



Emerging Smart Mobility Developments in Asia

A CALD BASELINE REPORT



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Background and Overview

Introduction

This baseline study is one of the first milestones in the three-year Smart Mobility and Infrastructure Development Project of the Council of Asian Liberals and Democrats (CALD). The project aims to provide guidance to local governments governed by CALD member-parties on developing their smart-mobility plans and initiatives.

Much of the content of the study is the result of workshops and discussions with experts in the transportation sector, as well as with political leaders who are actually implementing smart-mobility projects in their localities. The first workshop (held 20-22 April 2022 in Tagaytay City, Philippines) -- which was where the initial outline of this baseline study was defined -- focused on basic definitions and concepts related to smart mobility. That workshop also aimed to help CALD get a sense of the current developments and issues of smart mobility and infrastructure in Asia.

The second workshop (held 21-24 September 2022 in Bangkok, Thailand) gathered updates from experts and implementers in the region to define more clearly the content to be included in the baseline study. Taiwan, Indonesia, Thailand, and the Philippines reported on their respective smart-mobility developments. Their reports serve as this baseline study's case studies.

This study seeks to articulate definitions and concepts related to smart mobility, as well as explore the current developments and issues in smart-mobility deployment in select countries in Asia. Specifically, we will look into the general situation in Indonesia, Thailand, the Philippines, and Taiwan, and how these countries have used smart-mobility principles and technologies in addressing mobility challenges in their localities.

Urbanization, Congestion, and Smart Mobility Interventions

Rapid Urbanization and Congestion

A 2022 United Nations Economic and Social Commission for Asia and Pacific (UNESCAP) report¹ describes Southeast Asia as one of the fastest growing economies in the world, with an expanding population. According to the report, this is leading to rapid urbanization in the region, which was already at 49 percent in 2018 “and is projected to reach 56 percent in 2030.” Consistent with global patterns, urbanization in Southeast Asia has brought with it a myriad of social issues ranging from overcrowding, heavy traffic congestion, and lower air quality due to pollution, to social inequalities in terms of income and access to opportunities. If not addressed properly and quickly by governments, rapid urbanization can lead to reduced quality of life in the cities, where residents and workers could be grappling with longer commutes, which in turn could mean loss of potential income due to lost time in traffic, as well as safety concerns related to vehicular accidents.

Issues of sustainability also need to be addressed. The UNESCAP report² says that the transport sector in Southeast Asia consumes more than 25 percent of a country's total energy, “which is directly related to an increase in CO2 emissions.” Like the rest of the world, Southeast Asian nations are already dealing with the effects of climate change, and it has become obvious that they, too,

¹“Increasing the use of smart mobility approaches to improve traffic conditions in urban areas in the Southeast Asia Subregion,” United Nations Economic and Social Commission for Asia and Pacific (UNESCAP), accessed in September 2022, <https://www.unescap.org/kp/2022/increasing-use-smart-mobility-approaches-improve-traffic-conditions-urban-areas-southeast>

²UNESCAP, “Increasing the use of Smart Mobility Approaches.”

need to do better in terms of reducing their CO2 emissions. The transportation sector is a critical field of development with regard to this.

As urbanization spreads farther and wider and cities increase in number, systems need rethinking to ensure that there would be no marginalization or exclusion that would take place. Across the world, there is growing support for a paradigm shift. There are attempts to move the discourse away from the old ideas and shift into the language of mobility and access. As early as 2013, a UN Global Report on Human Settlements³ had noted that “access is the ultimate objective of all transportation” and that the focus of transport-related policies should be on the “human right to equitable access to destinations and opportunities.”

The lack of mobility results in many people being unable to participate fully in society. Governments have to “strengthen enabling and developmental role of transportation within cities,” said the UN human settlements global report⁴, with the idea that “(efficient) and high-capacity public-transport systems are the backbone of sustainable urban mobility.” Clearly, mobility and access should be the focus in the battle for sustainable transportation for all.

Deploying Smart-Mobility Solutions

Faced with the complex challenge of rapid urbanization, countries are now looking for innovative solutions that can respond effectively to problems it has brought, as well as to those that are yet to come. But the adoption of new technologies in transportation systems should not only improve the capacity of governments to respond to these problems. Indeed, participants in

³“Global Report on Human Settlements – Planning and Design for Sustainable Urban Mobility: Policy Directions,” United Nations Human Settlements Programme (2013), <https://unhabitat.org/planning-and-design-for-sustainable-urban-mobility-global-report-on-human-settlements-2013>

⁴United Nations, “Global Report on Human Settlements.”



the CALD workshops were clear in articulating that the bottom line of such interventions is the improvement of the people's quality of life. Smart-mobility interventions and technologies serve as means toward greater ends.

As an emerging concept, there is still no one definition for "smart mobility." UNESCAP⁵ sees smart mobility as "the integrated user-oriented transport systems and services that can make travelling safer, smarter, and greener using innovative technologies." Dr. Jin Young Park⁶, one of the resource persons at the Tagaytay City workshop, meanwhile introduced a loose definition of "smart mobility" and connected it with the emergence of smart cities. In his presentation, Park, Director at the Korean Transport Institute, identified data and technology as key features of smart cities that enable policymakers and leaders to make better decisions, which in turn make the cities more efficient, responsive, and sustainable. He then introduced the idea of mobility as "the ability to move freely or be easily moved."

Connecting the two ideas presented by Park, we can understand smart mobility as the use of data and technology that results in a more efficient, responsive, and sustainable transportation system for citizens. Too, both Park and UNESCAP consider smart mobility as contributing to a better quality of life.

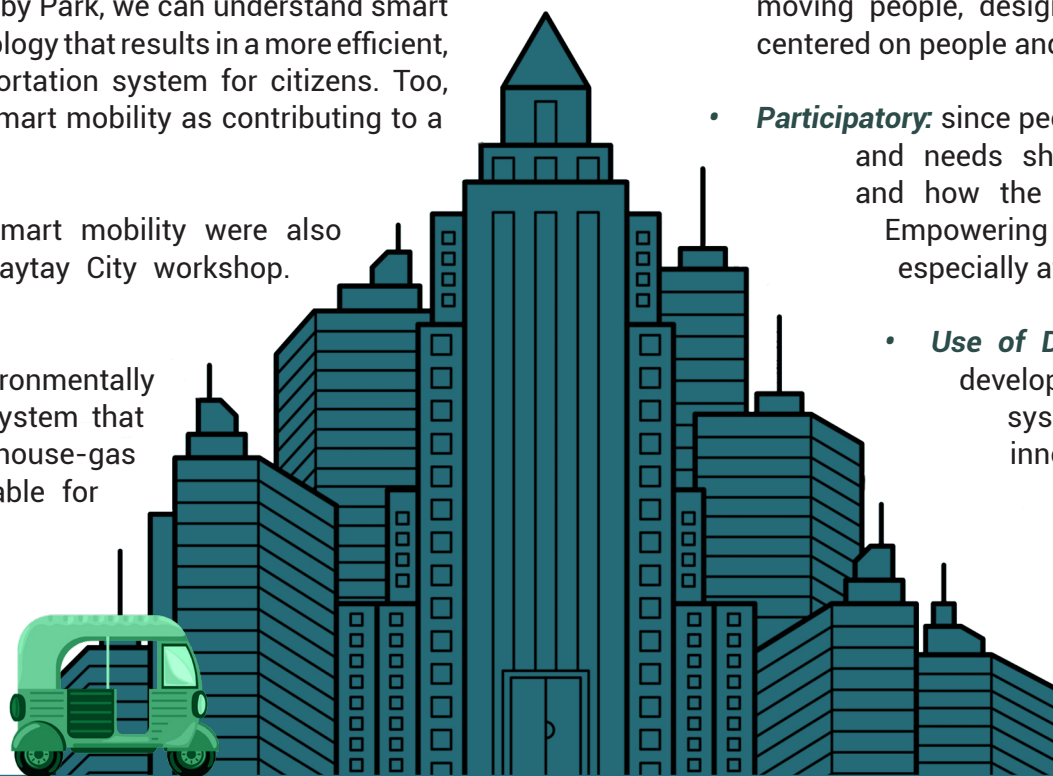
Some other concepts regarding smart mobility were also offered by participants in the Tagaytay City workshop. Among these were:

- **Green/Sustainable:** environmentally friendly; a transportation system that results in lower greenhouse-gas emissions and is sustainable for future generations;

⁵UNESCAP, "Increasing the use of Smart Mobility Approaches."

⁶Dr. Park gave his presentation via Zoom to attendees of the CALD Smart Mobility Workshop in Tagaytay on 21 April 2022. The workshop had a hybrid set-up.

- **Inclusive/Accessible:** ensuring that it can be accessed by the general populace, and is convenient for people;
- **Safe:** people need to feel safe and secure when travelling and commuting;
- **Efficient with Sufficient Supply:** as cities become denser and travel demand increases, the public transportation system needs to be able to manage the load;
- **Economically Cost-Efficient:** transportation has to be economically affordable to the general public;
- **Transparent and Accountable:** the transportation system should allow for feedback, as well as be accountable to citizens;
- **People-Centered/ Human-Centric:** because mobility is about moving people, designing the transportation system to be centered on people and their needs is critical;
- **Participatory:** since people are the end-users, their experience and needs should inform how policies are made, and how the transportation system is developed. Empowering people to participate in the planning, especially at the local level, is important;
- **Use of Data, Technology, and Innovation:** the development of a responsive transportation system using data, technology, and innovations in the sector;



- ***Diverse Transportation Modes & Integrated:*** to manage the increasing travel demand and to maximize the present infrastructure, diverse modes of transportation have to be developed, encouraged, and integrated with each other;
- ***Responsive to Present and Future Problems:*** transportation systems are developed to ensure that they respond well to the present needs of the populace, as well as to anticipate and prepare for future problems brought about by trends in society.

All these show that a wide range of features defines what smart mobility is to policymakers, experts, and implementers. It will be helpful to keep these ideas in mind as the case studies of countries across the region are discussed in the next section.



A grayscale photograph of a person's profile on the left, looking towards the right. A large, semi-transparent purple rectangle covers the center of the image. The background appears to be a screen or a wall with some texture.

Smart Enough?: Four Case Studies

This section looks into how Thailand, Indonesia, Taiwan, and the Philippines have progressed in terms of implementing smart-mobility policies and projects. The general situation in each country is laid out, and policies that govern transportation and smart mobility integration are discussed, along with how these policies and programs have actually been implemented.

The case studies show some of the best practices of, as well as the continuing challenges faced by, these countries in integrating smart mobility. While much of the material presented here are lifted directly from country reports submitted and presented at the CALD workshops, some parts of those reports have been reduced and edited to form a cohesive narrative for this baseline study.

CASE STUDY

Thailand



The source of this case study is the country report on Thailand submitted by green organization Environman co-founder and content director Romtham Khumnurak.

Introduction

The case of Thailand highlights the importance of a strong vision, comprehensive planning, and political will to ensure the delivery of changes needed in improving public mobility. Thailand's drive for innovation and continuous improvement in response to the needs of the populace has resulted in significant advancements in the integration of smart technology, processes, and practices into its transportation sector.

Local Context

Background

Over the years, Thailand has expanded and improved its transportation systems and modes of transport in efforts to meet the need for greater mobility of its people. Today the government, together with the private sector, is trying to diversify the country's transportation systems and strengthen its network with the help of innovations in the transportation sector and smart-mobility technologies.

Road transport accounts for 51 percent of all modes of domestic

public transportation in Thailand, followed by rail (40 percent), air (5.6 percent), sea (1.6 percent), and river (0.8 percent).⁷ Road transport is also the primary mode of domestic freight, accounting for 79 percent of total cargo shipment in 2020. Transport by sea is a far second (9.55 percent), followed by river (8.7 percent, rail (two percent), and air (0.005 percent).⁸ The most common means of public transportation used on roads in Thailand are vans, buses, minibuses, motorcycle taxis, and tuk-tuks (three-wheeled taxis).

Bangkok, the national capital, is also Thailand's most popular city. It is the most developed metropolis in the country in terms of infrastructure and transportation system. Bangkok has expressways that are usually elevated and are open for public use for a fee. The city offers a wide variety of public transport, including those that can be hailed using digital apps. There are boat transport services on the Chao Phraya River, Khlong Saen Saep Canal, and Khlong Phasi Charoen Canal. Aside from traditional boats, electric boats and ferries that cause less pollution are available on the Chao Praya River and Khlong San Saeb Canal. Bangkok also has an urban mass transit network that consists of the Bangkok Bus RapidTransit (BRT), Bangkok Mass Transit System (BTS or sky train), Metropolitan Rapid Transit (MRT or underground train), and Airport Rail Link (ARL).

Bang Sue Grand Station is the new center of rail transportation in Thailand. It is the largest railway station in Southeast Asia. Located in Bangkok, the Grand Station acts as a railway hub that connects to the urban mass transit railway network, and particularly to the suburban or commuter train, airport train, and long-distance train systems. In the future, it is expected to connect to a high-speed train system.⁹

⁷Number of passengers travelling by domestic public transport," ICT Center – Ministry of Transport, accessed in September 2022, <https://datagov.mot.go.th/dataset/freightdom/resource/9f500e0d-8b04-4905-a73e-19b818ab9428>

⁸ICT Center - Ministry of Transport, "Number of passengers."

⁹Ministry of Transport (2019), "Connect Thai, Forward, Connect the World."

Emerging Challenges

Rural-to-urban migration leading to greater urbanization continues to put pressure on major cities across the world. In Thailand, this is felt especially in Bangkok. As the country develops, its cities expand to accommodate ever-growing populations. Yet, many cities still end up overcrowded and suffering from constant traffic congestion.

The pressure on the government to invest more in transportation and infrastructure is now even more intense. Expanding the coverage area of public transportation to ensure citizens' access to opportunities, reduce inequality, lessen congestion, and decrease the use of personal cars¹⁰ has become critical. Unfortunately, in Thailand, road transportation focuses mainly on four-wheeled vehicles, and prioritizes these at the expense of bicycles and other smaller vehicles – and pedestrians.

Bangkok has advanced transportation systems in terms of infrastructure and smart mobility. But the problems of overcrowding, pollution, and traffic congestion remain. Various difficulties in using public transport have had people turning to personal vehicles, finding these more comfortable and convenient. These, however, only worsen the city's already horrible traffic conditions.

At present, Bangkok with its ever-increasing number of commuters has an insufficient supply of public transport. The absence of a joint-ticket system for the city's different means of public transportation also means added

inconvenience to commuters, who have to pay each time they shift or transfer to a different mode or system of transportation. Fares in the rapid transit system (BTS, MRT, ARL) are budget busters as well for those earning median wages, making the services inaccessible to many Thais. Widening accessibility to public transportation by expanding coverage areas and charging fair fees would help reduce inequality¹¹ and should be among the critical aims of future transportation developments.

Another related challenge concerns energy. Because Thailand imports a lot of its energy needs, it is vulnerable to fluctuations in energy prices, especially that of petrol.¹² In 2016, the transportation sector accounted for 37 percent of total energy consumption in Thailand; road transportation in turn accounted for 78 percent of the sector's total energy consumption.

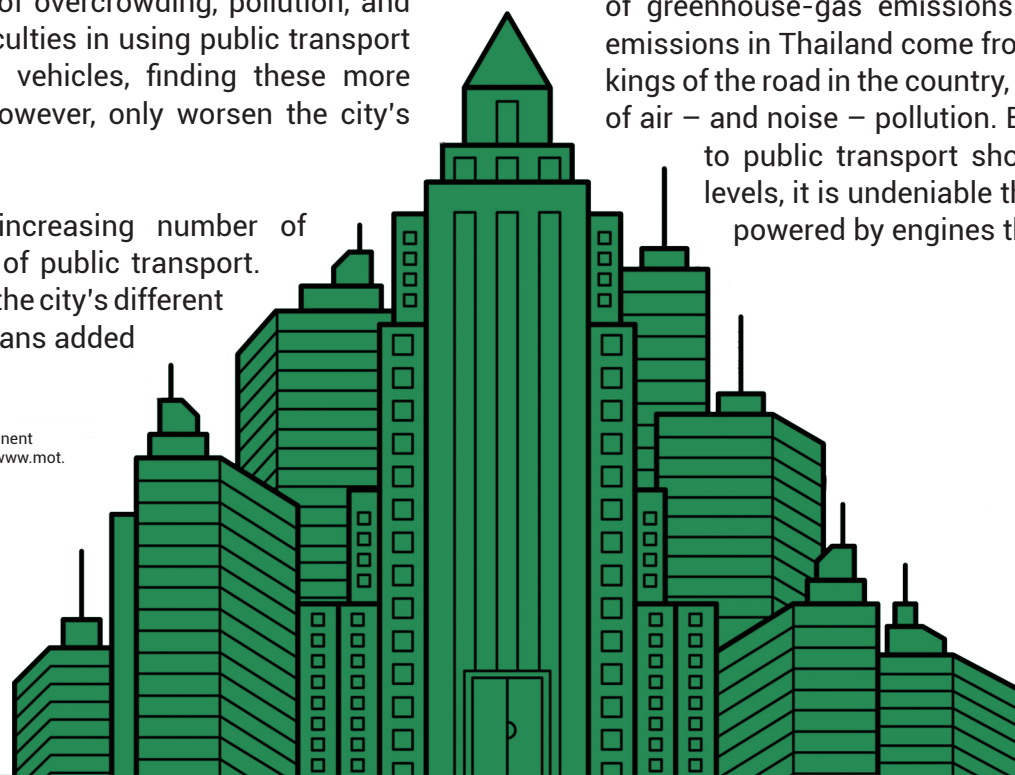
The impact of the transportation sector on the environment bears attention as well. Transportation remains to be one of the main contributors to climate change, accounting for a large proportion of greenhouse-gas emissions. About 28 percent of carbon-dioxide emissions in Thailand come from this sector.¹³ Private vehicles are still kings of the road in the country, and their sheer number has caused a lot of air – and noise – pollution. But while a significant shift from private to public transport should lead to reductions in air pollution levels, it is undeniable that most public vehicles in Thailand are powered by engines that spew toxic fumes.

