

Mainstreaming climate adaptation and mitigation policy: Towards multi-level climate governance in Melaka, Malaysia

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ABSTRACT

Cities' responses to the challenge of climate change mainly relate to urban spatial planning and capacity-building initiatives. Those are enhanced by supportive climate adaptation policies at the sub-national level, which open up potential benefits and opportunities. Using the city of Melaka as a case study, this paper examines the importance of supportive climate adaptation policies using 'good practices' within a multi-level climate governance framework. This framework is evaluated by horizontal and vertical dimensions which assess policy actions designed to close the gap between national and local levels. Melaka is aiming to become a greener city, and its carbon reduction target is intended to support climate mitigation. This is discussed in relation to dynamic horizontal and vertical interactions at various scales. This study also examined why Melaka is considered a testing ground for climate mitigation projects that may subsequently be applied in other Malaysian states. A dual, collaborative, top-down and bottom-up approach and likely ways forward are also discussed as elements of good multi-level governance. The findings of this study should inform the application of multi-level governance in other states in Malaysia and elsewhere with similar ecological and economic contexts.

1. Introduction

Climate change is one of the most complex and pressing environmental problems facing the world today, and multiple ways of tackling the problem are required (Ostrom, 2010; Bulkeley and Newell, 2015; Bache et al., 2016; Percival et al., 2017). The problem of climate change is fourfold, and key stumbling blocks are not technical, but rather political and institutional (Widerberg and Pattberg, 2015). Thus, what matters is the implementation of good governance practices which can tackle those problems. Over time, there has been a move away from rigid, top-down administrative control of climate change adaptation/mitigation practices, implying less hierarchical public decision-making structures (Kohler-Koch and Rittberger, 2006; Biesbroek, 2014; Popovski and Breakey, 2015) and a broadening of policy making beyond governments and their bureaucracies (Kooiman, 1993; Biermann, 2010; Biesbroek et al., 2018). Recent climate governance initiatives provide a chance for non-state actors, such as higher education institutions, non-government organisations, independent organisations, and non-governmental research institutions under the framework of United Nations Framework Convention on Climate Change (UNFCCC) to play an active role in various climate-related initiatives (Widerberg

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and Pattberg, 2015; Roger et al., 2017). Public and private sectors actors require the information and knowledge necessary to work together to solve diverse, dynamic and complex climatic problems.

Malaysia is in the same boat, and is looking arrangements which share power and strengthen capacity at various scales, as well as collaboration and partnerships which will reduce governmental control over climate initiatives (Al-Amin et al., 2013; Rasiah et al., 2016; Mustafa et al., 2019). Malaysia is the 26th and 2nd largest greenhouse gas (GHG) emitter in global and ASEAN terms respectively, due to its relatively high gross domestic product, GDP per capita, and population of 30 million (UNDP, 2006; Alam et al., 2013; Shahid et al., 2014). Recent statistics indicate that Malaysia's GHG emissions increased by 221% between 1990 and 2003 (Alam et al., 2013). This is an alarming increase for such a short period of time, but a fair number of climate mitigation actions are now on the national agenda (Al-Amin et al., 2015; Rasiah et al., 2016). A 2011 Malaysian climate change report noted that the energy industries have been responsible for 35% of GHG emissions over the last two decades (NRE, 2011), followed by transport (21%), manufacturing and construction (16%), forest and energy conversion (14%) and mineral production (6%). Recent climate change literature also indicates that urbanisation and associated increases in energy demand mean that emissions are continuing to increase (Shahbaz et al., 2016; Sarkar et al., 2019). Malaysia's annual rate of urbanisation is 2.66% with 75% of Malaysians currently living in cities and a projected total of over 85% by 2030 (Yusoff and Loh, 2013; Hasan and Nair, 2014). The pace of urbanisation, and the associated urban heating effect, have become intense recently, which means that there is an urgent need to improve urban environment quality and to control climate change through a sound action plan (IARC, 2013; Bekhet and Othman, 2017).

Many studies have noted that cities are the actors best placed to take the lead in controlling climate change as it is estimated that roughly 20% of carbon emissions come from urban transport alone (Boekhoff et al., 2015) whilst energy consumption in urban commercial and residential buildings account for another 40%. Urban carbon emissions could be reduced by a substantial amount by improving spatial planning, developing transit systems, raising awareness, and promoting cycling and efficient transport management systems (Erickson et al., 2013; Boekhoff et al., 2015). Undoubtedly, a proper strategic plan, related spatial planning, and a combination of climate mitigation and adaptation initiatives in cities and other urban areas would be a good way to tackle climate change in the years to come. A key question is 'what should such initiatives look like in practice?' The success of cities as strategic partners in climate change initiatives is largely dependent on coordination of strategy and policy at several levels of government (Erickson and Tempest, 2014; Gouldson et al., 2015; Jänicke, 2015; Colenbrander et al., 2017).

Several recent studies have addressed the links between urbanisation, the rate of carbon emissions, and the impacts of these on climate change on regions and cities. Several local studies have investigated the climatic effects of economic development, growth and infrastructure expansion, and other links including land use patterns, ecological and agricultural sustainability and the consumer lifestyle (Siwar et al., 2009; Yusoff and Loh, 2013; Al Amin et al., 2015). Urbanisation and climate change are closely related, and the importance of impacts on cities are not in doubt, hence new, multi-level approaches are needed (Wu et al., 2016). Al-Amin (2011) studied the potential impact of climate change on Malaysia's vulnerability to loss of biodiversity, food insecurity, landslides, coastal and natural disaster, flash floods, tsunamis, and political instability, by comparing contemporary vulnerability with vulnerability decades previously. The authors also addressed the impact of urbanisation on climate change.

Studies of national climate policies in addressing urban sustainability are available in many countries (Bulkeley and Betsill, 2005; Corfee-Morlot et al., 2009; Lindfield and Steinberg, 2012; Nevens et al., 2013). However, studies at the city or state level, which represents a new approach to policy planning, are still lacking, especially in Malaysia. Undoubtedly, economic development, urbanisation and infrastructure expansion are each contributing to global carbon emissions (Zhang et al., 2014; Wu et al., 2016; Wang et al., 2017). More than 50% of the global population, or over 3.49 billion people, are currently living in urban areas and it is predicted that this figure will reach nearly 70% by 2050 (UNFPA, 2009; Zen et al., 2016). Hence, shifting to healthier cities with a proper strategic plan, sound spatial planning, climate mitigation actions, and improved urban infrastructure is very important (Li et al., 2016). Unfortunately, due to lack of environmental care, many cities throughout the world are lagging behind in such efforts and so their carbon emissions are likely to increase further, contributing to additional climate change.

