

**Application of environmentally sustainable transport  
(EST) to local public transportation planning  
in the Philippines**

フィリピンにおける環境的に持続可能な交通（EST）概念の  
地方公共交通計画への適用に関する研究

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## **Abstract**

Environmentally Sustainable Transport (EST) considers the transport system in a way that meets social, economic, and environmental objectives. The Philippines National EST Strategy (2011) provided actions for the national and local governments to improve public health, manage air and noise pollution, integrate land use development, and provide safe public transportation that uses environmentally friendly modes and promotes walking and cycling in cities. However, barriers to implementation included the lack of appreciation and limited planning capacities. This research aims to communicate EST as part of the local planning process and explores its applications to support local public transport route planning. The study proposed a concept of sustainability in developing countries and clarified the linkages between EST and the Philippines Public Transport Modernizations Program. During the COVID-19 pandemic lockdowns, transport mobility responses included walking and cycling, the creation of bicycle lanes, and improvements to public bus transport systems, which are components of EST. Sustainable transport indicators from academic literature were selected using the term frequency-inverse document frequency (tf-idf), a statistic in text mining that shows the importance of words to documents. Topic modeling explored the categories that represent sustainable transport indicators and found that transport planning and walkability indicators are the most relevant topics. Transportation experts confirmed the applicability of EST indicators in local city planning. The selected indicators are related to the transport system, investments, accessibility, customer accessibility and satisfaction, and comprehensiveness of planning. It is recommended to integrate the investments in the profiling stage, accessibility in the demand analysis, and customer satisfaction in monitoring and evaluation of public transport systems. Lastly, comprehensive transport planning can be applied as the main indicator in preparing local public transport plans.

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## Abbreviations

ADB	Asian Development Bank
ATO	Asian Transport Outlook
BAU	Business-as-usual
BC	Black carbon
C/MHO	City/Municipal Health Office
C/MSWDO	City/Municipal Social Welfare and Development Office
CBMS	Community Based Monitoring System
CDP	Comprehensive Development Plan
CEI	Central European Initiative
CLUP	Comprehensive Land Use Plan
CO <sub>2</sub>	Carbon dioxide
COMET	City Optimized Managed Electric Transport
COVID	Corona virus
CPDO	City Planning and Development Office
CST	Centre for Sustainable Transportation
CTM	Correlated Topic Model
DENR	Department of Environment and Natural Resources
DepEd	Department of Education
DILG	Department of Interior and Local Government
DO	Department Order
DOE	Department of Energy
DOH	Department of Health
DOTr	Department of Transportation
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industry
ECQ	Enhanced Community Quarantine
EMB	Environmental Management Bureau
EP	Ecological Profile
EST	Environmentally Sustainable Transport
eVAP	Electronic Vehicle Association of the Philippines
GET	Global Electric Transport
GHG	Greenhouse Gas
IEO	Intergovernmental Economic Organization
IPCC	Intergovernmental Panel on Climate Change
IRAP	International Road Assessment Program
JICA	Japan International Cooperation Agency
LD	Light duty
LDA	Latent Dirichlet Allocation
LGU	Local Government Unit
LOS	Level of service
LTFRB	Land Transport Franchising and Regulatory Board
MC	Memorandum Circular
MECQ	Modified Enhanced Community Quarantine
MMDA	Metro Manila Development Authority
NCR	National Capital Region
NEDA	National Economic and Development Authority
NESTS	National Environmentally Sustainable Transport Strategy
NMT	Non-motorized transport
NO <sub>x</sub>	Nitrogen Oxide
NPMO	National Program Management Office
OECD	Organization for Economic Co-operation and Development
PHP	Philippine Pesos



PKT	Passenger Kilometer Travel
PM	Particulate Matter
PNP	Philippine National Police
PSA	Philippine Statistics Authority
PUVMP	Public Utility Vehicle Modernization Program
PWD	Persons with disability
RA	Republic Act
RTPD	Road Transport Planning Division
STM	Structural Topic Model
TF-IDF	Term frequency – inverse term frequency
UNCED	United Nations Conference on Environment and Development
UNCRD	United Nations Regional Development Center
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
UP-NCTS	University of the Philippines National Center for Transport Studies
UV Express	Utility Vehicle Express
VKT	Vehicle Kilometer Traveled
VOC	Volatile organic carbon
WCED	World Commission on Environment and Development
WHO	World Health Organization

## **1. Chapter I: Introduction**

Environmentally Sustainable Transport (EST) in the Philippines is "transport development that meets the needs of the present without preventing future generations from meeting their needs" (DOTr and DENR, 2011). The national strategy recognized the importance of an efficient and reliable transport system for delivering sustainable development. The main goals of the EST strategy are (1) to reduce transport sector energy consumption, greenhouse gas (GHG), and air pollution and (2) to promote environmentally sustainable transport systems with low carbon intensity. Local cities are at the frontline of EST. Strategies, indicators, and action plans involving national government and local cities are formulated to address key challenges on public health, vehicle emissions, transport planning and travel demand management, non-motorized transport, road safety, land use planning, awareness, and public participation. While policies are in place, there are still longstanding challenges of planning capacities, funding, and lack of leadership interest in EST. The Department of Transportation (DOTr) launched the Public Transport Modernization Program in 2017. It promotes a restructured, modern, well-managed, environmentally sustainable transport system. DOTr called on cities to prepare transport route plans that will be the basis for providing new public transport in their localities. Previously, only the Transport Department could plan public transport routes. This change featured a bottom-up participatory planning process to provide need-based services and emphasizes aligning local city development and land use plans with the transport route plan.

### **1.1. Background and motivation**

The Philippines is moving toward a restructured, modern, well-managed, sustainable transport system to reduce reliance on private vehicles. The Department of Transportation's flagship Public Utility Vehicle Modernization Program (PUVMP) aims to meet this goal. PUVMP introduced simultaneous reforms to modernize vehicle fleet, rationalize public transport routes, and engages public transport route planning

with local cities nationwide. These programs target the longstanding problems of limited and poor quality public transport services and vehicles, air pollution, and increasing private vehicle use, which is common in many developing countries. The PUVMP enhances the quality and attractiveness of the road public transport sector. Sustainable road transport is necessary for the Philippines since 98% of passenger traffic and 58% of cargo movement rely on the road sector (ADB, 2012). The road public transport system is important to the economy as highlighted by 18.8 million daily trips in Mega Manila (Metro Manila, Bulacan, Laguna, Rizal, and Cavite province). About 70% of these commuter trips use jeepneys, buses, and tricycles. This figure is estimated to increase to 22.5 million trips by 2030 (JICA, 2015). The economic costs of traffic congestion in Metro Manila are estimated at 3.5 billion Philippine Pesos per day by JICA (2015). The transport system has a poor quality road network and infrastructure with a lack of intermodal connectivity for transfers and the absence of quality urban transport systems. Weak governance and institutional capacities in the sectors, limited private investment in transport infrastructure, rapid urbanization and motorization and the negative externalities of traffic congestion and air pollution are among major problems (ADB, 2012; Gaabucayan-Napalang, 2016; Lidasan, Espada, & De Leon, 2010). Traffic congestion is generally considered an economic loss and a problem caused by too many buses on the road instead of systematic problems caused by poor road network conditions, economic concentration, and lack of efficient public transport facilities (Boquet, n.d.; Yee, 2003). The Transport Department issued a moratorium on accepting public transport applications in Metro Manila and provincial bus routes coming to the capital (Department Order no. 2010-21), citing the congested road conditions in the capital as the main reason, and was later implemented nationwide. New franchises would be open after the public transport route rationalization for buses and jeepneys is complete. However, the rationalization was challenged by the absence of data and technical capacities to conduct rationalization since public transport authorities are most involved in fare-setting (Tiglao and Patdu,

2007). Another restriction on public transport operations is apprehending '*colorum*,' or the local term for public transport vehicles operating without permission (Memorandum Circular no. 2020-88). Due to limited transit options, *colorum* vehicles take passengers to and from business centers in morning and evening peak hours, operating point-to-point services similar to the 10-18 seater UV express services.

In Southeast Asian cities like Manila and Jakarta, authorities prefer bus restrictions instead of discouraging private motorization. Public transportation is rarely considered a component of an environmentally sustainable transport system (Barter, Kenworthy, and Laube, 2003; Mateo-Babiano, 2014; Perez, Ng, and Tiglao, 2021; Yee, 2003). Metro Manila and some cities continue to implement license-plate-based vehicle restrictions in an attempt to reduce traffic congestion, despite research showing it is ineffective in both reducing congestions and not having significant effects on reducing air vehicular air pollution (Regidor, 2013; Salvanera, Sibayan, Tan, and Rosete, 2016). These actions push commuters toward the attractiveness of private motorization. The failure to recognize the dependency of the poor sector on public transport, including informal transit, and the absence of support for quality public transportation also negatively affect environmental air quality, road safety, and economic growth (Mateo-Babiano, 2016; Yee, 2003). The low-quality engines of buses and jeepneys, coupled with long commuting distances brought about by urban sprawl, are among the contributors to CO<sub>2</sub> emissions where sustainable transport policies need to consider not only the vehicles but also the effects of urban sprawl (Andong and Sajor, 2014). The demand for mobility in cities will find ways, as emphasized by the continued high demand for public transport and the proliferation of *colorum* vehicles. These are signs that mobility is persevering but at the cost of unsustainability.

## **1.2. Statement of the problem**

The Public transport modernization program is an opportunity to apply the EST concept to support local cities in creating demand-driven, environmentally sustainable

transport plans. This research explores how EST can support public transport planning aims to understand how the EST concept and indicators can support local cities in preparing data-based transport plans that will serve as the basis for the national government to provide demand-based public transport services. Public transportation networks in the Philippines remained relatively unchanged despite rapid urbanization and the PUVMP will address the lack of efficient quality public transportation services.

Before the Public Transport Modernization Program, road public transport routes are suggested by the private sector. These route service plans are submitted and evaluated by the Transportation Department and, if approved, will be operated as public transport routes using buses, jeepneys, or utility vehicles (UV) express. The system was halted in 2011 when a moratorium was placed on new transport routes, subject to the rationalization of the public transport network. Traffic congestion in the capital and negative externalities on air pollution were among the reasons the Transport Department placed the moratorium. All new applications for road-based public transport routes were not accepted. In effect, commuters were left to manage the existing limited and poor-quality services. At the same time, those who can afford to purchase private cars and motorcycles continue the cycle of insufficient public transportation and increasing motorization.

The Public Transport Modernization Program aims to improve the transport system by providing the responsibility of route identification to local governments. Cities and municipalities are mandated to prepare local development plans and are knowledgeable of the needs of their local areas. It is expected to address the long-overdue public transport supply gap problems, but yet another challenge emerged: local cities struggled to prepare transport plans due to lack of capacity and funding constraints. National transport policies need practical actions to support the application of environmentally sustainable transportation systems.

### **1.3. Objectives of the study**

This research discusses the applicability of the EST concept and indicators to support local cities in formulating local public transport route plans. The main objective includes three specific objectives:

- 1) To clarify and illustrate linkages of EST with the public transport modernization program, using the theory of sustainable development (environment, social, and economic);
- 2) To demonstrate a process for selecting representative sustainability indicators using topic modeling, and propose a set of indicators that can quantify an environmentally sustainable transport plan; and
- 3) To assess the Philippines' transport policy, funding, and planning guidelines, by comparing it with the proposed indicators, and recommending guidance for applying EST using an indicators data template for preparing sustainable transport plans.

The first objective will propose a model of EST and attempt to localize an EST concept for developing countries. Objective two will select indicators from a bottom-up identification of categories representing sustainability in literature. The final objective will introduce the indicators and potential data sources template and propose to be used by cities for preparing transport plans. The overall expected outcome of this research is to center EST concept and indicators in the city planning to prepare scientific and data-based transport plans to submit to the government. The latter will be able to provide demand-based public transport services, and the users will generate data and feedback systems in the next planning system.

### **1.4. Significance of the study**

There is no standard definition and indicators of sustainable transportation. Without a commonly agreed concept of EST, it becomes difficult for planners to apply

indicators in actual practice. In effect, research on sustainable transport indicators has focused on developing a set of measurements based on individual needs. The research addresses this gap by proposing a baseline sustainability concept in developing countries and validated this with small and medium cities and municipalities. Another academic contribution is demonstrating a process for selecting representative indicators in the existing literature to clarify a representative understanding of sustainable transportation. This research explored representative sustainable urban transport indicators in literature, identified potential data sources, and verified them for policy integration. Unlike previous studies, it contributes a combined image of sustainability indicators instead of proposing a new set of indicators from case studies, using existing policies to communicate the application of EST in the Philippines and primarily contributes to the national government by examining ways to support the implementation of local public transport planning. It demonstrates a case study to apply sustainable transport planning frameworks within the capacity and challenges of the Philippines and can contribute lessons to other developing countries facing similar challenges.

### **1.5. Scope and limitations**

This research focuses on the linkages between environmentally sustainable transportation and public transport route planning by assessing Philippine policies from the national level. The case study considers cities outside the Metro Manila areas included in the Public Transport Modernization Program. Data collection and availability are a universal challenge in developing countries. The research relies on academic publications and national and development policy documents as the primary data sources, followed by questionnaire surveys, local and national government key informant interviews, and expert validation. This research began during the COVID pandemic, when the Philippines was in lockdown from March 2020 to November 2021, making field visits and primary data collection not possible. Lockdowns also affected

mobility patterns, and restrictions on public transport services affected local conditions. Additionally, the 2022 national and local elections are another limitation. The COVID pandemic changed the mobility landscape globally, and it is important to recognize the impacts in this research, which also highlights the problems and possible solutions involving sustainable mobility. The study examined the acceptance and applicability of EST principles as COVID mobility responses in the Philippines. This study recognizes the importance of socio-economic impacts on public transport operations, particularly the displacement of jeepney drivers and other operators due to the lockdowns and public transport restrictions.

The ambitious goals of the PUVMP gained attention for researchers to study transport modernization from the following perspectives: state-led sustainability transitions, social equity and global south studies (Sunio, et al. 2019 & 2020; Mateo-Babiano, et al., 2020), electric vehicles as sustainable public transport (Aagaton, et al. 2019 & 2020), public transport jeepney operations, driver employment, and investment (Lagumbay, et al. 2018; Tacderas, et al. 2021; and Malasique, et al. 2022), and modeling public transport service quality (Tiglao, et.al, 2020). The mentioned studies focus on industry and governance transitions and vehicle modernization. On the other hand, the engagement of local cities in public transport route planning is yet to be studied and is the focus of this research.

## **1.6. Organization of the study**

This dissertation has eight chapters, shown in Figure 1-1. This chapter introduced the public transport situation in the Philippines which motivates this research. This introduction presented the problem, research hypothesis, scope and limitations and expected research contributions.

Chapter two is the literature review and shows the history of sustainable transportation and explores the basis for applying sustainability assessments at the developing country even when basic development needs (ex. public transport systems)



are yet to be established. Literature review on sustainability definitions, applications, frameworks, sustainable transport assessments, and public transport planning research are presented. It aims to show the common framing of sustainability (sustainable development) and sustainable transport (environmentally sustainable transport). This research uses both terms interchangeably.

Chapter three presents the research framework, and Chapter four presents the methodology and analysis frameworks used in this study. There is some overlap with the discussions of the chapters since the framework and methodology are linked. However, it was separated to introduce the specific tools used in the analysis, as found in the fourth chapter.

Chapters five, six, and seven are empirical chapters based on the three objectives of the research. Chapter five presented a proposed sustainability model and used images to clarify the concept of EST. It investigated transport mobility responses in the Philippines at the start of the lockdowns and explored Filipino people's awareness of EST concepts. Chapter six examined potential categories for sustainable transport indicators in literature and selected indicators that represent a combined understanding of sustainable transport. Chapter seven is a case study to assess the Philippines' policy, funding, and guidelines. It compares the selected indicators with the transport planning manual and identifies potential data sources for measuring transport sustainability. A second part of the chapter involves validation from local cities and transport experts regarding the results of the first and second objectives.

Chapter eight summarizes the study's findings and implications for the research objectives. It concludes the significant outputs of the research and recommends improvements for the transport planning guidelines in applying EST. Contributions and limitations of the research will be presented again with suggested directions for future research.

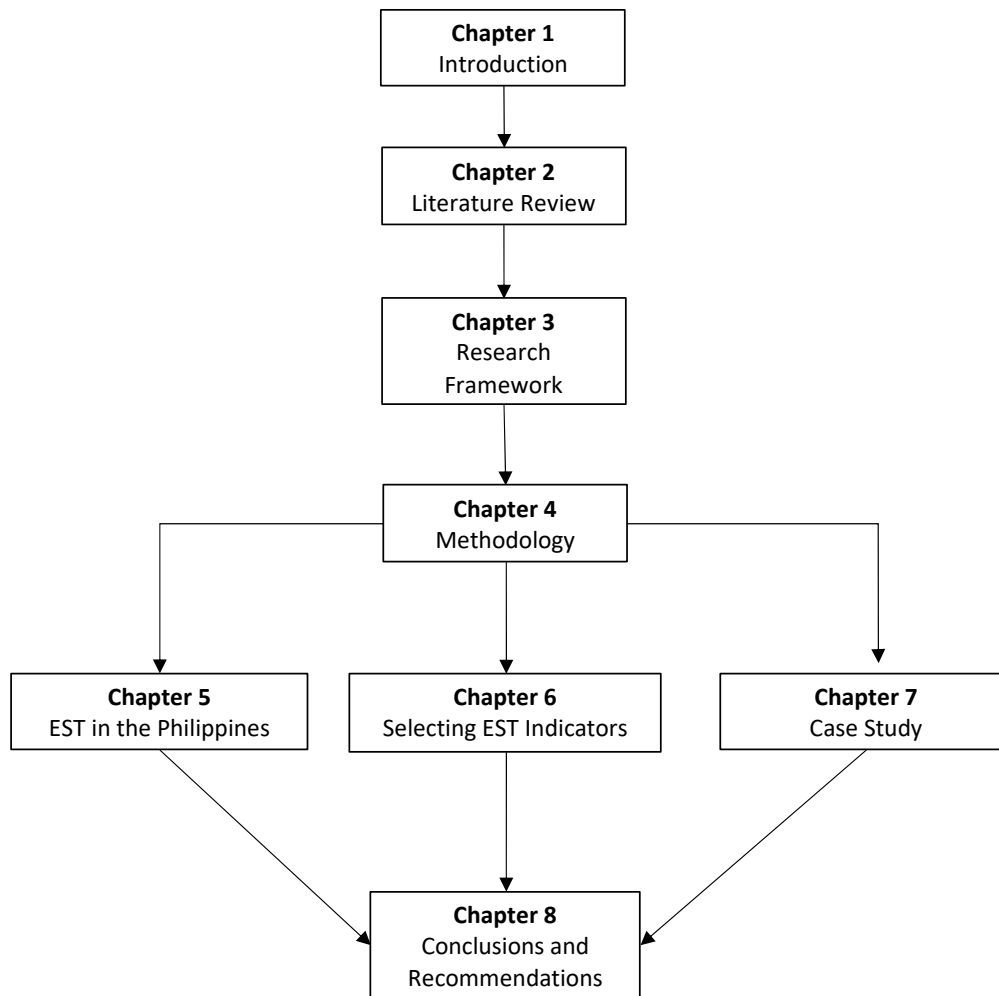


Figure 1-1 Organization of the study

## **2. Chapter II: Literature Review**

### **2.1. Environmentally Sustainable Transport**

Sustainability (sustainable development) refers to *“development that meets the needs of the present without compromising the ability of future generations to meet their own needs”* as defined in the Brundtland Report “Our Common Future” and World Commission on Environment and Development (WCED, 1987). The sustainability concept gained worldwide recognition in the 1992 Earth Summit Rio Declaration on Environment and Development also called as Agenda 21. Agenda 21 called on both developed and developing nations to participate in environmentally sustainable development (UNCED, 1992) and it recognizes that countries need to consider environmental sustainability in achieving its development goals. Voluntarily, nations are to prepare localized policies to address sustainable development at the national and local levels. Agenda 21 is an agreement among countries, but it also encourages the private sector to be involved in eco-sustainable businesses.

In 1994, the United Nations Framework Convention on Climate Change and its Protocols (UNFCCC) was established as an international effort designed to address the impacts of climate change. This was followed by the Kyoto Protocol (1997) that called for greenhouse gas (GHG) emission reduction targets. The Global cooperation on transport and the environment gained attention with the Vienna Declaration of the United Nations Economic Commission for Europe (UNECE) in 1997. And brought attention to the important role of transport in achieving sustainability with the concept of environmentally sustainable transport where (transport) *“does not endanger public health or ecosystems and meets needs for access consistent with (a) use of renewable resources below their rates of regeneration, and (b) use of non-renewable resources below the rates of development of renewable substitutes”* (OECD, 2000).

The Organization for Economic Co-operation and Development (OECD) EST Guidelines called on global responsibility and co-operation for sustainable

development. The Ministry of the Environment of Japan is the partner in promoting Environmentally Sustainable Transport (EST) in the Asian Region. In 2005, the Japan Ministry of the Environment and the United Nations Regional Development Center (UNCRD) established the Asia EST Forum. Prior to the formal establishment, The Philippines hosted the Manila Policy Dialogue on Environment and Transport in the Asian Region, called the Manila Statement (2004). The Manila Statement formally agreed to establish the Asia EST Regional Forum and requested the UNCRD to coordinate and support its activities. It recognized the need for strategic planning at the regional, national and local levels. Asian countries should work together to address the negative externalities of transportation, such as air pollution and health problems. The Asia EST Forum calls on member countries to discuss and share information on EST policies and invites Government Officials and experts in environmental and transportation fields, creating a venue to seek advice and foster support for adapting EST. The Forum has four main activities: 1. Policy and information sharing of EST; 2. Providing advice from environmental and transport academic experts; 3. Supporting the development of national EST strategies and action plans in developing countries and support for realizing action plans through international cooperation. And 4. Establishing regional actions, initiatives and collaboration to promote EST. The Philippines became the first member country to develop a National Environmentally Sustainable Transport Strategy in 2011.