¹⁰Ministry of Transport Strategic Plan 2017 – 2021," Office of the Permanent Secretary - Ministry of Transport, accessed in September 2022, https://www.mot.go.th/file_upload/2560/mot_strategy2560-2564.pdf

¹¹Office of Permanent Secretary – Ministry of Transport, "Strategic Plan 2017-2021."

¹²Office of Permanent Secretary – Ministry of Transport, "Strategic Plan 2017-2021."

¹³Office of Permanent Secretary – Ministry of Transport, "Strategic Plan 2017-2021."



Key National & Local Policies and Institutions

Transportation Governance

The Ministry of Transport (MOT) in Thailand is responsible for the development, construction, and regulation of the nation's land, marine, and air transportation systems. MOT is composed of eight departments and 15 for-profit state enterprises. Aligned with the 20-year National Strategy, MOT implements the 20-year Thailand Transportation System Development (2018 - 2037) as part of its long-term plan. But there is also a short-term Infrastructure Strategy and Development Plan (2015 - 2022) that is supported by a yearly Action Plan to evaluate the process along the 20-year path.¹⁴

The Thailand Transportation System Development is anchored on a framework that focuses on three areas: Green and Safe Transport (use of clean and alternative fuels); Inclusivity (access to transport services with affordability and equity and universal design and service design); and Transport Efficiency (improved transport and logistics efficiency, reduced transport and logistics costs, and international transport connectivity). The 20-year plan includes five strategies: a) Integrated Transport System: Connectivity, Accessibility, and Mobility; b) Transport Services: Safety, Reliability; c) Regulations & Institution: Transparency, Equity, Public-Private Partnership; d) Human Resource Development: World-Class Standard; and e) Technology & Innovation: Research and Development (R&D).



The short-term (2015 – 2022) plan meanwhile aims to enhance the operation and service of transportation management.¹⁷ The plan consists of: a) Intercity Rail Networks Development; b) Improving Public Transport Networks & Services; c) Enhancing Connectivity between Key Domestic Production Bases & Neighboring Countries; d) Increasing Water Transport Network; and e) Enhancing Air Transport Capability.

Apart from the Urban Mass Transit system in the capital, there are also light rail projects planned in major cities in seven provinces; Chiang Mai (Light Rail Transit or LRT), Phitsanulok (Bus, Micro Bus, Tram), Phuket (LRT), Udon Thani (currently at research stage), Khon Kaen (LRT), Nakhon Ratchasima (LRT), and Songkhla (LRT).¹⁸

In order to push its transportation strategies forward, the Thai government uses Public-Private Partnerships or PPPs that allow the country to overcome challenges related to development. With the government constantly facing a demand for a higher quality of infrastructure development even as it handles challenges in its budget, the PPP offers a solution in which the private sector shares expertise, innovation, and investment with the state.¹⁹

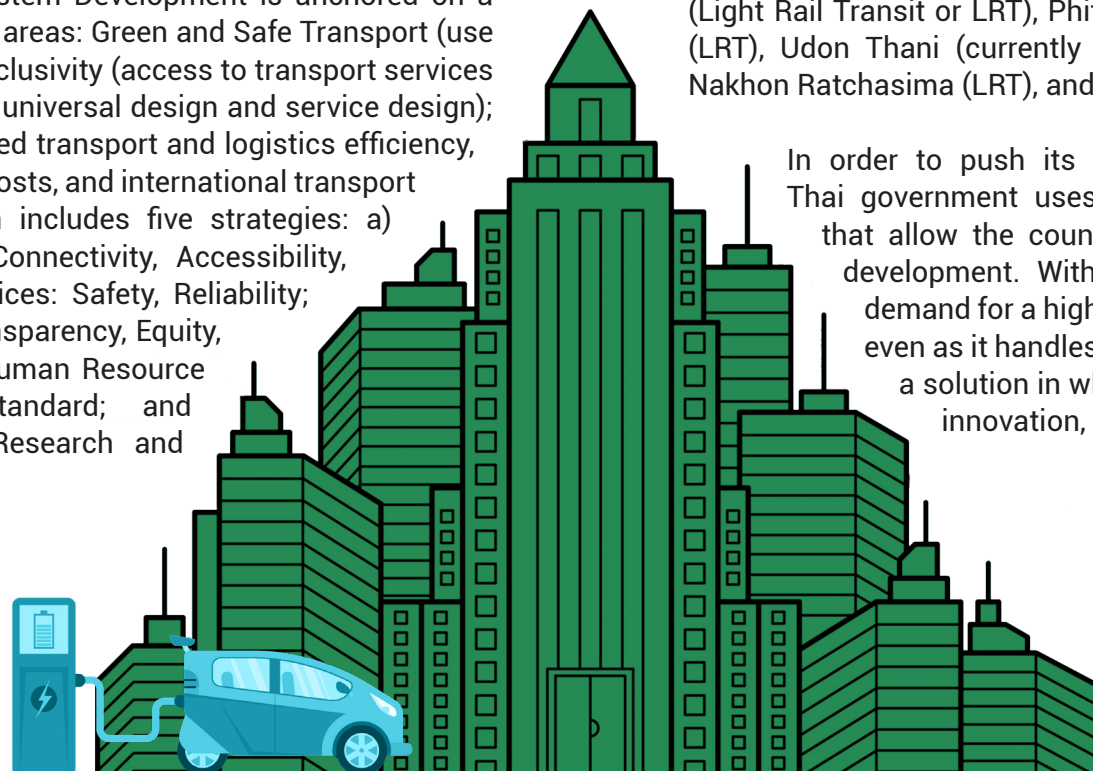
¹⁴Thailand Development, Connect Thai, Forward, Connect the World," Ministry of Transport (2019), accessed in September 2022, https://www.nesdc.go.th/download/document/Yearend/2019/03PPT_NESDC_02.pdf

¹⁶Image taken from "Thailand's Transport Infrastructure Development," Office of Transport and Traffic Policy and Planning, accessed in September 2022, <https://www.boi.go.th/upload/content/>

¹⁷Office of Transport and Traffic Policy and Planning, "Infrastructure Development Plans."

¹⁸Ministry of Transport (2019), "Connect Thai, Forward, Connect the World."

¹⁹Ministry of Transport (2019), "Connect Thai, Forward, Connect the World."



Smart Mobility Policies and Institutions

The Digital Economy Promotion Agency (DEPA) is under the Ministry of Digital Economy and Society of Thailand. It was established to promote and support the development of digital industry and innovation, and the adoption of digital technology in the country.²⁰ Under DEPA is the Smart City Office, which was established to create a smart-city plan and drive smart-city development in the country in line with the Thailand 4.0 scheme and the 20-year National Strategy.

Five principles for smart-mobility development underlie the 20-year Thailand Transportation System Development Strategy (2018-2037): Accessibility (e.g. universal design); Efficiency (e.g. Intelligent Transport System or ITS, intercity rail network development, Transit-Oriented Development or TOD); Green Transport (e.g., EV buses/vehicles, non-motorized transport, alternative/environment-friendly vehicle); Safety (e.g. speed camera, variable message speed signs); and e) Convenience (e.g. seamless transport, common ticket, on-demand services).²¹

Electric Vehicles Policy: In 2021, the National Electric Vehicle Policy Committee (EV Board) issued the policy 30@30 to push Thailand into becoming a low-carbon society by developing into a regional, if not global, EV hub or production base of electric vehicles and parts. The policy has set a goal of having, by 2030, zero-emissions vehicles or ZEVs making up at least 30 percent of Thailand's annual vehicle production.²²

²⁰"About DEPA," The Digital Economy Promotion Agency (DEPA), accessed in September 2022,

<https://www.depa.or.th/th/about-depa/background>

²¹Ministry of Transport, "Connect Thai, Forward, Connect the World."

²²"Electric Vehicles Promotion in Thailand," Energy Policy and Planning Office (2021), accessed in September 2022, <https://www.eppo.go.th/index.php/th/eppo-intranet/item/17415-ev-charging-221064-04>

The plan is to support both electric vehicles' consumption and call for investment by endorsing the EV car package. The package's goal is to incentivize the use of electric vehicles as this would align with the government's policy of promoting the use of environmentally friendly electric vehicles, as well as reduce carbon-dioxide emissions and air pollution, and help stimulate the country's economy.²³

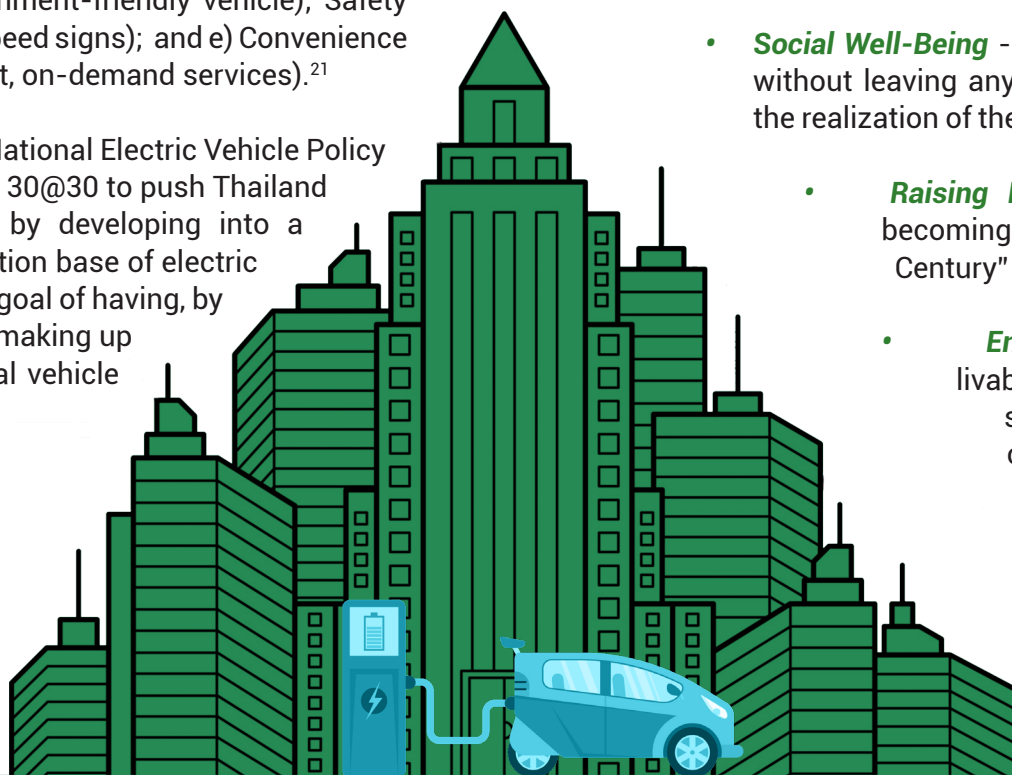
In addition, the package aims to reduce import and excise duties while providing buyers with financial subsidies. As an incentive for Thais to shift to electric vehicles, the government also reduced by 80 percent the annual tax for electric vehicles registered between 1 October 2022 and 30 September 2023.

Thailand 4.0: Thailand 4.0 is an economic model aimed at rejuvenating the Thai economy.²⁴ Its four objectives are:

- **Economic Prosperity** - creating a value-based economy driven by innovation, technology, and creativity;
- **Social Well-Being** - creating a society that moves forward without leaving anyone behind (inclusive society) through the realization of the full potential of all members of society;
- **Raising Human Values** - pushing Thais into becoming "competent human beings in the 21st Century" and "Thais 4.0 in the First World"; and
- **Environmental Protection** - becoming a livable society that possesses an economic system capable of adjusting to climate change and closer to transforming into

²³"Cabinet Meeting, 15th February 2022," Royal Thai Government, accessed in September 2022, <https://www.thaigov.go.th/news/contents/details/51583?fbclid=I-wAR1UUHPZFvSPcuNiEkM7CjVrozfJJoxR2i8WGSd96PUgZJoK-fM89moTZjrQ>

²⁴Thailand Board of Investment, accessed in September 2022, <https://www.boi.go.th/upload/content/Thailand>



a low-carbon society. The target is to transform at least 10 Thai cities into the world's most livable cities.

Bio-Circular-Green Economic Model (BCG): According to the National Science and Technology Development Agency or NSTDA, the BioCircular-Green Economy model is the Thai government's strategy for national development and post-pandemic recovery.²⁵ The BCG model focuses on applying science, technology, and innovation to turn Thailand's comparative advantages -- biological and cultural diversity -- into competitive advantages. The model focuses on four strategic sectors: a) agriculture and food; b) wellness and medicine; c) energy, materials, and biochemicals; and d) tourism and creative economy. It aims to promote sustainability of biological resources, strengthening communities and grassroots economy, enhancing sustainable competitiveness of Thai BCG industries, and building resilience to global changes.²⁶ The model is expected to create sustainability and inclusiveness in Thailand's economy, society, and the environment.

Climate Change: Aligning with the Paris Agreement, Thailand aims to move toward carbon neutrality by 2050 and toward net zero as early as possible -- within the second half of this century, or by 2065. To achieve these ambitions, Thailand is also looking forward to enhance international cooperation and support on finance, technology, and capacity-building.²⁷

²⁵"Bio-Circular-Green Economic Model," Thai Embassy (2021), accessed in September 2022, <https://thaiembdc.org/bio-circular-green-bcg/>

²⁶"Bio-Circular-Green Economy (BGC) Background," National Science and Technology Development Agency (NSTDA), accessed in September 2022, <https://www.bcg.in.th/eng/background/>

²⁷"Prime Minister Prayuth Chan-o-cha Speech in the Opening Ceremony of Thailand Climate Action Conference," Royal Thai Government (2022), accessed in September 2022, <https://www.thaigov.go.th/news/contents/details/57676>

Implementation of Policies and Programs

Intelligent Transport System (ITS) - This is the use of technology to support and improve Thailand's transportation system. Currently, it is composed of the Area Traffic Control System (ATC), which manages traffic, and the Travel Information System (TIS), which reports real-time commuting information on apps, billboards, and the like. There is also the Automation Traffic Enforcement (ATE), which is used to enhance safety, manage an urgent incident, and enforce proper vehicle behavior via CCTV. The Advanced Public Transportation System (APTS) meanwhile is used to manage and track public transportation through GPS; passengers can also track public transport movement via apps such as ViaBus, BMTA, or NAMTANG.²⁸

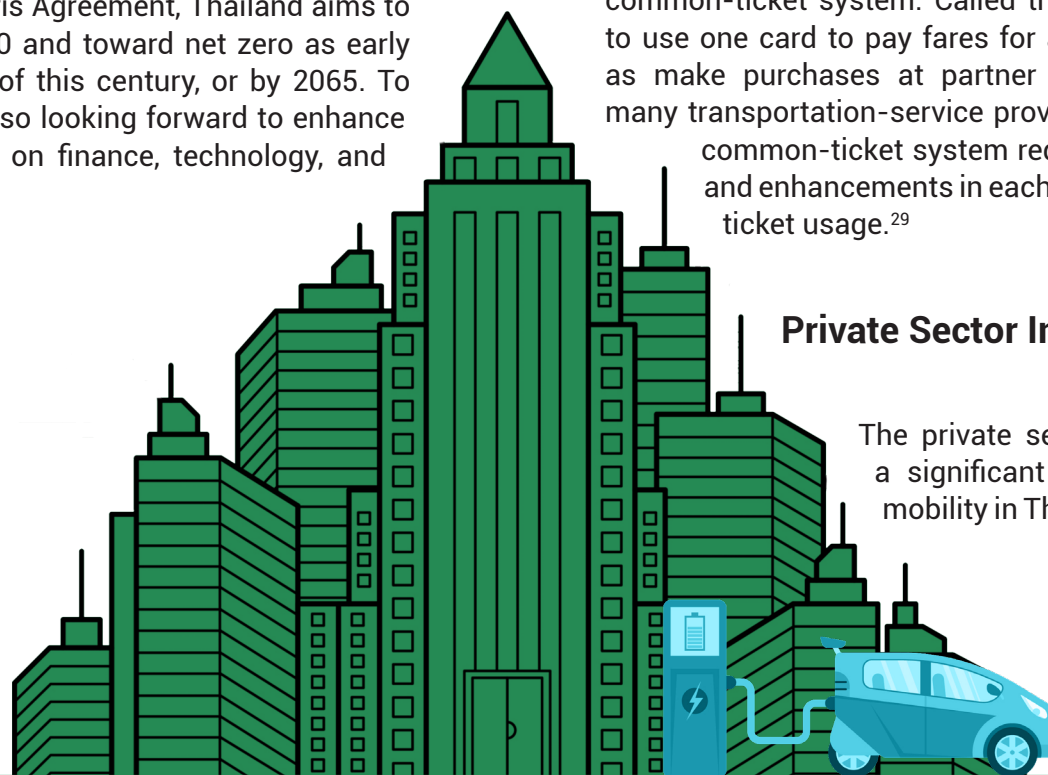
Common Ticket – The Thai government is creating its first joint or common-ticket system. Called the "Mangmoom," it will allow people to use one card to pay fares for all public transport systems, as well as make purchases at partner shopping stores. As Thailand has many transportation-service providers, however, switching to a single common-ticket system requires cooperation from all providers and enhancements in each company's system to support same-ticket usage.²⁹

Private Sector Involvement

The private sector played, and continues to play, a significant role in the development of smart mobility in Thailand. It creates new infrastructures

²⁸Ministry of Transport (2019), "Connect Thai, Forward, Connect the World."

²⁹"Mangmoom, Common Ticket," Mass Rapid Transit Authority of Thailand, accessed in September 2022, <https://www.mrta.co.th/th/news/information/mangmoom/>



and services for the improvement of transportation in the country. Examples of these include:

Transport and Delivery Application: Popular applications such as Line Man, Foodpanda, Shopee, Lazada, and Grab allow people to order food, buy groceries, shop online, and commute with ease. These apps connect people with drivers, riders, and shops, thereby also helping create jobs and revenue.

For those using public transport, Viabus, Namtang, and Moovit are apps that assist commuters by giving real-time information about buses, minibuses, sky trains, express boats, and subway trains. BKK Rail gives information on all metro routes of the Sky train (BTS), Subway Train (MRT), and Airport Rail Link (ARL). Another popular commuting app is U Drink I Drive, which people can tap whenever they need someone to drive their vehicle. There is also Winnonie, a start-up application that directs electric-motorcycle taxis to the nearest battery-swapping stations, as well as Muvmi, a ride-sharing service that uses electric tuk-tuks.

