on the 'ends or aims' of policy; the goals, objectives or settings".

Before we explain in Section 3 how we apply Howlett and Cashore's taxonomy, we briefly discuss concepts of sustainable transport policy. Over the past decades, shifts in approaches and frameworks for transport policymaking have taken place in the context of sustainable development. Such changes include the shift away from 'predict-provide-manage' to 'provide-predict' (Zuidgeest, 2005), a renewed emphasis on transport indicators such as accessibility, quality of life, equity and justice (e.g. Martens, 2017)), and interventions aimed at improving these, such as transport demand management (Litman, 2015; Banister, 2011; Buchanan, 1963) or people-focused policy development (e.g. Wright, 2001). There is an emerging consensus among scholars, international organisations and governments that in addition to the contribution transport makes towards economic and social development, its negative impacts on society need to be minimised to move towards sustainable transport (Bakker et al., 2014). The climate change policy agenda, in particular the notion that dangerous climate change cannot be avoided without deep GHG reductions in the transport sector, is one key driver for thinking on sustainable transport policy. It it also widely acknowledged that sustainable transport is essential in realising the Sustainable Development Goals (United Nations, 2016) and that reducing GHG emissions from transport yields important sustainable development benefits at the local and national level (IPCC, 2014). These benefits, rather than climate change per se, are often stronger arguments for decision makers for sustainable transport policy, particularly in developing countries.

One policy approach to addressing GHG emissions and other environmental impacts of transport is using the Avoid – Shift – Improve (ASI) framework (GIZ, 2012). In this approach, low-carbon transport policy needs to cover measures aimed at: (a) avoiding the need to travel e.g. by improved urban planning, travel demand management or road pricing, and e-communication options (mobile phone use, teleworking), (b) shifting travel to the most efficient or clean mode, e.g. non-motorised or public transport and (c) improving the environmental performance of transport through technological improvements to make vehicles more energy efficient and fuels less carbon-intensive (see also Appendix A). Bakker et al. (2014) argue that, to bring the ASI approach closer to a practical guide to sustainable transport policy, 'access' needs to be added to cover the positive impacts of transport as well as elements of sustainable lifestyles and transition thinking (following e.g. Geels, 2012). In analysing sustainable transport transitions and experimentation, Sengers (2016) concludes that in Thailand, sustainable transport niches do not (yet) challenge the dominant regime of motorisation.

3. Methodology and materials

In carrying out the comparative policy analysis, we apply concepts of low-carbon transport policy and policy components based on the taxonomy of Howlett and Cashore (2009). Table 1 and the next paragraph explain how we operationalise their framework for low-carbon transport policy, which will be used in Section 4. It is noted that our interpretation is close to that of Marsden et al.

(2012), although there are differences in operationalisation for some components, particularly the instrument logic.

Goals are related to overall development objectives as well as those for the transport sector and are derived from visions in development plans and sectoral transport strategic documents. *Objectives* are more specific *aims* of transport policy as stated in transport strategies and plans. In addition, we consider as objectives the Nationally Determined Contributions (NDCs) submitted to the UNFCCC in 2015 (UNFCCC, 2016a). These include country-wide emission reduction targets and thereby can be seen as 'meta-policy' objectives (Bache et al., 2014) that are relevant to the transport sector. The *settings* are the quantified targets related to those objectives. While there is often a plethora of such targets, we selected those directly or indirectly related to climate change mitigation (if available): GHG emission reduction, public transport modal share, energy efficiency, renewable or alternative energy or energy diversification, and limitation of motorisation.