## **2.2. Definitions of sustainability**

The Brundtland Report "*Our Common Future*" introduced sustainability to focus on providing for the needs of the present and future. There is a general recognition of the Brundtland Report and sustainable development to include the environment, society, and the economy. It initiated a global acknowledgment of sustainable development and became widely used in national policy, research, and business. Unlike the title of the report, the concept of sustainability does not have

one *common* definition. This is also considered for environmentally sustainable transport, where there is no standard definition (UNCRD, 2012). The OECD proposed a definition where environmentally sustainable transport is “*transportation that does not endanger public health or ecosystems and that meets needs for access consistent with (a) use of renewable resources that are below their rates of regeneration, and (b) use of non-renewable resources below the rates of development of renewable substitutes*” (OECD, 2002). Related to this definition Wiederkehr, et.al. (2004) suggested EST shares the broad definition of sustainable development and describes a sustainable transport system that can move goods and services that are viable to the environment, society, and economy.

Nijkamp (1994) clarified transportation is not solely directed to environmental impacts but has much to do with both economic and social pillars. As economic progress cannot do without the movement of people, goods, and services, it goes without saying transport is a vital component of sustainable development. Beatley, 1995 suggests the word “sustainability” is used to guide professional practice. There is also no universally accepted definition of sustainability, sustainable development, or sustainable transport (Beatley, 1995). Goodland (1995) discussed the concept of environmental sustainability as an overlap with social and economic sustainability, but distinctly different. Inputs necessary for basic social needs and economic growth are sourced from the environment. This relationship implies stress on the environment that can make it difficult to recover. Goodland considers an environmentally sustainable system where the natural capital is maintained, balancing inputs and outputs, and recognizes due to the nature of economic growth and social development, this can be hardly seen in actual practice. In the real world, a balancing act where economic growth will provide trickle-down effects to support society, and find ways to clean up the environment, this ‘*natural allegiance*’, cannot be found in practice (Banister, 2005).

The attractiveness of the sustainability concept transcended different sectors with different sectors providing variations of interpreting the definition. Miller, et.al., 2016 classified sustainability definitions as *aspirational* (general guidance for sustainability and transport) or *objective-oriented* (specific measurements for a system to be sustainable). Aspirational definitions are shown in the example by Black, (2010) which references the Brundtland definition of “*transportation that satisfies the current transportation and mobility needs without compromising the ability of future generations to meet those needs*”. On the other hand, an objective definition uses specific measurements for sustainability. The points raised by Goodland (1995) and Bannister (2005) can be observed in the definition of the Centre for Sustainable Transportation (CST, 2005) where a sustainable transport system 1) allows for the basic needs of individuals, companies, and society to be met safely and in a manner consistent with human and ecosystem health, and promoting equity within and between successive generations; 2) is affordable, operates fairly and efficiently, offers a choice of transportation mode, and supports a competitive economy, as well as balanced regional development; 3) limits emissions and waste within the planet’s ability to absorb them, uses renewable sources at or below their rates of generation and uses non-renewable resources at or below the rates of development of renewable substitutes while minimizing the use of land and the generation of noise. Dallmann and Huizenga, 2010 adapted the CST definition to consider the three dimensions of sustainability: social, economic, and environmental with the abovementioned features. And added 4) is designed in a participatory process, which involves relevant stakeholders in all parts of the society (degree of participation). *A low-carbon, sustainable transport reduces short and long-term negative impacts on the local and global environments, has economically viable infrastructure and operation, and provides safe and secure access for both persons and goods* (Dalkmann and Huizenga, 2010). Another perspective that considers the spatial and time-bound attributes of

sustainability in planning is that sustainable planning means local, short-term decisions are consistent with strategic, regional, and global, long-term goals (Litman, 2011).

Alternatively, the issue of the definition should not be considered a problem (Costanza and Pattern, 1995). Prevailing sustainability definitions describe the ideal future, rather than debating definitions, research should focus on how to achieve this desired future. Sustainability should be concerned with (1) what system persists, (2) how long can it last, and (3) when can it be assessed that the system persisted. Sustainability is often used as a compromise for competing interests this general definition posts more questions on what is to be measured and managed (Kates, et.al 2005). Most definitions of sustainability consider what is desirable, convenient, and measurable for the user group (OECD, 2000; Litman, 2011; White, 2013; Vàsquez, et. al 2018). Jeon and Amekudzi (2005) concluded there is no standard definition for transportation sustainability. In a study on characterizing sustainable transport and sustainability, mission statements from 15 Departments of Transportation in the United States and 16 sustainable transport initiatives from the United States, Canada, United Kingdom, and New Zealand, revealed a pattern in describing sustainable transport as *“effective and efficient in providing its users with equitable and safe access to basic social and economic services, should promote economic development, and not be harmful to the environment”*. A practical consideration for sustainable transport and infrastructure should consider 1) what is the right vision for a particular community and 2) how can this community most effectively achieve this vision? (Jeon and Amekudzi, 2005). The latter direction of sustainability definitions is observed to move from the environmental resource use to the concept of a sustainable society. Sustainability as defined to continue the capacity for the long-term future generations show a focus on sustainable societies, where it is expected each individual has the right to a “better quality of life”. The challenge for sustainability is how to separate social progress and economic growth from the expected negative environmental impacts (Litman, 2017).

In summary, definitions of sustainability involve the three dimensions of environment, society, and economy. It involves, time-frames and spatial attributes. Planning for sustainability considers the vision of a desired future for the users, involves participation from stakeholders, and expects sustainability will improve the quality of individual members of society. All these considered illustrate a comprehensive understanding of sustainability. It is considered a *broad* definition of sustainable transport and conversely, when sustainable transport only considers the negative impacts of motorization on the environment, it is a *narrow* definition (Zhao, et.al, 2020; Litman, 2011).

### **2.3. Applying sustainability in transport**

Sustainability is applied to address the negative externalities of transportation. Banister (2005) presented unsustainable transport in the context of cities and development. The increasing trends in rapid motorization are commonplace in developing countries even where less road space is available, car ownership rates are increasing. The most common symptom of this trend is traffic congestion associated with higher pollution emissions, economic productivity loss, and lower quality of life. Most developing countries do not have basic infrastructure and investing in roads has a strong impact on accessibility and it is not desirable to accommodate the expected demand for motor vehicle travel. Policies should consider seven basic principles to reduce the unsustainable impacts of transport. These include 1) reducing the need to travel 2) limiting car and road freight use in urban areas, 3) promoting energy-efficient modes for passenger and freight, 4) reducing noise and vehicle emissions at source, 5) promoting environmentally friendly vehicles, 6) improving pedestrian safety for all road users, and 7) improving the attractiveness of cities for all residents, workers, shoppers, and visitors (Banister, 2005). Kennedy, et.al (2005) view transportation and land use as currently unsustainable, and to address it prescribed four pillars that support the three dimensions of sustainability that are needed to achieve a more



sustainable future. The four pillars provide clarity to the factors that can be changed and are supporters to achieve sustainable transport systems.

1. *Governance – refers to the effective governance of land use and transportation*
2. *Funding – refers to fair and efficient, stable funding*
3. *Infrastructure – refers to strategic infrastructure investments*
4. *Neighborhood – refers to neighborhood design*

Sustainable transport is a widely acknowledged necessity of cities. Social and economic activities, through the movement of goods and services negatively impact the environment. Considering the application of sustainable transport in countries, nine key challenges in the transport sector were identified: air pollution, climate change, congestion, energy intensity, and natural resource consumption, energy security, equity of access, habitat fragmentation and land consumption noise, and road safety. Addressing one of these challenges will have significant co-benefits as these impacts are strongly connected. Governments can utilize indicators to measure the outputs of actions that aim to address these challenges (Bongardt, et. al, 2010).

Related to indicators, Litman (2010) introduced a starting point of ten key indicators for sustainable transportation. The indicators are consistent with the definitions of sustainability discussed in the previous section and show the importance of governance in enacting policies and also involving a participatory decision for transport policies and projects.

Table 2-1 Ten key indicators for sustainable transport

Dimension/Indicator	Goal
<b>Environment</b>	
1. Land consumption by transport infrastructure (as % of total surface)	Avoid sprawl and destruction of the environment by transport infrastructure
2. Transport GHG emissions per capita	Reduce transport contribution to climate change
3. Percentage of population affected by local air pollutants	Reduce detrimental effects on human health and the environment
<b>Social (Equity)</b>	
4. Road fatalities	Reduce the number of people killed or injured in road traffic accidents
5. Modal share of public transport and NMT	Foster transport modes that are both accessible for a large part of the population and environmentally sound
6. Share of transport cost from total household expenditure	Provide affordable transportation for all members of the society
<b>Economy</b>	
7. Minimum taxation on fuel	Consider the external costs caused by transportation based on fossil fuels (especially road traffic)
8. Transport investments by mode	Prefer transport modes that are accessible and environmentally sound
9. PKT/TKM per unit GDP	Decouple economic growth from transport demand
<b>Governance</b>	
10. Participatory transport planning	Involve the public in the decision process for transport policies and projects

Source: Litman, 2010. Adapted from Bongardt, et.al. 2011.

Public transport applications to the sustainability focus on providing efficient systems that can become alternatives to private car use. Previous discussions clarified the role of transport in both driving and hampering sustainable development. Public transport is recognized as a key component of sustainability and a tool to limit the negative impacts of car dependence in cities (Miller, 2016). The concept of the transit leverage effect was proposed by Newman and Kenworthy to demonstrate the significant impact of public transport where increasing the transit use per capita will exponentially reduce the use of cars per capita. Where car trips consider one purpose, public transport users can link multiple trip purposes by walking to and from public transit called “trip-chaining”. This represents small increases in public transport that

can help to mitigate car use (Newman and Kenworthy, 2015). Public transport also has additional effects of influencing businesses and people to adjust location behavior, influencing households to give up the car for public transport, and public transport users to walk or use cycling to reach public transport stations or stops.

## 2.4. EST application in developed and developing countries

Sustainable transportation actions in developed countries focus on regulating private vehicles through fiscal policies such as congestion charging and infrastructure-related high occupancy vehicle (HOV) lanes and toll roads. Developing countries consider introducing road-based public transport systems such as bus rapid transit (BRT). The table below briefly introduces some EST actions conducted in developed and developing countries and cities.

Table 2-2 EST in developed and developing countries

	EST Actions	Developed	Developing
Private vehicle related	Car-free days	Dortmund (Germany) Fukuoka (Japan)	Bangkok (Thailand) Pasig (Philippines)
	Car sharing / Car pooling	UK, USA, Germany, Fukuoka (Japan)	
	Emission standards	Europe	Bangkok (Thailand) Beijing and Shanghai (China)
	License plate bidding system	Singapore	Shanghai (China)
	Park and ride	UK, USA, Singapore	
	Road pricing / toll charges / congestion charge / HOV lanes	London (UK), Singapore	
Land use planning integration and public transport	Bicycle network and pedestrian facilities	Denmark, London (UK)	Iloilo and Pasig (Philippines)
	Bus rapid transit (BRT)	Los Angeles (USA)	Curitiba (Brazil), Bogota (Colombia) Jinan (China), Jakarta (Indonesia)
	Public transport systems integration	Japan, Singapore, Hong Kong	
	Travel awareness initiative	Australia, Sapporo (Japan)	

Sources: (Matsumoto, et.al 2007; Santos, et.al 2010; Garcia, et.al, 2022)

The EST actions are grouped as regulatory measures for private vehicles and includes restrictions on vehicle use (car-free) and purchasing vehicles using the license

plate bidding system in Singapore and Shanghai. It is worth noting developed countries have higher motorization rates and integrated public transport system options compared to developing country counterparts (Santos, et.al, 2010). Additionally, developed countries have clear economic policy instruments in place to promote EST. Elvik and Ramjerdi (2014) studied successful EST promotion can be achieved through policies related to (1) prices of motor fuel; (2) congestion charges; (3) toll schemes; and (4) reward systems for drivers to change behavior and can be seen as part of the entries for developed countries. Note that car-free days are implemented in Bangkok (Thailand) and Pasig (Philippines), which are metropolitan cities experiencing traffic congestion.

The pathways of transport in developing country cities once focused on public transport, walking and cycling. In the early 1970s Manila introduced the bus system, however the rapid motorization continued with preference for roadworks and less investment on public transport. The result is the saturation and continued motorization experienced in Manila. Figure 2-1 is modified from the Urban Accessibility Pathways based on Barter's city typology and transport development paths presented in Rode and Floater (2014). The typology describes public transport requires high density while private cars require high space disbursement. This idea is also mentioned by Rodrigue (2020) where in North American countries the car dependency is 90% and the spatial structure is far separated and low automobile dependency implies dense cities with transportation alternatives. In Figure 2-2 it is explained areas with automobile dependency lower than 50% means spatial structures are low where transit or public transport is centralized over space and there are many different alternatives than private cars. On the other hand developing country public transport mode trip share is high, but does not mean transportation alternatives are available. The figure is more representative of wealthier southeast Asian countries like Singapore and Hongkong

with high densities and integrated public transport network and government regulations on car ownership (Santos, et.al., 2010).

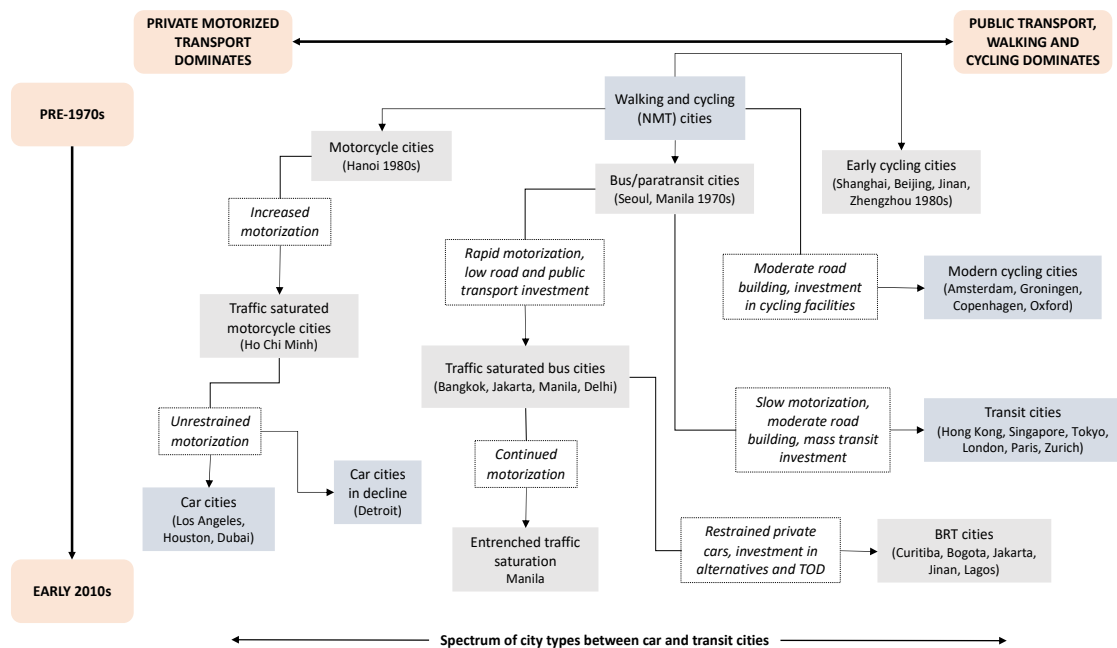


Figure 2-1 Urban Accessibility Pathways (Rode and Floater, 2014)

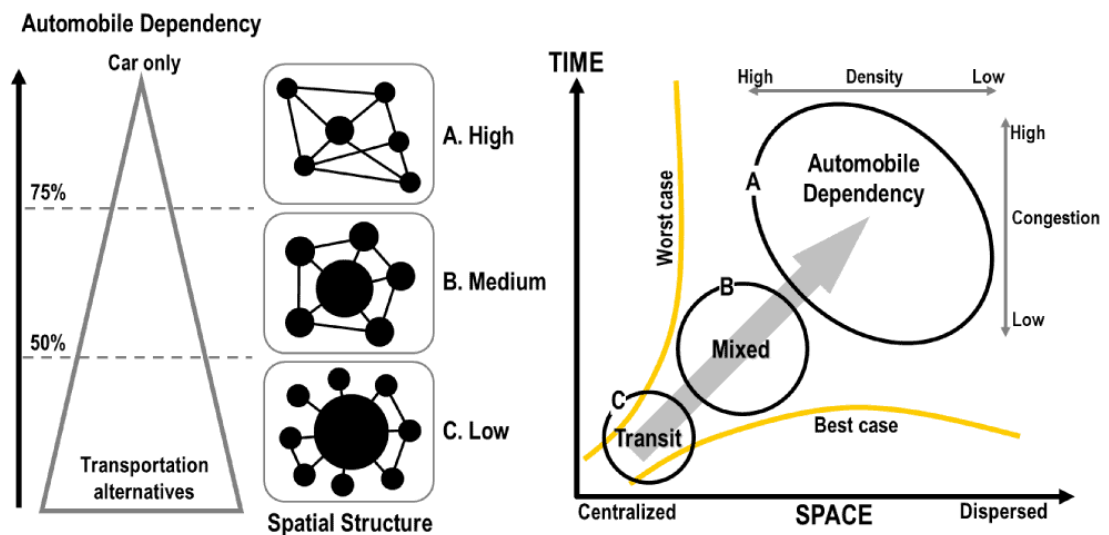


Figure 2-2 Automobile Dependency, Space / Time Relationships and Modal Choice (Rodrigue, 2020)

Cities in developing countries still need to focus on meeting basic infrastructure, road maintenance, and quality improvement. Weak public transport systems, limited road space, and traffic congestion is the main challenge to mobility for developing cities (Collier, et.al, 2020). Motorization rates in developing countries are still relatively low,

especially in rural areas, government interest in road infrastructure investment, and the attractiveness of owning private vehicles for “status” is a cultural factor (Santos, et. al., 2010; Wright and Fulton, 2005; Barter, Kenworthy, & Laube, 2003). Developing countries may benefit more from adapting the Land use planning integration and public transport approach of Singapore and Hong Kong (Santos, et.al. 2014).

## **2.5. Sustainable transport assessments**

Sustainability is assessed using frameworks and indicators to measure the progress of transport systems toward meeting the defined goal. Considering there is no standard definition of sustainability, different user groups worldwide have proposed initiatives and frameworks toward a specified desired future. Jeon and Amekudzi (2005) characterized emerging sustainability definitions and indicators in North America, Europe, and Oceania and found transport research initiatives reinforce the definition of sustainability as a critical element in developing indicators and metrics. A consensus on including the impacts on the environment, economy, and social well-being was found. Additional factors include the level of influence of oversight agencies to implement policies and procedures that affect sustainability; the appropriate balance of input and output measures; and a strong stakeholder component. Sustainability indicators are measured in transportation system effectiveness, efficiency, and the environmental impacts of the system. It identified a gap in recognizing the important role of education for social sustainability and that of infrastructure sustainability. Frameworks to determine indicator systems for measuring sustainability were classified and can be combined.

- “linkages-based” – refers to frameworks that capture relationships between causal factors.
- “impacts-based” – refers to capturing the nature and extent of impacts on economic, environment, and social dimensions to collectively determine the sustainability of a system.

- “influence-based” – refers to the level of influence of the agency or organization responsible for progress in sustainability.
- “process-based” or stakeholder approaches – refers to developing consensus with the community in creating a vision for sustainability.

Ramani, et, al (2011) proposed a generally applicable sustainability framework for sustainability assessment by transportation agencies (Figure 2-3). The framework approaches sustainability into key concepts and developing strategies to operationalize it within the boundaries of the system. An emphasis on the integrated design and coherence of policies related to improve social, environmental, and economic performance of the transport sector should not dampen the performance of other sectors. The feedback systems at every stage of the assessment is highlighted.

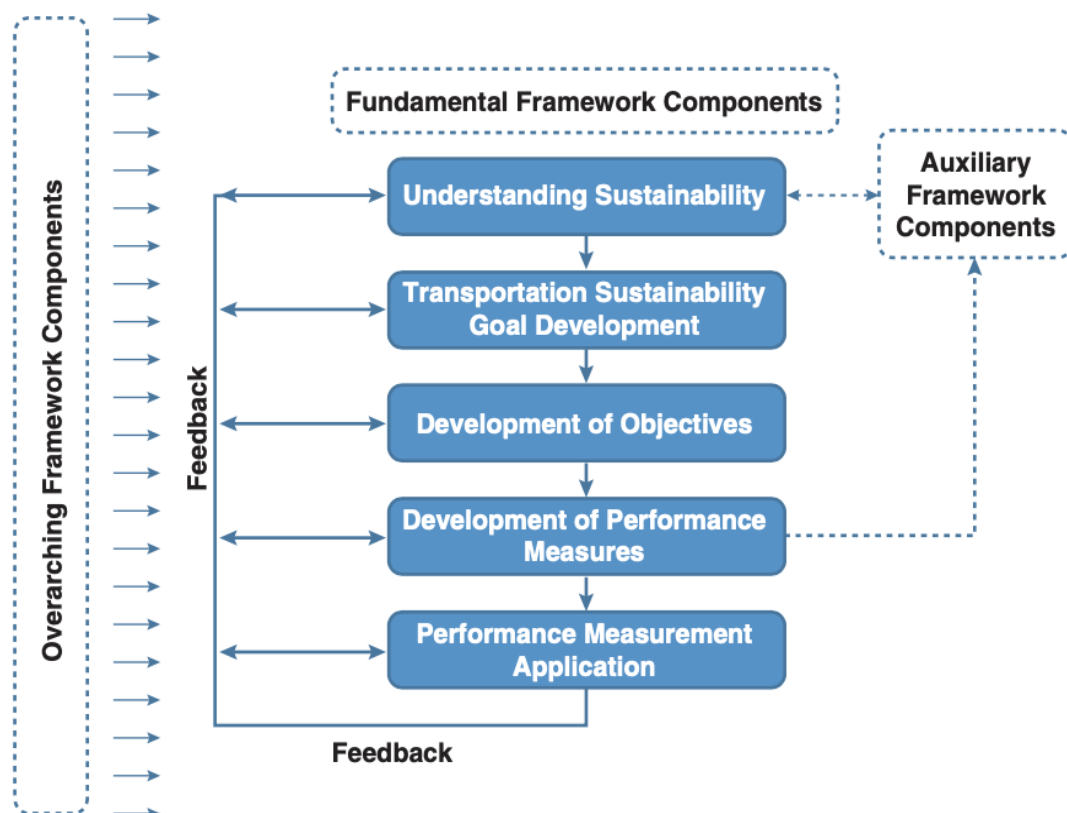


Figure 2-3 Transport sustainability assessment (Ramani, et.al, 2011)

Richardson (2005) focused on specific frameworks and identified the passenger and freight factors that affect the sustainability of the transport system which can be affected by government policy or industry action. The frameworks emphasize the tradeoffs between the factors and present the relationships and feedback mechanisms. For passenger transport, the factors are safety, fuel consumption, congestion, environment, and access. These passenger factors are further influenced by the individual physical, psychological, and social needs.