Electric Vehicle Services: Electric vehicle-charging stations have expanded all over the country, with companies, petrol stations, the Electricity Generating Authority of Thailand (EGAT), and EV-charging companies such as Evolt, Swap & Go, and Sharge putting up much of these. At the same time, electric-car users can now find and reserve charging stations through applications such as MEA EV, PlugShare, EA Anywhere, Evolt, and NOSTRA Map. There are also electric-vehicle manufacturers and developers in Thailand such as MINE, which produces electric cars, buses, and ferries; Etran, which has developed electric scooters and bikes; and Sakun C., which produces aluminum body buses, minibuses, and boats.

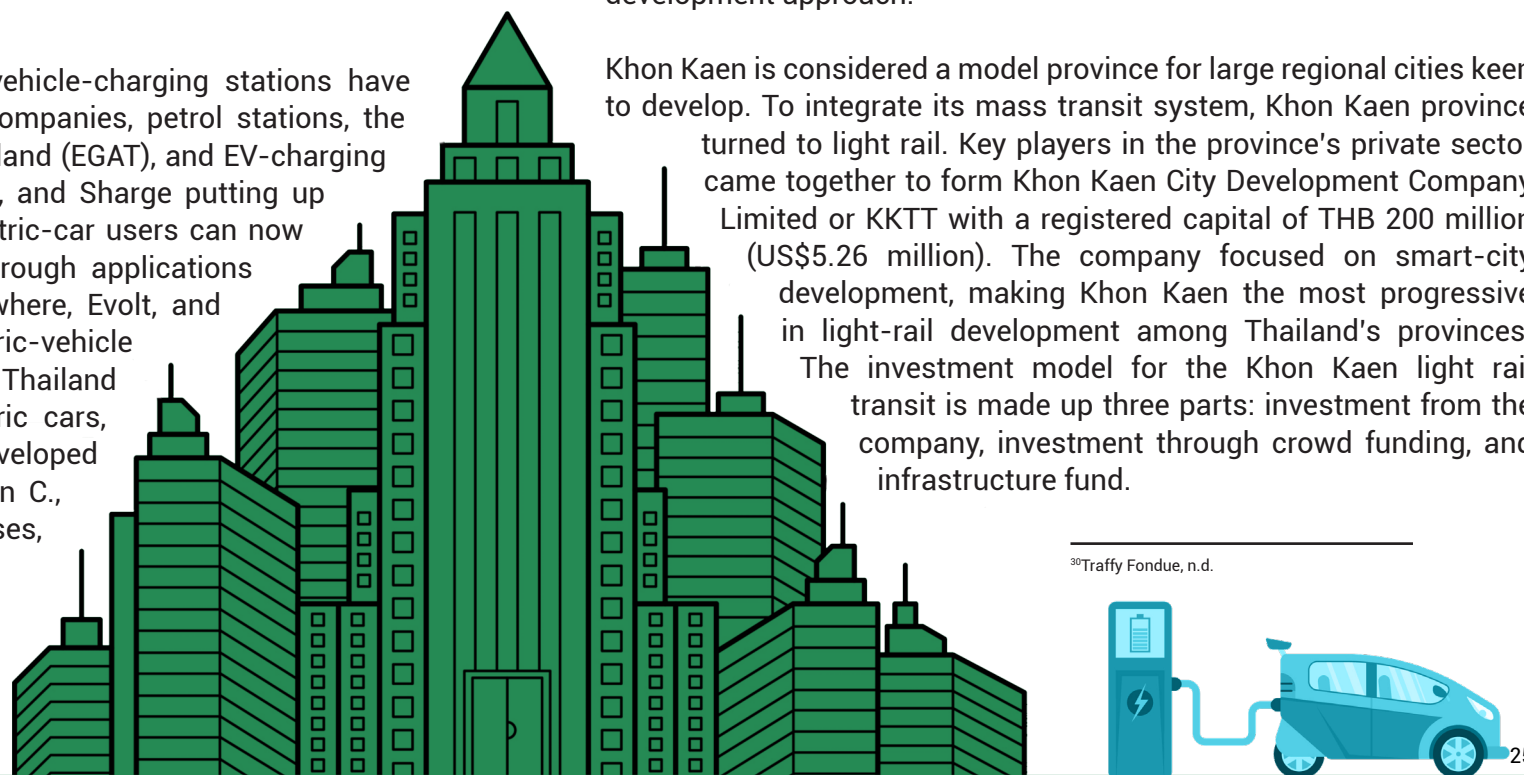
Traffy Fondue: Traffy Fondue is an online platform for citizens to report problems they encounter in the capital – floods, traffic, accidents, waste, and so on -- directly to the Bangkok Metropolitan Administration and the office in charge. People can connect with city government staff to report incidents and track the progress of any action done via the LINE application chatbot. This is aimed at increasing city management's efficiency, reducing the burden on staff, and enhancing the level of citizen engagement and relevant parties in all areas and at all times.³⁰

Beyond Bangkok

Khon Kaen Model Smart City: Khon Kaen is a province located in the eastern part of Thailand. Its capital city is also called Khon Kaen, which has established its own smart-city model through the collaboration of the local government, the education sector, private businesses, and its residents. The case of Khon Kaen is a good example of a bottom-up development approach.

Khon Kaen is considered a model province for large regional cities keen to develop. To integrate its mass transit system, Khon Kaen province turned to light rail. Key players in the province's private sector came together to form Khon Kaen City Development Company Limited or KKTT with a registered capital of THB 200 million (US\$5.26 million). The company focused on smart-city development, making Khon Kaen the most progressive in light-rail development among Thailand's provinces. The investment model for the Khon Kaen light rail transit is made up three parts: investment from the company, investment through crowd funding, and infrastructure fund.

³⁰Traffy Fondue, n.d.



KKTT developed a light-rail system prototype, and had parts manufactured in Thailand with the goal of raising it to industrial production levels in the future. Its objective is the development of rail transportation systems locally so as not to be dependent on sourcing trains and spare parts from abroad. The project encourages entrepreneurs in the country to research, develop, and design the production of electric trains and various spare parts that use high technology within Thailand to support future demands for rail transport.

Unlike Khon Kaen, other provinces and cities in Thailand have underdeveloped transportation systems due to the lack of budget, investment, and policies. Many places in Thailand typically offer limited options for commuters, such as minibuses, tuk-tuks, and motorcycles taxis. The lack of public transportation leads to the higher use of private cars and motorcycles, contributing to traffic.

There have been some efforts to correct this. The Ministry of Transport, for example, has pushed for mass-transit development projects in major cities in other regions. Target cities so far are Chiang Mai (Light Rail Transit, LRT), Phitsanulok (Auto Tram), Phuket (Light Rail Transit, LRT), Udon Thani (EV Bus), Khon Kaen (Light Rail Transit, LRT), Nakhon Ratchasima (Light Rail Transit, LRT), Hat Yai, Songkhla (Monorail), and Chachoengsao - Chonburi - Rayong (EEC Project, EV Bus/ EV Mini Bus/ Tram Bus).

Summary

Thailand continues to face challenges in terms of mobility and transportation systems, especially in big cities and rural areas. While the government focuses on transportation development in the Bangkok Metropolitan area and intercity transportation systems such as double-track rail and high-speed train projects, transport development in other cities should not be overlooked. The government needs to focus more on regional transportation development for a set-up that will have greater inclusivity. There is also still much room for the government to work with the private sector in pushing smart mobility further forward.

Nevertheless, the private sector continues to play essential roles in providing smart-mobility services in Thailand -- through apps, ride-hailing, car sharing, online delivery, passenger service, infrastructure, electric vehicles, and charging stations. People have felt concrete benefits from smart-mobility services, such as greater convenience, cost and time savings, and safer transportation.

There is currently a modest boom in EVs in Thailand, which is seeing a significant increase in newly registered electric vehicles. This surge is a result of the government's EV package promotion that has dovetailed with global trends and fuel prices. The use of electric vehicles can lead to lower pollution and greenhouse gas emissions from the transport sector. The government can look into developing the whole electric-vehicle ecosystem to include charging stations around the country, as well as increasing the number of electric public transport vehicles.

CASE STUDY

Indonesia



The source for this case study is the country report on Indonesia submitted by Indonesian Democratic Party of Struggle Foreign Department member Mohammad Yusuf Wuisan, Trenggalek City Mayor H. Mochamad Nur Arifin, and urban planning and public policy expert Harya S. Dillon, Ph.D.

Introduction

The case of Indonesia shows the desire of its government to become more responsive to its citizens' needs. Smart mobility is seen as a potential solution to addressing gaps in country's transportation system. Grounded on principles of social justice, plans are being drawn up to deploy smart mobility to ensure greater equity and access for Indonesians, grounded on principles of social justice.

Local Context

According to a 2019 World Bank study on Indonesia's urban potential, 40 percent of economic growth in the country is attributable to six major metropolitan cities. Consistent with development patterns in much of booming Asia, income growth in Indonesia is giving rise to suburbanization and increasing motorization in its cities. This has led to a severe crisis in urban mobility.

Congestion is one of the most common transportation challenges in large urban

agglomerations. Although congestion can occur in all cities, it is particularly prevalent above a threshold of about one million inhabitants. Increasing motorization and rising numbers of car ownership are leading to increased demand for transport infrastructure such as roads and parking spaces. Infrastructure supply, however, has often not been able to keep up with demand. Each year, at least one million new cars, and more than six million new motorcycles hit Indonesia's already congested roads.³¹ Based on data from the Indonesian Motorcycle Industry Association (AIS), total sales of two-wheeled vehicles in the domestic market rose 17.8 percent in the January-May 2021 period. The country's total motorcycle population reached more than 112 million units and those active were estimated at around 75 million units.

The 2019 World Bank report on Indonesia's urban potential also said that tailpipe emissions from urban transportation in the country accounts for 78 million tons of CO₂ each year. This puts Indonesia sixth on the list of the world's largest greenhouse gas emitters.³² The corresponding social-environmental cost is estimated at IDR 39 trillion (US\$2.51 billion). The health impact of pollution in Jakarta in 2004 was estimated at IDR 2.8 trillion (equivalent to US\$300 million at the time) while the traffic congestion was costing the urban economy IDR 12.8 trillion (US\$1.4 billion using 2004 rates) in loss of time value, wasted fuel, and deterioration in quality of life. Five years later, the National Development Planning Agency (more known by its Indonesian acronym BAPPENAS) estimated the economic loss due to road congestion in Jakarta at IDR 65 trillion (US\$4.67 billion using 2019 rates) or roughly 72 percent of the Jakarta Provincial Government's total annual budget.³³ The average commuting time in Jakarta today is twice that in Tokyo.

³¹Riska Rahman, "With freedom to break law on roads, comes deadly accidents," The Jakarta Post, <https://www.thejakartapost.com/news/2018/11/14/with-freedom-to-break-law-on-roads-comes-deadly-accidents.html>

³²Aldian, Amilia (2018), Framework for a National Urban Transport Support Program for Indonesia. Indonesia Urbanization Flagship Report Deep Dive Workshop on Urban Transport; Palembang, July 2018.

³³Source: <https://www.viva.co.id/berita/metro/1100871-in-fografik-apbd-dki-2019-naik-lihat-rinciannya>; "...tertuang dalam APBD Jakarta 2019 sebesar Rp89,08 triliun.."



Pollution, including noise generated by circulation, has affected the quality of life and health of urban residents. Furthermore, energy consumption by urban transportation has increased dramatically, resulting in dependence on petroleum. High energy prices have instigated a shift toward more efficient and sustainable urban transportation, i.e. public transport. There is pressure to "decarbonize" urban-transport systems, especially with the diffusion of alternative energy sources such as electric vehicles.

Jakarta, a megacity that is home to 9.7 million people, has been struggling with unsustainable growth of two-wheeler motorization and dwindling share of public transportation modes, much like its regional peers such as Manila and Bangkok. A 2018 activity-travel diary survey that was part of a Japan-Indonesia joint project found that eight in nine households (89 percent) owned at least one motorcycle and that ownership was equally distributed across income levels.³⁴ The omnipresence of motorcycles offered mixed interpretations. On one hand, it signaled income growth; on the other, it was choking the city. Other than the obvious congestion and air-quality effects, motorcycles users often encroach on pedestrian and other public spaces.

Adding to the problem is how motorcyclists in Jakarta behave: as if they are exempt from the rule of traffic law, resulting in public disorder. Some motorcyclists have been found to be too young to ride, are riding dangerously above the speed limit, sometimes without the protection of helmets, and, most notoriously, encroach on sidewalks at the expense of pedestrians. Riding on the wrong side of the road has become a common occurrence. National Police accident statistics

³⁴Japan International Cooperation Agency (JICA) (2019), "Jabodetabek Urban Transportation Policy Integration Project Phase 2 in the Republic of Indonesia," Coordinating Ministry for Economic Affairs Republic of Indonesia, pp. 39-40.

show that the sheer disregard of safety regulations corresponded with more than 98,414 traffic accidents in 2017, or an average of 270 accidents per day. These accidents, of which the highest proportion involved motorcycles, claimed 24,213 lives and injuring a further 16,410 that year.

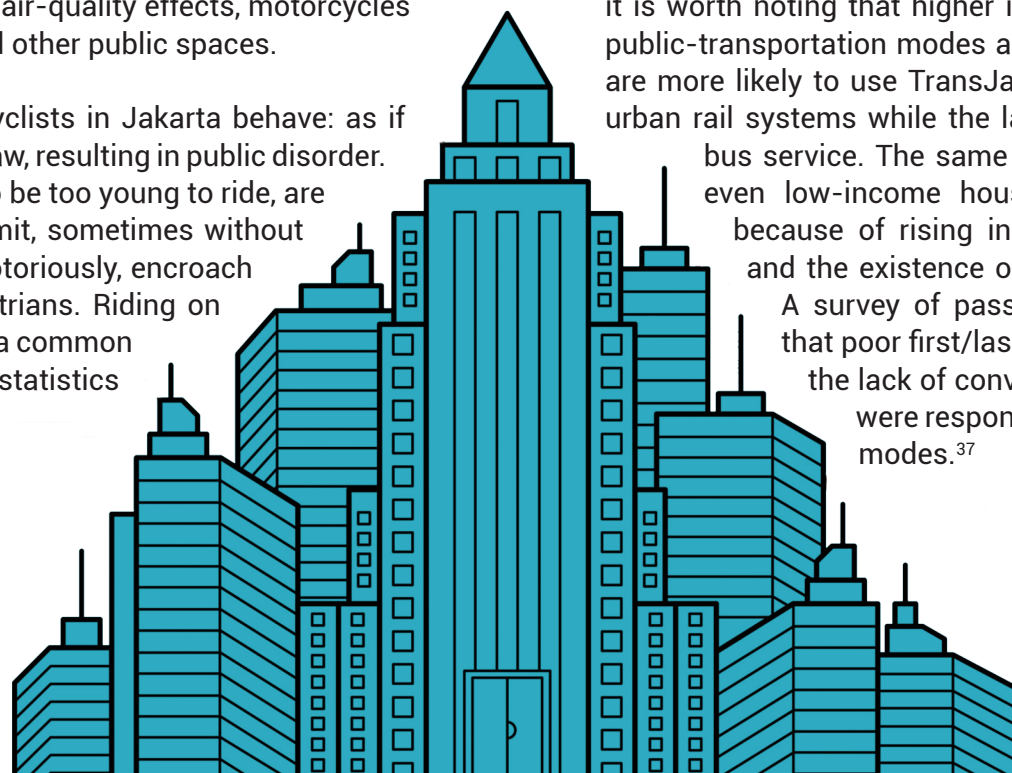
With few exceptions, public transportation is not as attractive as using private vehicles. Many public-transit systems are either overused or underused because demand for public transit is subject to peak and trough periods. During peak hours, crowding creates inconvenience for users as systems cope with temporary spikes in demand. Conflict on urban road space is fierce as pedestrians, bicyclists, and motor-vehicle users jostle for right of way, leading to increased unequal fatality risk on pedestrians and transit users. The situation is worse for vulnerable members of society: women, children, the elderly, and people with disabilities.

While the share of public modes has been dropping since 2002,³⁵ it is worth noting that higher income groups are just as likely to use public-transportation modes as their lower-income peers. The former are more likely to use TransJakarta municipal Bus Rapid Transit and urban rail systems while the latter are more inclined to use informal bus service. The same activity-travel survey³⁶ also found that even low-income households have access to motorcycles because of rising incomes, virtually zero down payments, and the existence of secondary markets for two-wheelers. A survey of passengers by the same project indicated that poor first/last mile connectivity, poor walkability, and the lack of convenience and comfort at transit stations were responsible for the low attractiveness of public modes.³⁷

³⁵JICA 2019, "Jabodetabek Urban Transportation Policy Integration," pp 56-58.

³⁶JICA 2019, "Jabodetabek Urban Transportation Policy Integration," pp 37-40, 58.

³⁷JICA 2019, "Jabodetabek Urban Transportation Policy Integration," p 71.



In response to this situation, the government has been moving to make great strides in improving public transportation in the last 10 years. The busway systems have doubled their ridership in the past three years; in February 2020 they achieved a major milestone of serving one million passengers per day, thanks to successful integrations with informal transit, as well as a 16-year expansion and improvement of service, and pedestrian-improvement projects. The March 2019 launch of Jakarta's first 16 KM (10 miles) of Mass Rapid Transit (MRT) was hoped to reverse this decline and revitalize public transportation overall. Before the COVID-19 pandemic, the MRT was carrying up to 100,000 passengers per day.³⁸

The government has been also advised to reduce the addition of motorcycles by improving and increasing the public transportation fleet, ensuring the timeliness of public transportation, as well as the security and safety, comfort, and most importantly the affordability of mass public transportation. This way, people would hopefully choose to use public transportation instead of motorcycles.