The pace of economic development and urbanisation in Malaysia is similar to that in other contemporary developing economies and thus, related climatic issues are not out of the question. Hence, in this study, we ask how far Malaysia is from the optimal level of climate change action plans based on horizontal and vertical interactions, and learning processes, given that a number of measures have been undertaken recently to reduce the effects of climate change. Broadly speaking, these measures are national-level, and do not deal with the actions required at state or city levels. Additionally, the main aim of the national measures is to limit national carbon emissions by improving public transportation, increasing use of green and renewable energy and introducing clean economic development (Al-Amin et al., 2015). Unfortunately, Malaysia is still far from implementing plans that might lead to sustainable and liveable cities. Hence, this study analyses the role and function of climate governance in reinforcing climate action initiatives at state and city levels.

Malaysia faces the challenge of minimising climate change-related environmental damage by developing a model for sustainable and liveable cities. At least four main dimensions¹ of environmental care are required to minimise Malaysia's environmental damage. Those four dimensions go beyond the conventional single organisation approach, by enhancing connections between the private, public and third sectors. Multi-sectoral and multi-level initiatives require action at all levels - from the local, state and national to the global level by an applicable solution (Colenbrander et al., 2017). This study uses a multi-level climate governance framework as the

¹ 1) Institutional liaison and the relative importance of informal and formal institutions; 2) The network of NSAs and state actors and their interactions in relation to climate change and green technology projects; 3) Multi-level interactions across administrative boundaries and the scope of vertical integration; and 4) Governance modes – markets, bureaucratic hierarchies, and networks.

basis of analysis, and explores a number of initiatives promoting low carbon development and green technology at the state level in Melaka, Malaysia.

1.1. Policy for mitigation and adaptation to climate change policy

The current Malaysian climate change policy framework covers three main domains: (i) adaptation, (ii) mitigation and (iii) vulnerability reduction. This paper focuses on the first two domains in order to explore Malaysia's adaptive capacity and its key implementation issues and challenges. The Malaysian Climate Change Policy (MCCP) defines climate adaptability as “the ability of a system to adjust to climate change in order to reduce its vulnerability and enhance the resilience to observed and anticipated impacts of climate change” (MOSTI, 2000). The Intergovernmental Panel on Climate Change (IPCC) describes adaptation as an “adjustment in natural or human systems to a new or changing environment (Parry et al., 2007). Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (Smit et al., 1999). Thus, adaptation in ecological, human and physical systems must contain a wide spectrum of actions related to environmental processes, social and environmental practises, perceptions, behaviour, awareness and exploration of new ideas to minimise the adverse effects of climate change.

Adaptive capability has been defined as the capacity to adjust ourselves to minimise the impact of climate change, and to take action to cope with the vulnerabilities created by the plausible consequences of increasing carbon dioxide levels (McCarthy et al., 2001). In contrast, climate mitigation is defined in the MCCP as an “action or approach to minimise the GHGs into the atmosphere, or to decrease its emitting amount” over time (Edenhofer, 2015). According to IPCC, mitigation of climate change is defined as a “technological change and substitution that reduces resource inputs and emissions per unit of output with respect to climate change (Metz et al., 2007). Mitigation involves implementing policies to reduce GHG emissions and/or increase carbon sinks. Both approaches, adaptation to and mitigation of climate change, require that global policy is translated to national and then local level policies which take into account local stakeholders' standpoints, desired climate change approaches, likely accommodation methods, and overall, a sound institutionalising process to lessen climatic change's effects.

Several studies have considered more extensive climate change adaptations that could cope with the irreversible impacts of climatic change (Mertz et al., 2009; Sharma and Tomar, 2010; Mimura et al., 2015; Brzoska and Fröhlich, 2016). The early stage of climate change discussions, in particular pioneering studies by Denevan (1983), and O'Brien and Holland (1992), recommended a systemic approach to adaptation, to reduce the vulnerability of ecological, human and physical structures. The likely implications of adaptation naturally lead to concerns about adaptive capacity and adaptive abilities as a limit on reducing negative exposure. In particular, Denevan (1983) studied the cultural aspects of adaptation to a change in the physical environment, such as demography, organisation and economics to establish a link between the processes of changes in the realm of responses. O'Brien and Holland (1992) studied the improvement of coping mechanism with environment to their cultural structures.

Some climate change research has included studies considering adaptation options at sub-national levels, such as city level, focusing on urban development and multi-level governance (Hooghe and Marks, 2003; City of Kansas City, 2008; Corfee-Morlot et al., 2009; Selin and VanDeveer, 2009; Sharma and Tomar, 2010). Recently, research has looked at existing national adaptation initiatives in planning, community development, resource management, risk management, susceptibility and exposure, livelihood security, food security, and sustainable development (Al-Amin and Ahmed, 2016). However the local context of community adaptive capacity needs more inquiry in some communities because of its complex interaction (Smit and Wandel, 2006; Hinkel, 2011; Ensor et al., 2015). Earlier, Sharma and Tomar (2010) showed how cities should address the mainstreaming of climate change adaptation in the context of urban development and urban governance, but their analysis did not refer to a multi-level governance framework involving a comprehensive and structural city-level approach to adaptation to and mitigation of climate change.

When translating climate adaptation policy into local action plans, cities should set targets which cover more than just carbon emissions. Action plans should address short-, medium and long-term goals, and these may vary between cities in terms of time frame, goals and targets (City of Kansas City, 2008). At the same time, it is important to differentiate between adaptation or policy actions at the national level, and those at the local or city levels for an effective overall approach, instruments and governance. The mainstreaming of adaptation can involve a combination of local or city-level adaptations or policies for specific sectors or several sectors that are vulnerable to climate change. The mainstreaming of adaptation generally involves the integration of objectives, actions, strategies, plans, policies and guidelines, measures and operations at all levels and stages. One critical component of the adaptation process at local or city levels is the bottom-up harmonisation of local policies with national conservation policies, environmental management plans, disaster management strategies, disaster preparedness and sustainable development policies. The policy exploration here involves a content analysis on the type of policy that is required, the instrument(s) required, and the application of good governance practices.

1.2. Development and climate change issues in Melaka, Malaysia

Melaka is recognised as a world heritage city by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and receives millions of visitors annually (Moy and Phongpanichanan, 2014). The strong tourist industry is responsible for approximately 45% of Melaka's GDP. In 2013, there were about 14.3 million tourists visits, with a GDP per capita of about USD 7649 (Zen et al., 2016). Located about 130 km away from Kuala Lumpur and well connected by road, Melaka State occupies 1650 sq. km and the state capital is the renowned historic city of Melaka (Zen et al., 2016). The population growth rate is 3 to 4% and the population was 289,000 in 2010 and 342,500 in 2013 with nearly 29% of the jobs in 2011 (Zen et al., 2016).