An indicator is a variable selected to define and measure progress toward an objective. Objectives are a means to achieve a goal or something that is desired, in this case, sustainable transport. Litman (2007) presented the best practices and principles to follow in selecting indicators for transportation performance as 1) comprehensive, 2) data quality, 3) comparable data, 4) easy to understand, 5) accessible and transparent, 6) cost-effective, 7) considers net effects, and 8) suitable for performance targets. While there are no standard indicators for sustainable transport planning, organizations must develop their own set based on the needs and capabilities. Additionally, Litman (2011) explained the differences in measuring transportation, mobility as shown in Table 2-3. Among the three, accessibility measurements are considered to incorporate sustainability principles.



Table 2-3 Different measurements for transportation

	Traffic	Mobility	Access
<i>Definition of transportation</i>	Vehicle travel	Person and goods movement	Ability to obtain goods, services and activities
<i>Unit of measure</i>	Vehicle-miles and vehicle trips	Person-miles, person trips and ton-miles	Trips
<i>Modes considered</i>	Automobile and truck	Automobile, truck and public transit	All modes including mobility substitutes such as telecommuting
<i>Common performance indicators</i>	Vehicle traffic volumes and speeds, road way Level of service, costs per vehicle-mile, parking convenience	Person-trip volumes and speeds, road and transit Level of Service, cost per person-trip, travel convenience	Multi-modal Level of Service, land use accessibility, generalized cost to reach activities
<i>Assumptions concerning what benefits consumers</i>	Maximum vehicle milage and speed, convenient parking, low vehicle costs	Maximum personal travel and goods movement	Maximum transport options, convenience, land use accessibility, cost efficiency.
<i>Consideration of land use</i>	Favors low-density, urban fringe development patterns	Favors some land use clustering, to accommodate transit	Favors land use clustering, mix and connectivity.
<i>Favored transport improvement strategies</i>	Increased road and parking capacity, speed and safety	Increased transport system capacity, seats and safety	Improved mobility, mobility substitutes and land use accessibility.

Source: Litman, 2011

Castillo and Pitfield (2010) proposed a framework for selecting indicators called Evaluative and Logical Approach to Sustainable Transport Indicator Compilation (ELASTIC). It involves a multi-criteria decision methodology. The framework aims to provide the smallest possible set of appropriate indicators, judged by stakeholders, to assess the sustainability performance of a transport system. Stakeholders will score indicators based on five criteria: 1) measurability, 2) ease of availability, 3) speed of availability, 4) interpretability, and 5) transport's isolatable impact. The second round of surveys will ask stakeholders to score the importance of pairs of indicators. The ELASTIC method relies on the value judgments of stakeholders and is considered a process-based or stakeholder approach framework.

Karjalainen and Juhola (2021) set to examine how urban transportation sustainability is assessed in academic literature. In terms of assessment methods, multi-criteria decision analysis (MCDA) is the most common, followed by indicator or framework development, modeling, and simulations. The review identified 24 categories for the most frequently applied indicators. The thematic groups include GHG emissions; air pollutants; noise pollution; energy and resource use; land use; physical access; access with disabilities; socio-economic access; safety and security; accidents and fatalities; travel time and traffic flow; trips; walking; cycling; private motorized transport; public transportation; modal share; governance and public participation; finance and economy; expenditure and costs; revenue; user costs; environment; quality of life, equity, and livability. Some gaps in literature found include the limited focus on the perception (feeling) of safety; health impacts unrelated to emissions are often not considered. Governance while often mentioned, is only represented by public participation. Comfort, crowdedness, and cleanliness of public transportation; citizen satisfaction and perceptions are considered to congestion, noise disturbances, or reliability of public transport. Walking and cycling considerations were also found to be limited. It presented key issues in the academic literature on urban transportation sustainability assessments to include: a focus on the global North, the absence of comparative studies where most studies are the single case, and focused on motorized transportation versus walking and cycling. The review observed tendencies to introduce new assessment indicators and frameworks. Analysis revealed current research is highly fragmented and fails to acknowledge lessons from previous assessments and recommended the development of more reliable, comparable, and inclusive sustainability assessments for the urban transport sector. Finally, it is suggested future research to establish common criteria for sustainability assessments, consideration for improving local knowledge utilization and focusing on urban areas in developing countries, as well as identify new ways to generate data.

## **2.6. Summary**

There is a strong focus to define sustainability in terms of the environment, economy, and society regarding time frames and spatial scales in terms of impact. And where it is generally accepted the three pillars are the foundation of any sustainability definition, framework, and assessment. Literature also provides evidence of the critical importance of influence from governments and organizations to effectively apply policies and actions to meet sustainable development goals. In terms of frameworks used to identify sustainability measurements, a combination of frameworks with a focus on comprehensively considering the three dimensions, wherein data is available, and is consulted with stakeholders is a preferred approach. Common to the assessment frameworks is the intent to ground the large concept of sustainability into measurable actions by the government sector and institutions. Related to developing countries, it appears EST focusing only on private vehicles is not enough to introduce sustainability. Developing countries should focus on integrating land use and public transport systems, and preserve the high public transport mode trip share. Lastly, there is a general call to develop standardized criteria and standards to measure transportation sustainability where an emphasis on accessibility, including all modes and even telecommuting is being measured.

### 3. Chapter III: Research Framework

This chapter introduces the theories, concepts, and frameworks used in the study to achieve the main objective of applying EST in the Philippines through local public transport planning (Figure 3-1). The first specific objective looks at transport policy from the sustainability perspective and attempts to visualize relationships and present an understanding of sustainable transport. The second objective collects sustainable transport indicators from academic literature and operational indicators. It aims to discover and select representative sustainability indicators using the knowledge discovery method of text mining. The third and final objective uses the proposed conceptual model and selected indicators to validate the applicability in the Philippines.

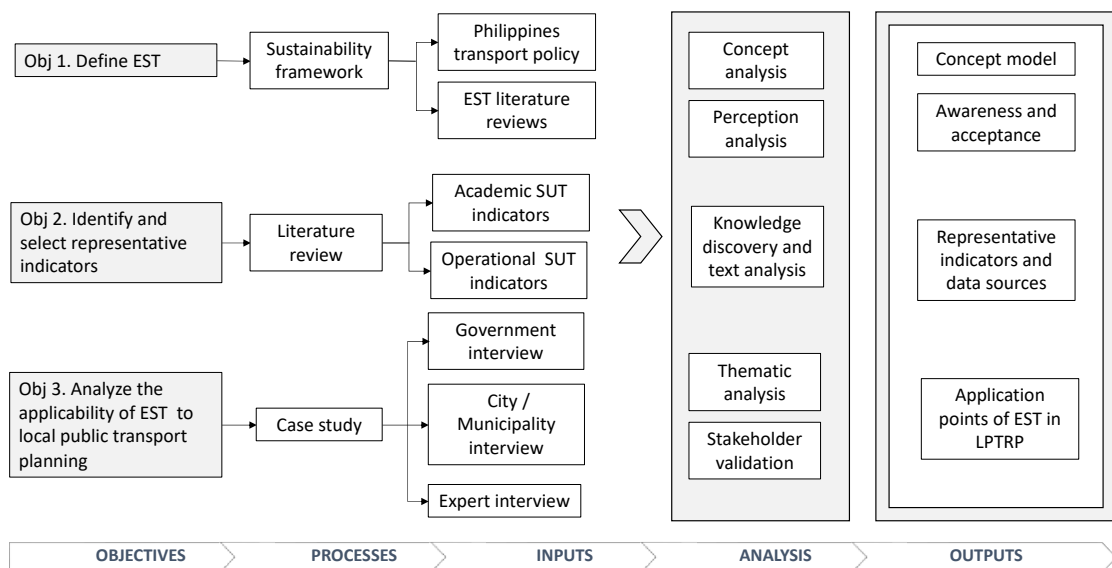


Figure 3-1 Research framework

#### 3.1. Theory and concept visualization

This research uses the sustainability concept, wherein a comprehensive understanding of sustainability considers environmental, economic, and social dimensions (Jeon, 2007, Litman, 2007; Zhao, et.al 2020). Sustainability is a central concept applied in many academic fields, including social sciences and engineering. Many other disciplines also use and interpret sustainability. Due to the complexity,

applying the concept to policy and creating targeted actions can be difficult. Especially with the acceptance that sustainable development concept is contested and agreed to be “*everything and nothing*” at the same time (Connolly, 2007). To address this gap, this research uses visualization as an approach to communicate what sustainable transportation is in the context of a developing country. Researchers have employed concept visualization mapping and consensus building through word clouds to illustrate and “*carry the message*” of the elusive definition of sustainability (Connolly, 2007; White, 2013). Novak et.al (2008) clarifies the importance of communicating concepts through models, using concept maps as a learning and exploratory tool where users can discuss, validate, and agree on ideas. Related to all three objectives, the first visualization approach aims to set a common baseline of expectations; this asks what users need and want to continue (sustain) for the future, noting the intergenerational feature of sustainability. The second point considers indicators’ academic and operational discourse and asks if this reflects the users’ expectations. The third point focuses on the application and asks whether data is available to support EST.

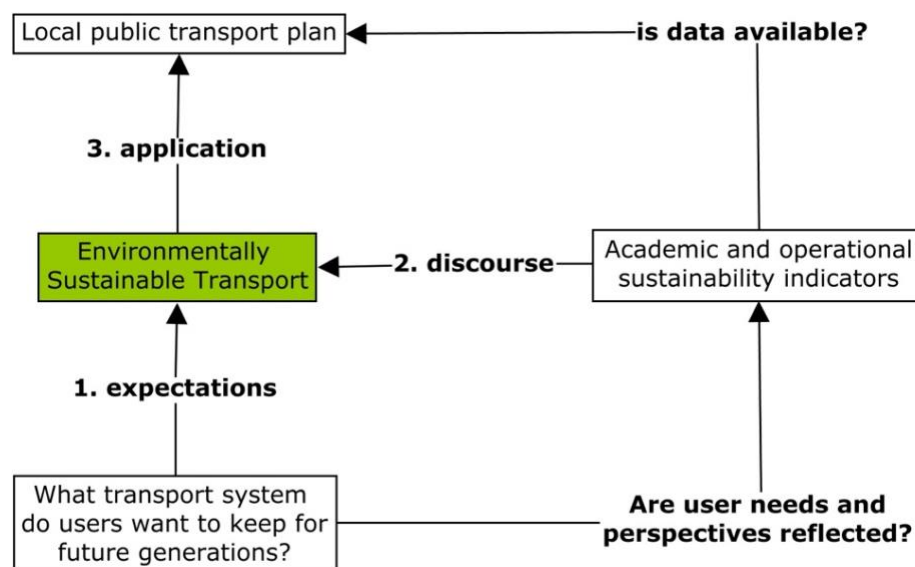


Figure 3-2 Research questions

In the background and motivation, the study introduced the problems and unsustainable characteristics of transportation in the Philippines. Sustainability science

is solution-oriented, problem-solving oriented, and generates knowledge toward guiding society to transition toward sustainability (Abson, et.al, 2017). Action theories in sustainability frame or guide this transformation by examining the interdependency of institutions, technologies, mindsets, and actors to steer sustainability (Schlüter, et.al. 2022). Abson, et.al (2017) uses systems thinking action theory and identified three leverages for sustainability transformation re-structure change, stability, and learning in institutions; re-think the intention of sustainable transformation and select the appropriate design or methods that will achieve it. And re-connect or understand how people behave with nature. Figure 3-2 considers (re-thinks) the intent of local public transport plan policy and examines if the measurements in current indicators discourse can meet its objectives. The re-connect leverage is explored in the users expectations of sustainable transport systems and analyses the perceptions and acceptance for environmentally-friendly modes and whether this meets the current directions of the society, and future societies. Finally, re-structure examines the institutional systems, policies, and actors involved in communicating and applying the sustainability concept.

### **3.2. Knowledge discovery and text analysis**

This research uses descriptive and exploratory analysis on academic papers on sustainable transport indicators and operational transport sustainability indicators using topic models. Mohr and Bogdanov (2013) defined topic models as an automated procedure for encoding text into substantive and meaningful categories or “topics”. The theory of topic models works under the presumption the meaning of words is relational, and the meanings that define a topic are created from the set of words that occur in discussions. Topic models begin with a collection of documents called corpus. The corpus is transformed into a “bag of words” and sorted into topics. The researcher selects the number of topics the algorithm finds and produces the probability and distribution of words in the topic. This unsupervised procedure is illustrated in Figure 3-3.

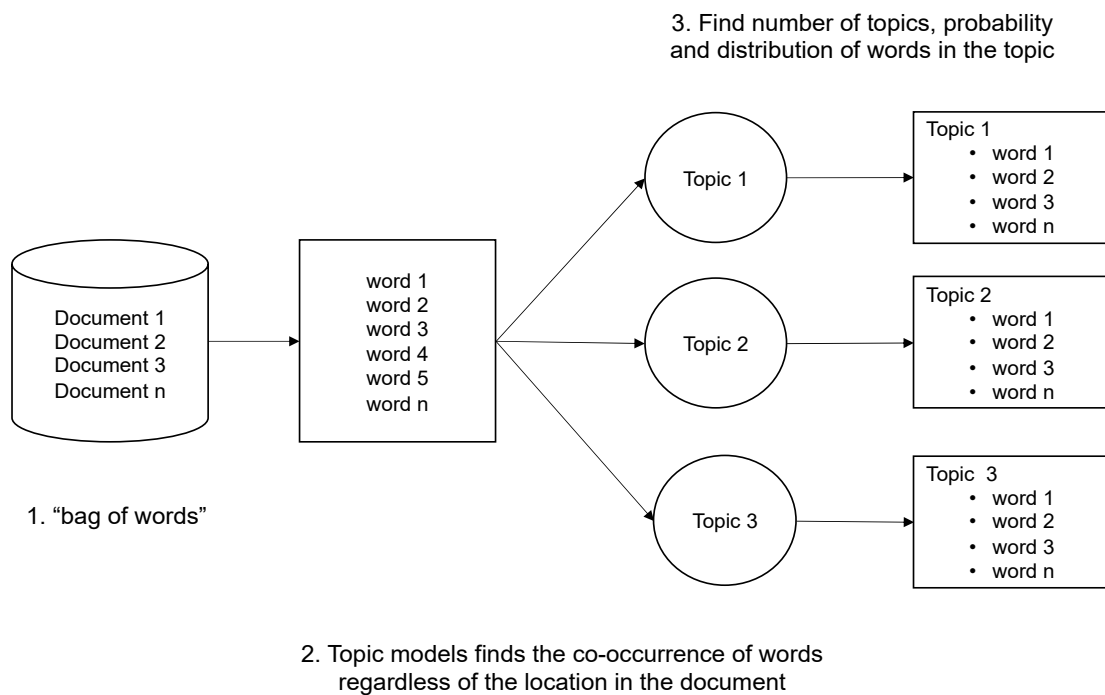


Figure 3-3 Unsupervised procedure (illustrated from Mohr and Bogdanov, 2013)

The importance of the topic is allowing researchers to automate the coding of large amounts of data (big data) objectively and more efficiently than traditional content analysis methods. Traditional manual coding of text is a resource and time-intensive process where, the researchers decide the categories at the start of the research, coders are trained, and the manual reading, coding, and counting process begins. Once the coding guidelines have been decided, it is difficult to revise the initial set parameters. On the contrary, topic modeling shifts the subjectivity of the method to the post-counting stage. The method also facilitates a macroscopic lens that allows researchers see how the discourse is changing. At the same time topic models can also examine smaller sets of data as studied by Mohr and Bogdanov (2013) to explore the ways topic models were used in eight academic papers.

On the limitations of the method, topic models require a meaningful dataset is considered before making the analysis. Regardless of how sophisticated the method, researchers can use topic modeling and text analysis as a lens to view phenomenon at a different light and scale. And a well-informed interpretation is required to

appreciate the value of the topic models. To address the meaningfulness of source data, the academic papers considered were collected from systematic literature review and includes global and regional perspectives (Appendix D). Another point is about the differences of results of this research with the systematic review mentioned in Chapter II. Topic model reverses the methodology of systematic reviews where categories are not determined by the researcher. This implies, the method of classifying categories is based on the statistical relevance of words used in the documents. The knowledge of the researcher comes later in the analysis stage. This is also the reason why the case studies and expert validations are part of this research framework. Since the topic model removes the context and sequence of how the words appeared in the documents, it is necessary to understand the context of the selected indicators in the real situation.

### **3.3. Case study framework**

Case study approach is commonly used to understand the context of a phenomenon and what factors are related to it. Cervero (1998) proposes the case study is not only rich in context but also effective in relating to policy makers in that is easily understood. To address the limitation that a case study can only be applicable in a specific context the variable-wise analysis can be adapted to find common themes and lessons present in different cases (Cervero, 1998). This research uses a mixed methods approach using questionnaire surveys, key informant interviews, document analysis and text mining. Contributors for the case study and validation include the implementing agency of the local public transport route plan from the government side. Selected cities and municipalities were also interviewed on their experiences in preparing the local public transport route plan to validate the variables or themes that were identified. Lastly, transportation experts with EST experience were interviewed as part of the validation and selection of indicators.



## 4. Chapter IV: Methodology

This chapter relates to the inputs and analysis portion presented in Figure 3-1 in the research framework chapter. The methodology, data analysis, and validation criteria to achieve the research objectives are discussed as follows.

### 4.1. Concept images

The first research objective research aims to establish what sustainable transport means in the Philippines context. To meet this objective, a methodology focused on creating images is shown in Figure 4-1. The first image of sustainability is drawn from existing models and a conceptual model in the Philippines will be proposed. On the second image, a questionnaire survey (Appendix A) will be conducted to find out the awareness and acceptance of Filipinos for implementing EST. The survey is premised with the COVID-19 pandemic mobility responses that reflect EST actions and asks respondents to describe an ideal transport future. A word cloud will be generated to create a collective definition from the respondent's answers.

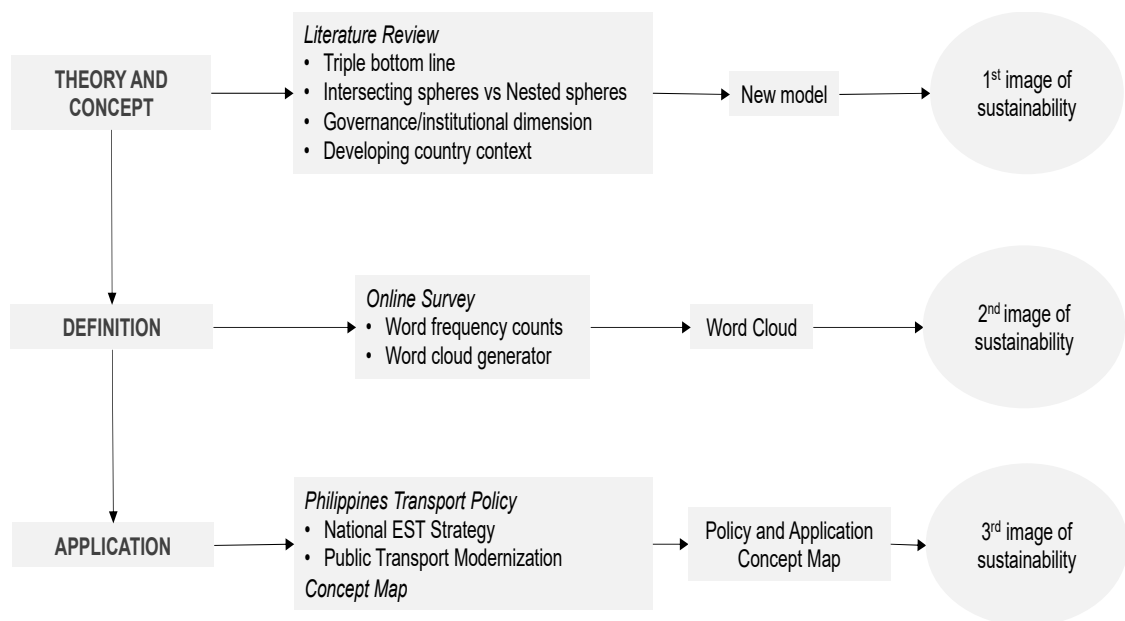


Figure 4-1 Methodological framework

A concept map is a tool to organize and represent knowledge using images.