Key National & Local Policies and Institutions

Transportation Governance

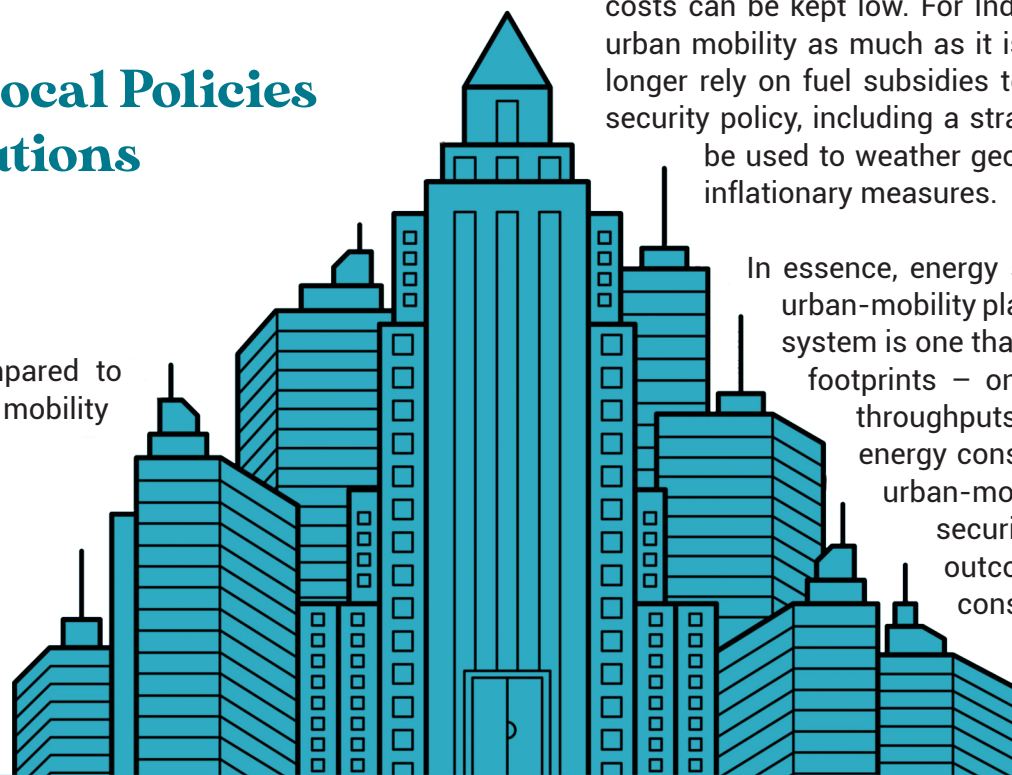
BAPPENAS has recognized that, compared to peer global cities, investment in urban mobility

³⁸Sausan Atika, "MRT Jakarta delays phase 2 construction amid COVID-19 outbreak," The Jakarta Post, <https://www.thejakartapost.com/news/2020/05/01/mrt-jakarta-delays-phase-2-construction-amid-covid-19-outbreak.html>

infrastructure is not quite where it needs to be. Under the directive of President Joko 'Jokowi' Widodo, BAPPENAS has articulated that mobility planning must achieve both equity and efficiency goals for it to be truly sustainable. Social justice and equitable development has long been enshrined in the constitution and is very much consistent with the late President Soekarno's founding ideas of Indonesia. A socially progressive and sustainable urban-mobility planning must ensure that: a) public transportation is affordable; b) improves productivity of the urbanites; and more importantly c) improves welfare distribution and promotion of social justice outcomes through equity of access for people with disabilities, the elderly, women, children, and other vulnerable groups. These groups are entitled to mobility and access to economic and social opportunities as much as the rest of the population. This can be achieved not only through discounted fares for eligible groups, but also through universal design and pedestrian-friendly infrastructure.

With the current the geopolitically induced energy crises, the government is accelerating the transition to electromobility so that transportation costs can be kept low. For Indonesia, this transition is a strategy for urban mobility as much as it is for energy security. Indonesia can no longer rely on fuel subsidies to keep prices low. It needs an energy-security policy, including a strategic energy reserve or funds that can be used to weather geopolitical energy woes without inducing inflationary measures.

In essence, energy security is completely compatible with urban-mobility planning. An efficient urban transportation system is one that has smaller environmental and energy footprints – one that is capable of producing larger throughputs (measured in passenger-km) with less energy consumption. As such, socially progressive urban-mobility planning will encompass energy security and resiliency as larger mobility outcomes can be achieved with less energy consumption.



BAPPENAS has identified four key focus areas in addressing the investment backlog for transportation:

Bus Reform - Informality Issues and Municipalization: First, cities rarely have coherent urban-mobility plans in place. Until recently, cities had been overly reliant on entrepreneurs to design, plan, and operate bus routes. Meanwhile, unreformed transportation agencies seemed content with reaping concessions from these small-scale private operators, often run as an informal business with virtually zero financial management.

The main issue with such a set-up is that bus operators are not reliable social planners; they do not have society's best interests in mind. When privately operated, bus services tend to be undersupplied in less dense areas and are oversupplied in areas where demand is high. In both areas, bus services are likely to be offered at a low quality to minimize costs, to the point that they are no longer attractive to those with access to private vehicles. In turn, this results in rapid decline in ridership and revenue, forcing operators to lower costs – and service quality -- even further. But these only make more people consider purchasing and using private vehicles for their daily commute. It doesn't take long before this vicious cycle turns cancerous.

This laissez-faire approach to “privately provided” public goods does not work because fixed-route transport exhibits strong scale economies. Economists had long predicted that unfettered competition in the urban bus industry will not yield socially desirable outcomes. Coherence in urban-mobility plans must begin with a wholesale reform in the bus industry. Bus operators should no longer operate as informal businesses; neither should cities continue to extract rent from operators in the form of route-licensing.

In fact, municipalization or city-ownership of bus operations offers a promising future. This approach allows for centralized route-planning, equitable and sustainable fare-setting, and service integration, and can therefore effectively reverse the aforementioned vicious cycle. Stronger control over transit service also allows urban planners to better shape their cities. Electrification of bus fleets and pandemic management response can be better implemented as well. The caveat is that maintaining a high-quality service at an affordable price may require substantial subsidy.

Fiscal reform: The second challenge that needs to be addressed is fiscal in nature. One of the fundamental problems in promoting sustainable urban mobility is that public transportation does not typically generate sufficient revenue to cover its capital and operating costs. Cities can and should be able to generate revenues in ways that are socially equitable and are acceptable to private businesses. Investments in high-quality public transport are beneficial not only to fare-paying passengers, but also to property owners – indirectly, through improved access. As such, they, too, should contribute to funding public-transport infrastructure through property taxes, betterment levies, and other land-value capture mechanisms. According to an Asian Development Bank (ADB) study, the biggest financing gap in the public sector comes from transportation infrastructure.³⁹

Another stream of revenues should flow from users of private motor vehicles, this time under a polluter-pays principle. Motorists should bear charges designed to internalize the attendant externalities of their driving in the form of air pollution, congestion, and noise. Since driving is proportional to fuel consumption, full implementation of these concepts requires substantial reform in energy and fiscal policy. Fuel should be taxed,

³⁹Bambang Susantono, “Metros Push Up Land Values – So Why Not Create a Triple Win,” in Asian Development Blog, accessed in September 2022, <https://blogs.adb.org/blog/metros-push-land-values-so-why-not-create-triple-win>



not subsidized. Taxing vehicle ownership is a poor substitute for fuel taxation. Under the former, owners are charged a fixed annual fee for their vehicle regardless of the amount of driving and subsidized fuel they consume. This creates a perverse incentive for people to overuse their vehicles at the expense of society in general.

Finally, cities should reform their parking policy. City managers must understand that public parking is a misnomer. While there is a myriad of issues, the first step is to acknowledge that underpricing and non-enforcement of parking infringements are hidden subsidies benefiting motorists. Instead, parking should be priced to reflect the resource-inputs: scarce urban land, especially in the central business districts. Flat parking fees do not reflect this scarcity and as such do not offer any incentive for commuters to park their cars at the nearest station and continue by public transit to their downtown destinations.

Metropolitan governance: Thirdly, urban-mobility improvements have to overcome trans-boundary administrative issues. While urban agglomeration does not respect jurisdictional boundaries, decisions that affect urban mobility are confined within municipal polities. Agglomeration areas are characterized by close economic and social linkages between core employment clusters and residential neighborhoods. The geographical scope of these linkages often reaches beyond the jurisdictions of individual municipal governments.⁴⁰ This implies that no single municipality has the tool to address all the challenges and opportunities within an agglomeration area on its own.

Officials representing low-density, car-dependent suburbanites do not have the incentive to alleviate congestion downtown. Conversely, officials representing the metropolis core lack the legal authority to

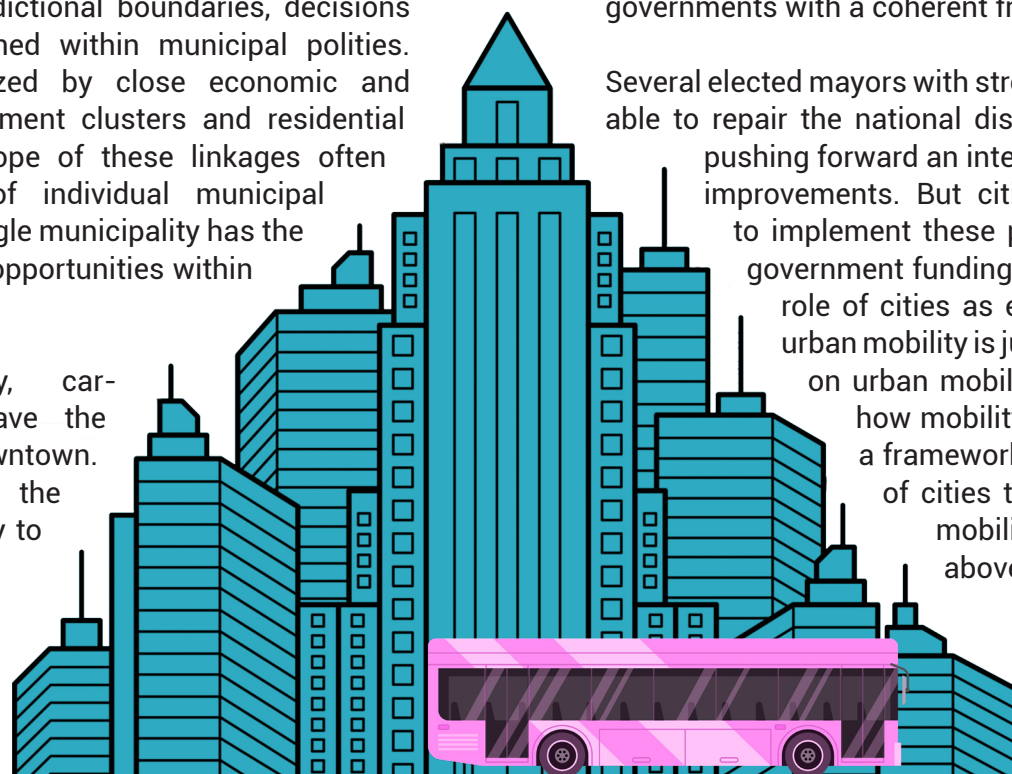
extend transit investment beyond their jurisdictional boundaries, even when they have the resources to do so.

A Smart & Progressive National Urban Mobility Policy: The final question is about the role of National Government in this whole scheme of things. Historically, BAPPENAS has had a strong central planning function in Indonesia. Working closely with the Ministry of Finance, BAPPENAS is responsible for preparing development plans and budgets, maintaining technical relationships with sectoral ministries.

At the national level, at least in theory, urban mobility is the responsibility of two ministries: the Ministry of Transportation and the Ministry of Public Works and Public Housing. In reality, they have tended to work with minimal interface. At the sub-national levels, this has resulted in difficult communication between the transportation agencies that deal with public transportation and traffic management, and the public-works agencies that are responsible for roads and sidewalks. No one is assuming the leadership role in providing sub-national and municipal governments with a coherent framework for urban-mobility planning.

Several elected mayors with strong visions for urban mobility have been able to repair the national disconnect within their own jurisdictions, pushing forward an integrated approach toward urban-mobility improvements. But cities typically lack the fiscal resources to implement these plans and are likely to rely on national government funding in some way, shape, or form. Given the role of cities as economic engines, national funding for urban mobility is justifiable. In this regard, a national policy on urban mobility would provide a strategic vision on how mobility needs will be fulfilled sustainably and a framework to enable and strengthen the capacity of cities to plan, finance, and implement urban-mobility projects. That is, to deliver all the above.

⁴⁰Rüdiger Ahrendt and Abel Schumann, "Approaches to Metropolitan Area Governance," OECD Regional Development Working Papers, (April 2014): <https://doi.org/10.1787/5jz5j1q7s128-en>



Implementation of Policies and Programs

The government as a policy maker is formulating regulations that accommodate modern, technology-based transportation mode services such as the development of smart mobility, online transportation technology, the development of use of electric vehicles, unmanned transportation vehicles (autonomous vehicles), and the widespread use of drones.

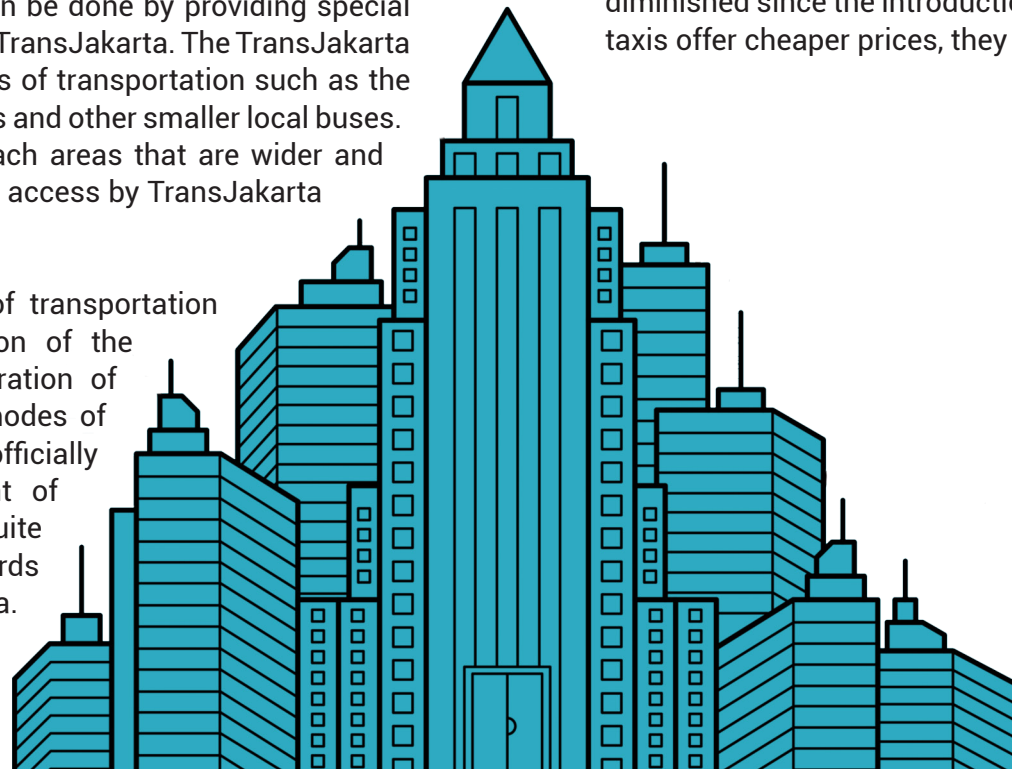
Smart Mobility in Public Transportation: One example of the application of smart mobility can be seen in Jakarta. DKI Jakarta has integrated its transportation modes by connecting MRT, LRT, and commuter line stations with TransJakarta bus terminals. This facilitates movement between modes of transportation. In addition, the integration of transportation modes can be done by providing special lanes for transportation modes such as TransJakarta. The TransJakarta special lane can be used by other types of transportation such as the "Jakarta City Tour" double-decker buses and other smaller local buses. This application makes it easier to reach areas that are wider and more numerous and that are difficult to access by TransJakarta buses.

The integrations of different modes of transportation go hand in hand with the integration of the payment system. Although the integration of payment systems between different modes of transportation in Jakarta has not been officially issued by the Provincial Government of DKI Jakarta, the payment system is quite simple and makes use of electronic cards issued by various banks in Indonesia. The electronic card can be used in various types of transportation modes

such as MRT, LRT, TransJakarta, commuter-line trains, and even for toll road and parking payments.

The implementation of an integrated public transport system at an affordable cost is aimed at attracting private-vehicle users to switch to using public transportation. Affordable costs ensure greater accessibility for commuters. Ideally, the switch to using public transportation should reduce private-vehicle use, leading to reductions in congestion and pollution.

Use of Applications: In Indonesia, the use of motorcycles is popular. The most widely used motorcycle transportation application is Gojek, a company engaged in transportation. The advantage of motorcycle transportation is that it allows clients to reach their destinations faster. In the past, independent motorcycle taxi drivers locally referred to as ojek banded together and used intimidation tactics to keep Gojek from entering certain areas. Now almost all motorcycle transportation uses the Gojek app. The popularity of taxi transportation has also greatly diminished since the introduction of online taxi apps. Not only do online taxis offer cheaper prices, they are also safer.



Summary

A decade's worth of public transportation improvements and access to cheap motorcycles has reduced socioeconomic inequality in transportation access. A recent online survey of 462 respondents does not suggest that income alone predicts mode choice. Furthermore, 66 percent of active public-transportation users are keen on using the service either in full or with reduced frequency, as soon as the pandemic is under control. Then again, a 2018 survey found that 89 percent of respondent households own at least one motorcycle and that ownership is equally distributed across income levels.⁴¹ While the omnipresence of motorcycles offers mixed interpretations, high-quality public transportation seems to have improved transportation equity and therefore mobility justice in Jakarta.

The development and implementation of smart mobility is part of the realization of a smart city. The strategic use and deployment of such technologies can have great potential for the development and progress

of a region especially in improving the commute life and movement of people within cities. Smart-mobility technologies can be tools to integrate people and communities into various forms of public services and modes of transportation. They can function as potential solutions to solving traffic problems especially in big cities that often experience congestion and pollution.