Although the historic city of Melaka is a tourist destination, one of the main issues facing the city is conflicts between competing modes of transportation and the increasing number of vehicles. Melaka City and Melaka State have an average of 1.9 motorcycles and 1.4 automobiles per household respectively, which is considered a high level of private vehicle ownership (Zen et al., 2016). Specifically, there are 467 motorcycles, 342 cars and an average of 809 private motor vehicles per 1000 population (Zen et al., 2016). The number of private vehicles in the state increased from by 58% (cars) and 36% (motorcycles) from 2004 to 2011 (Shah, 2014). Thus, as a tourism-based city, private motor vehicles contribute to deteriorating air and environmental quality which compound the effects of climate change.

The key environment-related challenges in Melaka are: i) development of coastal areas without proper assessment of climate-related vulnerabilities; ii) heritage degradation; iii) continuous expansion of the urban periphery; iv) expanding green activities sufficiently in order to offset vulnerability to climate change, and; v) urbanisation and carbon emissions. If the city is to become sustainable, a 'green city' policy covering green growth, green initiatives, and assessment of the value of urban land is needed. Many of the efforts to accelerate green urban growth in the Melaka City have involved low-carbon green initiatives and green economic development initiatives that attempt to lessen the negative environmental impact of urban development on environmental services and natural resources.

About two thirds of Melaka is categorised as an environmentally sensitive area due to its rich biodiversity (GOV, 2014). Agriculture activity is still the dominant mode of land use and half the land in Melaka is used for agriculture. Two local authority areas dominated by agricultural activities are Alor Gajah and Jasin District (Zen et al., 2016). Appropriate urbanisation could help to reduce carbon emissions and the negative impact overall for climate change.

This study uses Melaka to demonstrate how states can play an active role in translating the national agenda to state and community levels, and in advancing green technology initiatives involving private public partnerships, using the framework of multi-level climate governance. Using a city state as a case study, we explore existing practices, implementation processes and the status of initiatives at the city level to harmonise with the national policy.

2. Framework

Based on the needs for Malaysia-specific research which better describes the establishment of links between climate change and adaptive measures, a conceptual study framework was developed. The study method consisted of three steps: (1) explanation of multi-level climate governance, (2) identification of mainstream climate policies and (3) comparative analysis of multi-level climate change governance. A detailed description of the methods and the profile of Melaka are given below.

2.1. Explanation of multi-level climate governance

Multi-level governance has been described as an evolving governance model by the European Union (Hooghe and Marks, 2001) and as a system of continuous negotiation among several nested organisational tiers (Marks, 1993). It is used as descriptive term that goes beyond the usual two-level federal system, adding the option of negotiation among different parties and organisations (Weibust and Meadowcroft, 2014). More recently, the term is used in environmental policy beyond the European context, and is used to fill the necessary needs of policy negotiated by different levels of governmental.

In the context of climate change, local governments and authorities are the main actors translating policy into various actions. Multi-level climate governance has been defined as "an action by local governmental authority in areas related to climate change in legal and institutional frameworks at higher scales" (Corfee-Morlot et al., 2009). It is an approach which transcends vertical and horizontal levels of social organisation in order to create multi-jurisdictional policy (Hooghe and Marks, 2001; Corfee-Morlot et al., 2008; Selin and VanDeveer, 2009; Corfee-Morlot et al., 2009; Cerna, 2013). Based on a reciprocal top-down/bottom-up approach, multi-level climate governance provides an interface for policy-making decision processes, and at the same time it functions as a reinforcing mechanism and an enabler of action. Nevertheless, this explanation leaves out the involvement of non-state actors, which are increasingly seen as important actors to be involved in climate governance.

Multi-level climate governance simultaneously involves both top-down processes (e.g. related to translation of federal policy decisions into lower level plans) and bottom-up processes (e.g. related to translation of policy decisions from local levels to a higher levels) (Gornitzka et al., 2005; Cerna, 2013). Thus, multi-level climate governance involves inter-sectoral, multi-actor and multi-dimensional processes related to climate change adaptation/mitigation policy and a variety of factors at various levels of action (Hooghe and Marks, 2001). Normally, implementing multi-level climate governance requires government reform, restructuring and transition away from previous approaches. A multi-level climate governance framework can be used to coordinate the interactions of actors at various levels as they relate to global environmental challenges, i.e. climate change adaptation/mitigation is translated at national, sub-national, and local levels of vertical interaction, as well as via various sectors of horizontal interactions.

Dealing with carbon emissions-related issues requires horizontal interactions and cross-sectoral strategies, which should create opportunities to educate actors about climate change and lead to more flexibility in collaborative arrangements (e.g. public-private partnerships). Non-state actors (NSAs) play a crucial role in facilitating climate education to other actors and society at large. NSAs often require various other actors (e.g., individuals or organisations, the community, private and business entities and researchers) to work together in a platform for collaboration and learning. This mode of engagement has been identified in Melaka City, which will be further discussed below. Tackling the challenge of climate change requires the involvement of multiple actors, not just the government.

Multi-level climate governance is inherently a functional process which involves creating links between international and federal

or national governments, between national and sub-national governments and between sub-national and local level entities to achieve stronger action related to climate change (Hooghe and Marks, 2003). The approach is popular in OECD countries, both for rural and metropolitan regions. A multi-level framework closes the policy gap by adopting tools for horizontal and vertical co-operation among different levels of government and non-governmental agencies. It has also been widely used in recent European policy formulation (Jänicke, 2015). However, multi-level climate governance needs best practices to be followed during both bottom-up and top-down decisionmaking, and should be carried out via cooperation, competition, networking and benchmarking guidelines (Jänicke and Lindemann, 2010; Cerna, 2013; Jänicke, 2015;). Corfee-Morlot et al. (2009) outlined the characteristics of good climate governance:

- i. both climate change mitigation and adaptation policies at national level;
- ii. the capacity to test both mitigation and adaptation projects at local level to inform national strategy and policies;
- iii. close collaboration (for cost-effectiveness) on capacity building for both mitigation and adaptation actions, and for authorities from local on up to national levels.