Figure 4-2 illustrates the features and functions of *concept maps* to represent

organized knowledge and helps to answer “focus question(s)” (Novak and Cañas , 2008). The third image will examine the components of transport policies and linkages will be presented using this map. The three images are expected to clarify what is sustainable transport in the Philippines. By using images it is expected to propose a common baseline of the concept of sustainability in the Philippines.

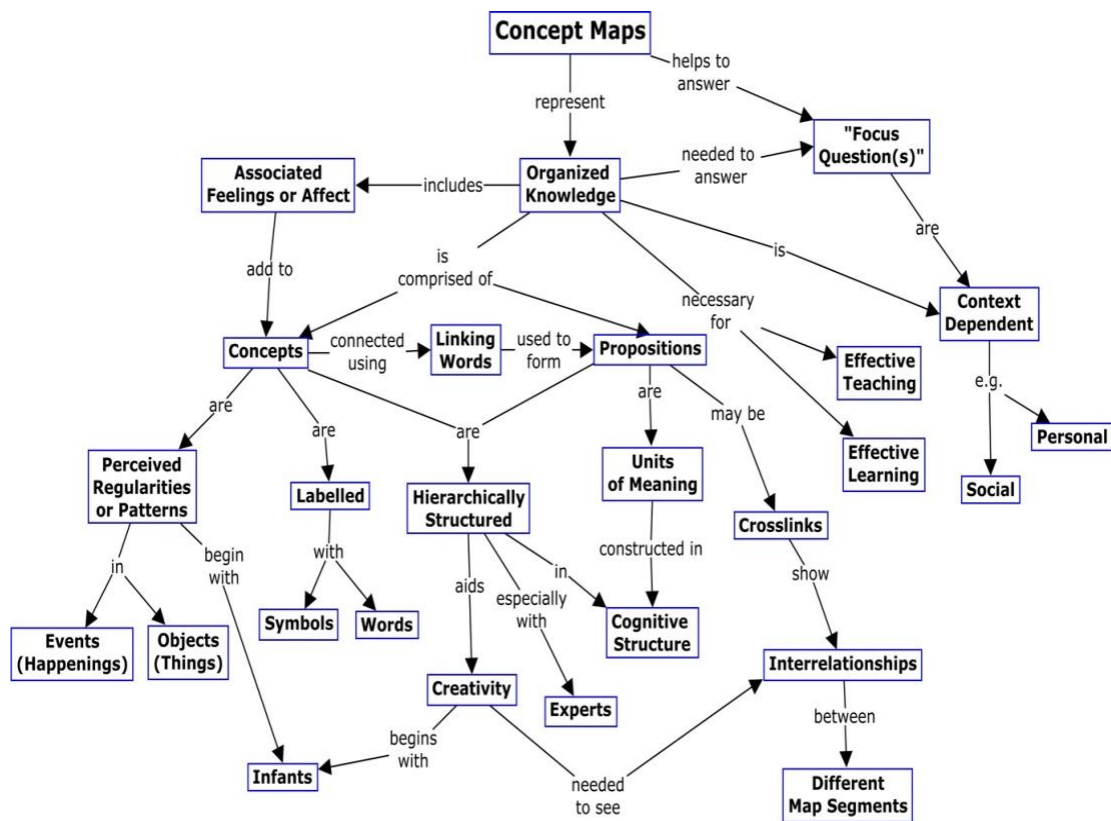


Figure 4-2 Key features of concept maps (Novak and Cañas, 2008)

## 4.2. Exploring indicators with knowledge discovery

### 4.2.1. Text mining and topic modeling

Text mining is a form of knowledge discovery in text, deriving high-quality information from unstructured word documents. It is an unsupervised method that allows for investigating connections and relationships among text databases. Topic modeling is a statistical model for discovering unstructured topics occurring in a collection of documents. Topic models automate text coding into sets of meaningful categories called “topics”. It differs from traditional hand-coding, where the researcher defines the code or categories before analyzing the text. The researcher specifies the

number of topics for the algorithm to find. The model returns the probability of words belonging to the topic and the distribution of the documents per topic (Mohr and Bogdanov, 2013). The value of the topic model is it clusters similar data into groups to allow researchers to discover similar clustering that may have been unknown. It offers a bottom-up perspective in analyzing data where specific text is analyzed to provide more general insights. The foundation of topic models is the Latent Dirichlet Allocation (LDA), developed by Blei, et.al. (2003). The LDA calculates the probability that the words belong to the same topic and can be used as an exploratory tool to answer what are the fundamental themes in the documents (Kinra, et.al, 2019). A visual representation of the topic modeling process is shown below. The topic model converts a document into small sets of numeric variables. After selecting the distribution of “topics” (colored boxes on the right), the algorithm chooses the word from the related topic (Kinra, et.al, 2019). LDA produces values on topic prevalence or the words about a document and the topic content or the words that belong to a topic.

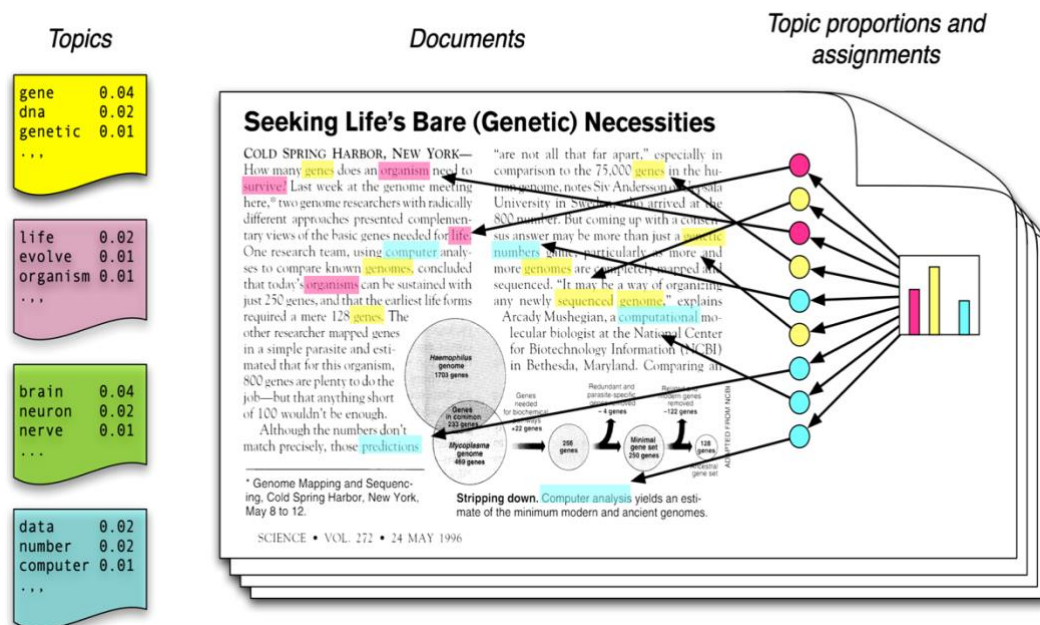


Figure 4-3 Visual representation of topic modeling process (Blei, et.al. 2010)

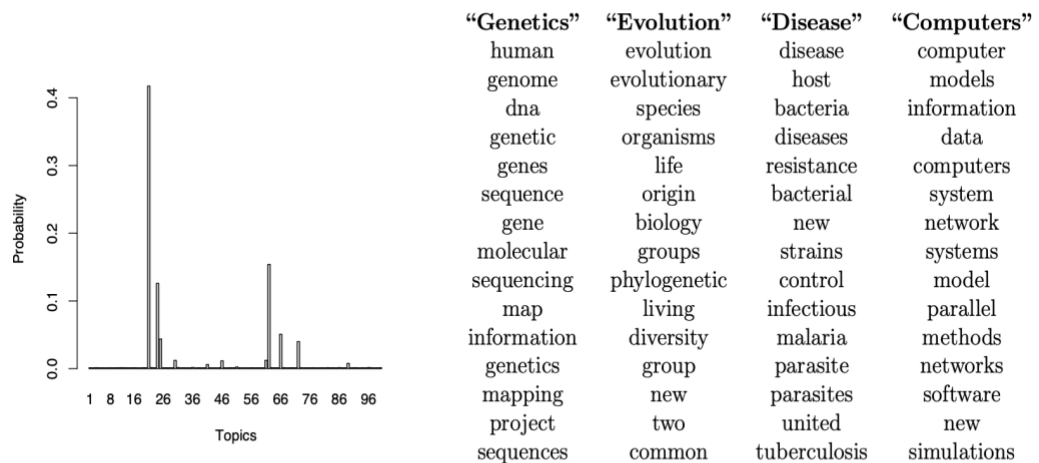


Figure 2: **Real inference with LDA.** We fit a 100-topic LDA model to 17,000 articles from the journal *Science*. At left is the inferred topic proportions for the example article in Figure 1. At right are the top 15 most frequent words from the most frequent topics found in this article.

Figure 4-4 Most frequent words in most frequent topics (Blei, 2010)

A limitation of the LDA is that it only considers the document’s text when determining topics and does not explore other information, such as the authors and sources of the document (Lebryk, 2021). The structural topic model (STM) developed by Roberts, et.al (2016) addresses this limitation of the LDA. The STM can explore topics, estimate uncertainty, and visualize quantities of interest in the database (Roberts, et. al, 2019). It uses metadata or information about each document in the model. The additional features of the STM are presented in the figure below.

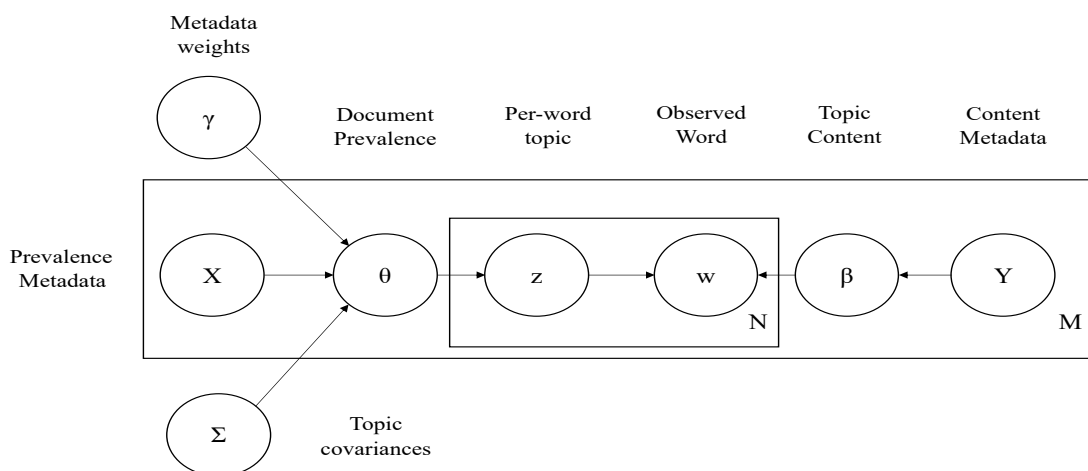


Figure 4-5 A graphical illustration of the structural topic model (Lebryk, 2021)

Where in LDA it considers  $\theta$  or the document preference to determine the topics belonging to a document, and  $\beta$  the topic content to collect the words forming a topic. The first process analyses  $M$ , the documents in the corpus. Wherein  $stm$  includes  $X$ ,  $Y$ , or the documents metadata (ex. author, source, date) and uses metadata weights  $\gamma$  as the parameter to map the topic prevalence and  $\Sigma$ , the correlation between topics to determine the composition of topics. The second process analyses the words in the document, where  $z$  are the words assigned to the topic and  $w$  are words generated from the topic. The two-loop process and the added consideration of metadata allows for a more a robust analysis.

This research will use the text mining method called topic modeling to derive representative categories and indicators of sustainable transport in existing literature. Topic models were used to categorize environmental sustainability indicators (Park and Kremer, 2016) and demonstrated the model was able to find conceptual similarities among a collection sustainability of indicators. This research follows a similar methodology, using the  $stm$  to find out the distribution of documents per topic or category of indicators.

#### **4.3. Validation of results**

To clarify the context where EST can be applied in the Philippines the case study variable approach (Cervero, 1998) and descriptive exploratory action research design of Mateo-Babiano, et.al. (2020) were both adapted in this methodology. The latter's method reviewed dominant themes from other developing countries in a similar case to the Public Transport Modernization Program in the Philippines. The selected themes were verified using unstructured one-hour interviews of 13 participants representing different stakeholders in the transport sector. Themes present in the interview were coded and analyzed in their study. Following this method, the research uses the literature review from the first objective and presented the resulting three images of sustainability to the respondents from the local government sector and the

implementing agency. The criteria for validating the relevance of the themes includes the mention of the 12 thematic areas of EST strategy, components of the PUVMP, and the common experiences in the local public transport route planning. For the validation of applicability of the selected EST indicators, the experts' criteria involved the principles for best practice in indicators by Litman (2007). The same set of principles were also considered in measuring public transport performance in developing cities (GIZ, 2011). All interviews were conducted from 30-90 minutes and followed guided questionnaires (Appendix B).

## **5. Chapter V: EST in the Philippines**

The purpose of this chapter is to clarify and illustrate the linkages of EST with the public transport modernization program. First, it will introduce the public transport situation in the Philippines to set the context for this analysis. Second, it will present the understanding of EST from a developing country's perspective using the theory of sustainable development to anchor the connections between EST and current transport policy. Third, the applications of EST will be discussed in the perspective of mobility responses during the COVID-19 pandemic. This is in service of creating common baselines for understanding EST and its possible applications to support mobility needs in the Philippines. This chapter also clarifies the unique situation of the Philippines compared to other developing countries; having the National EST strategy and the Public Transport Modernization Program. This research uses the modernization policy to explore the application of EST in transport planning in the Philippines.

### **5.1. Public transport situation**

Metro Manila is the economic capital of the Philippines. Traffic demand in Metro Manila is at 12.8 million trips and an additional 6 million in surrounding provinces (JICA and NEDA, 2011). Public transport trips comprise 69% of total trips, while trips made using private modes use 78% of the road space (JICA and NEDA, 2011). Bus and train systems are in place for a large portion of Metro Manila, and new stations are being expanded, yet mobility remains a problem due to traffic congestion, poor integration of transport modes, and expansion of the urban areas (JICA and NEDA, 2011; Mabazza, 2018). In 2014, the Japan International Cooperation Agency (JICA) and the National Economic and Development Authority (NEDA) estimated traffic congestion accounts for 2.4 billion Philippine Pesos (PHP) lost per day, with the estimate increasing to PhP 3.5 billion per day in 2017. Public transport systems in Metro Manila and surrounding provinces are characterized by long commuting times, and unreliable, and inefficient

services. Although the public transport situation is undesirable, commuters persist with these inconveniences due to the lack of alternative mobility options. Small and medium cities in the Philippines also experience problems with traffic congestion, traffic management, and urban expansion. Like the condition in the capital, public transportation also needs to be improved.

## 5.2. Proposed sustainability model for developing countries

Sustainability models allow an alternative way to understand the meaning of sustainable development through visualization (Figure 5-1). The classic dimensions of the sustainable development model from the Brundtland Report are the most well-known image of sustainability. The triple bottom line regards sustainability as a result of balancing the environment, social, and economic components. A critique of the classic model is that the three components should not be considered equal. Society and economy function within the environment and institutions are needed to regulate the use of environmental resources. Criticisms of this model are that natural balancing does not occur especially when human factors are involved (Banister, 2005; Low, 2005; Newman and Kenworthy, 1999; Goodland, 1995; Nijkamp, 1994).

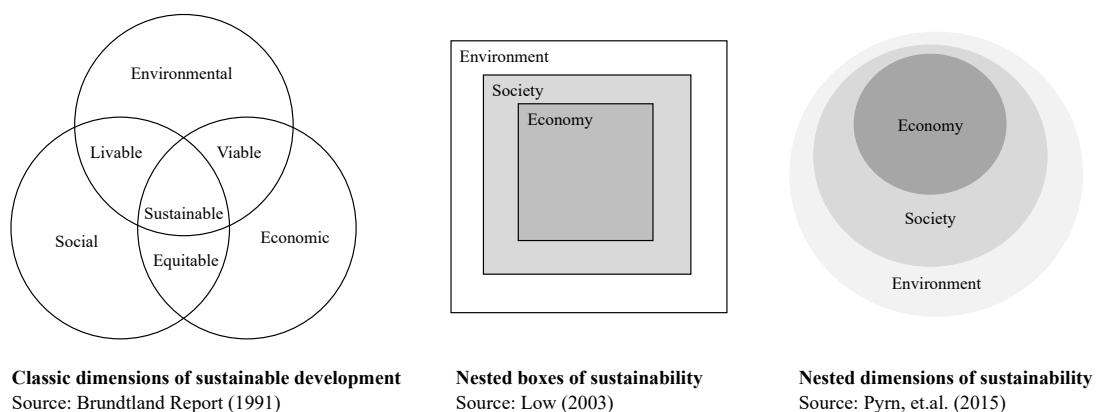


Figure 5-1 Sustainability models (WCED, 1991; Low, 2003, Pryn, et.al, 2015)

From the engineering perspective, spheres are a less stable shape, and boxes may be more appropriate. Low (2003) presented environment or ecological dimension receives the impacts of human activities and growth (society). These impacts can



change depending on local and global scales. In economic development, growth processes, productivity, and welfare are factors, and the social dimension deals with issues of equity and inclusion that affect the economy. Addressing the earlier critique on natural balance, Low suggests, that sustainability is a paradox since society and economy changes the environment in both local and global venues. Another factor is the institutional outdated beliefs that can also determine worldview, governance, and influence how resources are used and who can access them. It is related to Goodland's (1995) explanation that environmental sustainability should be championed by the global north. Global south countries are still developing and are heavily dependent on natural resources, although it is often within the limits of the natural carrying capacity. Regarding the third image, Pryn, et. al (2015) discussed the nested dimensions of sustainability following four assumptions. First, environmental capital is not equal. An informed analysis from environmental ecologists and experts can provide directions on how environmental capital is assessed and environmental impacts can be categorized as long-term and short-term. Third, while the environment has high priority, if social and economic benefits are perceived to outweigh critical environmental impacts, then the natural environment might be compromised. In developing countries, minor improvements in infrastructure and motorization can widely contribute to the economy. In this situation, the environmental dimension might be impaired for the benefit of economic and social dimensions (Santos, et.al, 2010; Wright and Fulton, 2005). Fourth, both the intersecting and nested models represent society, economy, and environment.

The first image corresponds to a proposed model for the triple bottom line that supports the dimensions of sustainability and considers the situation of developing countries. The theory and concept of sustainability emphasized the dimensions of sustainable development as environment, society, and economy. It adopted the nested spheres model (Pryn, et.al, 2015) and used the nested boxes (Low, 2003), and used the square to frame the influencers of sustainability. This is to mean that governance,

worldview, resilience, and institutional capacity are influencers taking place within the frame of sustainability. This is different from the previous models where the influencing factors to sustainability are not shown in the model but are instead featured in the discussions. The addition of the square frame is intended to communicate the importance of socio-institutional factors and represent natural boundaries to meeting sustainability actions in the context of developing countries. Figure 5-2 on the left shows the proposed sustainability model for developing countries, and the figure on the right side explains the relationship of the influencers to the three pillars of sustainability. This model adapted the nested spheres approach where the environment encompasses society as the location where humans live and as the provider of resources to both society and the economy (Pryn, et.al, 2015). Related to the comments that a natural balance does not occur in sustainability when human factors are involved (Banister, 2005; Low, 2003; Newman and Kenworthy, 1999; Goodland, 1995; Nijkamp, 1994), the proposed figure puts a focus on society's role regarding the institutional beliefs/*worldview* (Nested box model), governance and institutional capacity (Nested spheres model). Society covers the economy as the users and providers of input to the economy. Based on discussions on previous models and discussion, *governance* and *worldview* were added as influencers of sustainability.

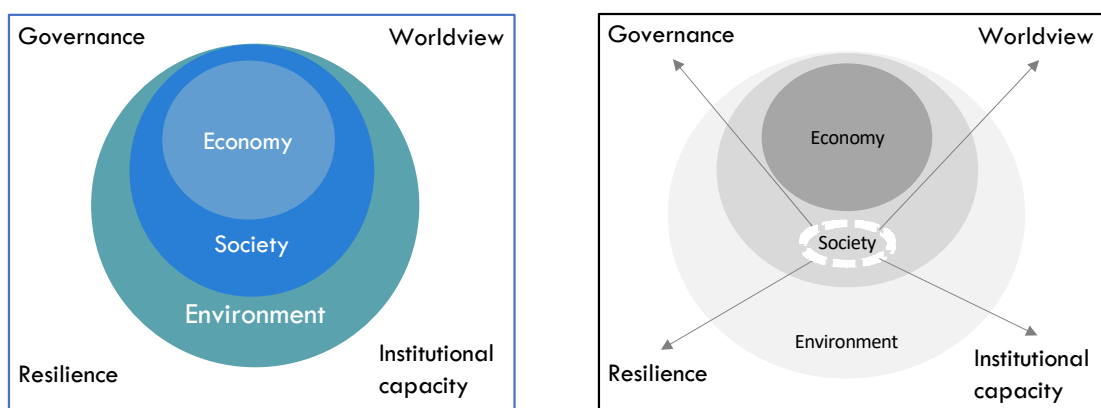


Figure 5-2 Proposed Sustainability Model

Society as the actor can have different forms of governance and worldviews, this is represented by the arrows pointing to these points and the word society in broken lines to represent the understanding of society for these factors are not fixed. The research of Pryn, et.al (2015) concluded that the nested model clarifies the intention of the Brundtland Model and acknowledged its weakness to include the influence of governance on sustainability. Additionally, the concept worldview aims to show the difference between sustainability goals among developed and developing countries as these can show differences in their development priorities. This is explained by the previous research wherein developing countries focus on meeting basic human needs while developed countries focus on human wants. To reflect the situation and challenges in developing countries, *institutional capacity* and *resilience* were also included. Likewise, institutional capacities are also different within different societies and these affect the resiliency of systems. Jeon and Amekudzi (2005) clarified the importance of the levels of influence of agencies to implement actions to support sustainability. The influence of institutional capacity and its effects to sustainability is seen in the challenges to provide sustainable transportation systems. The transport and mobility situation in the Philippines emphasizes the lack of resilience (in terms of efficiency and safety) in its transport systems. Billions are forgone in economic loss due to traffic congestion. And this problem has persisted for years in Metro Manila. Developing countries like the Philippines need to consider the resiliency or duplication of transport systems to ensure that society and economy are functioning. The resiliency of the economy is considered to depend also on the society in this model. Lastly, the natural environment, on its own, can create balance and resilience because of the natural carrying capacity. It is when human factors are involved that this natural balance may be influenced (Goodland, 1995).