Indonesia has started to deploy the use of smart mobility in its big cities, such as Jakarta. The government's efforts to promote such innovations and changes in the transportation sector are laudable, but it can continue to push the boundaries in improving transportation in Indonesia to be better and more advanced. There are still many problems that have not been resolved, resulting in public transportation still being less attractive to the public. This needs to be evaluated and improved so that the government can truly respond to the needs of its citizens.

⁴¹JUTPI2 2019, pp. 39-40.



The source of this case study is the country report on the Philippines submitted by AltMobilityPH Director Ira Cruz.

Introduction

Transportation governance in the Philippines suffers from persistent problems. Commuting woes seem endless, most especially in the national capital region, Metro Manila. While a constant strong push from civil society has led to some advancements in aspects of transportation in the country, such as the creation of bike lanes and the EDSA busway, the framework and mindset of local leaders still need to be shifted away from a car-centric paradigm of transportation.

Local Context

During the latter years of the Benigno Aquino III administration, traffic congestion in Metro Manila kept on getting worse, in large part because of a steady increase in the number of private vehicles in the metropolis. The policies of the Philippine government continued to support the increase of vehicles on the road through the construction of more highways and roads as a solution to curb the growing traffic in Metro Manila;

public transportation, meanwhile, was largely neglected. Between 2018 and 2019, or as the Duterte administration completed the first half of its term, Metro Manila's transportation system began to feel even more pressure from growing demands for mobility. According to the Japan International Cooperation Agency (JICA), the Philippines was losing as much as an estimated PhP 3.5 billion (US\$61 million) daily due to traffic congestion.⁴²

By 2019, the years of neglect of public transport saw the capital region's railway services seriously tested, with the Metro Rail Transit (MRT)-3 line facing capacity and electrical issues⁴³ and even a station of the Light Rail Transit (LRT)-2 line catching fire, cutting the network short.⁴⁴ The MRT-3 and LRT-2 are two of three railway services in Metro Manila and had become vital to commuters wanting to avoid traffic. But other mass public transportation modes were also apparently in trouble, with buses and jeepneys unable to meet commuter demand. After some time, it became quite common to see commuters walking along rail tracks after train breakdowns, or clambering through bus windows just to get seats.

Private businesses have attempted to provide solutions in the face of such worsening public transportation: Transport Network Vehicle Services (TNVS)/ride-share providers such as Uber (URL: uber.com) and Grab (URL: grab.com) have offered an alternative to dilapidated and often over-charging taxis. (Grab eventually bought Uber's Southeast Asian businesses in 2018.) Another is Angkas, a motorcycle ride-share provider.

⁴²"PH Traffic May Worsen, to Cost PhP5.4 Billion Daily," Japan International Cooperation Agency (JICA), accessed in September 2022, <https://www.cnnphilippines.com/news/2018/09/19/JICA-study-traffic-5-billion.html>

⁴³Raymond Carl Dela Cruz, "MRT-3 Passengers Offloaded Due to Power Issue," Philippine News Agency, 2 October 2019, <https://www.pna.gov.ph/articles/1082021>

⁴⁴Cathrine Gonzales, "LRT-2 Suspends Operations after Fire Hits Santolan Station," Philippine Daily Inquirer, 8 October 2020, <https://newsinfo.inquirer.net/1345054/lrt-2-suspends-operations-after-fire-hits-santolan-station>

The Covid-19 Pandemic Era

Included in the National Government's initial response to address the Covid-19 virus was to suspend Metro Manila's entire mass public transportation system.⁴⁵ This left health workers and frontliners,⁴⁶ as well as essential travelers with no means to travel, and the entire transportation sector with no source of livelihood.

With the suspension of taxis, jeepneys, buses, UV Expresses (commuter vans offering point-to-point service), and even local tricycles, Filipinos who were not car owners resorted to active transportation – that is, human-powered forms of travel -- to go to work or to buy food, medicines, or have health check-ups and treatment. Philippine streets, however, usually lack sidewalks or bike lanes to support either walking or biking.

Some local government units (LGUs) went by way of tactical urbanism -- deploying materials to create bike lanes within their jurisdiction, with some going as far as issuing Executive Orders declaring biking as an essential form of transportation and allowing bike shops to reopen. Organizing LibrengSakay (free shuttle) together with the private sector was also done by some LGUs⁴⁷ as well as the Office of the Vice President.⁴⁸

⁴⁵Azer Parrocha and Raymond Carl Dela Cruz, "Mass Transport Suspended Under Enhanced Community Quarantine," Philippine News Agency, 17 March 2020, <https://www.pna.gov.ph/articles/1096849>

⁴⁶Kristine Joy Patag, "Health Workers Walk to Work, sleep in clinics as Quarantine Halts Transportation," Philippine Star, 17 March, 2020, <https://www.philstar.com/headlines/2020/03/17/2001601/health-workers-walk-work-sleep-clinics-quarantine-halts-transportation>

⁴⁷Lade Jean Kabagani, "Pasig Launches Transport Microsite for LibrengSakay," Philippine News Agency, 16 August 2020, <https://www.pna.gov.ph/articles/1112439>

⁴⁸Catalini Ricci Madarang, "With Transport Shutdown, (Vice President) Robredo, Citizens Lead LibrengSakay Effort for Covid-19 Frontliners," Interaksyon, 17 March 2020, <https://interaksyon.philstar.com/trends-spotlights/2020/03/17/164469/free-rides-frontliners-quarantine-public-transportation/>



To date, several LGUs continue with their respective initiatives to promote active transportation through the expansion and improvement of existing permanent, protected bike lanes; bike loans for City Hall employees; free bike lessons for the public; People's Streets (car-free streets); and policies that aim to promote walking, biking, and such.

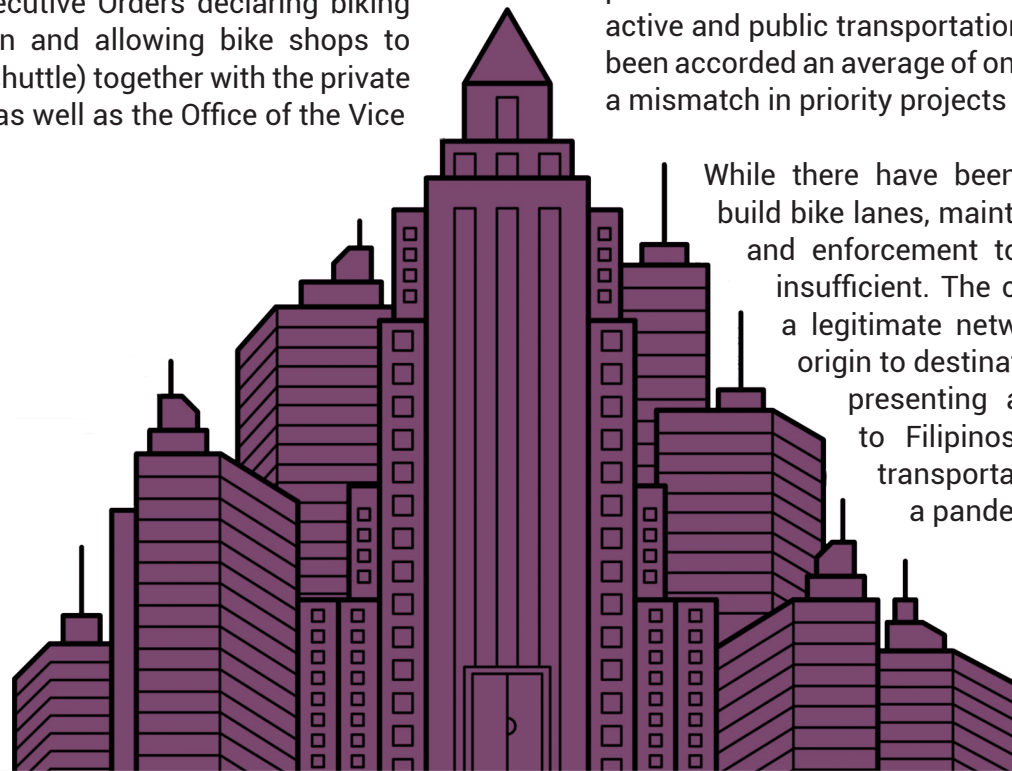
Era of Hostility

From 2018 to 2022, the Philippines went from having a worsening transportation system to a total shutdown. Yet even now that things are returning to normal, much is still to be desired of the present response of the Department of Transportation (DOTr) and its attached agencies. The new Marcos Jr. administration has also announced that it will continue the major infrastructure program called "Build, Build, Build" started by its predecessors. The program aims to construct infrastructure such as bridges, expressways, and roads, even as 88 percent of households in Metro Manila do not own a car and rely on active and public transportation.⁴⁹ Public-transport vehicles have also been accorded an average of only 20 percent of road space⁵⁰-- revealing a mismatch in priority projects and actual demand.

While there have been efforts from DOTr's Road Sector to build bike lanes, maintenance to ensure its quality and safety, and enforcement to ensure its exclusive use have been insufficient. The current bike lanes also fail to introduce a legitimate network that can safely bring bikers from origin to destination -- a key component to successfully presenting an additional mode of transportation to Filipinos - in an environment where public transportation remains impaired and at a time of a pandemic.

⁴⁹JICA MUCP, 2015.

⁵⁰Regidor and Javier, 2015.



As of this writing, Executive Departments, including DOTr, are still presenting the 2023 budget before the Philippine Congress. Unfortunately, reports show that the budget for the Road Sector has been cut severely by the Department of Budget and Management (DBM) - in particular, the budget for Libreng Sakay.⁵¹ Interestingly, in the same budget presentations, the Office of the Vice President (Sara Duterte) was granted an allotment of PhP 32.5 million (US\$566,000) in 2023 for its own Libreng Sakay.⁵²

In recent years, civil-society organizations (CSOs) have been engaging both the Executive and Legislative arms of government, as well as LGUs, to demand and collaborate for better mobility policies. Such has been one of the strategies of AltMobility PH, the country's first advocacy organization composed of professional practitioners in mobility. It has been taking an active role in policy and design through Congress and Technical Working Groups (TWGs), capacity development for LGUs, and public engagement through talks and conferences, and news media. At the height of the COVID-19 pandemic, a multisectoral group, the Move As One Coalition, also organized hundreds of groups together and took an active role in transport policies, the National Budget, and the welfare of the transportation industry, among many others.

⁵¹Ted Cordero, "No Budget for Libreng Sakay in 2023; DOTr Asks Lawmakers for Funding," GMA News, 25 August 2022, <https://www.gmanetwork.com/news/topstories/nation/842720/no-budget-for-libreng-sakay-in-2023-dotr-asks-lawmakers-for-funding/story/>

⁵²Llanesca Panti, "OVP Earmarks PhP32.5M for Libreng Sakay Program for 2023," GMA News, 14 September 2022, <https://www.gmanetwork.com/news/topstories/nation/844816/ovp-earmarks-p32-5m-for-libreng-sakay-program-for-2023/story/>



Key National & Local Policies and Institutions

Transport Governance

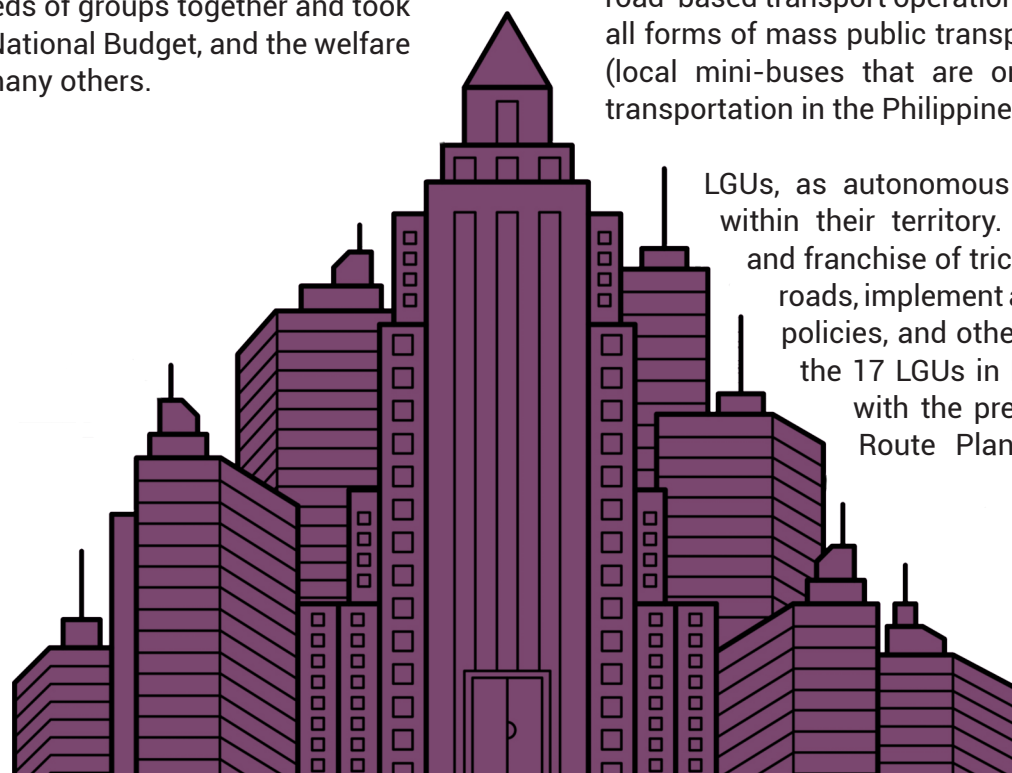
The Philippine Department of Transportation has the primary mandate to promote, develop, and regulate "dependable and coordinated network of transportation and communications systems...." It is organized by sectors defined by modes of transportation: aviation, maritime, railways, and road. In addressing the day-to-day needs of the majority of Filipinos, the railways and road sectors take center stage, with the former overseeing the operations of existing railways, and the latter, road-based transportation.⁵³

The Franchising and Regulatory Board (LTFRB) issues licenses for road-based transport operations. LTFRB's functions include regulating all forms of mass public transportation such as taxis, buses, jeepneys (local mini-buses that are one of the most used modes of land transportation in the Philippines), and UV Expresses.⁵⁴

LGUs, as autonomous governments, also influence mobility within their territory. Aside from regulating the operations and franchise of tricycles, LGUs can construct and redesign roads, implement and enforce their own mobility and traffic policies, and other local initiatives. With the exception of the 17 LGUs in Metropolitan Manila, LGUs are charged with the preparation of the Local Public Transport Route Plan (LPTRP). The LPTRP is a detailed

⁵³"About," Department of Transportation, accessed in September 2022, <https://dotr.gov.ph/>

⁵⁴Narboneta, C., Teknomo, K, "A Study of Metro Manila's Public Transportation Sector: Implementing a Multimodal Public Transportation Route Planner," Asian Transport Studies, Volume 4, Issue 2, 460-477.



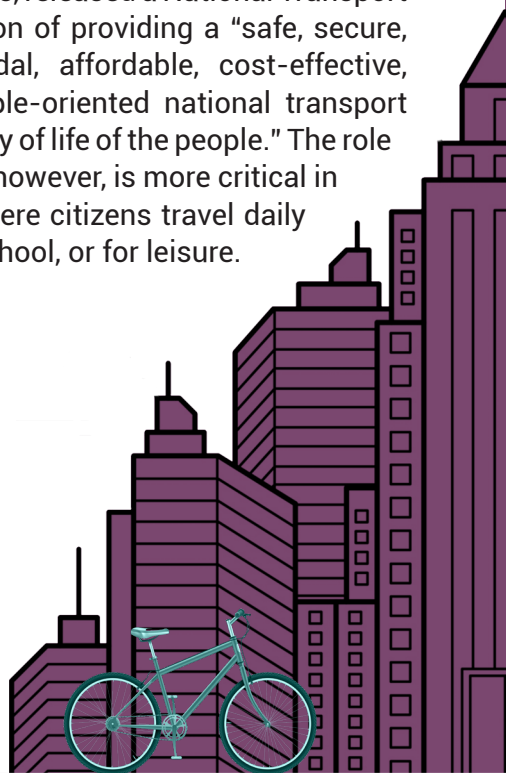
transport plan that includes a public-transport route network and mix of modes of transportation that, among others, will inform the issuance of franchises.

Aside from DOTr, other national government agencies (NGAs) figure in defining the level of mobility in the country. The Metro Manila Development Authority (MMDA), for one, is a regional coordinating body that is mandated to assist Metro Manila's 17 LGUs Manila craft and implement a development plan.⁵⁵ Among the key functions of MMDA are traffic management, flood control, and waste collection. Another agency is the Department of Public Works and Highways (DPWH), the country's construction arm⁵⁶ that includes the construction of road infrastructure. In September 2017, the National Economic Development Authority (NEDA), the country's socio-economic planning body, together with DOTr, DPWH, and several other NGAs, released a National Transport Policy (NTP)⁵⁷ aimed at fulfilling a vision of providing a "safe, secure, reliable, efficient, integrated, intermodal, affordable, cost-effective, environmentally sustainable, and people-oriented national transport system that ensures the improved quality of life of the people." The role of a coordinating body such as MMDA, however, is more critical in contiguous cities like Metro Manila, where citizens travel daily from one city to another for work, for school, or for leisure.

⁵⁵"About," Metro Manila Development Authority, accessed in September 2022, <https://mmda.gov.ph/>

⁵⁶"About," Department of Public Works and Highways, accessed in September 2022, <https://dpwh.gov.ph>

⁵⁷National Transport Policy Implementing Rules and Regulations.