The *instrument logic* is based on two aspects. First, we look at specific features or aspects in strategic policy documents that could be indicative of the background of policy directions, such as those related to vehicle manufacturing industry development and mentioning of 'lifestyle' issues. It is noted that there may be a subjective element here, and our data are not necessarily comprehensive. Second, we consider the use of ASI as a policy framework in strategic documents: it can be argued that its use - explicitly or implicitly in the instruments being deployed - may indicate an understanding with policymakers that a comprehensive approach to sustainable transport including changing behaviour is required. For *mechanisms* and specific i*nstruments*, we make use of a comprehensive inventory (explained below) of low-carbon transport policies and measures in each country organised by the ASI framework. We also look at if and how countries are making use of international climate change instruments for the transport sector, in particular nationally appropriate mitigation actions (NAMAs), the Clean Technology Fund of the World Bank and other multilateral development banks, and the carbon trading instrument Clean Development Mechanism. Finally, as we cannot cover *calibrations* for all low-carbon transport measures, we provide examples for three types of measures that are comparable but differently used across the four countries: specific measures in transport demand management, promotion of cycling and fuel economy of new vehicles.

Table 1. A taxonomy of policy components, with examples for low-carbon transport (adapted from Howlett and Cashore, 2009)

		Policy content		
		High-level abstraction	Programme level operationalisation	Specific on-the-ground measures
Policy focus	Policy ends or aims	Goals What general types of ideas govern policy development? • Protection of the environment • People-oriented transport system	Objectives What does policy formally aim to address? • Increase public transport ridership • Increase energy-efficiency • Save GHG emissions	Settings What are the specific on-the-ground requirements of policy • % or quantity of GHG reduced in the transport sector by year x compared to baseline • Modal share target for public transport
	Policy means or tools	Instrument logic What general norms guide implementation preferences • Behaviour change • Primacy of economic growth • Limit motorization • Decentralization • Preference for cooperation with private sector • Use of Avoid-Shift-Improve	Mechanisms What specific types of instruments are utilized? • Investing in public transport infrastructure • Electronic road pricing • Vehicle fuel efficiency standard	Calibrations What are the specific ways in which the instrument is used? • Introduction of EURO IV emission standards for new cars • Free public transport before 7.15 am • Annual budgets for transport infrastructure

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The choice of the four countries is based on three sets of considerations. First, they are all located in one highly relevant but under-researched region in the field of sustainable transport (Southeast Asia) and are the four of the five largest transport sector GHG emitters of that region (Bakker and Trigg, forthcoming). Second, they have characteristics that set them apart from many other countries – particularly North-America and Europe - including rapid motorisation, lower current urbanisation but rapid growth of megacities, higher urban density, importance of informal transport sector including paratransit, high modal share of motorcycles, inadequate and hierarchically unbalanced infrastructure, high but decreasing share of public transport (except Vietnam), lower government revenue and lack of private sector financing, weak land-use control (Morichi and Acharya, 2013). Third, they have differences amongst them in other aspects including culture, economic development, economy structure, governance systems, geography and roles of actor groups. These could help in explaining differences that may be found (see also Section 5).

Table 2 shows a set of indicators that help in describing the context of transport and climate change policy in the four countries, using secondary data from a range of sources. Out of a larger set of possible indicators, we have limited ourselves to those which provide key information on the transport system, particularly related to climate change, and those that are arguably relevant in explaining differences between countries.

Table 1. Selected country indicators.

	Unit	Source	Year	Indonesia	Philippines	Thailand	Vietnam
Population	million	a	2015	257.5	100.7	68.0	91.7
GDP growth	%/a	a	2012-15	5.4	6.4	3.4	5.8
GDP/capita	USD (PPP)	a	2015	10,385	6,926	15,345	5,668
Urbanisation	%	a	2015	51.4	44.4	50.4	33.6
CO_2 emissions from transport	Mt	b,c	2010	121.4[b] (2012)	23-36[c]	61.1[b]	28.0[b]
tCO_2/capita	tonnes		2010	0.49 (2012)	0.25-0.4	0.91	0.32
Motorisation index	#vehicles/ 1000 capita	d,e,f	2010	344[f]	75[e]	310[d]	364[d]
Annual passenger vehicle fleet growth	%	d,e,f	2000-2010	10.4[f]	6[e]	8[e]	16[d]
Share two-wheelers in passenger vehicle fleet	%	d,g	2012	87[d]	55[g]	61[g]	95[d]
Domestic car/ motorcycle production	Million units/ annum	h	2015	1.1 / 5.7	0.1 / 0.8	1.9 / 1.8	0.2 / 2.9
Fuel prices (diesel/petrol)	USD/ litre	i	2014	0.80 / 0.93	0.82 / 1.05	0.90 / 1.29	0.91 / 1.04