3. Mainstreaming climate policy

Mainstreaming climate policy involves making objectives, strategies, policies, measures, operations and actions part of national and regional development policies, processes and budgets at all levels and stages. Knowing that the critical component of adaptation processes often lies in existing national development plans, the mainstreaming of climate policy should encompass national conservation strategies, environmental management plans, administration actions for disaster-preparedness, and sustainable development strategies for forestry, agriculture, transportation, fisheries to name but a few. Appropriate climate change action requires a content analysis of these policies, and decisions about which instruments can be used to promote good governance. As but one example, in response to a global policy, the Sustainable Development Goals (SDGs)/Agenda 2030, Malaysia took a proactive step in responding to Goal #11: making cities more inclusive, safe, resilient and sustainable (Zen et al., 2016). At the national level, Malaysia promoted green growth poles and mechanisms for low carbon growth under its national 11th Malaysia Plan (2016–2020). Malaysia's interest in green growth reflected a fundamental shift away from the “grow-first and clean-up later” mind set (Zen et al., 2016). The country's new model of development views resilient, resource-efficient, low-carbon, and socially inclusive development as an upfront investment that will produce future advances for multiple and upcoming generations. The country's national vision for green growth has already influenced state and regional policy and institutional frameworks. This response to national green growth priorities are seen as positive towards climate change action by creating successful co-ordination that will help to expand city-level institutional capacity. The intention is to achieve green growth through partnerships with non-governmental and private organisation, using a bottom-up approach at the local level as well as top-down policy approach involving collaboration with national and international actors at the regional and global level (Fay, 2012).

Malaysia is using the green city concept developed by the Asian Development Bank (Lindfield and Steinberg, 2012) to translate its national climate change agenda into actions. A green city is defined as “A city that is resilient, inclusive, manages its natural resources well, and promotes low carbon growth to remain competitive and enhance liveability for all its residents” (De Jong et al., 2015). In Malaysia, as defined and indicated by the National Green Technology Policy, 2011 (Table 1), there is equal emphasis on environment, economic competitiveness and equity (the 3Es) in an effort to achieve balanced growth instead of business-as-usual practices. The green city concept also informs the maintenance and conservation of parks and local authorities' implementation of policies, implementation of recycling programs and efforts to reduce global warming by the efficient use of energy.

In the following section we use Melaka as a case study to demonstrate how state leadership plays an active role in translating the

Table 1

Nine important sectors under Malaysia National Green Technology Policy, 2011.

Source: National Green Technology Policy, 2011 by Zen et al. (2016).

Wide spectrum sector-based climate policy	Detailed explanation
1. Energy	Energy sources, power generation and the transmission, and distribution of energy.
2. Waste	Municipal solid waste, medical/clinical waste, hazardous/schedule waste, agriculture waste, and e-waste. This sector derives its green technology areas through the various parts of the waste value chain, such as generation, storage, collection and transport.
3. Transport:	Transport-land use planning, advanced public transport systems, traffic management, and enforcement and vehicle technology.
4. Manufacturing	Manufacturing processes, input materials and resources, as well as fundamental and applied technologies.
5. Water	Resource management, treatment, storage and distribution of water, water usage, and wastewater treatment and recycling.
6. Building	Design, site-planning and management of building materials, the construction of buildings, operation and maintenance of constructed buildings. A total of eight technology areas were identified under these categories.
7. Agriculture	Input, production, processing, storage or distribution, and consumption of agriculture products.
8. ICT	Green of ICT that focus on energy efficiency of ICT equipment, and Green by ICT that relates to resource efficiency and sustainability attributed by ICT applications.
9. Forestry	Planting and improvement of trees, forest management, production and process of forestry products and end of-life management.

Table 2

Carbon intensity status of Malaysia and Melaka State.

Source: Blueprint for Melaka Green Technology State 2013 by Zen et al. (2016).

Index	2005		2020 (BAU)		2020 (Mitigation)	
	Malaysia	Melaka	Malaysia	Melaka	Malaysia	Melaka
GDP (RM Billion)	449.250	14.825	906.640*	48*	906.640*	48
Emissions (Million tons)	279	4	375.5	8.95	336.6	7.68
Carbon Intensity of GDP (COeq/GDP)	0.62	0.27	0.42	0.18	0.37 (40% reduction of 2005 level)	0.16 (40% reduction of 2005 level)

Notes: Difference on the carbon intensity: $0.27 - 0.16 = 0.11$ (**mitigation). Melaka carbon intensity reduction: $0.11/0.27 = 0.407$ or 40%.

national climate change agenda to state- and community-level green technology initiatives involving private-public partnerships and a multi-level government approach.

4. Multi-level climate governance

4.1. Issues in Melaka City: mitigation and adaptation

According to recent literature, a good number of cities have implemented or are in the process of implementing multi-level climate governance and have set up a carbon emission reduction target aimed at long-term climate change mitigation (Zen et al., 2016). The 2017 “Greener, Greater New York Campaign” is a good example and includes a target of a 30% reduction in emissions between 2005 and 2030 (Rosan, 2012; Jabareen, 2014). The actions of London are another good example of multi-level operations, focused on achieving a 60% reduction compared to 1990 emission levels by 2025, a commitment entered into in March 2007 and supported by London's Climate Change Action Plan (LCCAP) (LES, 2018). Melaka Municipal Council is working along similar lines to New York and London, and several climate mitigation actions are already in place as part of the Industry Driven Smart Communities Program, which is part of the Science to Action (S2A) initiative for Melaka City (Mallek, 2014).

In response to the national emission reduction target, Melaka has set a target of a 40% reduction of 2005 carbon emissions by 2020 (Table 2). This is part of the green city initiative, coordinated by the Indonesia–Malaysia–Thailand Growth Triangle (IMT-GT) collaboration at regional level, which is supported by the Asian Development Bank (ADB). In a further attempt at climate change mitigation, a target has been set that 20% of total energy consumption should be met by renewable energy (Shah, 2014). The programs directed at meeting this target include installation of solar panels in residential houses and government buildings and the development of low-carbon initiatives in rural areas under the auspices of the Rimbunan Kasih projects. A GHG emissions inventory project has been set up using 2013 as the baseline (Zen et al., 2016).