### 5.3. EST and Public Transport Modernization

This section will discuss the national strategy and public transport modernization program, specifically the local public transport route planning guidelines. It aims to establish the linkages in transport policy sustainable development to build the case for better incorporating sustainability in local plans.

#### 5.3.1. National EST Strategy

The transport sector accounted for 38% of GHG emissions and is the second largest contributor of CO<sub>2</sub> emissions in the country, according to the Department of Transportation (PIA, 2020). DENR reported 65% of air pollutants were generated from road transport. This figure increased to 88% in the emissions inventory for the National Capital Region (NCR) where 38% of the country's motor vehicles are registered (LTO, 2015). The linkages of CO<sub>2</sub> emissions and climate change; air pollution and its environmental impacts have been researched with recommendations for considering non-motorized transport walking and cycling are actions toward low-carbon transport (Fabian and Gota, 2009; Bakker *et al.*, 2018). The Philippines National Environmentally Sustainable Transport Strategy (2011) was created by engaging various stakeholders and discussing key strategies for EST initiatives in the country. The objective of the National EST strategy is to develop and mainstream EST toward achieving sustainable mobility. It encompasses a broad understanding of sustainability with components on the social and economic factors towards sustainable development.

Table 5-1 National EST strategy thematic areas

<i>Thematic Area</i>	
1.	Public health
2.	Air quality monitoring
3.	Traffic noise management
4.	Vehicle emission standards
5.	Cleaner fuels
6.	Public transportation planning and Travel Demand Management (TDM)
7.	Non-motorized transportation
8.	Environment and people-friendly infrastructure and development
9.	Social equity and gender perspective

10. Road safety and maintenance
11. Land use planning
12. Knowledge base, awareness, and public participation

Regidor (2011) explained that local cities would be at the frontline of implementing EST with actions tailored to the needs and situations of their local areas. There are several challenges in engaging local governments to implement EST. Generally, local governments view EST as additional requirements and are not given priority, especially by local chief executives. More barriers to sustainable transport planning include weak institutional systems, lack of financial resources, technical capacity, and lack of incentives to implement transport planning (Tiglao and Vergel, 2007; Regidor, 2011; Sunio, et.al, 2019). Communicating EST is also a critical factor for local governments, since many are not aware that EST is already part of their regular mandates, projects, and program (Regidor, 2011). The National EST Strategy should be continuously advocated by the national government. And there is a need to re-familiarize the planning sector with sustainable transport, particularly active transportation (Regidor, 2020). Lastly, the national policy must send a clear message of shifting from car-centric to people-centered infrastructure, particularly in the era of the COVID pandemic.

#### 5.3.2. Transport Modernization Program

The Public Transport Modernization Program is a policy of the Department of Transportation. It *“envision[s] a restructured, modern, well-managed and environmentally sustainable transport sector where drivers and operators have stable, sufficient and dignified livelihoods while commuters get to their destinations quickly, safely and comfortably”* (DOTr, 2017). The Department of Transportation created a policy that engages local cities to prepare local transport route plans in 2017. These plans are the basis for providing public transport services in the local government’s administrative area. This policy is called “Local Public Transport Route Planning”

(LPTRP). The Public Transport Modernization Program has a total of ten components as follows: regulatory reform, local transport planning, route rationalization, fleet modernization, service contracting, financing, vehicle useful life, pilot implementation, stakeholder support, and communication. These components share similarities with the 12 thematic areas of the National EST Strategy.

#### **5.4. Local Public Transport Route Planning**

The Public Transport Modernization introduced the LPTRP where it enlists local governments to propose public transport routes and determine the number of services needed while coordinating it with their land use and development plans. The national government will review and issue public transport franchises based on the submitted plan. A capacity-building program was provided to support the cities in preparing their transport plans where 1,379 (87%) local government units (LGU) attended in 2018. The training included conduct of traffic surveys and on ground surveys. The planning process starts as the LGU collects and provides the data-based plan and suggests new or rationalized routes found viable in the survey. It is submitted to the DOTr and the Land Transport Franchising Regulatory Board (LTFRB) for evaluation. Accepted plans will be issued a notice of compliance to the LGU. It will be submitted to the Provincial Government will call for public hearings and stakeholder consultations and prepare a *Sanggunian* (municipal council) Resolution or Ordinance to endorse the transport plan. The LTFRB will publish a memorandum circular (MC) to formally open the route and call on the private sector to apply and operate the public transport services. Transport route planning and route rationalizations demonstrated a bottom up process in the way road public transport services are provided in the country. LTFRB established a National Program Management Office (NPMO) to implement the route rationalization components of the Transport Modernization Program. In addition, the NPMO supports LGUs to prepare local transport plans. As of July 9, 2021 a total of 697 LGUs or 50% of the total trained cities have submitted transport route plans with

varied levels of revision. 61 LGUs received the Notice of Compliance and 2 MCs were issued for new route franchises. 11 routes with 6 operators and 68 compliant units (DO 2017-11) are currently operating.

### **5.5. Linkages of EST and Transport Policy**

This analysis attempts to create a visual image representing the linkages in transport policy using CmapTools concept mapping software. The concept map in Figure 5-3 started with “EST in the Philippines”. This concept map was plotted regarding the thematic areas of the National EST Strategy and the goals of the Public Transport Modernization Program. The thematic areas of the policies listed downward. From the discussions, policy actions, and current transport responses during the COVID-19 pandemic, linkages were assigned. The fundamental theories are found at the top and more specific policy components at the bottom. The relationship of the concepts is explained by using links. This map can show many linkages in one image.

An explanation of one possible linkage is shown through the thick lines wherein, sustainability is influenced by resilience, and where the public transport resilience in the Philippines can be considered weak. During the COVID pandemic, the government restricted public transport services. As an alternative to public transport, non-motorized transportation (NMT) like bicycles became a popular mobility solution in the pandemic. NMT is a component of the EST Strategy and is one of the goals of the Public Transport Modernization Program. Additionally, the map shows EST strategies such as NMT, road safety and maintenance, cleaner fuels, and fleet modernization as part of its components. The map makes it easy to see the relationships between concepts. Additionally, concept maps are living documents that can be validated and revised as more information and new ideas become available. This map shows that the National EST Strategy is very much relevant to the existing policy directions in the Philippines.

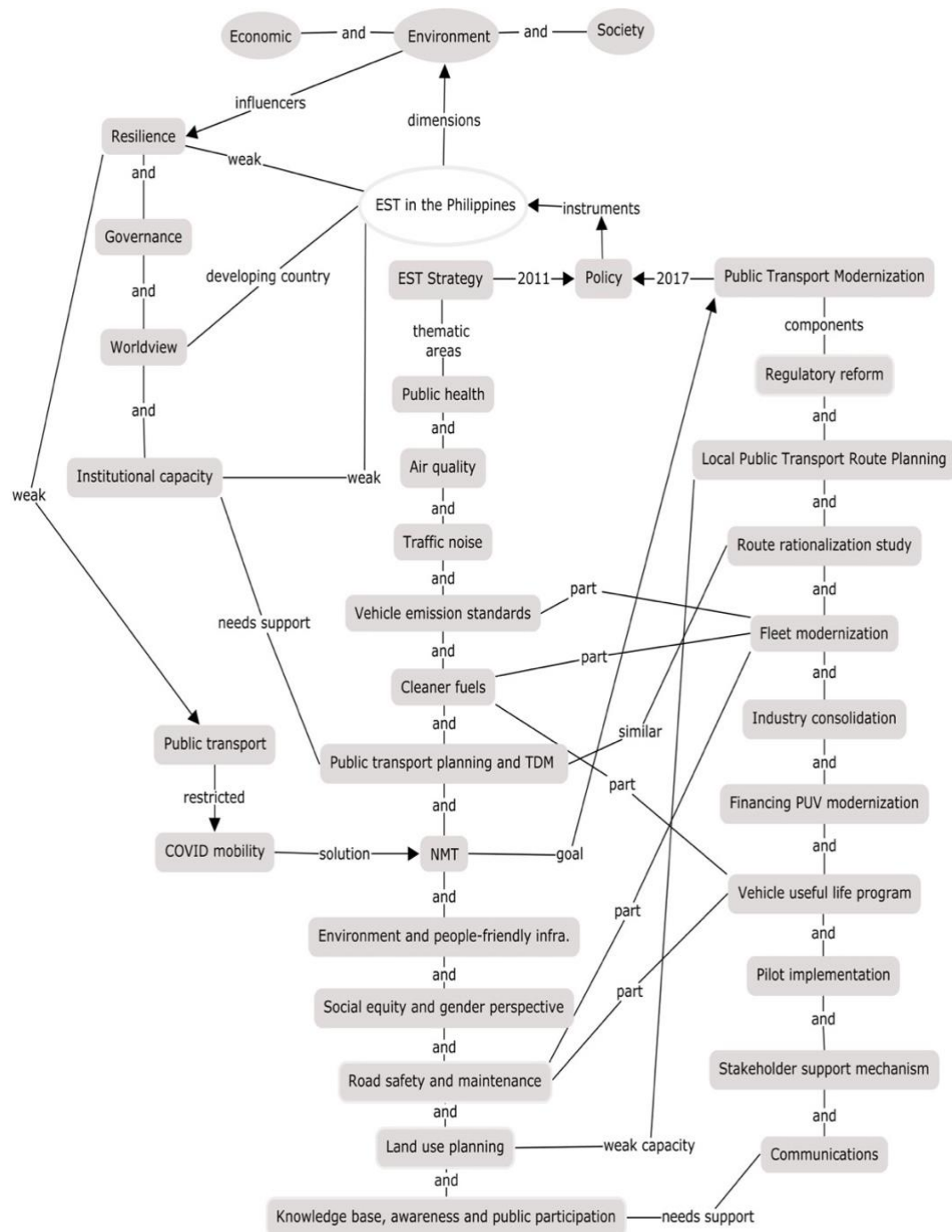


Figure 5-3 Concept Map of EST and Transport Policy in the Philippines

## 5.6. Discussion

This section provides an overview of the public transport situation and introduced two policies that are positioned to address the environmental impacts of transport National EST Strategy and the Public Transport Modernization Program which envision providing a rationalized, data-driven public transport system. Both



policies appear to overlap, yet in actual practice, one policy is more pronounced than the other. To clarify potential linkages, this analysis proposed a sustainability model as the baseline image of sustainability. This research believes a common grounded understanding of what can be sustained needs to be established to move toward applying sustainability principles. The importance of institutional capacities is highlighted in the discussions. The capacity to have a common understanding of concepts and actions leading to sustainability is important to realizing key impacts. It is clear that current transport policies and programs are aiming for a similar desired future and there is a potential to combine these policies to help develop a more complete picture of sustainability. Well-intended policies may fall short when the message is not communicated to the stakeholders. Local governments are the key actors in transport planning. In the discussion with NPMO, it was noted that LGUs consider the transport plans for compliance and it would be beneficial to have more appreciation in this aspect. This finding confirms a limited understanding and appreciation of sustainability. Challenges to changing political climates, leadership priorities, and staff turnover are also among institutional constraints. The pandemic also affected the planning process where mobility patterns were changed, and ultimately priorities shifted to the pandemic response. After discussing the concept of sustainability and national policies the following section will discuss the applications of EST in the local setting.

### **5.7. Framing EST in mobility responses**

EST considers the transport system in a manner addressing social, economic, and environmental objectives. Used in this study, it includes non-motorized transport, walking, cycling, and e-vehicles. This section explores the application of EST as a mobility response during the pandemic and discusses the awareness and acceptance of EST in the Philippines. The pandemic mobility response provided an opportunity to re-shape transport and mobility options. Key factors include: the re-emergence of

active mobility, the creation of median busway along major roads, transport policies for the “new normal”, and the role of EST in “better normal” transport future.

#### 5.7.1. Re-emergence of active mobility

There is a growing recognition of walking and cycling as legitimate, primary modes of transport. The early days of the pandemic response stopped public transport operations. Similar to global trends in public transport response, commuters saw bicycles as a safer option to travel during the pandemic. For many working Filipinos without private vehicles, cycling and walking had been the only options. In June-July 2020, the Metropolitan Manila Development Authority (MMDA), the regional planning and coordinating agency, conducted cyclist counts for the first time, as influenced by the public sector groups. A total of 100,792 cyclists were counted in June and 77,484 in July along major roadways, including EDSA, demonstrating the importance of non-motorized or active transport in the pandemic. Research on active transport before the pandemic had already identified the difficulty of walking and cycling in the Philippines due to the lack of relevant facilities even in major cities. Non-motorized transport (NMT) policy goals should have coordinated plans for cycling facilities, improving air quality standards, and congestion management using sustainable transport measures.

#### 5.7.2. EDSA Carousel

The Department of Transportation revised bus routes and stops along the major thoroughfare. EDSA Carousel authorized 550 bus units to operate in the median lane with designated bus stops (LTFRB Resolution No.81, S.2020). In compliance with health and safety protocols, busway services must observe strict social distancing of 1-2 meters inside the vehicles and utilize cashless payment. Mandatory face masks and face shields, non-permeable and transparent barriers, limited passenger capacity, no eating or talking are among the policies for commuters' strict compliance when using public transport. The EDSA Carousel initiated the rationalization of bus routes

and called on bus operators to consolidate their fleets in order to meet the required number of units for operation.

#### 5.7.3. “New Normal” Transport Policies

A national transport policy passed in August 2020 is the *Guidelines on the Proper Use of Active Transport During and After the COVID-19 Pandemic*. The guidelines are laid out in a joint order of the Department of Health (DOH), DOTr, Department of Public Works and Highways (DPWH), and the Department of Interior and Local Government (DILG). The guidelines largely reflect lessons from transport responses in Metro Manila and provide guidance for local government units to emphasize active transportation in their respective areas. Local governments are instructed to evaluate local roads and identify potential areas for 'continuous cycle lanes' and places the responsibility of identifying and coordinating bicycle networks among different cities. Bicycle network proposals should be linked to city local plans.

### 5.8. EST and “better normal” transport

While the term 'EST' does not often appear in literature, concepts such as 'active mobility', 'eco-mobility', a concept first used in South Korea in 2011, and 'responsible transport' (Budd and Ison, 2020) were suggested in academic research. These terms all share similar concepts toward achieving an environmentally sustainable transport future. In the Philippines “better normal” is used to describe a desirable situation during and after the pandemic. As an example, the Philippine Congress defines “better normal” in relation to achieving a sustainable future in the pandemic (House Bill No. 6864). This research positions COVID-19 transport, and mobility responses reflected components of EST.

#### 5.8.1. Questionnaire survey on EST awareness and acceptance

To find out the awareness and acceptance of Filipinos on EST an online questionnaire survey was conducted with target respondents as Filipinos living in the Philippines before and during the pandemic. The objectives of the survey are to (1)

identify awareness and acceptance of EST in the Philippines, (2) find out mobility options during COVID-19 and car ownership attitudes towards electric vehicles and non-motorized transport, and (3) find out in what ways can EST help achieve a "better normal" in the Philippines during and after the pandemic. The survey was distributed using Facebook from August 3 and was shared with a group that discusses traffic and mobility issues in the Philippines called '*How's your byahe, bes?*' (How is your commute, friend?) and '*Pinay Bike Commuter*' and relied on the online snowball method. The scope of both Facebook groups included the entire Philippines, not only Metro Manila. 255 responses were collected on August 17, 2020. Since it was conducted online, the survey received responses from different parts of the country, and the distribution was not controlled. The age and gender of respondents also varied, and these factors could not be regulated due to the nature of the online survey. The survey period coincided with the declaration of ECQ in Metro Manila, which meant public transport could not operate and non-essential movement was again restricted. The survey questionnaire provided respondents with examples of EST which include electric jeepneys (private sector initiative), Iloilo City protected bike lanes (local government); electric vehicles (private and national government); and Pasig transport bike share program (local government) with photographs and descriptions of each initiative. This provided a common reference for all respondents to answer the questions related to EST (Appendix A). This survey design had been recommended in previous research on comparing different attitudes on bus rapid transit in developing countries (Sivakumar *et al.*, 2006).

#### Respondent profile, trip frequency and mode use (before COVID-19)

The online survey received 255 respondents with an average age of 34 years old. The youngest respondent is 18 years old and the oldest is 75 years old. 45% belong to the 24–34 age group, while 8% are aged between 55-75 years old. The majority of respondents among all age groups are female, which comprises 72% of the

entire sample. The location is determined by Philippine province with 62% coming from Metro Manila, followed by Rizal at 9%. The survey was answered by respondents belonging to 26 out of 81 (32%) Philippine provinces. Seventy-six percent (76%) (193) of respondents are employed, with 22% (56) government employees and 36% (93) company employees. Students comprise 7% (17) and the unemployed 6% (15). Twenty-four respondents 9% answered 'others' but did not specify their occupation. Of the employed respondents (76% of the entire sample), 84% answered they can work from home during the pandemic.

Table 5-2 Respondent profile

Sex	n	%	Occupation	n	%
Female	184	72.16%	Company employee	93	36.47%
Male	68	26.67%	Government employee	56	21.96%
Did not say	3	1.18%	Part-time worker	8	3.14%
Age	n	%	Self-employed	36	14.12%
18-24	46	18.04%	Housewife / husband	6	2.35%
25-34	115	45.10%	Student	17	6.67%
35-44	49	19.22%	Unemployed	15	5.88%
45-54	25	9.80%	Other	24	9.41%
55-64	16	6.27%			
65-75	4	1.57%			

On private transport, car ownership among respondents is at 67% (172). While 26% (66) respondents own a motorcycle. Among them, 11% (29) respondents have both private car and motorcycle in their households. Respondents were asked to recall how frequently they went out of their residence before COVID-19. While the lockdown in the Philippines started in mid-March, for this question the period was not specified as some respondents may have refrained from making trips even before March lockdowns.

Table 5-3 Trip frequency and mode share before COVID-19

		Private	% Private	Public	% Public
More than 5 times a week	166	87	52%	79	48%
3-4 times a week	24	13	54%	11	46%
1-2 times a week	22	18	82%	4	18%
About a few times a month	5	3	60%	2	40%

Less than a few times a month	4	4	100%	0	0%
Total	<b>221</b>				

Table 5-3 does not include responses that selected non-motorized modes (walking, bicycle) as the primary mode of travel to show the private-public share of motorized transportation. Non-motorized modes accounted for 13% (34) of respondents. For respondents who regularly leave their residence (3 or more times/week), private and public transport use is relatively even. On the other hand, less frequent trip makers mostly use private cars for their trip purposes.

#### *Public transport concerns during the pandemic*

Respondents are most concerned with the availability of public transport (75%), followed by safety (69%) and travel time (68%) as show in Figure 5-4. Safety considerations ranked first among public mode choice of commuters in Metro Cebu in a previous study (Mayo and Tabaoda, 2019). A year prior, Mabazza's (2018) research on paratransit as feeder modes revealed a significant correlation between safety and the propensity of commuters to take the bus or MRT in Metro Manila. For government transport projects, travel time reduction is a common feature point when communicating the benefits to the public. However, survey results show safety is a higher concern among respondents. Policy decision-makers are often concerned with a reduction in travel time, yet even before the pandemic, commuters have already prioritized safety concerns. At a time when public transport is having a negative perception, it is important for policymakers to ensure that public transport services are safe and to communicate this to the public.