[a]World Bank (2016), [b]Biennial Update Reports (UNFCCC, 2016b), [c]Mejia et al. (2016), [d]ITPS (2014), [e]Clean Air Asia (2012), [f]Statistics Indonesia (2015), [g]Adapted from ASEAN-Japan Transport Partnership (2013), [h]ASEAN Automotive Federation (2015), [i]GIZ (2015)

The lowest and highest per capita incomes differ by a factor of three, yet all countries are rapidly motorising – in line with global trends for vehicle ownership in low and middle income countries (Dargay et al., 2007). The growth rate for cars is higher than for motorcycles, however the latter still dominate the vehicle fleets. It could be expected that the share of motorcycles will decrease over time as income levels grow (Nishitateno and Burke, 2014). Thailand has the highest rate of passenger cars

per 1000 inhabitants, of which a significant share are domestically manufactured pick-ups with relatively low fuel efficiency as compared to sedans (Kijmanawat et al., 2016), which explains the relatively high per capita transportation emissions. Biofuel blending targets are present in all countries for biodiesel and/or ethanol (Mofijur et al., 2015).

The data used in the analysis in the next chapter were collected through a literature survey and studying policy documents – many of which in the local language – as well as through semi-structured interviews with policymakers and/or transport researchers in each country. The interviews provided insights into the institutional structure, the development of policy documents, as well the role of different policy objectives, including climate change mitigation, in policy development. Feedback from policymakers and academics was gathered in workshops and in writing, and draft results were discussed in a workshop with representatives from all four countries. The results are included in four country studies, the Stocktaking Reports on Sustainable Transport and Climate Change for Indonesia (Kappiantari et al., forthcoming), the Philippines (Mejia et al., 2016), Thailand (Narupiti et al., 2014) and Vietnam (Dematera et al., 2015). These studies review the existing sustainable transport policy framework and key policy documents and related sources that include strategies, policies or measures with a direct or indirect impact on energy use and CO_2 emissions from transport, resulting in an inventory of policies and measures, organised along the ASI approach (see Appendix I).

4. Results: low-carbon transport policy components

In Table 3, we provide an overview of policy components related to sustainable (passenger) transport and climate change mitigation for the four countries, following the methodology introduced in Section 3. When policy components are relatively similar for all four countries, we use merged cells. As noted in Section 2, sustainable transport is a wider concept than low-carbon transport. However, most measures taken to promote sustainable transport will reduce greenhouse gas emissions, and given the key relevance of local and national sustainable development for transport policy makers, it is useful to focus on sustainable transport policy.

Table 1. Components of low-carbon transport policy in four ASEAN countries (status: end 2016).

Policy component	Operationalization	Indonesia	Philippines	Thailand	Vietnam
Goals	Vision/theme in medium term development plan[a]	Realisation of an Indonesia that is prosperous, democratic and just	Pursuit of inclusive growth	A happy society with equity, fairness and resilience under the philosophy of a Sufficiency Economy	A modern, industrialised country by 2020
	Visions relevant to sustainable transport	"to develop transport infrastructures which is environmental friendly and takes into account carrying capacity through climate change mitigation and adaptation as well as improving safety and quality of environment"[b]	To achieve "a safe, secure, efficient, viable, competitive, dependable, integrated, environmentally sustainable and people-oriented Philippine transportation system."[d]	An efficient transport system that is environment-friendly and, appropriate for the development of sufficient and sustainable socio-economic infrastructure for Thailand[f]	Transport Development Strategy refers to "modern and high-quality system with reasonable cost, safety, reducing environmental pollution and energy saving by application of advanced transport technology, especially multi-modal transportation and logistics."
Objectives	Selected objectives in transport sector documents	Reduce GHG emissions; Promote public transport and multimodal transport; create jobs; Limit the growth of the ownership and use of private vehicles[b]	Fuel diversification, energy self-sufficiency; Promote public transport	Reduce GHG emissions; Promote public transport; Increase energy efficiency; Promote electric cars	Limit motorization; Promote public transport; Promote renewable and clean energy and energy efficient vehicles
Settings	Selected specific targets in	- CO_2 reduction up to 4.109 $MtCO_2e$ by 2019 for land transport (including rail)[b]	- energy self-sufficiency from 59.6 to 60.3%[c]	- Reduce 15-16 $MtCO_2$ by 2020 from transport[f]	- 25-30% mode share target for public transport by 2020[h];