Several climate change mitigation actions have been implemented at the State level to support strategic adaptation actions. With special attention from a federal government body called the Malaysia Industry-Government Group for High Technology (MIGHT), Melaka City aims to be the first demonstration project for green technology city application at the community level. The signing of a Memorandum of Understanding (MOU) between MIGHT and the Melaka Green Technology Corporation has resulted in industry investment in six initial projects with a total budget of RM550 million² to support Melaka's climate mitigation initiatives (Bernama, 2014). The six projects map to six key green areas, and are: (i) energy efficient buildings; (ii) city infrastructure; (iii) green tourism; (iv) smart grid; (v) waste water eco-park, and; (vi) solar industry eco-park. As a national government body, MIGHT functions as the key delivery partner for projects that are part of the Melaka Green City Action Plan (GCAP) and facilitates the involvement of sub-national actors in the smooth implementation of the climate agenda at a state level. This effort represents one of the characteristics of good climate governance identified by Corfee-Morlot et al. (2009), namely, that there are both mitigation and adaptation projects at a local level that provide a testing ground for national government policies.

The vision for Melaka City is in line with the national vision for 2020 wherein GDP per capita should reach USD 15,000 by 2020 under the Melaka Green City Action Plan (GCAP) 2014 (Zen et al., 2016). The Melaka Development Blueprint (Mohammad, 2013) takes into account the status of developing states followed by the Organisation for Economic Cooperation and Development (OECD). This brings the national agenda and existing local initiatives in harmony for per capita income. It should also be noted that the Melaka GCAP covers five key areas: (i) economy; (ii) society; (iii) infrastructure; (iv) environment, and; (v) administration, and contains 32 indicators for monitoring the progress of the Melaka Green City Plan. In contrast, the Melaka Development Blueprint covers the seven key areas of the United Nation Urban Environmental Accords (UN-UEA), which are organized in terms of 21 sub-areas, 152 indicators and 11 key areas from the National Sustainable Indicator for Local Authorities (NSILA) indicators (Mohammad, 2013). The aim of these initiatives is to make Melaka City into a green city state by 2020, and specifically for Melaka State to be the first Malaysian state to sign up to the United Nation–Urban Environmental Accords (UN-UEA).

² US\$ 1 = RM4.15

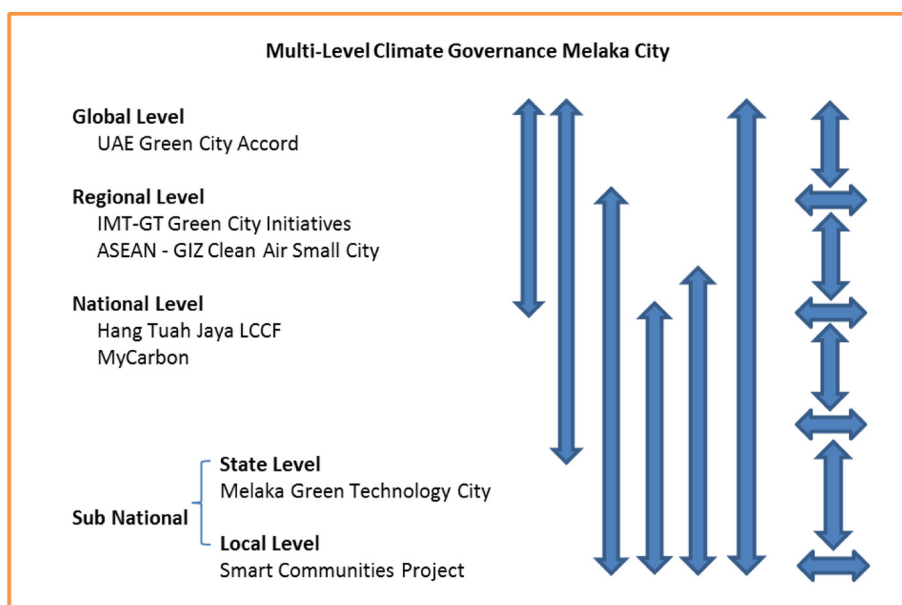


Fig. 1. Multi-level Climate Governance in Melaka: Vertical and Horizontal and Interactions.

Source: Jänicke, 2015 (modified from)

4.2. Multi-level climate governance in Melaka City

Melaka City has been playing an active role in linking organisations and agencies at global and regional levels in order to achieve carbon emission reductions as part of its green city initiative. The global level is supported by the UN-UEA, and the green city action plan helps to make the environmental dimension a mainstream part of Melaka's overall city master plan. At the regional level, supported by Asian Development Bank (ADB), Melaka has developed a comprehensive green city action plan (GCAP) that takes into account the 'National Development Master Plans', green city frameworks and planned anchor projects (Fig. 1) (Zen et al., 2016). Melaka signed the UN-UEA, which has seven key areas: (i) waste reduction; (ii) urban environment; (iii) energy; (iv) urban design; (v) transportation; (vi) water, and; (vii) environmental health. These seven sectors are further divided into 21 sub-areas and 12 indicators in order to track the actions more pro-actively. However, lack of governmental capacity for implementing and monitoring all of the initiatives is a key problem. Thus, the building of implementation and monitoring capacity is crucial to the success of several climate initiatives (Dietz et al., 2003).

Melaka, as the first GCAP project, sets an example which other cities in Malaysia are expected to emulate. The GCAP project is coordinated by a GCAP committee which is responsible for monitoring and managing the implementation process. The GCAP project is to be followed by the setting-up of a baseline database, an urban management partnership with ADB, CIMT and GCA, and a long term public awareness forum to support green city achievement plan. These achievements and plans demonstrate the dynamic interactions between Melaka state government and ADB in governing climate initiatives in key sectors of green city indicators.

Regional collaboration under the IMT-GT Green Cities initiative has led to the twinning of Melaka in Malaysia with Songkhla in Thailand and Medan in Indonesia. These arrangements both strengthen city-to-city collaboration and enhance state-level climate action initiatives (Fig. 1). Furthermore, the vision of IMT-GT for “a seamless, progressive, prosperous and peaceful sub-region with improved quality of life” is considered as an important collaborative effort that focuses on the green cities initiatives and sustainable urban development (Sandhu, 2014). The IMT-GT vision is based on the three objectives: i) energy efficient government buildings; ii) advanced electric management unit (EMU) system, and; iii) green city indexing. Along with Songkhla, Thailand and Medan, Indonesia, Melaka is one of three cities in the region where the ‘green city’ model is a priority. Efforts to make government buildings energy efficient should translate into economic benefits and provide best practice examples of local-level actions to reduce GHG emissions (Betsill and Bulkeley, 2007). Private-public partnerships (PPPs) should also contribute to regional programs for sustainable economic development and social integration. Hence, climate action initiatives, strategies, and adaptation initiatives have seen more activity in addition to satisfying the main concern of spurring sustainable economic development by participating states, local governments and provinces in strengthening green infrastructure expansions.