Critical Laws and Policies in Transportation Governance in the Philippines

Below are some critical laws and policies behind transportation governance in the country:

Laws and Policies	Key Provisions
National Building Code of the Philippines, Presidential Decree No. 1096 (1972)	<ul style="list-style-type: none"> - Minimum width for pedestrian sidewalks; - Provision of temporary sidewalks during construction
Creating the Manila Transit Corporation, Appropriating Funds Therefore and Other Purposes, Presidential Decree No. 492 (1974)	<ul style="list-style-type: none"> - The primary aim of the Decree is to address the inadequate and unresponsive service of independent road transportation utility officers in Metro Manila, improve "destructive competition and other structural diseconomies in public utility operations," and institute through an appropriate instrumentality the rationalization of the Metro's transport system. Among its goals were to build and operate an "integrated transportation system in Metropolitan Manila" and to "rationalize route allocation and provide proper balance of commuter service in all routes."
Reorganizing the Presidential Task Force on Climate Change, Executive Order No. 774 (2008)	<ul style="list-style-type: none"> - "Those who have less in wheels must have more in road. For this purpose, the system shall favor non-motorized locomotion..."
Uniform Ticketing System and Establishment of Interconnectivity among Government Instrumentalities Involved in the Transport and Traffic Management in Metro Manila MMDA Resolution No. 12-20 (2012)	<ul style="list-style-type: none"> - Penalty for driving in bicycle lanes

<p>National Transport Policy (2018)</p> <p>Inter-Agency Document signed by the National Economic Development Authority (NEDA), Department of Public Works and Highways (DPWH), the Cabinet Secretary, Department of Budget and Management (DBM), Department of Transportation (DOTr), Department of Information and Communications Technology (DICT), Department of Energy (DOE), Department of Trade and Industry (DTI), and Department of Agriculture (DA)</p>	<p>- "In addressing traffic congestion and other related concerns, priority shall be given to cost-effective mobility management measures over more expensive infrastructure facilities. In the re-design or expansion of roads or the development of new roads, consideration will be given to achieving higher throughput of people rather than vehicles. In this regard, the design and evaluation of road and bridge projects shall consider the mix of transport modes (including public transport, walking, and cycling) that will optimize people throughput."</p>
<p>An Act to Improve Land Transportation Terminals, Stations, Stops, Rest Areas, and Roll-On, Roll-Off Terminals, Appropriating Funds Therefore and Other Purposes, Republic Act No. 11311 (2018)</p>	<p>- Targeted at ensuring commuter comfort and convenience by requiring owners, operators, and administrators of land transportation terminals, stations, stops, rest areas, and roll-on/roll-off (RORO) terminals to improve facilities, i.e., clean sanitary facilities and free Internet access</p>

Smart Mobility in the Philippines

At a Smart Mobility Forum in early 2022, then Transportation Secretary Arthur Tugade mentioned the need for a gradual shift to the new normal by promoting smart mobility through digitalization:⁵⁸ Media reports quoted Tugade as saying that "the department is gearing to a future wherein technological advancements will be highly optimized, where there is a gradual shift to the 'new normal'."

"By promoting smart mobility through digitalization," he added, "the DoTr continues to support initiatives in the present as a long-term solution for the future, and in the process, allow commuters to regain confidence in commuting."

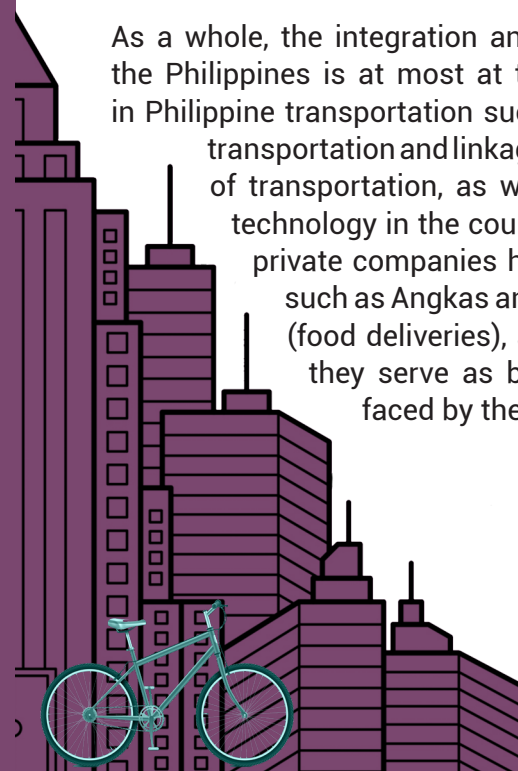
For all that, though, the National Government has failed to address the basic needs of ordinary commuters⁵⁹ and has even resulted in substandard cycling infrastructure.⁶⁰

As a whole, the integration and implementation of smart mobility in the Philippines is at most at the basic level. Foundational concerns in Philippine transportation such as having a proper system of public transportation and linkages and networks across different modes of transportation, as well as strengthening the use of digital technology in the country first need to be addressed. Though private companies have developed and brought in services such as Angkas and Joyride (motorcycle taxi), Food Panda (food deliveries), and Grab (car services, deliveries, etc.), they serve as band-aid solutions to critical problems faced by the country's transportation sector.

⁵⁸Bjorn Biel M. Beltran, "Transporting the Country Forward," Business World, 24 January 2022, <https://www.bworldonline.com/special-features/2022/01/24/432959/transporting-the-country-forward/>

⁵⁹Kurt Dela Peña, "As PH Transport Crisis Worsens, Workers Say Traffic, Lack of Rides are Draining Them," Philippine Daily Inquirer, 27 June 2022, <https://newsinfo.inquirer.net/1617567/as-ph-transport-crisis-worsens-workers-say-traffic-lack-of-rides-are-draining-them>

⁶⁰"TV Patrol," ABS CBN, 3 March 2022, <https://youtu.be/2e-J3misVmXY>



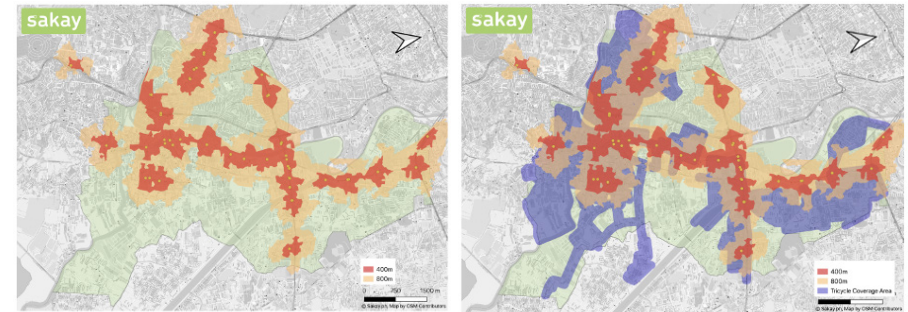
Implementation of Policies and Programs

The Rise of Local Governments

City Government of Pasig: In order to meet the basic mobility needs of its constituents, the City Government of Pasig worked with city-bus operators to expand the City's free shuttle service and collaborated with Sakay (URL: sakay.ph) to make the real-time location of buses available via an app.⁶¹ Aside from providing transit information to the commuting public, this has given the local transport office (URL: facebook.com/PasigTransport) a dashboard to analyze the performance of the shuttle service. Coupled with a feedback mechanism on social media, the dashboard has allowed the local transport office to dynamically adjust supply, frequency, routes, and stops to effectively meet the needs of the commuting public.

As a transport office, PasigTransport has always understood the critical role of data in informing decisions. The partnership between PasigTransport and Sakay started in 2019, when they collaborated to map the terminals and service areas of tricycles in the city. During a transportation strike in September 2019, the mapping exercise provided PasigTransport with data that proved crucial to temporarily providing public transportation throughout the city by combining the coverage of the free shuttle service and service area of tricycles.⁶²

⁶¹"Pasig's 'LibrengSakay' buses can now be tracked via app," spin.ph, accessed in September 2022, <https://www.spin.ph/life/guide/pasig-s-libreng-sakay-buses-can-now-be-tracked-via-app-a1374-20200519>



Sakay Heatmap: Service area of the Free Shuttle Service (Right) superimposed on the coverage area of Tricycles (Left)

As pandemic restrictions were relaxed, several LGUs (re-) introduced People's Streets; for a few days (usually weekends), roads were closed to motor vehicles and reserved for the exclusive use of pedestrians and cyclists, and the rest of the community. It was an initiative to provide more city space to people and to promote active transportation.

City Government of Iloilo: In his presentation at the CALD smart mobility workshop in Bangkok, Iloilo Province Board Member Jason Gonzales mentioned that there were some critical policies released during the pandemic that could be used to help promote more progressive paradigms and frameworks for the improvement of transportation. Specifically, a joint Administrative Order made by key NGAs has provided guidance for the promotion and safe use of active

⁶²Wilhansen Li, "Transit Area Coverage in Pasig During the Transport Strike," The Sakay Blog, accessed in September 2022, <https://blog.sakay.ph/transit-area-coverage-in-pasig-during-the-transport-strike/>



transport all over the country.⁶³ The guidelines cover non-motorized transport including walking and prescribe the creation of a local active-mobility committee in LGUs.

For Gonzales, the COVID-19 pandemic was an eye-opener to the further development of cycling infrastructure in the city. But he also shared how Iloilo City had long pushed for the proactive use of bikes. Even before the pandemic, its LGU was already busy building the right infrastructure for bike commute. Iloilo City emerged as the Most Bike-Friendly City in the PhilBike Awards 2018. It built the first (2014) and longest dedicated and traffic- segregated bike lane in the country. Iloilo City policies include requiring buildings to provide bike-parking zones, and regulating use of bike lanes. The city now has approximately 98 kilometers of bike lane.

⁶³DOH-DILG-DPWH-DOTr Joint Administrative Order No. 2020-0001 on the Promotion of Active Transport During and After the Covid-19 Pandemic," Department of Health, accessed in September 2022, <https://doh.gov.ph/sites/default/files/health-update/DOH-DOT-DILG-DPWH-jao2020-0001.pdf>

Summary

This country report opened with a narrative of the Philippine transport scenario on a national level -- presenting an environment where there are several and fragmented NGAs that provide minimal guidance to LGUs. It further pointed to a continued deployment of car-centric policies and metrics that result in a failure to address the basic needs of the majority of ordinary Filipino commuters. The Philippines evidently still has a long way to go in the conversation of smart solutions. First and foremost, the National Government must heed calls for a paradigm shift and urgently address the fundamentals.

But it's not all grim in the Philippines: Under this dark cloud are sparks of progress on the ground by way of progressive LGUs -- local governments that demonstrate an intimate understanding of their constituents, roll out infrastructure and solutions that respond to basic mobility needs, and have now begun collecting sensible data and deploying technology to uplift the lives of their citizens.

CASE STUDY

Taiwan



The source of this case study is the country report on Taiwan submitted by Ellie Kan, Hansen Derrick, and Tobias Larkin, all of the International Division of the Institute for Information Industry.

Introduction

Among the four countries included in this baseline study, Taiwan could be said to be one of the most advanced in terms of the development of its transportation system. Its case shows the importance of the integration of technology in the transport systems, and the role of private sector participation and strong private-public partnerships in developing smart mobility.

Local Context

Background

Taiwan has an area of 36,000 km and is predominantly mountainous in the east, while plains in the west cover around 26 percent of the entire island. There are countless hills, rugged mountain ranges, and steep forests, which are inhabitable. With several small and medium islands scattered around Taiwan, sea transportation needs to be taken into consideration when it comes to mobility. Because of its geography, a large percentage of the total population

in Taiwan resides in the west, especially in the urban areas.⁶⁴ The country ranks 14th in the world in terms of population density and has a high level of urbanization, with 79.7 percent of the population (23 million in total) living in urban areas. Taiwan's urbanization rate itself is 0.65 percent per year.⁶⁵

Taiwan has a total of 22 administrative regions consisting of six municipalities, three cities, and 13 counties. These regions have their own history, development, demographics, social problems, and mobility challenges. Since this report focuses on smart mobility of key urban areas in Taiwan, three major municipalities were picked for further explanation and elaboration: Taipei, Tainan, and Kaohsiung.

Taipei:⁶⁶ As the capital of Taiwan, Taipei, located in the north, is the pinnacle of multimodal smart-mobility transportation options, which serve millions of people daily. Taipei residents especially favor public transportation. Using statistics before the COVID-19 pandemic for a more accurate perspective (2019), 49.4 percent of Taipei residents and 34.6 percent of New Taipei City residents took public transportation.⁶⁷ Taipei Mass Rapid Transit (MRT) is one of the most popular choices among commuters. According to the 2021 Statistical Yearbook of Transportation, Taipei City, there was a daily average of 2,163,285 passengers on the MRT in 2019.⁶⁸ In addition to the government-

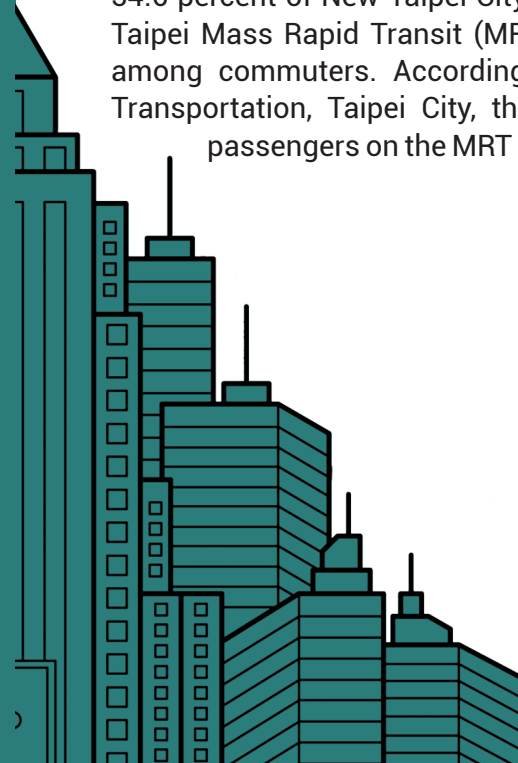
⁶⁴"Taiwan Population," World Population Review (2022), accessed in September 2022, <https://worldpopulationreview.com/countries/taiwan-population>

⁶⁵"About The World Factbook - The World Factbook," U.S. Central Intelligence Agency 2022, accessed in September 2022, <https://www.cia.gov/the-world-factbook/about/>

⁶⁶Despite Taipei and New Taipei being two different counties, with each having its own city government, we often refer to them together as the Greater Taipei Area (sometimes includes Keelung) because of their very close relationship. For example, the number of citizens commuting to each county is enormous and there are extremely complex and regular public transportation network linkages.

⁶⁷"What percentage of the population travels by public transportation every day in Taipei? What are the future targets? (Planning)," Department of Rapid Transit Systems - Taipei City Government 2019, accessed in September 2022, https://english.gov.taipei/News_Content.aspx?n=ADAE9018C6CFA1FE&s=E62708B-F6A355A23.

⁶⁸"2021 Statistical yearbook of transportation, Taipei City," Department of Transportation - Taipei City Government 2022, accessed in September 2022, <https://www.ws.gov.taipei/Download.ashx?u=LzAwMS9VcGxvYWQvMzkxL3JlbGZpbGUvMTk3OTAvODIxMDA2Ny9kYjU4OGE5My0yZyZ3LTQwNDc-tOTcwMC01NzllMjhhMGFjMzQucGRm&n=MTwE5bm05bm05a-CxLnBkZg%3d%3d&icon=.pdf>



run MRT, Taipei also has other high-quality transportation options such as municipal buses, autonomous buses,⁶⁹ and shareable rental bikes and scooters.

Transit stations within Taipei are often transfer stations that serve as a large and integrated system for passengers to choose and seamlessly connect to the next transit mobility option. Such integration is the best solution to the last mile in every journey. Taipei Main Station is a true one-stop solution for all travel needs and fully embodies the smart-mobility essence. The large network contains a large main building in the center, with a plethora of spaces for various purposes, including restaurants, shops, several underground and aboveground shopping malls, pathways, tunnels, sky bridges, and parking lots. As the center of transit in Taipei, Taipei Main Station currently is the busiest station within the Taipei Metro Network⁷⁰ and multiple intra-city bus lines. Taipei Main Station also provides the best and most mobility options for intercity travel all around Taiwan, including Taiwan Railway, HSR, taxi pick-up, and drop-off stops, and an express metro line to Taoyuan International Airport.

Tainan: Tainan is one of Taiwan's most popular cities for domestic and foreign tourists. It boasts of age-old architecture and city layout due to Dutch colonization dating back to 1624. But the outdated urban planning, old infrastructure, packs of tourists, and more have resulted in some mobility challenges. One of the most dangerous among these is illegal parking. According to 2015 data, illegal parking accounted for over 50.1 percent of the traffic violations reported in Tainan. Furthermore, Tainan so far has not built its own metro system. Bus rides and biking are also

not yet too popular. Tainan residents still prefer to drive cars and ride scooters.

Kaohsiung: Kaohsiung is a rapidly growing city in the south. While not as big as the Greater Taipei Area or blessed with as many transit resources, it has continued to make leaps and bounds in recent years with regard to its smart-mobility options. Like the capital and its integrated transit system of Taipei Main Station, Kaohsiung possesses a (comparatively smaller) integrated system of MRT, Light Rail, Taiwan Railway, HSR, Kaohsiung, International Airport, city buses, and a harbor ferry.⁷¹ The system also offers a popular bike-sharing at many stations.

Following the central government's zero emission and green-energy policy goals,⁷² plus the abundance of sunshine in the south, the Kaohsiung City Government has been devoted to the promotion of electric scooters and vehicles (EVs). Commencing in July 2022, the Kaohsiung City Government will be implementing a law that requires every new building to reserve space for EV-charging stations.⁷³ Furthermore, EV and E-scooter drivers registered in Kaohsiung can enjoy complete license-tax exemption until 2025.⁷⁴

Challenges

There are still numerous ongoing challenges and plans for improvement regarding the general situation of transportation within urban areas. Based on statistics from the Taiwan National Statistic Bureau, the entire country has more than 20 million registered private

⁶⁹Turing Drive and its autonomous driving solution will be discussed further in the report.