	transport plans and strategies	- Modal share for public transport in mega-cities increased to at least 32% (2019)[b]	- 10% energy savings and target (30%) for alternative fuels in public utility vehicles by 2030 (energy plan)	- Modal share targets for freight and urban passenger - Energy savings target in energy efficiency plan - 1.2 million electric vehicles sold in 2036	- 10% of fuel from clean and alternative sources[h] - Restraint of the growth of private motorized vehicles to 4 million automobiles and 40 million motorcycles by 2020[g]
		Short (2020) to medium (2030) term quantitative scenarios are developed in the INDCs and other strategies, however no comprehensive government scenario on long-term low-carbon transport has been found.			
Instrument logic	Salient features of plans and strategies	Involvement of private sector participation and restructuring in the business sectors in accordance with the demands of the domestic market and the global market as well as in accordance with the spirit of free trade[b]	National Climate Change Framework Strategy calls to "formally adopt a socially equitable and integrated land-use and transport planning processes at the national and local levels"	EV promotion plan 2015-2036 includes research, development, production and incentives for vehicles and charging infrastructure	"greening lifestyle"[h] and promotion of "thrifty energy consumption of citizens' lifestyles"
	Use of ASI in transport plans and strategies	ASI used as organising principle in the 2010 Sectoral Climate Change Roadmap	ASI implicit in measures in (e)	ASI mentioned in (f) but not explicitly used	ASI explicitly used in Environmentally Sustainable Transport Strategy
Mechanisms	Avoid	Number plate restrictions; Electronic road pricing in discussion	Number plate restrictions	Several measures being studied	Vehicle restriction measures in discussion
		Parking management and land-use – transport integration limited; fuel prices relatively low			

	Shift	Greater Jakarta inter-provincial transport authority established	Public transport reform planned; integrated ticketing	Integrated ticketing; Initial cycling policies	Bus management reform in Hanoi and Ho Chi Minh City (HCMC)
		Rail (urban and inter-urban) and bus rapid transit being developed; non-motorised transport (NMT) not prioritised			
	Improve	Incentives for small cars	Electric jeepney programme	Fuel economy incentives; EV production promotion	Fuel economy policies
		Biofuel blending targets; alternative fuels for public and informal transport; Euro standards for vehicles and fuels Missing: promotion of electric two-wheelers, hybrid buses			
	International climate change instruments[i]	NAMA: sustainable urban transport transport programme	NAMA: improvement of public transport system and vehicles; CTF: electric jeepneys	NAMA: urban public and non-motorized transport	NAMA: promotion of low-carbon buses and public transport improvement; CTF co-finances metro in Hanoi
		No Clean Development Mechanism projects in transport			
Calibrations (examples)	Transport Demand Management	Odd-even number plate scheme in Jakarta	Prohibition of vehicles based on last digit of number plate for certain days of the week in Metro Manila	Transit-oriented development piloted in Bangkok	Congestion pricing scheme in HCMC under discussion
	Cycling	Weekly car-free day in multiple cities; limited infrastructure	Weekly car-free day in Pasig City in Metro Manila; limited bikelane construction	Budget (USD 50 million) for bikelanes in 2015; bike sharing system; road design guidelines	No policy implemented yet
	Fuel economy of new cars[j]	Low Cost Green Car Program: zero luxury sales tax for <1200	Labelling scheme planned; fuel efficiency	Labelling in place; CO_2-based excise tax (pick-	Labelling and voluntary standards based on vehicle

		cc vehicles with 20km/litre or 128 gCO_2/km	standards and incentives proposed	ups excluded); incentives for 'eco-cars' (<23 km/L)	weight classes in place, mandatory standard planned