5. Discussion and policy implications

This study outlines a multi-level climate governance framework, using Melaka City to illustrate the links between local, state, national, regional and global levels envisaged by Jänicke (2015) and shown in Fig. 1. The outline suggests an overall mechanism, and possible innovation with different parts of the governance system, which allows pathways for vertical and horizontal interactions as

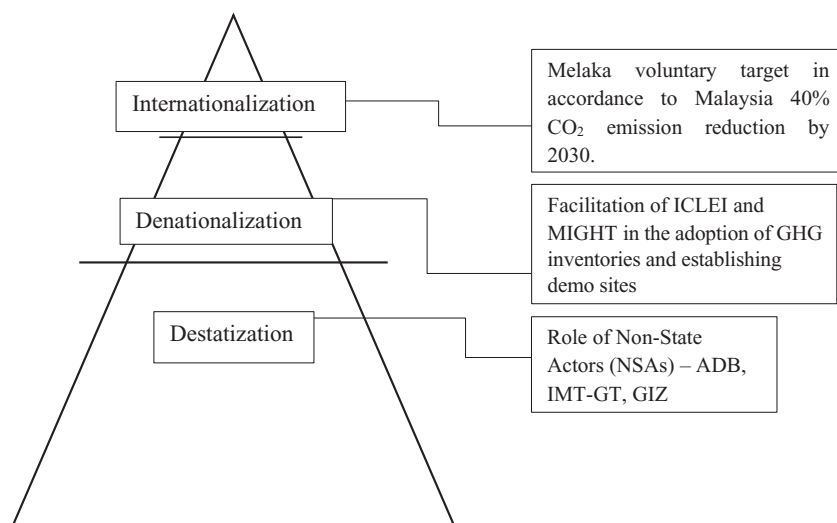


Fig. 2. Three Tier Climate Governance Up to Melaka State.

mentioned previously. The framework also explains the dynamic socio-technical transitions in Melaka, drawing on the work of Geels (2011). It further defines sub-national horizontal dynamics such as benchmarking, networking, cooperation and competition between states or cities through a combined top-down and bottom up relationship. It also addresses issues of environmental quality, economic competitiveness and equity, the three foundations of a sustainable city and dynamic interactions among actors. The dynamic interactions among actors involved in green technology and infrastructure are outlined using the multi-level climate governance framework represented in Fig. 1. We also contend that good governance practice requires support from active community participation (Fig. 2). All proposals for good governance should follow the plan developed by Kansas City (2008). The plan calls for Kansas City as well as the greater Kansas City community to conduct evaluations every five years and proposes partnerships between the Greater Kansas City Chamber of Commerce, Kansas City Power and Light, the Kansas City Green Builders Council, and other home associations (City of Kansas City, 2008).

To have a positive outcomes from multi-level climate governance and sub-national horizontal dynamics, there are two basic indicators which are important to facilitate good decision-making processes at the city level. Firstly, city-level decision-making processes should be consistent with national climate change preparation and monitoring systems. Secondly, the city-level approach should improve climate change knowledge and awareness at the local level, in order to support national urban decision-making and action plans. This study referred to the arrangement of the vertical translation or top-down/bottom-up approach of climate change policy from national to states level shown in Table 3. It also shows the harmonisation and its related function to match climate change policy at national level. Tables 4 & 5 show how the city-level approach is linked to national strategies and how the various climate adaptation initiatives of the Malaysia Green Technology Policy have been implemented at the city level.

Both Table 3 and Table 4 show the interactions between national climate change policy and the climate change policy of Melaka

Table 3

Translation of the national climate change policy at Melaka State.

Source: Author's compilations.

Climate change policy at national level	Climate change policy at Melaka State
<p>The Malaysia National Green Technology Policy (2009) stated that 'Green Technology shall be a force to stimulate sustainable development and expedite the national economy'.</p> <p>The Malaysia National Urbanisation Policy (2006) outlined the sustainable urban development as to response to climate change challenge. This document highlights the importance of strategy, action, decisions making, policy and implement strategy by creating a sustainable urbanisation.</p>	<p>The five objectives of Melaka State's National Green Technology Policy are:</p> <ol style="list-style-type: none"> To minimise the growth of conventional energy consumption, innovate green technology industry in maintaining the economic progress and sustainable development; To increase national capacity and capability of green technology expansion in the global arena; To enhance public awareness, knowledge and education on green technology and usage. <p>The six strategic thrusts are:</p> <ol style="list-style-type: none"> An well-organized, resilient, dynamic effective, competitive and sustainable urban growth, An integrated and effective urban utility services, transportation and infrastructure; A conducive urban environment with a good governance.

Table 4

The climate change adaptation policy in Melaka.

Source: Author's compilations.

The strategic thrusts of Malaysia green technology policy	Melaka Response's Towards Green Technology Policy
Strengthen the institutional frameworks on low carbon economy, and oversee the development of green growth by a structured and systematic manner.	The establishment of Melaka Green Technology Council to govern the green city initiative with the following objectives: <ol style="list-style-type: none"> To discuss strategies on green technology, To plan and screen the green technology development and its implementation to the state, To review the Melaka Green City State Blueprint for the application of green technology to the state. The establishment of Melaka Green Technology Corporation functioned are as follows: <ol style="list-style-type: none"> To lead the green development actions and green policies, To plan and screen the green technology development and its implementation, and To enhance investment and businesses opportunities to the green technology.
Helpful environment for green technology and its development by: <ol style="list-style-type: none"> A financial incentives and supports, Increase Direct Domestic Investment (DDI). Strengthen human capital development by the innovation of green technology as by: <ol style="list-style-type: none"> Provide primary education and knowledge on the scope of Green Technology and advancement. To increase green jobs by preparing scopes on more undergraduates/postgraduates studies on green technology and innovation. Intensify green technology research and innovations. Provide education, knowledge, awareness and promotion of the concept of sustainability by engaging various activities, means and modes.	<ol style="list-style-type: none"> Green exploration program provides a training module for all primary and secondary students. There are eight green exploration modules are exists on GHG calculation, carbon sequestration, green building sampling and low carbon vehicles, The establishment of campus at Hang Tuah Jaya Green City in 2014.
Promotion and public awareness on climate change.	<ol style="list-style-type: none"> Melaka green practices provides training by Melaka Green Technology Corporation (MGTC). The program is to create awareness of green technology for state government offices, Training to introduce the compliance on Green Office Practices Certification, Training skills programs and related activities by using the national occupational skilled and national competency standard, Promote green technology compliance, such as energy audit, renewable energy prospects and solar power. 'Don't Mess with Melaka Campaign'. Melaka imposes immediate compounds and local authorities take the necessary steps to the enforcement of compounds, 'NO PLASTIC BAG day program' that had been implemented since 2011, Two Plus One (2 + 1) municipal waste collection system was introduced since 2013 and to separate the organic and non-organic/recyclable waste from household.