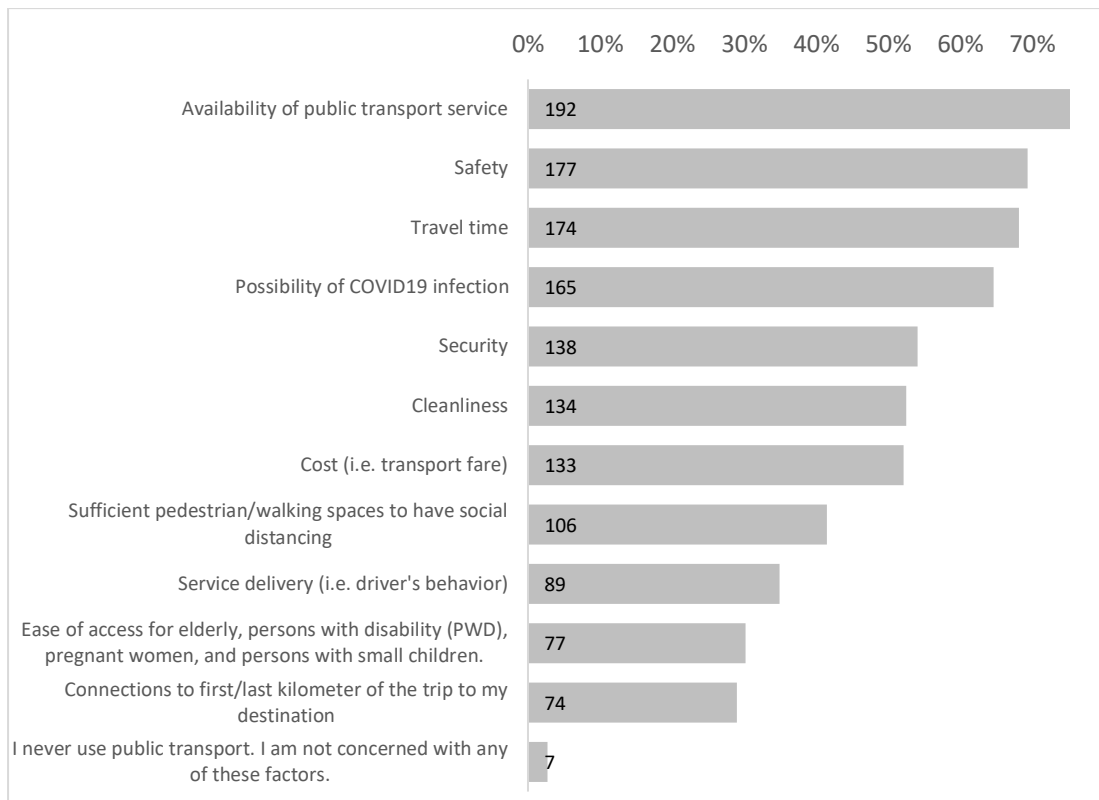


Figure 5-4 Ranking of factors when using public transport during COVID

Sixty-five percent (65%) of respondents said they were concerned about a possible infection of COVID-19 when using public transportation. It should be noted from the previous section, the government limited public transport availability during the lockdown period and has started re-introducing public transport services from mid-October. Security, cleanliness of vehicles, and cost all ranked above 50%. Interestingly, connections to the first and last kilometer of the destination only received 29%. Public transport in Manila has a connotation of door-to-door service where buses and jeepneys can pick up and drop off passengers at any point. In recent years, much of the effort from the government has been to introduce specified bus stops, especially along EDSA. In 2015, the Premium Point to Point (P2P) bus service was introduced along EDSA; before this service, there had not been any bus service that strictly followed designated stops and routes. In this regard, the concept of EDSA busway with rationalized routes and designated median stations implemented during the pandemic is also relatively new in the Philippines.

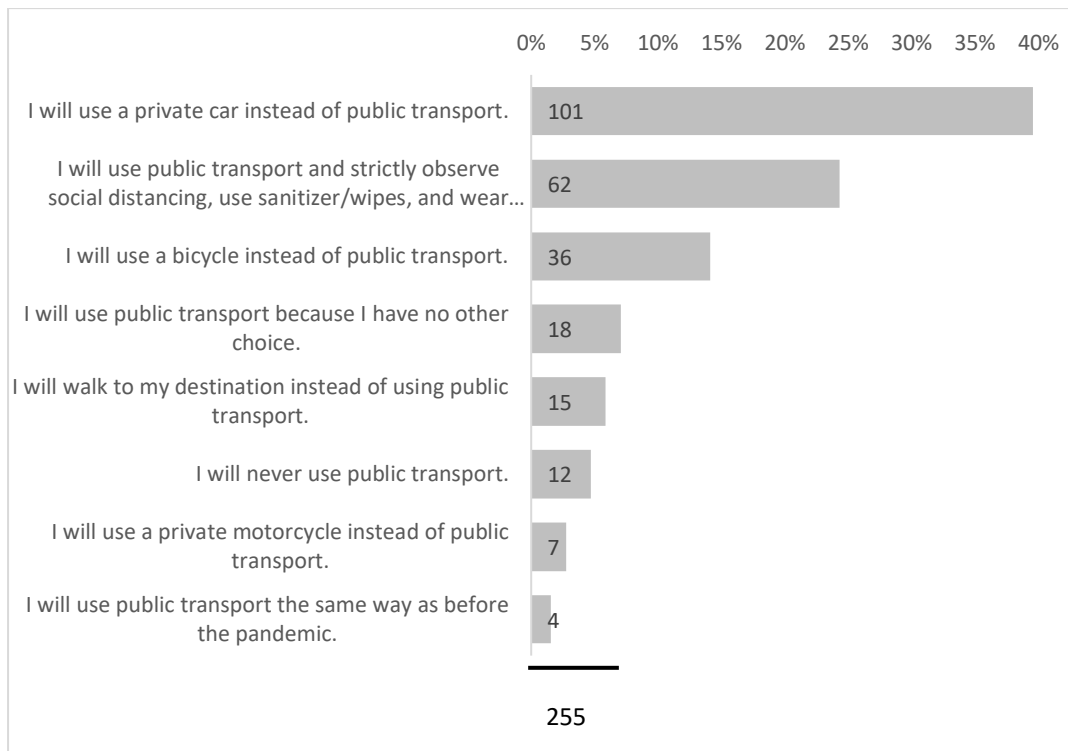


Figure 5-5 Ranking statements about using public transport during COVID

On using public transport amidst the pandemic, 40% of respondents said they would use a private car instead, 3% said they would use private motorcycles and 5% said they would never use public transport during this time. On the other hand, 24% of respondents said they will continue to use public transport while observing social distancing and personal preventive measures, while 7% said they had no other choice but to use public transport. Bicycle use and walking are also considered with 14% and 6% respectively, for a combined 20% of respondents who will use active transport during the pandemic as shown in Figure 5-6.

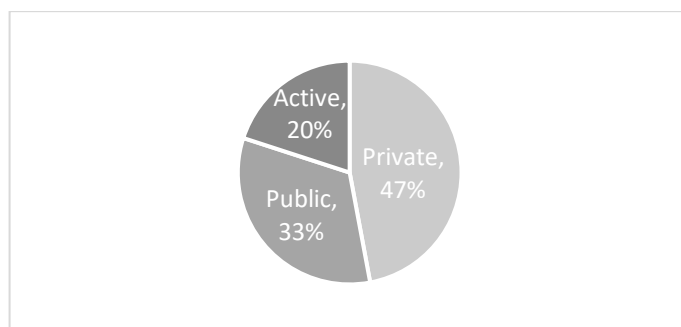


Figure 5-6 Stated preference for mode choice during COVID



### Respondents considering purchasing a private car

Twenty-six respondents answered they are considering purchasing a private car within the next 12 months (from August 2020). Among them, 17 (65%) answered the decision was influenced by COVID-19, while 35% already considered purchasing before the pandemic. Twenty-six respondents stated they considered buying an electric car or hybrid vehicle. Respondents are concerned about the cost of the vehicle (65%), maintenance (65%), and using e-vehicles around the city, and looking for charging stations (62%). Interestingly, 50% said there is a lack of information about e-vehicle and hybrid vehicle options in the Philippines. Despite the environmental benefits of electric vehicles, Agaton, et.al (2020) notes public acceptance is one of the challenges to having e-vehicles become more common in the Philippines, in addition to the overhead costs, limited charging infrastructure and supporting policies. Public awareness for e-vehicles appears low. The Electric Vehicle Association of the Philippines (eVAP) which aims to educate the public on the economic and ecological benefits of e-vehicles. eVAP is a private sector initiative supported by the Department of Trade and Industry (DTI) and Department of Energy (DOE) and has been operating since 2009. Electric jeepneys or e-jeepneys had been operating as early as 2007 in Makati City with e-jeepney Transport Corp. Global Electric Transport (GET) Philippines' City optimized managed electric transport (COMET) jeepneys started in 2014. One COMET unit serves 150,000 commuters and operates 80 thousand kilometers traveled (KMT) and mitigates 30 thousand liters of diesel per year. According to GET Philippines, this translates to a reduction of 40,000 kg of CO<sub>2</sub>, 65,000 kg reduction of particulate matter (PM).

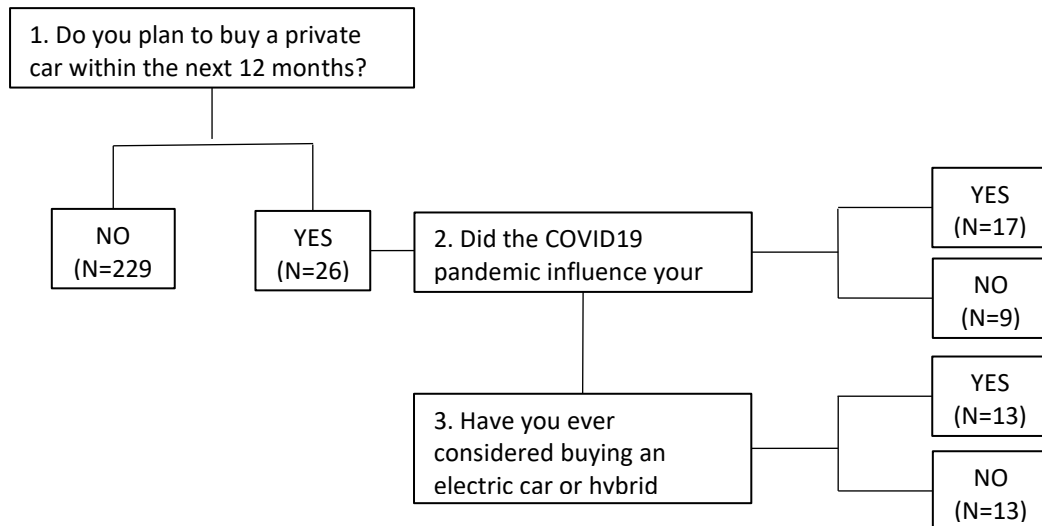


Figure 5-7 Choice of respondents on purchasing a private car

Energy source is an important consideration for the electrification of vehicles especially since the Philippines is promoting electric jeepneys as part of the modernization program. Agaton, et.al (2020) studied the additional requirement for renewable energy sources in relation to the modernization program. An additional 750 MW (megawatts) of dependable generating capacity is necessary to meet the new demand in addition to the current 6592 MW produced. Moreover, Agaton et.al (2020) suggests this is in line with the Philippines's goal of having a 60% increase to the renewable energy capacity by 2030. On the impacts of electric vehicle charging to the power grid, research led by Mitsubishi Motors with Philippine Universities estimated 5.3% of projected system reserves and 3% from Visayas and Mindanao will be consumed for electric vehicles. This translates to maintaining power reserves of 25.43 MW in Luzon, 4.44 MW in Visayas, and 5.46 MW in Mindanao by 2030 (Mitsubishi Motors, 2019). This study on electric vehicle policy recommends demand interventions that include: recommending EV shares for corporate fleets, government vehicles, and the public transport sector, suggesting potential EV lead areas, and providing supporting regulations for EV fringe benefits.

### 5.8.2. Awareness on EST

Respondents have answered 70% had heard the term EST before while 30% heard about it for the first time during the survey. Across all occupations, awareness is higher than 63%, except for students with only 59% are aware of EST (Table 5-4). The sources where respondents have heard about EST is varied (Figure 5-8). At the highest, 40% heard from social media, while 39% from traditional media sources such as TV and newspaper reports. It appears there is not one dominant source of EST information from the sources listed in the survey.

Table 5-4 EST awareness by occupation

Occupation	Yes	%	No	%	Total
Company employee	59	63%	34	37%	93
Government employee	47	84%	9	16%	56
Self-employed	26	72%	10	28%	36
Part-time worker	6	75%	2	25%	8
Unemployed	10	67%	5	33%	15
Housewife/husband	6	100%	0	0%	6
Student	10	59%	7	41%	17
Others	15	63%	9	38%	24
<b>Total</b>	<b>179</b>		<b>76</b>		<b>255</b>

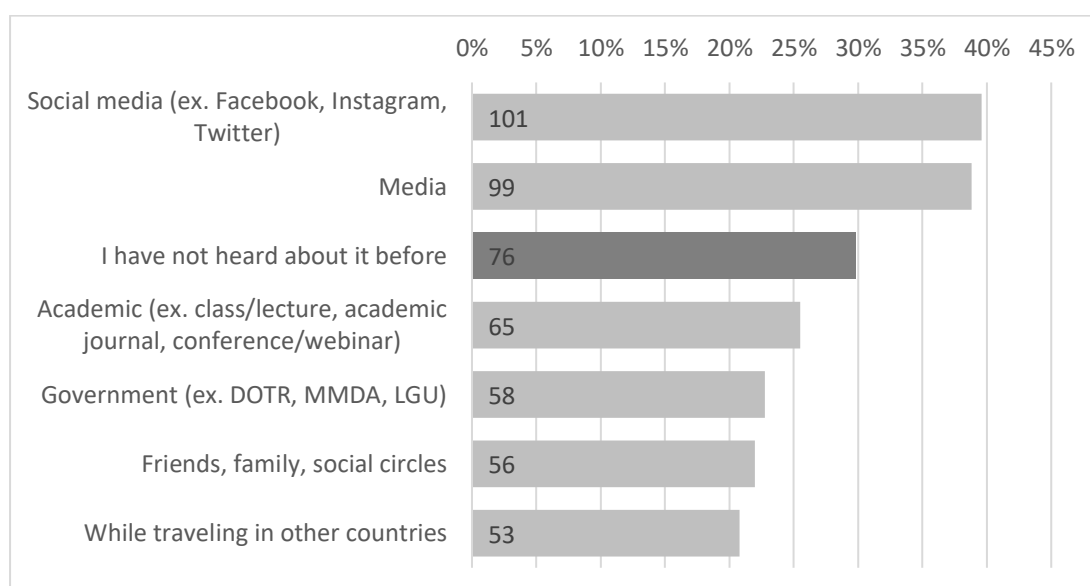


Figure 5-8 Where respondents have heard about EST

### 5.8.3. Attitudes on EST

Having provided respondents with local examples and information about EST in the Philippines, the survey asked respondents to describe their level of agreement with selected statements about environmentally sustainable transport and choice. Figure 5-9 shows the level of agreement of respondents to six statements about EST, representing public transport use, active transport, private car use, and local city transport planning. The statement “I think EST should be considered by my local government” received the strongest agreement among the statements provided. Combining positive responses it was agreed on by 91% of the respondents.

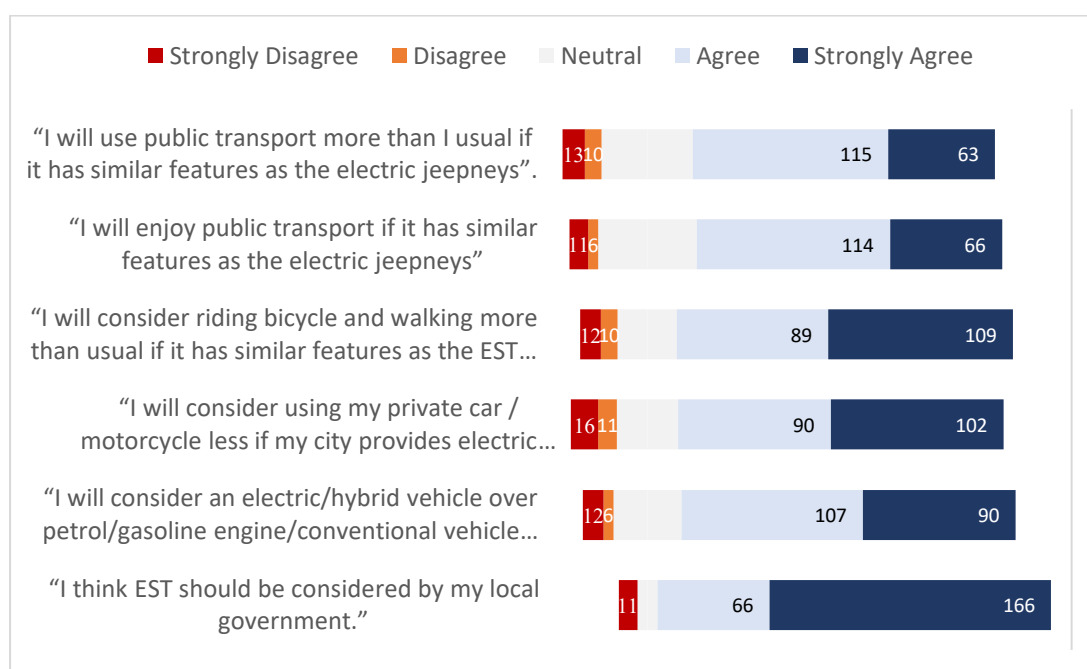


Figure 5-9 Statements about EST that respondents agree

On public transport behavior choice, results show mostly neutral or agree about statements that mentions increasing use of public transport when it has similar features as the electric jeepneys. This may imply there are other factors that respondents are considering rather than if the vehicle is an e-jeepney. From the earlier discussion, other factors respondents are concerned about public transport are availability, safety, and travel time. Statements about active transportation received strong agreement compared to increasing public transport use. Concurring trends on increased

appreciation for active transportation during the pandemic that was seen all over the world. On electric vehicles, 77% respondents will consider it in the future, with strongly agree that is higher compared to values for public transport.

Table 5-5 Summary of statements about EST that respondents agree

Choice Set	N	%
"I will use public transport more than I usual if it has similar features as the electric jeepneys".	178	70%
"I will enjoy public transport if it has similar features as the electric jeepneys"	180	71%
"I will consider riding bicycle and walking more than usual if it has similar features as the EST examples."	198	78%
"I will consider using my private car / motorcycle less if my city provides electric jeepney, bike and walking facilities like the EST examples."	192	75%
"I will consider an electric/hybrid vehicle over petrol/gasoline engine/conventional vehicle in the future."	197	77%
"I think EST should be considered by my local government."	232	91%
<b>Total</b>	<b>255</b>	<b>100%</b>

#### 5.8.4. Ideas of "better normal" transport

The final objective of the survey is to find out how EST can achieve a "better normal" transport situation in the Philippines. Respondents were asked to select only one option among the statements provided below. The statements are about public transport service, safety in using active transport, traffic congestion, safety while walking, air pollution, and accessibility for the elderly, children, and persons with special needs. Among the responses, 68% said a "better normal" includes all these factors as shown in Figure 5-10. EST examples in the survey touched on active transport, e-vehicles, and public transportation. EST as a strategy involves a combination of different action points to achieve a sustainable transport goal. Philippines EST strategy involves 12 components that include public health, air quality, safety, social equity and gender perspectives, public transport and land use planning, as well as education, awareness, and public participation. From this survey, it appears the EST strategy continues to be relevant in achieving the targeted better normal transportation situation in the Philippines.

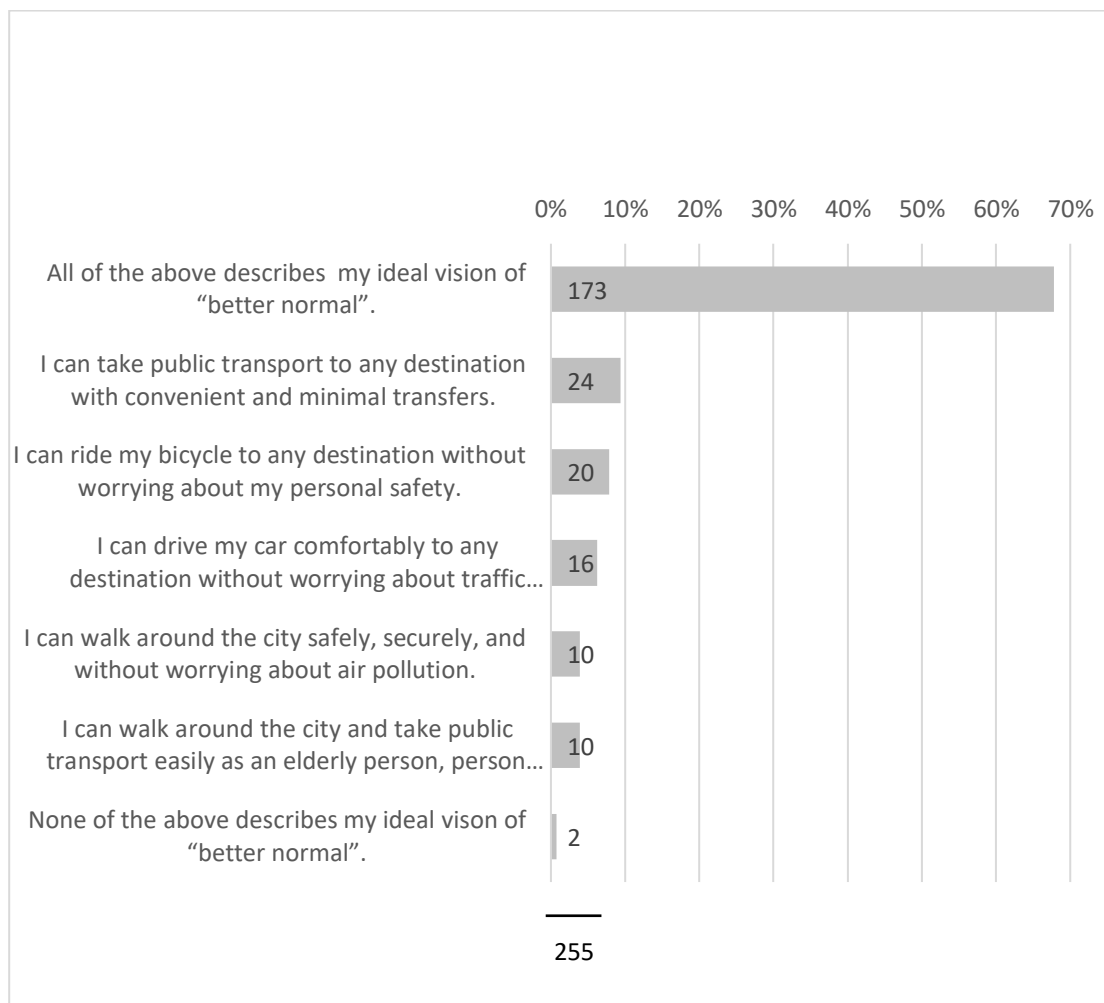


Figure 5-10 Statements about "better normal" that respondents agree

Finally, respondents were asked to describe their idea of "better normal" transport in one sentence. Among the answers, five themes were found to be common with the majority of the responses. These themes were classified as 1) health and safety; 2) urban and transport planning; 3) active transport; 4) accessibility; 5) Public transport reliability and infrastructure.