[a]OECD (2013); [b]Medium and long-term development plans of the Ministry of Transport Indonesia; [c]National action plan on GHG (RAN-GRK); [d]Philippine Development Plan; [e]National Implementation Plan for environmentally sustainable transport (DOTC, 2016); [f]Master Plan for Sustainable Transport and Climate Change (Thailand); [g]Transport Development Strategy (Vietnam); [h]Green Growth Strategy (Vietnam); [i]www.transport-namadatabase.org (last access 27 December 2016); [j]Hygge and Mahalana (2017) 1st Forum of the ASEAN fuel economy platform, 9 November 2016. Summary report; other sources are the Stocktaking Reports for each country. ASI: avoid-shift-improve; EV: electric vehicles CTF: Clean Technology Fund

Looking at the level of policy goals, we observe that sustainable transport appears to support various high-level national development goals, such as inclusive growth, sufficiency economy, people-oriented development. Visions in transport strategies acknowledge the need to be environmentally-friendly, and in some cases explicitly mention climate change or energy issues. In general, improving connectivity and transport infrastructure is the key goal in transport strategies, with 'accessibility' found in Thailand (Jaensirisak et al., forthcoming) and Indonesia.

Each country has a set of objectives for the transport sector, which include climate change mitigation explicitly for two countries, however indirectly, through other objectives such as increasing public transport and energy efficiency, all countries address low-carbon transport. The same is true for the settings: all countries have quantified targets related to sustainable transport (e.g. public transport modal share, energy self-sufficiency, GHG emission reduction); however, these targets are different in nature and in the way these are formulated. When considering the NDCs, which for all countries include quantified GHG emission reduction targets for 2030 compared to business-as-usual, we observe that the transport sector is included, even though the level of ambition and detail differs from a minor mention as part of the energy sector (Indonesia) to concrete actions (Vietnam) (Bakker and Trigg, forthcoming).

In support of the NDCs, the Biennial Update Reports and climate change policy, countries are carrying out initial mitigation potential analysis and develop scenarios (e.g. for 2020 or 2030), and in policy processes, stakeholder dialogues on which changes in the transport systems are required, desirable and feasible, which are documented in national strategies. However, a comprehensive approach going beyond incremental improvements appears to be lacking, and the scenarios are mostly based on existing policies. Long-term (e.g. 2050), ambitious scenarios to achieve deeper carbon reduction in line with global climate change goals (ITPS, 2014), and visions on what low-carbon transport should be and which technologies and changes in the transport systems are required, are not yet developed by national governments. There is limited discussion yet of the need for a 'transition' or transformational change, and changes in behaviour and lifestyle are discussed in a limited fashion (e.g. in Vietnam).

In terms of the instrument logic, it should first of all be noted that, to improve sustainability in the transport sector, a large set of policies and measures can be deployed (see Appendix I). Indeed, we find that the four countries are using or considering the majority of these options, which cover economic (including public investments), regulatory (including planning) and information instruments. In many cases, a combination of instruments is used to achieve a similar objective such as improving vehicle energy efficiency. Further research would be required to be able to draw conclusions on long-term preferences for types of instruments, if at all such statements are possible for the transport sector as a whole. That said, some initial observations may include that the government plays a role in behaviour change and limiting motorisation in Vietnam and Indonesia, and in the Philippines with the number coding scheme. The electric vehicle roadmap in Thailand, which focuses predominantly on the vehicle production side, could be indicative of the key role of economic development versus other policy drivers. We should note however that these are merely examples, and it cannot be concluded that in the other countries the situation is fundamentally different. In this relation, the absence or relatively low level of fuel taxes for both petrol and diesel for all countries could be seen as a sign that limiting the use of private vehicles is considered difficult or not necessarily a shared objective among stakeholders. In the instrument logic component, we also look at the Avoid-Shift-Improve approach, which is used explicitly in policy documents on environmentally sustainable transport or climate change in two countries, however it does not appear in the main transport development strategies. ASI therefore may not play a major role as a policy concept yet. As it has become well-known only in recent years (see Bakker et al., 2014) it would be premature to draw conclusions from this observation. Nevertheless, all four countries are developing or implementing measures in each of the ASI categories (see below).