Table 5

Climate Initiatives in advancing climate adaptation policy in Melaka.

Source: Author's compilations.

Forces	Climate Initiatives at City Scale
Engaging Endogenous Forces	I. Framing green indicator and linking it to adaptation with other agenda to fulfil the sustainable development outline, II. Engaging NGOs, stakeholders, research communities, academia, and consultants e.g. 'Do Not Mess Melaka Campaign', Kitakusy organic project, etc., III. Building new action plans based on new and previous on environmental programs by engaging local authorities, IV. Maintain commitments as proposed and ensure voice for marginalized population.
Engaging Exogenous Forces	I. Hosting National Disaster Day in 2011 and come up with Melaka Declaration, II. Joint 'Readiness Campaign for Disaster', III. Hosting the Asia Pacific Resilience City with ICLEI, IV. Creating Twinning Green Cities under IMT-GT, V. Partnering with several international organisations e.g. ADB, GIZ.

State, and indicate the vertical and horizontal interactions between local and national entities. Multi-level climate governance can only be effective if it follows the related structures addressed in both tables with a reasonable responsibility from both by the national and state level governance. Undoubtedly, the success of climate mitigation depends mainly on policy-makers executing actions related to national climate policy and to government's experiences in translating and adopting the national climate policy to the state

level. It is important to create economic competition that may lead to policy diffusion at all levels by the economic spill-over effects across jurisdictions. Henceforth, the vertical process and horizontal interactions would be fruitful and operative as applied to Melaka.

It is understood that under a 'government' definition, government authorities have the power to control the people, but under a 'governance' definition the government is no longer the single decision making authority and it gives more power to the people or other stakeholders in order to convince them to get involved in contributing to policy development and implementation (Fröhlich and Knieling, 2013). This transition is captured in Fig. 2, where internalisation, denationalization and destatization should follow a three tier climate governance model suggested by Coolsaet (2014). This approach urges the use of climate education in order to train this group under the NSAs, which in turn generates more concrete and meaningful contributions to climate policy and implementation at the state level.

As explained in Fig. 1, the first stage of involvement of NSAs as part of multi-level climate governance is referred to as 'de-statisation' (Fig. 2). It involves NSAs such as the ADB, GIZ, IMT-GT trying to translate Malaysia's climate change policy into various climate-related actions, programs and initiatives, such as the Melaka GCAP developed by the ADB, which has adopted institutionally and accommodated the green technology council as a manifestation of climate adaptation. The implementation of the Green City initiative where Melaka became a model city to other cities (i.e. Medan, Sumatera and Songkhla in Thailand) came under the regional collaboration of the IMT-GT initiatives on Green Cities.

The following four dimensions are introduced to deal with the complexity of governance systems which can examine the features of environmental governance systems:

- i. Institutional liaison and the relative importance of informal and formal institutions;
- ii. The network of NSAs and state actors and their interactions in relation to climate change and green technology projects;
- iii. Multi-level interactions across administrative boundaries and the scope of vertical integration;
- iv. Governance modes – markets, bureaucratic hierarchies, and networks.

In the context of climate governance, it is important to understand the existing modes of governance, NSAs' strategies and the actions of private corporations and networks in order to develop policy instruments or public policy that is compatible with existing policy. It is also important to understand how to 'steer' and 'manage' change by influencing the behaviour of informal and formal organisations (Pahl-Wostl, 2009). The mode of governance may differ in the context of multi-level climate/low carbon governance where the voluntary commitment of carbon emission reduction target may provide a direction for the various stakeholders' involvement. We reconceptualise this in Fig. 3.

The positive spill-over effects of climate mitigation projects are often related to their implementation process, and it mostly depends on how this implementation process stimulates adoption of similar policies by other states (Shipan and Volden, 2008). Recent studies indicate that climate mitigation project experimentation needs to act as an intensifier regardless of whether a top-down or bottom-up approach is used to close gaps between national and local policy. This applies in the case of Melaka City. Although mainstreaming climate change policy at the state level was designed for national action, it spread accordingly to also support local levels of the Melaka Green City State Blueprint (Jamaliidin and Sulaiman, 2018). Consequently the Melaka Green City Blueprint supported Malaysia's *Vision:2020*, which sees Malaysia as a high-income nation with a sustainable economy, whilst at the same time supporting the state's economy and the development of Melaka as a low-carbon city.

Additionally, the Melaka green technology council was set up to formalise and coordinate the implementation of climate change mitigation and adaptation policies at state and city levels, as well as to coordinate cross-sector green city initiatives (Zen et al., 2016). The three council objectives identified are: (i) Action policies on green technology; (ii) application and monitoring of green technology, and; (iii) proposals for green technology investment (Jamaliidin and Sulaiman, 2018). The three objectives mainly facilitate the development of green technology from policies, developments and applications chaired by the Chief Minister of Melaka. This was then followed by the implementation of low carbon actions as well as monitoring and the development of a blueprint for action on GHG mitigation measures established in 2012 (Zen et al., 2016). The state-level harmonisation of GHG emission inventories over time should improve the mechanisms for tackling climate change, especially policy and decision making in relation to local urban development. These efforts demonstrate the response by the Melaka state government towards the nation regarding tangible low carbon targets.

Recently Melaka State introduced several cross-sectoral initiatives representing a combination of sub-national and local governance. For example, the core government agencies responsible for the Melaka Green City Action Plan are:

- The Melaka GreenTech (Melaka Green Technology Corporation,
- The Economic Planning Unit (EPU) of the Prime Minister's Office,
- The National Solid Waste Consortium,
- Southern Waste Management (SWM),
- The Solid Waste and Public Cleansing Corporation (PPSPPA),
- The Department of Environment (DOE),
- The Green City Action Plan Committee,
- The Department of Irrigation and Drainage (DID),
- The Department of Agriculture,
- The Department of Rural and Town Planning (JPBD),
- The Department of Transport,