#### Health and safety

Consistent with previous discussions, safety especially during the pandemic is the most crucial factor in transportation services. Many of the responses echo the desire for safer public transportation services. At the same time, respondents mentioned an interest in having e-vehicles to reduce motor-vehicle emissions and air

pollution. On the other hand, several responses mentioned the feeling existing public transport systems are unsafe, especially for commuters with different needs. The qualitative responses have confirmed a stronger emphasis on safety in transport systems is a vital component in the desired future.

#### Urban and transport planning

Urban and transport planning should go hand in hand in creating more sustainable networks. From the previous discussions, many changes are being introduced especially in transport systems in Metro Manila. The pandemic created an opportunity for the government to implement long-standing public transport rationalization plans. At the same time, private sector and advocacy groups and individuals are also initiating ways to create better than business-as-usual. It is important not to think of urban planning and transport as individual components but as integrated systems. An issue that is not part of this research scope is the situation of public transport drivers, especially jeepney drivers who had been out of work due to public transport service restrictions during the pandemic. The situation is evolving and jeepney routes are being opened from October 2020. Public transport such as buses and jeepneys do not receive subsidy, compared to other southeast Asian countries like Thailand, Indonesia, Vietnam, and Cambodia (Muromachi *et. al*, 2015). As a result of the ban on public transport, many commuters not only had to find alternative modes, but those in the public transport service sector also lost income sources. Transportation experts recognize public transport fare in the Philippines is quite low compared to other Asian countries. Public transport needs to be brought back with a focus on improved safety, sanitation, and service (Regidor, 2020).

#### Active transport, accessibility, and public transport reliability

Many statements reflect the need for public transport systems and infrastructure to be accessible for all users across different types of modes including non-motorized transportation or active transport. Access to inclusive and affordable

public transport services is a common concern among responses. Whereas some responses mentioned dissatisfaction toward preference on car-oriented facilities, respondents mentioned the need to have more people-focused perspectives especially for those who do not have access to private modes of transport.

#### 5.8.5. Image of “better normal” transport

This word cloud analysis collected the responses to the question: “Please describe in 1 sentence your image of “better normal” transport in your city” and the online word cloud tool Word clouds ([wordclouds.com](http://wordclouds.com)) was used to generate a from answers that described “better normal transport” in the Philippines.



Figure 5-11 Word cloud of "better" normal transport

The responses generated 716 unique words, excluding *stop words* or words that do not contribute meaning to the sentences. For readability, 19 words (not including 'better', 'normal', and 'transport') repeated 15 or more times, were visualized. The resulting image is shown in Figure 5-11. Word size reflects how frequently it was mentioned. 'Safe', 'public', and 'transportation' are key components of the desired transport vision. Moreover, 'safely' and 'safety' were stated more than ten times, emphasizing their importance. This image summarized the descriptions of "better



normal" transport and clarifies the aspects that respondents consider as the desired situation.

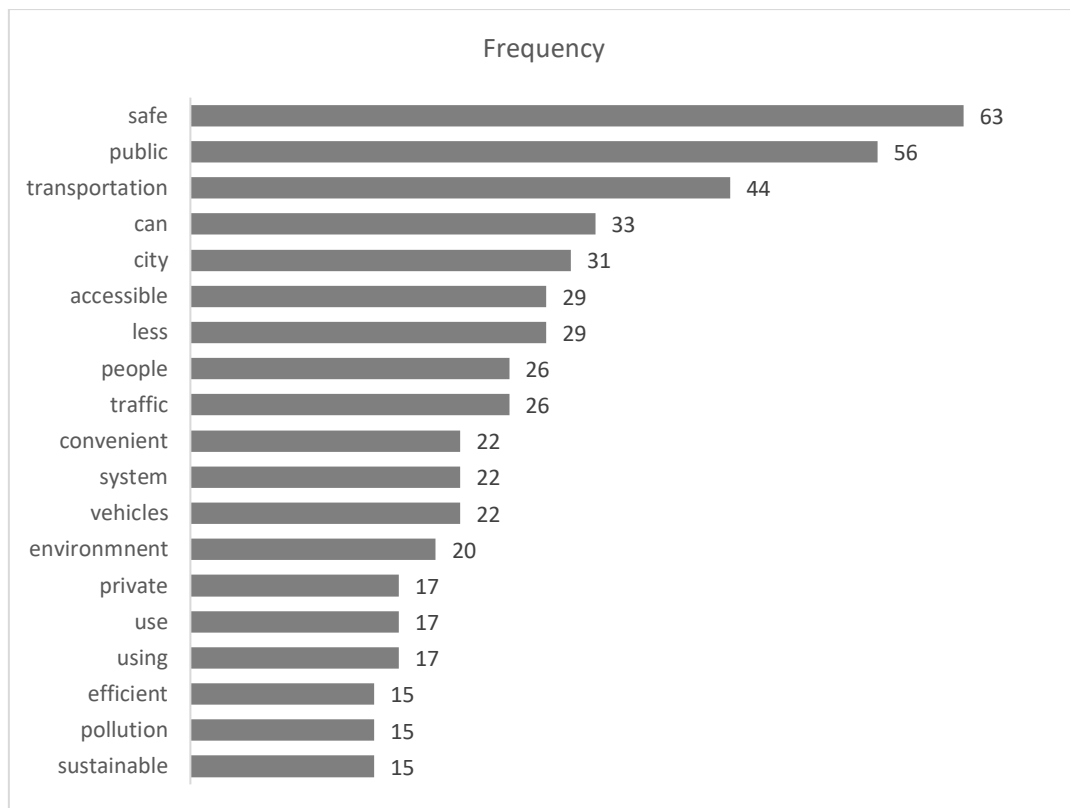


Figure 5-12 Word frequency

Figure 5-12 shows the frequency of words used in the respondents' answers. Open-ended questions are generally analyzed in a qualitative method where the researcher's expertise is used to explain the significant findings. This frequency analysis revealed a simple result. The graph shows safe (63), public (56), and transportation (44) as the top three most mentioned words. The word 'transport' (85) was filtered in the analysis to avoid slanting the graph. Moreover, the terms 'transpo', 'transport' and 'transportation', while having the same meaning are considered different terms. This analysis preserved the exact terms used by the respondents to clarify the most prominent features of "better normal" transport. These results show that it will be useful for planners to consider making existing public transportation systems safer, more accessible, and more convenient.

## **5.9. Conclusions**

A sustainable transport definition can be localized to support user groups in achieving sustainability. This analysis made use of images as a tool to communicate and clarify the linkages between sustainability and Philippine transport policies and concludes there are many linkages between the Philippines' national EST strategy and the Public Transport Modernization Program that are complementary and can be used to support the local government's technical capacities in local public transport route planning. It is recommended that the government revisit the thematic areas of the EST strategy as it may offer ways to support the Public Transport Modernization Program. These approaches can be adapted to the local conditions of developing countries, with consideration of challenges and opportunities to support local cities in creating plans that are sustainable and reflect the common vision of the community.

The COVID pandemic worsened mobility in the Philippines. On one hand, there is renewed interest in bicycle and pedestrian walking facilities, but at the same time, private vehicle use is also becoming more prevalent due to negative perceptions and restrictions on public transport services (DOTr, 2017). Respondents have shown significant acceptance of EST and interest in these strategies to be implemented by their respective cities. Owing to concerns about safety, respondents have signified an interest to purchase private vehicles during the pandemic. On a positive note, interest in electric vehicle options was also observed. Responses signified that a “better normal” involves a holistic approach that reflects the strategies of environmentally sustainable transport and should be incorporated as integrated systems, rather than piece-meal initiatives from different sectors to have broader scale impacts. It is recommended that the national and local governments in the Philippines become re-acquainted with the concepts of EST in a coordinated approach.

## 6. Chapter VI: Selecting EST Indicators

### 6.1. Objectives and analysis

One of the primary aims of this research is to communicate EST is part of local planning and can support planners in preparing sustainable transport plans. There are operational challenges in communicating sustainability without a standard definition. This research attempts to derive a sustainability measurement using available literature on sustainable transport indicators. This analysis explores text analysis and topic modeling as a process to select representative sustainability indicators and propose a set of indicators that can quantify an environmentally sustainable transport plan. The research is guided by the following questions: (a) What keywords are used in sustainable transport indicators? (b) Which indicators are used to measure it? (c) What topics represent the existing body of sustainability indicators? (d) Which indicators are used in the local public transport route planning guidelines? (e) Which indicators can be recommended for consideration in the guidelines?

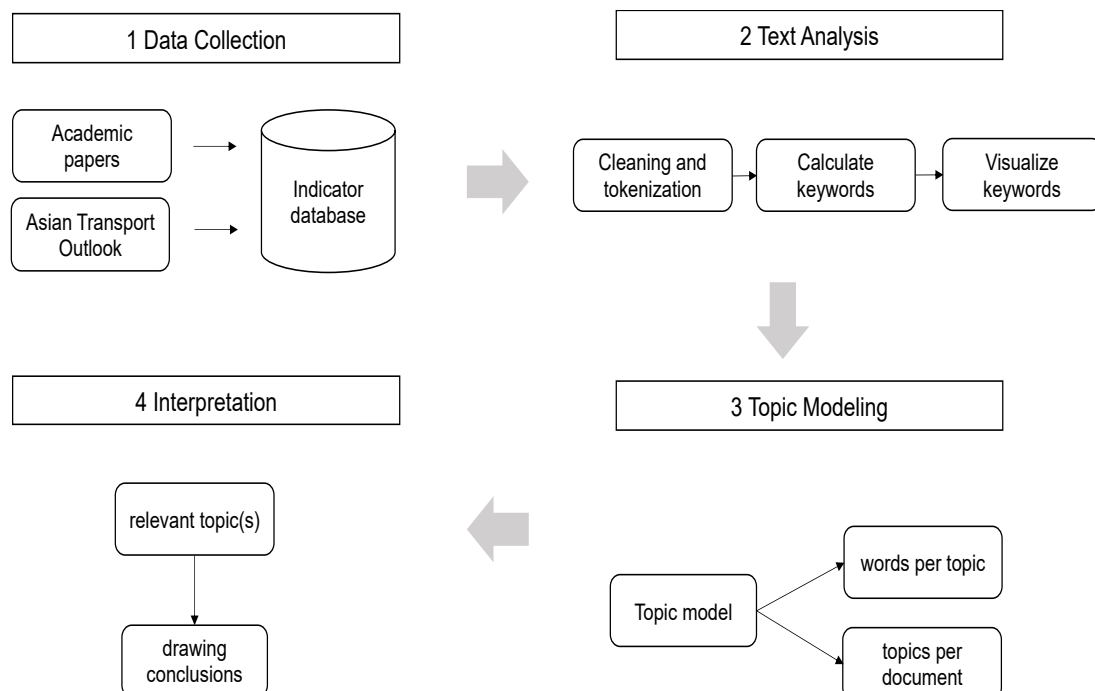


Figure 6-1 Analysis framework

Figure 6-1 shows the overall process of this analysis. The framework involves (1) data collection, (2) text analysis, (3) topic modeling, and (4) interpretation and the analysis framework is described briefly as follows:

1. The primary sources of sustainability indicators were collected from academic papers and the Asian Transport Outlook (ATO) of the Asian Development Bank. The latter was included as it is recognized as EST indicators by the Asian EST Regional Forum. A total of 1,337 indicators were included in the database for analysis.
2. To facilitate text analysis, the indicators were separated into one word tokens or individual word units. Cleaning and pre-processing was done to remove *stopwords* from the indicator database. Examples of stopwords removed include: *and, to, for*, etc. as these words are common but do not have particular meaning by itself. The next step is to calculate the keywords and plot graphs to visualize and explore relationships among keywords. This analysis was done using R packages *tidyverse* and *tidytext*.
3. This analysis used unsupervised methodology to find similar classifications in documents and combine it in topics. Structural topic model (*stm*) and *quanteda* R packages were used to generate topic models. The topic model finds natural groups that are unknown to the modeler (Silge and Robinson, 2017).
4. Results of the topic model will aim to answer the question: what topics represent sustainable transport indicators? This research uses identified topics to clarify what are the features of sustainability from existing literature.

This chapter will present and discuss the results of the text analysis and topic modeling to answer questions a-c, while the research questions on comparison of selected indicators with Philippines guidelines will be discussed in Chapter 7: Case Study.

## 6.2. Results and discussion

After cleaning and preparing the database into one-word tokens, each word can be analyzed to determine keywords. Term frequency – inverse document frequency (tf-idf) measures the importance of the words in relation to the total collection of words in the document (Silge and Robinson, 2013). It functions both as a pre-processing step as it has predictive value compared to the raw term frequencies, and as an exploratory or visualization technique (Lavin, 2019). Table 6-1 shows words with the highest tf-idf values. Freq (frequency) in the table refers to the number of times the word was mentioned in the database and Group refers to where the word was derived. In text analysis, most frequent words does not automatically mean it is an important keyword. Note that in the table, 'data' and 'pollutants' both appeared 10 times in the database. The tf-idf value of 'data' at 0.00294 is higher than 'pollutants' at 0.00248. The statistic tf-idf measures the importance of the word relative to all words in the database and is an important statistic that qualifies what the document is about. Figure 6-2 shows the highest ranked keywords among the two groups. With academic papers these words include: noise, costs, ft (feet), parking, expenditures, pollutants, modes, facilities, wise, waste, system, residents, portion, planning, modal, materials, split, day, affordability, resources, impacts, greenhouse, and equity. The Asian Transport Outlook (ATO) includes: *bau* (business as usual), *projections*, *domestic*, *aviation*, *covid*, *international electricity*, *targets*, *registration*, *irap* (international road assessment program), *trade*, *wheeler*, *shipping*, *rural*, *data*, *sustainable*, *passengers*, *assistance*, *route*, *official*, *lcv* (light commercial vehicle, and *bc* (black carbon). The difference in these results shows the ATO indicators are more operational indicators and focus on the functions of the existing transport systems. While the academic papers have more general and thematic words involved. The specific word differences and similarities on of the two data sets is presented in the summary portion of this chapter.

Table 6-1 Word frequency and tf-idf highest values

Rank	Group	word	freq	tf	idf	tf_idf
1	Asian Transport Outlook	bau	77	0.032669	0.693147	0.0226441803
2	Asian Transport Outlook	projections	70	0.029699	0.693147	0.0205856184
3	Asian Transport Outlook	domestic	44	0.018668	0.693147	0.0129395316
4	Asian Transport Outlook	aviation	21	0.00891	0.693147	0.0061756855
5	Academic Paper	noise	22	0.007874	0.693147	0.0054578518
6	Asian Transport Outlook	covid	15	0.006364	0.693147	0.0044112039
7	Academic Paper	costs	17	0.006084	0.693147	0.0042174309
8	Asian Transport Outlook	international	14	0.00594	0.693147	0.0041171237
9	Asian Transport Outlook	electricity	13	0.005515	0.693147	0.0038230434
10	Asian Transport Outlook	irap	12	0.005091	0.693147	0.0035289632
10	Asian Transport Outlook	registration	12	0.005091	0.693147	0.0035289632
10	Asian Transport Outlook	targets	12	0.005091	0.693147	0.0035289632
11	Asian Transport Outlook	trade	11	0.004667	0.693147	0.0032348829
12	Academic Paper	ft	13	0.004653	0.693147	0.0032250943
13	Academic Paper	parking	12	0.004295	0.693147	0.0029770101
14	Asian Transport Outlook	data	10	0.004243	0.693147	0.0029408026
14	Asian Transport Outlook	projection	10	0.004243	0.693147	0.0029408026
14	Asian Transport Outlook	rural	10	0.004243	0.693147	0.0029408026
14	Asian Transport Outlook	shipping	10	0.004243	0.693147	0.0029408026
14	Asian Transport Outlook	wheeler	10	0.004243	0.693147	0.0029408026
15	Academic Paper	expenditures	11	0.003937	0.693147	0.0027289259
16	Asian Transport Outlook	assistance	9	0.003818	0.693147	0.0026467224
16	Asian Transport Outlook	passengers	9	0.003818	0.693147	0.0026467224
16	Asian Transport Outlook	sustainable	9	0.003818	0.693147	0.0026467224
17	Academic Paper	facilities	10	0.003579	0.693147	0.0024808417
17	Academic Paper	modes	10	0.003579	0.693147	0.0024808417
17	Academic Paper	pollutants	10	0.003579	0.693147	0.0024808417
18	Asian Transport Outlook	bc	8	0.003394	0.693147	0.0023526421
18	Asian Transport Outlook	lcv	8	0.003394	0.693147	0.0023526421
18	Asian Transport Outlook	official	8	0.003394	0.693147	0.0023526421
18	Asian Transport Outlook	route	8	0.003394	0.693147	0.0023526421
19	Academic Paper	materials	9	0.003221	0.693147	0.0022327576
19	Academic Paper	modal	9	0.003221	0.693147	0.0022327576
19	Academic Paper	planning	9	0.003221	0.693147	0.0022327576
19	Academic Paper	portion	9	0.003221	0.693147	0.0022327576
19	Academic Paper	residents	9	0.003221	0.693147	0.0022327576
19	Academic Paper	system	9	0.003221	0.693147	0.0022327576
19	Academic Paper	waste	9	0.003221	0.693147	0.0022327576

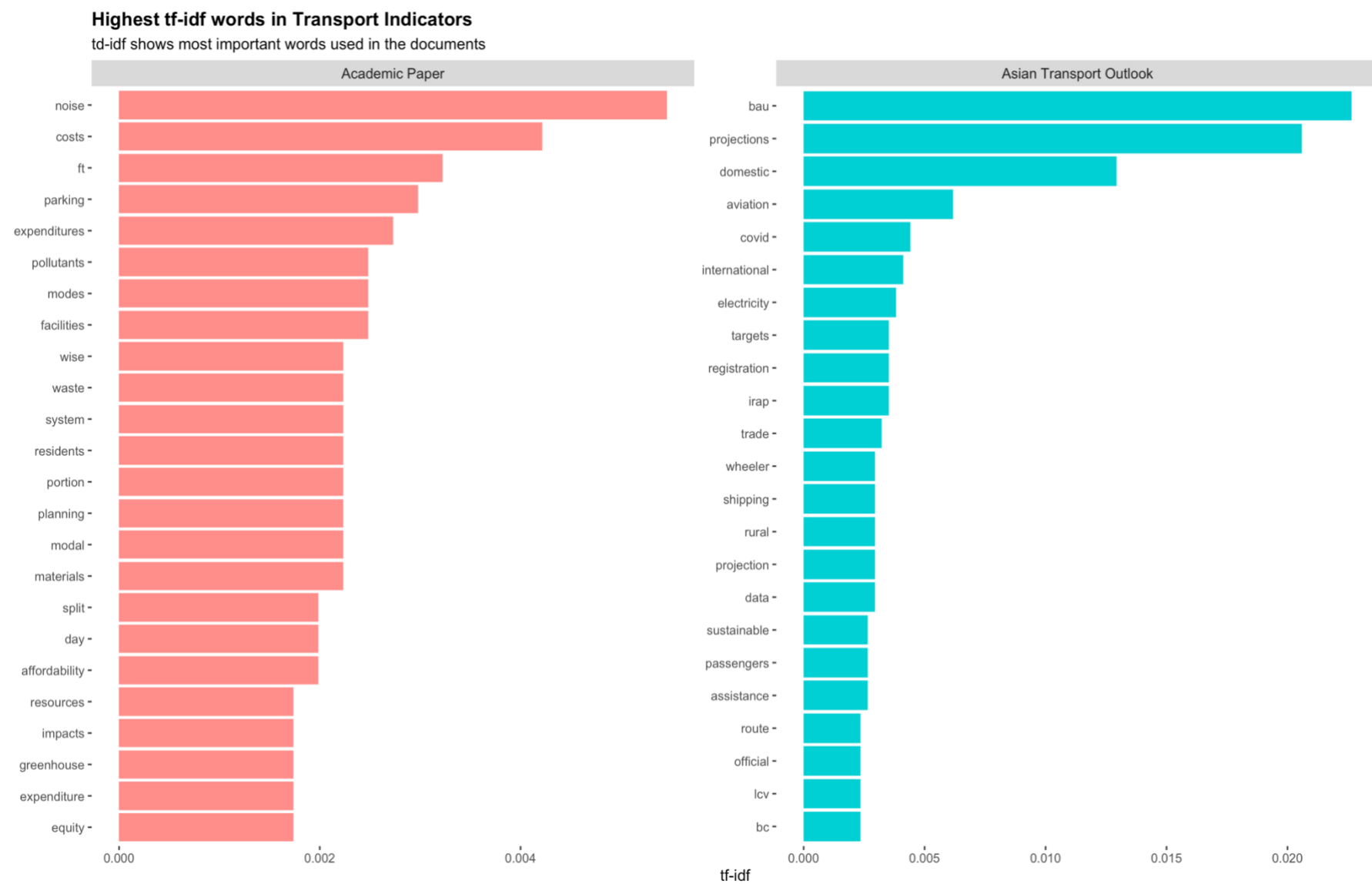


Figure 6-2 Highest tf-idf words transport indicators

### 6.2.1. Bigram network

Co-occurrence networks in text analysis can visualize the relationships of words tend to appear together in the database. Tf-idf bigrams are useful in providing more context in the relationship showing structures that are not present when analyzing one word. The disadvantage of bigram counts is that they are *sparse* or may be rare in the document (Silge and Robinson, 2017). In this analysis the bigram network is used to explore what co-relations exist in the database as shown in Figure 6-3 where clusters are formed with darker lines signifying stronger connections. The arrows point to the direction how the words appear. Text analysis assumes the modeler does not yet know what relationships exist in the document and this bigram network reveals these kinds of insights to the researcher. It is useful in uncovering new relationships that were not yet considered by the researcher. On another note, the researcher should have knowledge of the meaning of these words and make an interpretation of what it means. To interpret the results the largest cluster shows strong connections related to *bau projections, transport CO2, CO2 emissions, energy consumption, and public transport*. Also in the largest cluster, *transport system, road length, road user, road traffic, noise pollution, air pollutants*. These show emissions projections and energy consumption from public transport, and basic road characteristics are the more common topics of sustainable transport indicators. On the new insights generated, it shows covid google, google mobility, mobility rating, mobility data, sustainable mobility, and irap ratings formed a separate cluster. The previous chapter on EST in the Philippines discussed the impacts of COVID pandemic to mobility and sustainability. The results highlight the importance of considering pandemic mobility responses in relation to safety and sustainable mobility.