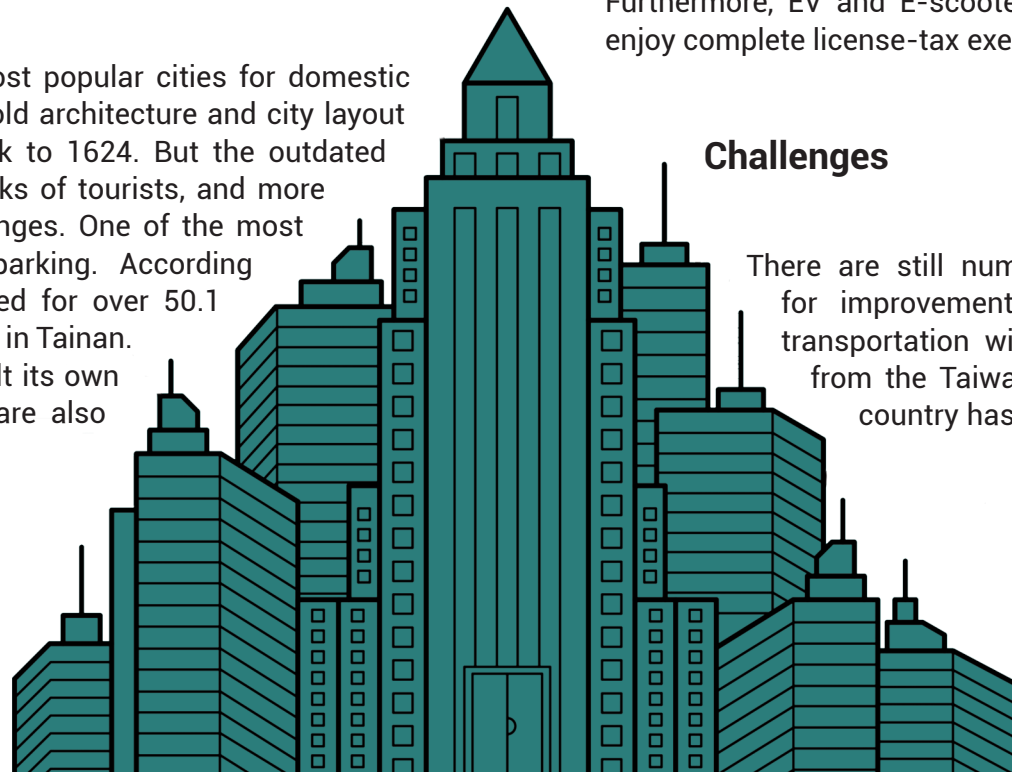
⁷⁰Focus Taiwan, "Big underground Maze in heart of Taipei," The Central News Agency, 16 April 2020, <https://www.cna.com.tw/project/20200416-metro-english/page2.html>.

⁷¹KMRT Map, https://www.krtc.com.tw/eng/Guide/guide_map

⁷²For example, Taiwan Executive Yuan has drafted a policy to only allow the selling of electric scooters after 2035 and EVs after 2040 within Taiwan.

⁷³Jake Chung, "Kaohsiung to require new buildings to make space for EV charging stations," Taipei Times, 30 March 2022. <https://www.taipetimes.com/News/taiwan/archives/2022/03/30/2003775709>.

⁷⁴Finance Bureau Kaohsiung City Government, https://finance.kcg.gov.tw/News_Content.aspx?n=3E69661D-A174B31A&sms=79C01BA4F34F3694&s=57FBA0F0D11FAE33



vehicles, composed of around 14 million motorcycles and six million cars.⁷⁵ The combination of both high private ownership of vehicles and population density in urban cities results in congestion, insufficient parking spaces, pollution, and setbacks to Taiwan's net-zero emission goals by 2050.⁷⁶

Despite its many successes, Taiwan is still facing several mobility challenges, such as unnecessary traffic lights, waste of police officers manually directing traffic (unmanaged peak/rush hours), decreasing labor force due to an aging society, unwanted jobs by the younger generations (e.g. bus driving), outdated urban infrastructure planning, insufficient number of EV- charging stations, changing mobility behaviors, and high number of parking violations.

Key National & Local Policies and Institutions

Transportation Governance

There is currently tremendous institutional reform at the central governmental and administrative levels in Taiwan. The Presidential Palace and Executive Yuan both give specific and broad directions in terms of transportation, e.g. green energy-driven mobility and shared mobility. At the ministry level, the Ministry of Transportation and Communications is in charge of transportation

⁷⁵General Accounting Office, Executive Yuan 2021, "Statistical Yearbook of the Republic of China," 128-129.

⁷⁶Matthew Strong, "Taipei City sets 2050 as target date for net zero emissions." Taiwan News, 23 April 2021, <https://www.taiwannews.com.tw/en/news/4185101>

infrastructure and countrywide mobility, such as the Taiwan Railway and HSR. It also devotes efforts to smart mobility projects with 5G and an R&D focus.

In August 2022, Taiwan established the Ministry of Digital Affairs. Its missions and goals are data-related solutions, a better data ecosystem, and open data promotion. In addition to government, there are organizations, associations, and companies that take on state projects as the actual implementers and fulfillers of smart-mobility goals. The two largest are the Institute for Information Industry, and Industrial Technology Research Institute.⁷⁷

Smart Mobility Policies and Institutions

Taiwan has been actively promoting all kinds of smart-city projects and policies by adopting both top-down and bottom-up approaches.⁷⁸ All the efforts are jointly collaborated on by the central and local governments of Taiwan, private industries, and local citizens. Scales of projects and policies vary. The figure below summarizes the plan and process of Smart City Taiwan.⁷⁹ This regime adopts both top-down and bottom-up approaches:

Explanation of Taiwan Smart City Project Regime:

- **President of Taiwan:** The Presidential Palace may announce new goals or national policies regarding smart mobility;
- **Executive Yuan:** Aligning with the Presidential Palace, the Executive Yuan reviews all the proposed policies,

⁷⁷Institute for Information Industry (IIT): <https://web.iii.org.tw> ; Industrial Technology Research Institute (ITRI): <https://www.itri.org.tw/english/index.aspx>

⁷⁸Please refer to the figure.

⁷⁹Please refer to the explanation.



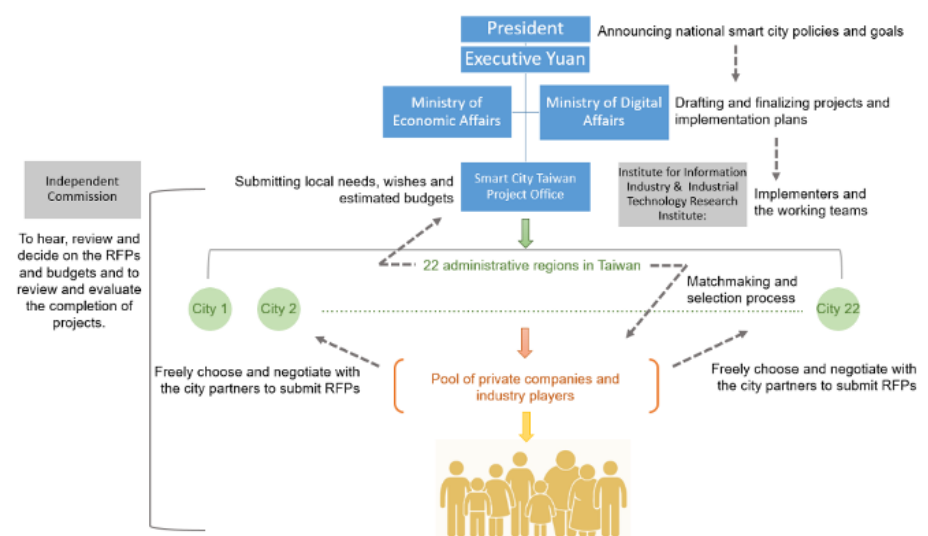
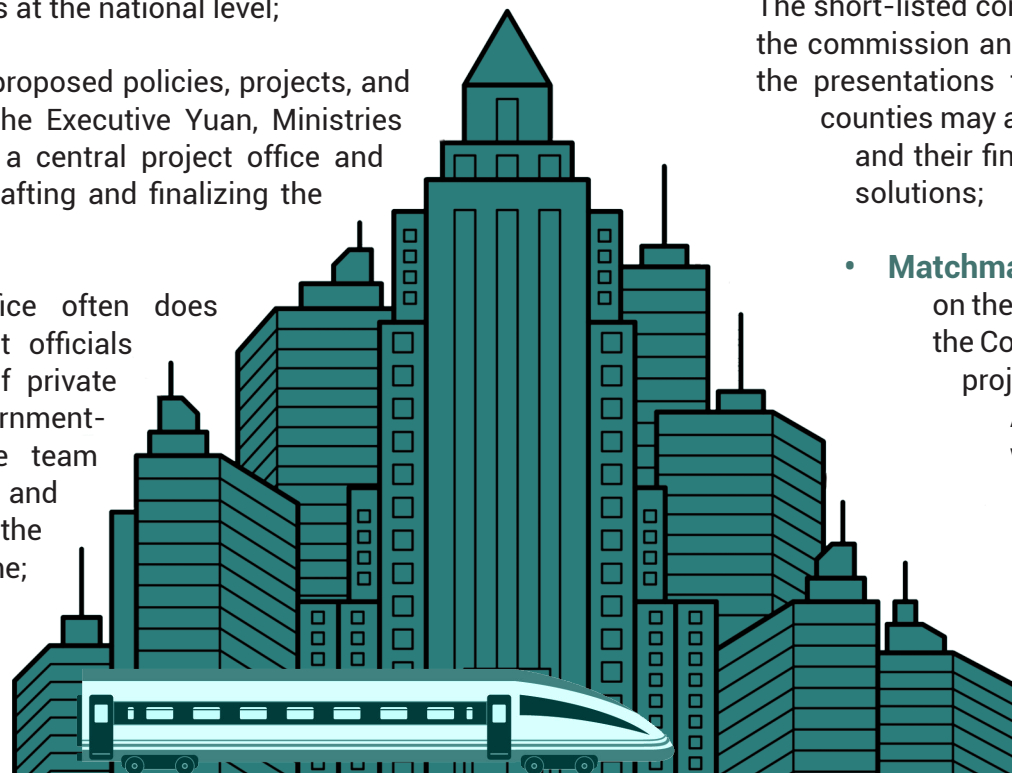


Figure 1 Taiwan Smart City Project Regime

projects, budgets, plans, and expenses from all of the Ministries and Commissions at the national level;

- **Ministry Level:** When the proposed policies, projects, and budgets are approved by the Executive Yuan, Ministries may establish and govern a central project office and have the office assist in drafting and finalizing the implementation plans;
- **Project Office:** This office often does not consist of government officials but instead has a team of private companies or government-funded organizations. The team is sponsored/paid to run and maintain the office and the implementation of the regime;

- **22 Administrative Regions of Taiwan:** All of the 22 cities and counties submit their local mobility needs, challenges, and estimated budget to the project office. Oftentimes, the 22 administrative regions seek opinions and advice from their own local agencies, police stations, and any public and private sectors related to mobility;
- **Private Players:** Any private company and industry player who sees the announcement of local needs, mobility challenges, and inquiries from local governments or the project office may start proposing technology solutions. It could be a sole private company or a corporate team;
- **Independent Commission:** The composition of the commission shall be confidential and is done by industry experts, academic scholars, mobility-related stakeholders, and so on. The commission reviews all the proposals from private players and selects a pool of short-listed companies. The short-listed companies must present their solutions to the commission and all 22 cities and counties may attend the presentations they are interested in. The cities and counties may ask questions and submit their feedback and their final choice of the private companies and solutions;
- **Matchmaking and Selection Process:** Based on the review and presentation process above, the Commission announces the winners of the projects - the companies and their solutions. All of the 22 cities and counties and the winning companies may freely choose and negotiate with each other to finalize the implementation plans;



- **Implementation and budgeting of the project:** It could be a single year, three-year project, or even a longer time stamp;
- **Independent Commission:** The project office and the commission may conduct quarterly or yearly site visits and evaluations. The independent commission of different commissioners then conducts a final review and scoring for the autonomous driving project scenario. The commission may take the following factors into consideration: if the project was executed along with the planned timeline, how many traffic conditions and scenarios were tested, how many passengers in total experience the rides, and the overall results, satisfaction rates, citizen feedback, and media exposure.

Implementation of Policies and Programs

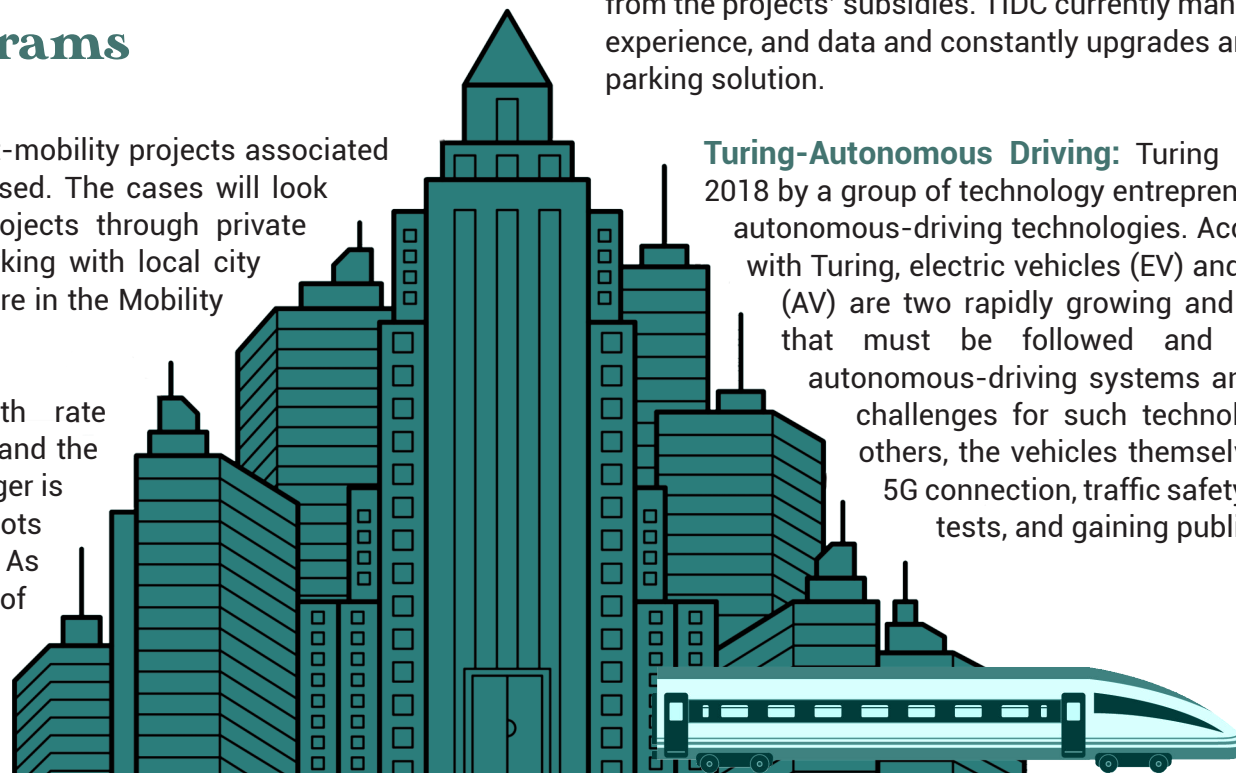
In this section, three companies' smart-mobility projects associated with Smart City Taiwan will be discussed. The cases will look into the actual implementation of projects through private participation and their experience working with local city governments. All of these companies are in the Mobility as a Service (MaaS) sector.

TIDC-Smart Parking: As the birth rate declines, society ages, and labor laws and the work environment change, there no longer is enough manpower to manage parking lots or issue fines for illegal parking 24/7. As the population and private ownership of

cars in major cities both grow rapidly, the current urban infrastructure struggle to cope. This leads to more traffic accidents, violations, and crowdedness. Simply building more parking lots would not solve the root problem. Working on parking management and operation is necessary.

Tainan City Government gave TIDC a chance with a 40-percent subsidy of the total project costs to test its smart-parking solution, starting in 2018 through the Smart City Taiwan Project. At the beginning of the project, TIDC along with other private corporate partners built over 2,500 new roadside parking spaces and installed over 2,000 smart -parking poles and placed more than 3,900 magnetic sensors under the ground. In addition to hiring over 150 ticketers (non-police officers), TIDC established a central control management office with a huge display monitoring and managing all the parking spaces and data generated. As for profit-sharing, all the newly built and managed parking spaces through the projects are owned by the Tainan City Government and all the parking fees and fines go to the city's revenues. TIDC only profits from the projects' subsidies. TIDC currently manages all feedback, user experience, and data and constantly upgrades and improves its smart-parking solution.

Turing-Autonomous Driving: Turing Drive was founded in 2018 by a group of technology entrepreneurs passionate about autonomous-driving technologies. According to an interview with Turing, electric vehicles (EV) and autonomous vehicles (AV) are two rapidly growing and relevant technologies that must be followed and integrated, including autonomous-driving systems and total solutions. The challenges for such technologies include, among others, the vehicles themselves, steady and stable 5G connection, traffic safety concerns, actual road tests, and gaining public trust.



Turing worked with the Taipei City Government on autonomous city bus lines for five years. Initially, it covered its own expenses in the project for R&D purposes because it felt that its technology was not yet fully ready. The Taipei City Government supported the projects by redesigning the bus lines around Taipei 101 and Xinyi District and building fixed tracks for Turing. After countless tests in the middle of the night on the street, in rain, and in the extreme heat during the summer, Turing was ready for its actual operation. The Taipei City Government and Turing then worked together on the reservations, operation schedules, and media exposure. Not only did Turing have a great opportunity to test and improve its technologies, the Taipei City Government also learned that autonomous driving could be an alternative for Taipei in the future. During an interview, Turing stated that if local governments in Taiwan want to continue promoting autonomous driving, financial incentives and ease of road testing are two key elements to attract private industry to participate in such ventures.

Noodoe-EV Charging: Noodoe entered the Taiwanese EV-charging industry by chance, through a tourism promotion project with the Taitung City Government. The project started with building EV-charging stations at local hotels. After this unexpected success, Noodoe gradually made its EV-charging solution as its core business and has now expanded its solution all over Taiwan and overseas.

Initially, in the local government projects, Noodoe was struggling with having private sites agree to install EV-charging stations due to uncertain needs and the construction

process. The local governments mostly took a hands-off approach and respected Noodoe for the site selection and implementation process under one condition: the charging stations built on private sites through the projects must be open for public use. For example, hotels must open their stations even for EV drivers who are not their guests. Noodoe did not see it as a setback but worked harder by believing “today's parking is tomorrow's charging.” The efforts turned into great success; there are now more than 230 EV-charging stations in Taiwan run by Noodoe.