Mechanisms: many of the Shift and Improve policies included in ITPS (2014) are being developed and implemented in the four countries, even if not yet sufficient in ambition. Avoid policies such as transit-oriented development, road pricing, parking and vehicle restrictive policies

are essential in meeting long-term targets (ITPS, 2014), however are in an early stage of development or missing. In this context, Han (2014) also notes that 'fast developing countries are at a crossroads', and current policies may not be sufficient to avoid a lock-in into high-carbon, unsustainable transport based on individual motorised transport.

There are also notable differences in calibrations, e.g. for fuel economy policies, with Vietnam (labelling and standards) and Thailand (CO_2 based vehicle excise tax) having more advanced policies than the other two countries. In terms of transport demand management, it is noteworthy that the Philippines and Indonesia have implemented number plate-based vehicle restrictive measures.

A final observation concerns institutional development in the connection to transport and climate change. This is an aspect that may not fit in well with Howlett and Cashore's taxonomy that focuses on policy content, however could be indicative of the development of policy ideas (Hall, 1993) and thereby relevant for low-carbon transport policy. In response to climate change and other environmental issues, all four countries have set up specific institutions in their ministries of transport. These include climate change and sustainable transport committee (Thailand), a transport technical working group in the climate change council (the Philippines), a Department of Environment (Vietnam), a Center for Sustainable Transport (Indonesia) and an Environmentally Sustainable Transport Unit (the Philippines). Even though the number of full-time staff is limited as yet (11 for Vietnam, the others fewer), emergence of these institutions show the growing relevance of climate change in transport policy.

5. Discussion

In this section, we first reflect on the methodology and then consider explanatory factors related to the findings in the comparative analysis.

Application of the policy component taxonomy of Howlett and Cashore (2009) to sustainable transport policy was possible after interpreting and operationalising it for our purpose, and yields insights into similarities and differences between ASEAN countries. Its benefit lies in the consideration of multiple components relevant for policy, which may not have become apparent without using it. For example, we could observe that the components of sustainable transport policy at the level of policy ends (goals, objectives, settings) are not consistently matched with the currently applied tools (instrument logic, mechanisms, calibrations) to achieve these. We however note several methodological challenges as well. First, tackling climate change in the transport sector is a complex problem and requires simultaneous implementation of policies and measures in the realm of mobility (Avoid and Shift) on the one hand, and vehicles and fuels (Improve) on the other. All of these can be taken with a view to a wide range of different policy objectives (see Table 3), with climate change mitigation being only one of them. Assessing the current situation in a comprehensive manner, and assessing progress in the future, is therefore challenging. This was particularly the case when describing the mechanisms and the calibrations, and for the latter we could only use three examples out of a much larger set of options, due to limitations of space. Dupuis and Biesbroek (2013) appear to suggest a similar approach – i.e. based on selected examples - for assessing change in climate change adaptation. Second, the presence of long-term quantitative scenarios for low-carbon transport was considered in the connection to 'settings', however this could also be seen as being part of 'goals'. Third, assessing the instrument logic poses methodological challenges and since our data is limited and we chose to report specific examples of each country, this means some subjectivitiy is involved here. Finally, we consider institutional development specifically for sustainable transport and climate change a relevant aspect of policy even if not a component of policy content per se.

The framework offered by Howlett & Cashore is useful for taking stock of sustainable transport policies in the four countries, but their categorisation does not explain the content and character of those policies nor differences between the countries. Although not a core aim of this article, we will now explore possible explanatory factors for the trends and differences found between the four countries. We will do so in an inductive way, i.e. starting from our research findings we will flag up possible explanatory factors and suggest links to the broader literature. It is duly noted this is rather challenging due to the complex array of factors influencing transport policy, the large number of

possible options in the sector, as well as our data limitations. A more systematic explanatory analysis is beyond the scope of this paper.