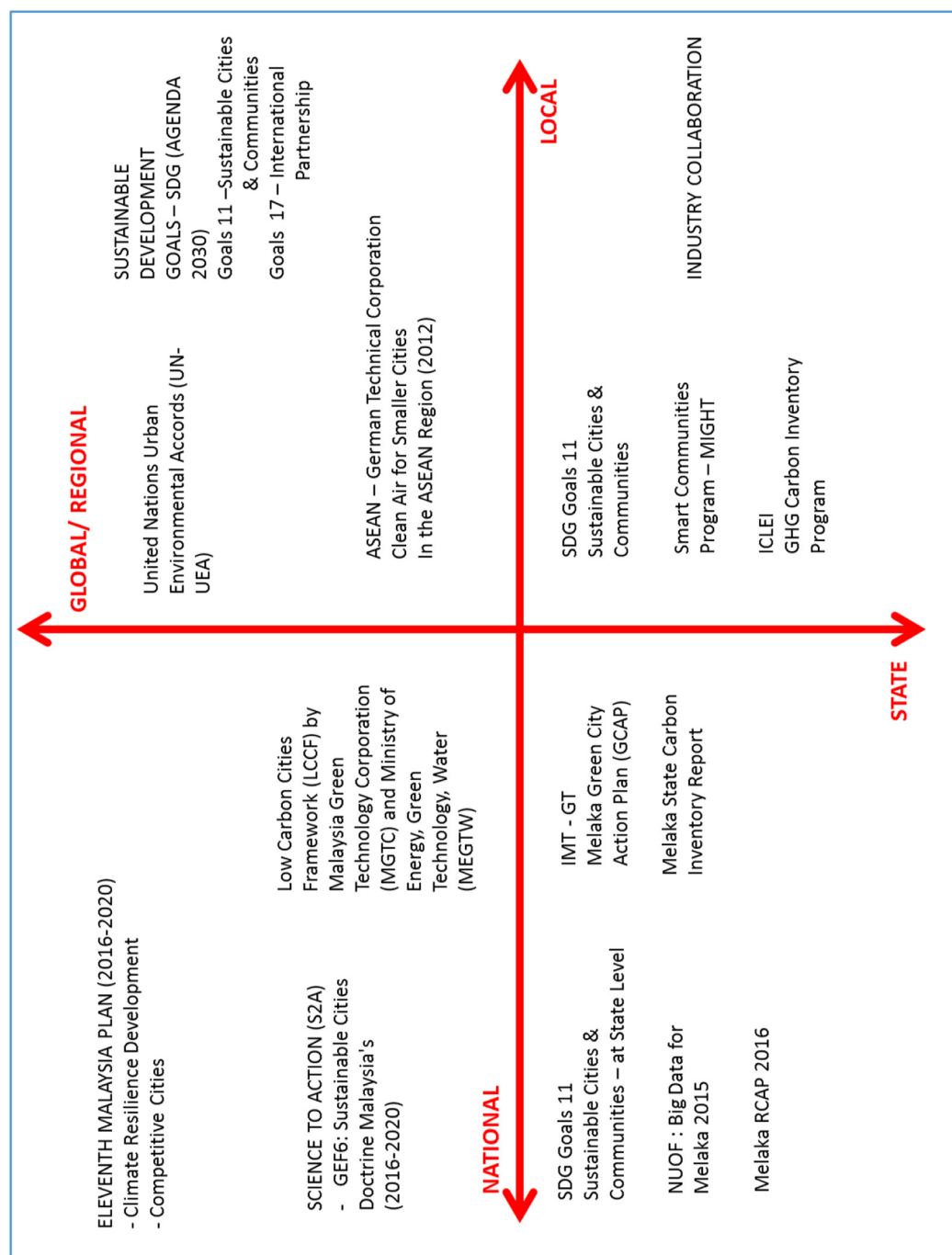


Fig. 3. Interactions of Multi-scale and Multilevel Climate Change Adaptation & Mitigation Policy Framework in Melaka State.
Source: Coolsaet, 2014 (modified form)

- The Melaka Historical City Council (MBMB),
- The State Economic Planning Unit (UPEN), and
- The National Energy Company (TNB).

At first, climate governance in Melaka state was largely dominated by top-down processes due to the involvement of national agencies, however lately, the involvement of four local urban bodies has had a positive impact and the state now uses a combination of top-down and bottom-up approaches to advance its climate policy. This indicates a scope of closing the gaps between the climate national and state policy with subjective response by the sub-national and local government.

Finally, this study analysed two tools that exist as a mode to strengthen multi-level governance by using the Melaka Green Technology city approach. Melaka can be considered an example of how climate change adaptation policy can lead to links between cities and advances in national and sub-national capacity and tools. Melaka links climate mitigation and adaptation policy implementation at sub-national government levels, uses a top-down/bottom-up approach, and pursues a multi sector, multi-actor and multidimensional process while also deploying the 'good practice' of multi-level climate governance. Thus, Melaka state government has an important role in building local capacity through vertical and horizontal and interactions with other state and non-state actors. There is a growing recognition of the importance of 'good governance' at local government levels. Among the challenges faced by national and international agencies is the need to understand local political and institutional constraints, which are important factors in the success of translating adaptation policies into local climate change initiatives. This study has also identified forces that stimulate climate-related initiatives in Melaka City; these are shown in Table 5. It is evident from the table that a combination of endogenous and exogenous forces is driving climate adaptation policy in Melaka, which is consistent with research by Carmin et al. (2012).

It can be concluded that there are two basic types of indicator that are required at state or city levels to facilitate good climate decision-making. The first are city level indicators that are aligned with national indicators and national inventory preparation and GHG monitoring systems. The second are local level indicators which can be used to drive improvements in local knowledge and awareness of the impact of climate change on national urban decision-making processes. The process should be followed by (i) national, (ii) sub-national level and sub-national level should be followed by (a) state and (b) local level for climate initiatives. Thus, in pursuing multi-level climate governance, vertical and horizontal and interactions at the local and city level to other states would be fruitful and effective.

6. Conclusions

Melaka City is translating national climate adaptation and mitigation policies to local levels. In doing this, it is supported by top-down and bottom-up climate initiatives designed to close the gap between local and national authorities, and by movement towards multi-level climate governance. Melaka City also demonstrates the existence of dynamic interactions in a multi-level climate governance framework. This framework stimulates horizontal and vertical learning at all levels and links local, sub-national, sub-regional, national and the global climate initiative and initiatives in different sectors. This study provides an example of a city-level good governance framework and thus contributes to knowledge about how to involve various organisations or actors and promote horizontal interactions among them in the context of climate change. This study has also identified that the horizontal dynamic interactions at sub-national levels involve networking, cooperation, processes and actions in the institutional landscape, and sub-national government and harmonisation system from the top-bottom policy support within the climate change realm. The new climate governance approach explored by Melaka City should help to create innovative opportunities to diffuse climate adaptation/mitigation initiatives to other states in Malaysia and elsewhere.

Declaration of Competing Interest

We declare that there is no significant competing financial, professional or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

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