Noodoe is still serving as the big brain for all the data and feedback collected through all the EV- charging stations in Taiwan. It makes constant improvements to its charging solution and adopts a flexible and efficient management system in accordance with peak and off-peak hours, and power consumption surging times in summer.



Summary

For Taiwan, smart mobility is important in the future of every country. A developed transportation system does not only ease citizens' comfort, productivity, and safety, it can also help in reducing the pollution generated by transportation services, and help future generations to live better and healthier lives.

Here are some general points from Taiwan's experience of implementing smart mobility, as well as some suggestions from the companies that took on smart-mobility projects:

TIDC-Smart Parking: Parking problems and suitable solutions vary from country to country. It will be critical for those forwarding solutions to understand the local environment, terrain, infrastructure, and parking laws in order to further decide on applying parking poles, geomatic sensors, or other technologies. Surveys of potential sites and local needs are important to estimate the number of parking spaces to be built, roadside or in a garage. Marking planned parking spaces is also essential since there are construction, electricity, and wire works needed.

Turing Drive-Autonomous Driving: Deep and thorough market research and knowledge studies are the very bases of promoting autonomous driving. Governments cannot be fully hands-off and rely solely on private companies to take the reins. At the same time, better infrastructure, safe testing grounds, and the legal framework must be created. Lastly, from its experience, Turing learned that autonomous driving is really a capital game, so it believes that governments and private companies should be open-minded and open to any potential partnership and cooperation.

Noodoe-EV Charging: Although Noodoe's solution may adjust the capabilities, loads, fees, and system, it is still strongly suggested that if Southeast Asian countries are interested in pursuing a shift to EV, they would need to first secure electricity supplies and electrical infrastructure related to EV-charging. Additionally, EVs would not be promoted well if fuel prices are cheaper. Subsidies, grants, and tax benefits may be provided, but Noodoe believes that a completely open market and free competition are key for the EV industry to prosper.



Emerging Trends and Challenges

While Taiwan is very much advanced in its implementation and use of digital technologies, the Philippines is still at the foundational level of fixing the basics of public transportation governance and infrastructure, even as many groups push for active transportation such as biking. For Indonesia and Thailand, foundational concerns in public transportation have partially been addressed; both are now looking at smart-mobility technologies and processes to address gaps in transportation-service delivery.

What these case studies show is that as the respective governments of these countries attempt to respond to their citizens' needs and address the concerns and demands for an efficient, safe, inclusive, and accessible transportation system, their struggles vary in forms and degree. Each local context is unique, and thus approaches to smart-mobility implementation have been diverse. Nonetheless, there are some common themes that can be identified based on the four case studies.

The following insights were initially articulated by participants of the second CALD Workshop on Smart Mobility held in Bangkok in September 2022.

Push Factors for Smart Mobility Adoption

A number of interconnected factors have been identified as push factors in Smart Mobility adoption. These are

Improving Quality of Life of Citizens: Any smart-mobility initiative should start by addressing the needs of the citizens, as well as aiming to improve the quality of their lives. As mentioned in the beginning of this baseline study, smart mobility functions as a means to a greater end of really ensuring that people are able to enjoy the city, and are able to access opportunities and other necessities they need to live a full and dignified life. Public transportation and infrastructure, including walkways and bike lanes, play fundamental roles in allowing for greater mobility of people.

Rapid Urbanization and Congestion: Rapid urbanization and worsening traffic congestion are also among the primary push factors that have led governments and the private sector in each country to look into smart-mobility solutions. As populations in major cities grow, travel demand increases. Failure to address the emerging challenges related to rapid urbanization can lead to a deterioration of the quality of life of urbanites, as well as economic damages resulting from productivity loss from uncontrolled traffic.

Environmental Challenges: Another related factor is the environment. The transportation sector in general consumes a lot of energy, contributing significantly to greenhouse-gas emissions. The commitment of countries to the issue of climate change by reducing their overall carbon footprint is one of the push factors leading governments to find innovations and technologies related to smart mobility. An example of this is the

electrification of transportation services (electric vehicles and charging stations), which give leeway for countries to use more renewable-energy sources instead of being dependent solely on fossil fuels.

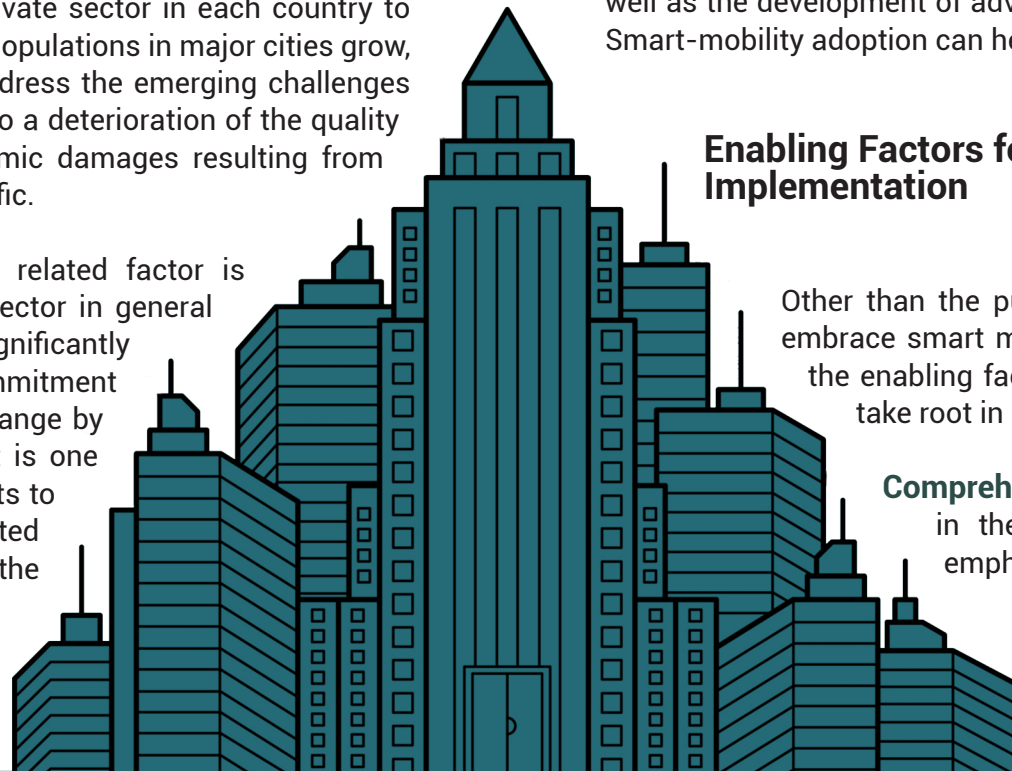
Sustainability: Recent increases in oil prices in the world brought by the Russia-Ukraine war have led to countries also thinking about sustainability of costs in their transportation systems. Price shocks brought by shortages in oil supply affect the transportation sector significantly. Becoming less dependent on oil through electrification is pushing countries to adopt new technologies related to smart mobility into their transportation systems.

Economic Growth: The last factor that has pushed the adoption of smart mobility is how it is seen as an opportunity to develop new sectors and industries for economic growth. As seen in the case studies, the private sector plays a crucial role in furthering innovations in transportation within countries. New businesses and industries are developed, such as the case of electrification and its related infrastructure in Taiwan, as well as the development of advanced light rail technology in Thailand. Smart-mobility adoption can help drive economic growth.

Enabling Factors for Smart Mobility Implementation

Other than the push factors that have led countries to embrace smart mobility, it is critical to also understand the enabling factors that allow for new innovations to take root in countries.

Comprehensive Planning: Consistently seen in the reports and presentations was the emphasis on the importance of a good and



comprehensive plan to be followed. A strong vision, coupled with a clear roadmap in terms of smart-mobility adoption and how it plays a critical role in a country's development, enables smart mobility-related innovations to flourish. Planning with multiple stakeholders, such as the private sector and various implementing government agencies, is important.

Competent Leadership and Stable Governance: The implementation of new innovations in the transportation sector requires competent leadership that has the will to implement plans. Stable governance that ensures the continuity of plans across changing administrations also ensures the sustainable development of new sectors and technologies.

Public-Private Partnership: The partnership between the government and the private sector is crucial in smart-mobility adoption. The private sector, having a greater drive for innovation, helps to push societies toward new technologies and solutions. The government meanwhile creates the enabling environment for such innovations to thrive, whether through policies that support their development, or by partnering with private entities in pilot-testing new products and services before these are scaled.

Diffusion of Digital Technology: The rapid development and diffusion of new digital technologies and products across the world is one of the enabling factors for smart-mobility adoption.

Buy-in and Support of the People: At the end of the day, it is the support of the people that is critical to the sustainability of smart mobility and its development. The successful adoption of new technologies and applications is driven by the demand and feedback from the people. Ride-sharing applications for example would not thrive if people do not use them.

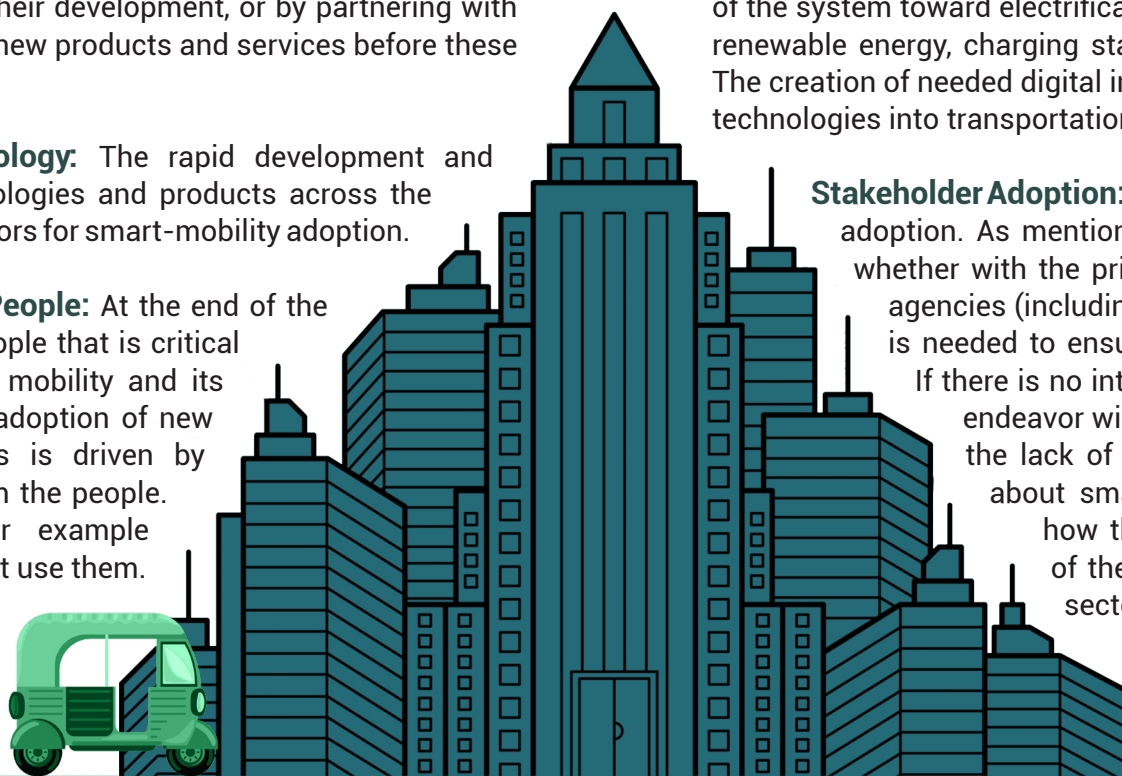
Public transportation would not improve if people do not demand better and more affordable services. A people-centric approach to the improvement of the transportation sector is crucial. The sustainability of plans across administrations is strengthened when citizens expect continued improvement of transportation services.

Barriers and Challenges to Smart-Mobility Adoption

Not all is rosy when it comes to the adoption of smart-mobility processes, innovations, and technologies. As the case studies show, there remain challenges and barriers that prevent its development in even in countries keen to turn smart.

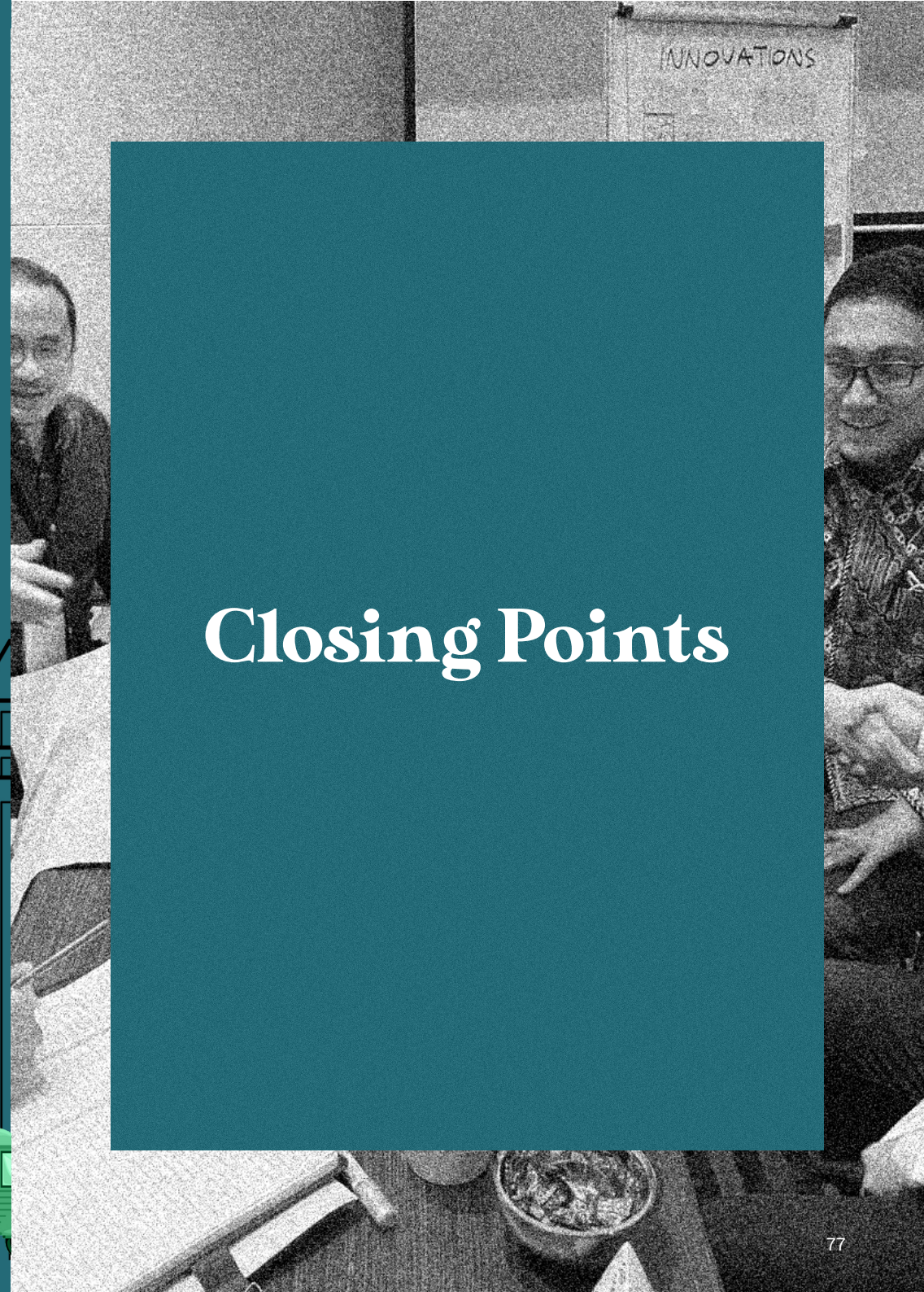
Financing: One of the primary challenges is financing. Not enough investments are being put by some governments and the private sector in terms of developing the industry. For example, the overhaul of the system toward electrification requires significant investments in renewable energy, charging stations, and electric-vehicle production. The creation of needed digital infrastructure and the integration of new technologies into transportation governance require financing as well.

Stakeholder Adoption: Another barrier is the lack of stakeholder adoption. As mentioned earlier, stakeholder engagement -- whether with the private sector, implementing government agencies (including local governments), or the citizens -- is needed to ensure the development of smart mobility. If there is no interest or stake in these innovations, the endeavor will not thrive. Connected to this might be the lack of access to knowledge and information about smart technologies and innovations, and how these can serve a role in solving some of the problems faced by the transportation sector.



Fragmentation of Initiatives: The last challenge highlighted by participants in the discussion was the problem of fragmented initiatives. There are situations where the efforts of national government can be inconsistent with efforts being done at the local government level, and what the private sector is also pursuing. The lack of synergy, and at times conflict in terms of interest and policy, can severely affect the changing of paradigms in transportation governance (e.g., away from a car-centric model), and the adoption of new technologies and innovations.

Closing Points



Smart mobility has great potential in helping address critical challenges faced by governments when it comes to managing and developing cities. Rapid urbanization has brought with it a myriad of issues such as overcrowding, traffic congestion, and higher levels of pollution. Complex problems demand comprehensive solutions, and smart mobility can play a role in that. As UNESCAP⁸⁰ points out, “There is great potential in using smart mobility to address transport issues by improving overall efficiency and equity within the transport sector. At the same time, there is a need for timely intervention through policies that promote smart mobility to achieve the maximum potential for sustainable development.”

Global trends such as the adoption of the Sustainable Development Goals (SDGs), growing climate consciousness in societies, movements toward decarbonization, electrification, and renewable energy adoption, the technological revolution, and the diffusion of new technologies can serve as impetus for governments to create policies that facilitate the growth of smart- mobility interventions.

Much can and should still be done. It must be noted, however, that the application of smart technologies into transportation systems must always be taken in the greater context. Decision-makers in governance must not forget that the fundamental reason for the adoption of innovations must be toward the improvement of the mobility of the general populace. It is about the people and addressing their needs. Adopting smart mobility is a means to a bigger end of fundamentally improving the quality of life of citizens in the cities.

⁸⁰UNESCAP, “Increasing the use of Smart Mobility Approaches.”