When it comes to fuel economy policy instruments and calibrations (see Table 3), different approaches appear to exist in countries with (Thailand, Indonesia) and without (Vietnam, Philippines) a large domestic car manufacturing industry (see Table 2). Vietnam was the first country to implement labelling for all new passenger cars, while Thailand and Indonesia provide incentives for smaller cars and Thailand exempts larger pickups from the incentive scheme, which benefits manufacturers. 'Limiting motorisation' as a policy objective and/or implementation of vehicle restriction measures was found in three countries, although the relatively low fuel taxes (calibration), found in all four countries, may not support this objective. While no firm causal relationship can be established from our data, we could theorise that policy coherence (Kivimaa and Virkamäki, 2014; Bache et al., 2014), i.e. the use of policy means and tools based on consideration of different and potentially conflicting policy ends and aims (see Table 1 and 3), may be a factor influencing transport policy instruments and calibrations. In other countries, 'industry promotion' was also found (e.g. in Vietnam, based on interview) to be a policy objective. As Kivimaa and Virkamäki (2014) note, "established regimes not only for transport but for energy and industry, i.e. multi-regime interaction" are relevant to low-carbon transitions, which require coherence in policies in different sectors.

Local stakeholders are also relevant factors. For example, non-motorised transport policies like cycling appear to be more developed in Thailand and the Philippines, in the development of which an advocacy role for civil society groups was observed (Bakker et al., forthcoming). Aside from local stakeholders, international organisations and processes such as the UNCRD Environmentally Sustainable Transport Forum are likewise relevant. This Forum (according to interviews with Vietnamese and Thai policymakers) appears to influence policymakers in transport agencies who develop strategies and action plans. Howlett et al. (2009) consider them policy entrepreneurs by their way of using policy windows to put issues on the policy agenda. Whether other factors, such as cultural values and orientations (Okma et al., 2010), political systems and decision-making processes (Howlett et al., 2009), income levels and professionalism of legislature (Berry and Berry, 2009) are relevant in low-carbon transport policy development would require more analysis. In such research, the design should include a list of possible factors and clearly defined policy outcomes as the dependent variable.

In addition, we consider to what extent climate change objectives are relevant for transport policy. In all countries we observe that the transport sector is included in climate change action plans as one of the key sectors that should contribute to the national mitigation objectives as included in the NDCs. As to the question whether climate change objectives have a real impact on transport policy development and implementation, i.e. whether it is symbolic (Dupuis and Biesbroek, 2013) or not, there is evidence from one country (Indonesia, based on interviews) that the climate change objectives and sectoral action plans provide additional arguments or drivers for national and local transport policies, i.e. it can create new windows for policy entrepreneurs to influence the transport policy agenda. For other countries we were not able to find direct indications for such windows. In all four countries, climate change actions (NAMAs) are developed in the transport sector, however none of these are implemented yet, hence no impact on transport policy can be observed yet. Therefore, although we consider it possible that climate change mitigation is more than a 'symbolic' meta-policy, i.e. having real and positive impact on sustainable transport policy, more research is required to test this hypothesis.

6. Conclusions

Countries in Southeast Asia are experiencing rapid growth in motorisation and associated negative impacts on congestion, air quality, road safety, energy security, city liveability, and greenhouse gas emissions. To be compatible with sustainable development and climate change objectives, significant change is required. This article has shed light on the policy developments in four ASEAN countries in this context. When looking at the current transport system, the countries are relatively comparable in some aspects such as the importance of motorcycles and vehicle fleet

growth rates, whilst there are substantial differences in motorisation levels and per capita transport CO_2 emissions. These can only partially be explained by the variation in income levels.

When looking at the current status of policies on sustainable transport and climate change, we found several common elements across the four countries. At the level of policy ends, each country has a set of goals, objectives and specific targets or settings in policy plans and strategies that support sustainable transport, and, directly or indirectly, climate change mitigation. Looking at the component of policy mechanisms, it appears the countries are active in development of nationally appropriate mitigation actions in the transport sector. In the realm of transport demand management and 'avoid' strategies, policies and measures are in an early stage of development or absent. Shift and Improve are in general more developed.

There are notable differences as well. A policy objective to limit motorisation was found in two countries, while the other do not address this explicitly. The avoid-shift-improve approach is used in transport policy documents in two of the countries, however as yet it does not appear to have major importance as a framework to structure and develop policies. With regard to policies to improve vehicle fuel efficiency, the use of different policy means and tools varies strongly from one country to the other.

Although climate change mitigation is of lower concern for transport policymakers compared to improving efficiency of the transport system and reducing local impacts, we found significant attention to the climate change agenda. Climate change is addressed in key transport policy documents and, vice versa, transport plays a role in climate change policies. Institutions are being set up to specifically deal with transport and climate change. Our policy review also shows that a range of ASI policies are being discussed, developed or implemented, which could result in significant emission savings compared to business as usual. Yet, an absolute reduction in GHG emissions from transport is not likely in the near future, nor are long-term plans in place that enable a transition to climate-compatible transport development.

With regard to policy research, we found that applying the taxonomy of policy components of Cashore and Howlett can readily be applied to structure the comparative policy on sustainable transport in ASEAN countries. The analysis results in interesting insights into similarities and differences in policy emphasis. Further research into how climate change can be better reflected in and used as a driver for transport policy would be relevant in connection to the transformational change required in transport policy in order to meet long-term climate change objectives.

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[1] www.transportandclimatechange.org

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Appendix A. Reference table for ASI policies and measures analysis, as used in Stocktaking Reports.

Strategy	Policy instrument type	Policy / measure	Strategy	Policy instrument type	Policy / measure
Avoid	Infrastructure	Telecommunications	Improve	Economic	CO_2 based vehicle taxation
	Information	Telecommuting		Economic	Tax rebates for efficient vehicles
	Regulatory	Transport – land use planning integration		Regulatory	Import restrictions for inefficient vehicles
Avoid, shift	Regulatory	Transit-oriented development		Economic	Vehicle scrapping
	Economic	Parking pricing		Regulatory	Fuel economy / CO2 emission standard
	Regulatory	Reduce available parking space		Regulatory	Inspection and maintenance
	Economic	Road pricing, congestion charging		Regulatory	Speed limits / speed management
	Regulatory	Vehicle use restrictions (e.g. number plate schemes)		Regulatory	Low-emission zones
	Regulatory	Vehicle sales limits		Information	Eco-driving
	Regulatory	Traffic calming, access restrictions		Information	Car labelling
	Regulatory	High-occupancy vehicle lanes		Regulatory	Traffic management
	Regulatory	Street design standards		Economic	EV tax incentives
Shift	Infrastructure	Bike sharing		Economic	Hybrid vehicle incentives
	Regulatory	NMT friendly building regulations		Economic	Electric two-wheeler incentives
	Regulatory	Design standards for intermodal integration		Economic	EV programmes
	Information	Real-time public transport information		Economic	Biofuel incentives

	Information	Campaigns promoting public transport / NMT		Economic	CNG / LPG incentives
	Regulatory	Master planning for public transport / NMT		Regulatory	Emission standards
	Regulatory	Bus route optimisation		Information	Clean vehicle campaigns
	Regulatory	Bus management reform		Infrastructure	Charging infrastructure
	Infrastructure	Bus prioritisation measures		Regulatory	Biofuel blending standards
	Regulatory	Integrated ticketing		Economic	Fleet renovation programme
	Infrastructure	NMT infrastructure		Economic	Clean bus fleet programmes
	Infrastructure	Park and ride	Avoid, shift, improve	Infrastructure	Intelligent transport systems
	Infrastructure	Urban rail infrastructure		Economic	Fuel taxation / subsidy reduction
	Infrastructure	Bus rapid transit		Economic	Vehicle taxation
	Infrastructure	Inter-urban rail			
	Infrastructure	High-speed rail			
	Economic	Public transport fare policy			

Source: Authors' compilation

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In the text, reference numbers should be placed in square brackets [ ], and placed before the punctuation; for example [1], [1–3] or [1,3]. For embedded citations in the text with pagination, use both parentheses and brackets to indicate the reference number and page numbers; for example [5] (p. 10), or [6] (pp. 101–105).

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