### Strongest connections:

- Bau projections
- Transport, CO2, emissions
- Energy consumption
- Public transport

- Transport; system; road
- Road length
- Road user
- Road traffic; noise pollution; air pollutants

- Covid, google, mobility
- Mobility rating
- Mobility data
- Sustainable mobility
- irap (safety) rating

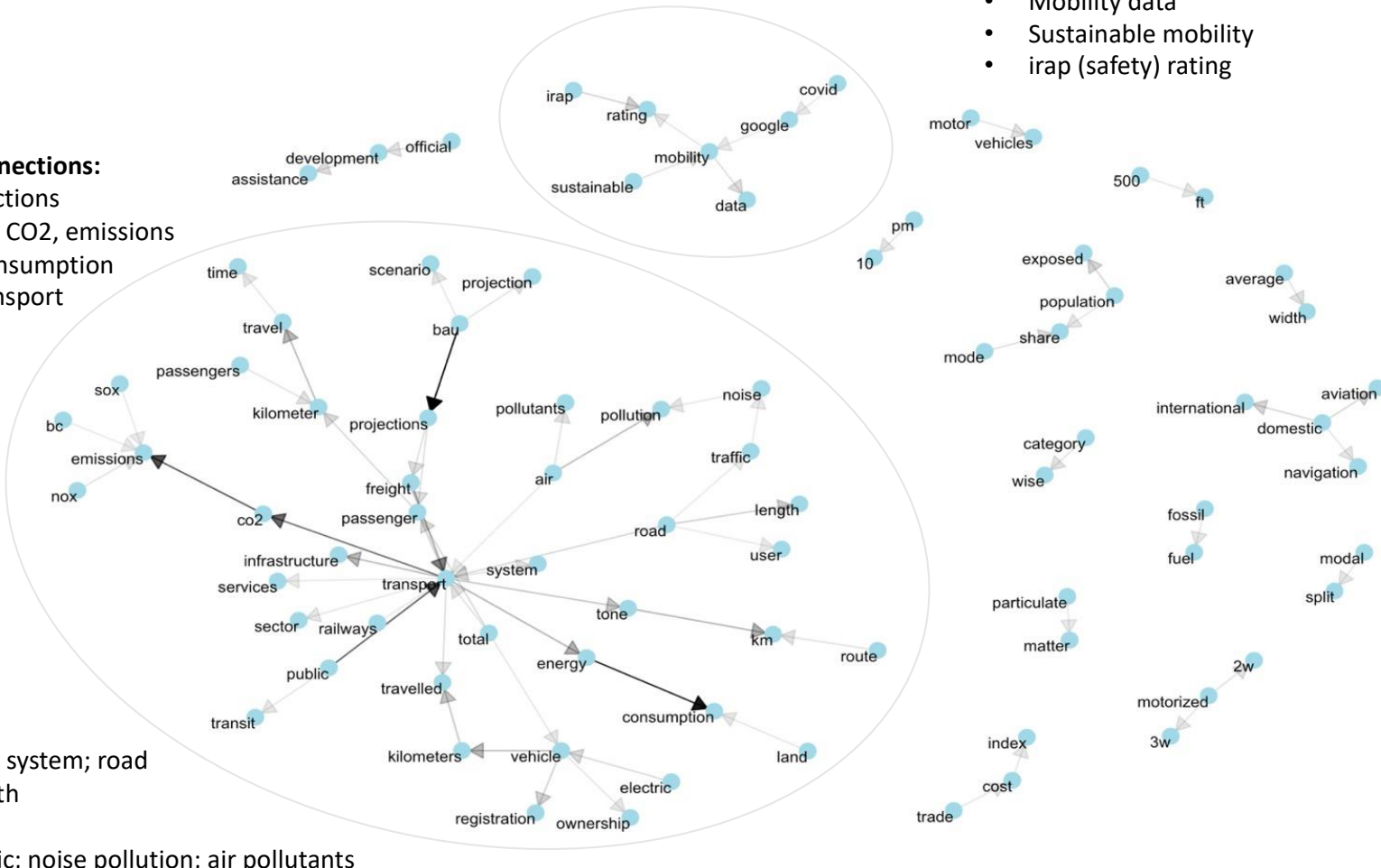


Figure 6-3 Bigram network of indicators

### 6.2.2. Topic models on sustainability indicators

Topic models are useful in discovering knowledge for large sets of data. It is used in this research to explore and clarify what words are considered to in sustainability indicators. The topic models considered the tf-idf values calculated from the text analysis. This topic model was assigned to generate 6 topics with the top 7 words that are related to the topics shown below. The highest probability of words refers to the beta values and these are the word showed in the topic model below. FREX refers to the frequent and exclusive words found in the topics. The lift and score are statistics of the LDA model.

A topic model with 6 topics, 25 documents and a 1141-word dictionary.

#### Topic 1 Top Words:

Highest Prob: share, road, capita, density, length, total, population

FREX: modeshare, brt, built, storm, density, buildup, floods

Lift: modeshare, center, composite, fares, gridded, gross, intersection

Score: modeshare, brt, surges, wide, buildup, floods, route

#### Topic 2 Top Words:

Highest Prob: road, public, wise, category, day, energy, length

FREX: wise, day, category, rail, proportion, emission, cycling

Lift: accidental, adults, allocated, butadiene, citizens, cleaner, commuters

Score: wise, day, category, million, pkt, commuters, accidental

#### Topic 3 Top Words:

Highest Prob: capita, public, emissions, air, consumption, pollution, land

FREX: facilities, materials, planning, portion, residents, affordability, equity

Lift: acid, amount, auto, automobile, based, chemicals, community

Score: costs, portion, residents, materials, planning, accessibility, affordability

#### Topic 4 Top Words:

Highest Prob: average, ft, traffic, width, public, percentage, building

FREX: ft, sidewalk, width, average, building, coverage, expenditures

Lift: ft, sidewalk, bb, bldg, buffer, calming, canopies

Score: ft, sidewalk, width, enclosure, cross, crossing, curb

#### Topic 5 Top Words:

Highest Prob: production, share, vehicle, electric, length, km, road

FREX: production, electric, heavy, models, mobile, internet, country

Lift: battery, cobalt, copper, ev, graphite, heavy, line

Score: electric, production, models, heavy, route, country, broadband

#### Topic 6 Top Words:

Highest Prob: bau, projections, emissions, vehicle, share, total, domestic

FREX: bau, projections, aviation, electricity, irap, registration, targets

Lift: accreditation, adjusted, age, agencies, answering, apple, apps

Score: bau, projections, domestic, aviation, electricity, travelled, registration

Figure 6-4 shows the distribution of documents per topic. The x-axis shows the number of documents and y-axis shows the gamma probability or the likeliness that each document is related. This is followed by the figure on the prevalence of that topic depending on the author and source of the document. To interpret the results, for topic 1,5,6 only the ATO indicators: ATO Urban (1), ATO SND (5), and ATO National (6) are directly related to it. This implies these topics are represented by operational sustainability indicators. Topic 3: *capita, public, emissions, air, consumption, pollution, land* has the most concentration of documents related where it includes 16 of the 22 academic papers with varying degree of probability. This shows many papers about sustainability indicators in transport discuss the public emissions, air pollution and land consumption. Wherein these words relate to air pollution and emissions. More importantly, the frequent and exclusive, lift and score show *planning, accessibility, affordability, and equity*. These words are important features in planning and public transport systems. Also, from the FREX, Lift and Score words as *sidewalk, canopies, enclosure, and building* are found important. It can be interpreted Topic 4 is related to walkability and pedestrian indicators and that is also related to the non-motorized component of sustainable transport.

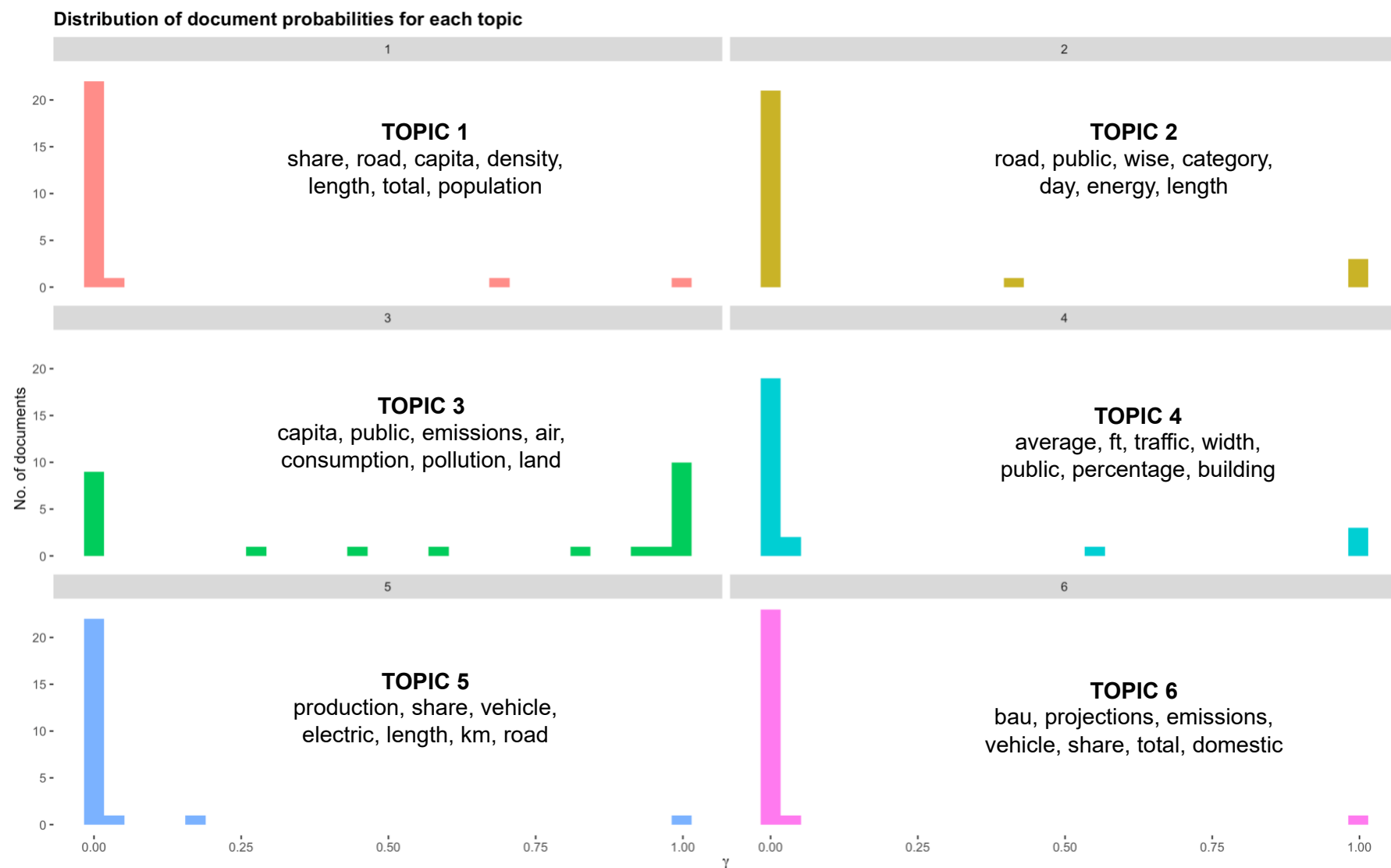


Figure 6-4 Distribution of documents per topic and highest word probabilities

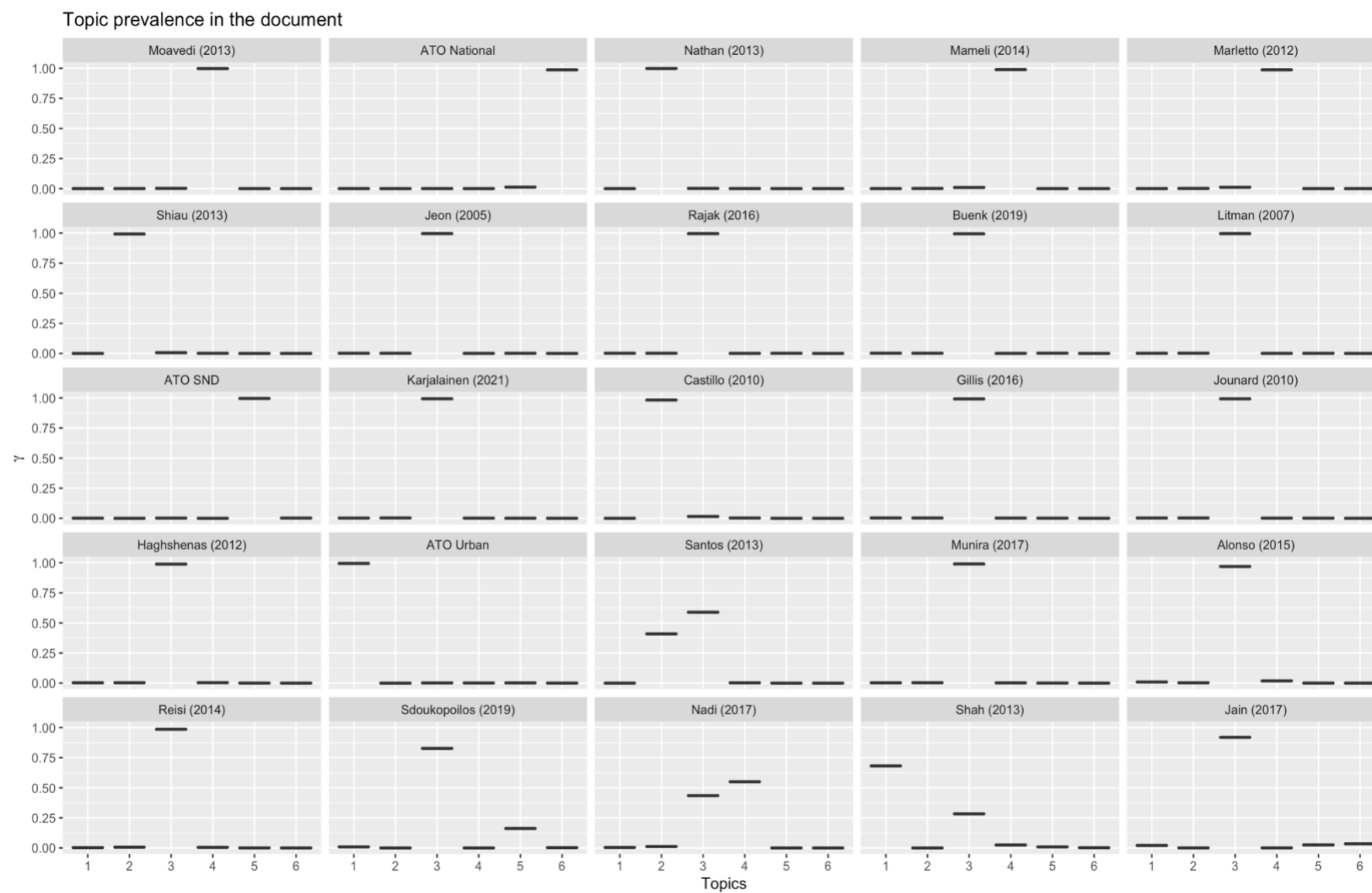


Figure 6-5 Relation of the document to the topic

### 6.3. Selecting indicators

Text analysis inferred the most important keywords in the indicators database and identified 3 general categories that represent sustainability indicators. To select indicators, the highest tf-idf words shown in Table 6-1 were matched with the original indicators database. The selected indicators containing these words from the road sector (including applicable to all sectors) were categorized based on the sustainability pillars (economic, social, and environment) and further divided by indicators that can be collected at the National or Regional level and indicators that can be collected at the city level as shown below. The initial filtering resulted in 381 indicators for the national and city level when duplicates were removed.

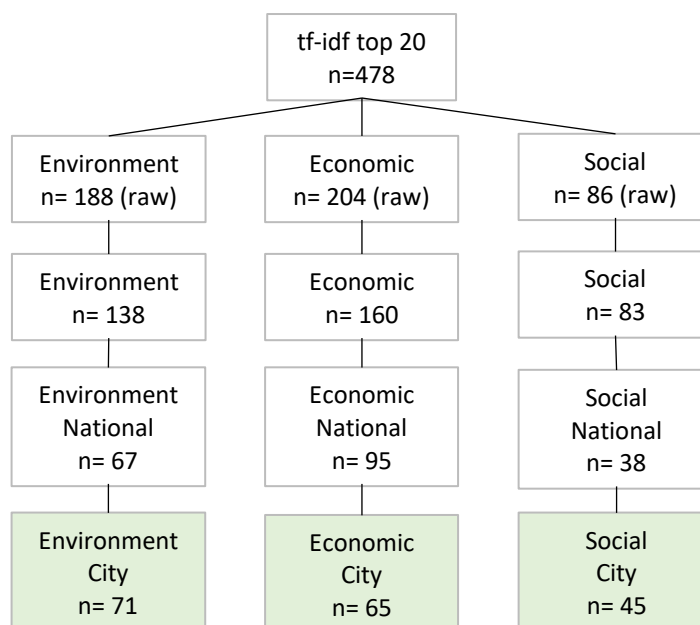


Figure 6-6 Selection flow chart

This research focuses on selecting indicators that the City level can use, and 200 indicators may be counterproductive given the capacity constraints. To further limit the number, another filtering was conducted using the highest tf-idf single words and tf-idf bigrams, which narrowed down the dataset to 160 indicators. Bigrams denote the two words appearing together in the indicator and reduce the dataset. Another consideration in selecting indicators only from the academic papers group as the ATO

indicators are specific operational measurements that can be incorporated into the more general academic indicators. The results were again classified into environmental, economic, and social dimensions and categorized as national or city-level indicators. Table 6-2 found ten indicators on the national level. Economic indicators included subsidies to the transport system, energy efficiency, and variety of transport systems available. Environmental indicators focused on greenhouse gas emissions, air pollutants, land use devoted to transport facilities, and the technological maturity of the transport system. At the city level Table 6-3 found social indicators are most common with focus on accessibility of the transport system, comprehensive transport planning that involves stakeholders and considers cultural resources, and the health impacts of vehicular pollution and noise pollution. Topics related to environmental pollution (environment) are Topic 3 and 6, passenger mobility characteristics (social and economic) is inferred from Topic 2. Road characteristics, vehicles, and networks (environment and economic) from Topics 1 and 4-5 are represented in the tables below.

Table 6-2 Selected indicators (National)

<b>National</b>	<b>Indicators</b>
<b>Economic</b>	<ol style="list-style-type: none"> <li>1. Public subsidies to transport system</li> <li>2. Transport energy efficiency (Utility) – by mode and category</li> <li>3. Transport monetary efficiency (Utility) – category wise</li> <li>4. Transport system diversity/transportation variety</li> </ol>
<b>Environment</b>	<ol style="list-style-type: none"> <li>1. Emissions of air pollutants</li> <li>2. Fossil energy consumption by transport system</li> <li>3. Greenhouse gas emissions</li> <li>4. Main air pollutants from transport PM10 NMVOC NOX CO</li> <li>5. Per capita land devoted to transport facilities (roads, parking, ports, and airports)</li> <li>6. Technological maturity of transport system</li> </ol>

Table 6-3 Selected indicators (City)

City	Indicators
<b>Economic</b>	<ol style="list-style-type: none"> <li>1. Average speed of transport – category wise</li> <li>2. Investments in transport systems and infrastructure</li> <li>3. Modal split transit and NMT</li> <li>4. PKT per population – mode and category wise</li> <li>5. Vehicles per road length – category wise</li> <li>6. VKT and PKT proportion – mode and category wise</li> </ol>
<b>Environment</b>	<ol style="list-style-type: none"> <li>1. Air and noise pollution exposure</li> <li>2. Greenhouse gas emissions from passenger travel (kg/capita)</li> <li>3. Portion of land paved for transport facilities</li> </ol>
<b>Social</b>	<ol style="list-style-type: none"> <li>1. Customer accessibility to transport system</li> <li>2. Degree cultural resources are considered in transport planning</li> <li>3. Degree to which transport planning is comprehensive by considering all significant impacts and using the best evaluation practices</li> <li>4. Modal split of trips to school/Share of children driven to school by car</li> <li>5. Mortality effects of air pollutants</li> <li>6. Overall satisfaction rating of transport system (based on objective user surveys)</li> <li>7. Proportion of people exposed to vehicular pollution, and traffic noise</li> <li>8. Proportion of people with health impacts related to air and noise pollution</li> <li>9. Transport system accessibility to other locations</li> <li>10. Universal design (consideration of disabled people's needs in transport planning)</li> </ol>

Further examination of the indicators above show some points can be used to describe the other indicators. For example, environment indicator no. 1 air and noise pollution exposure can include social indicator no. 7 proportion of people exposed to vehicular and traffic noise. Another example is social no. 3 degree to which transport planning is comprehensive can be combined with social no. 2 degree cultural resources are considered in transport planning and 10. Universal design (consideration of disabled people's needs in transport planning) as shown in the table below. The combined 13 indicators will be used and validated in the case study.



Table 6-4 Combining city indicators

	<b>Main indicator</b>	<b>Combined indicator</b>
<b>Environment</b>	1. Air and noise pollution exposure	Proportion of people exposed to vehicular pollution, and traffic noise
<b>Economic</b>	2. Average speed of transport	
<b>Social</b>	3. Customer accessibility and overall satisfaction rating of transport system	Overall satisfaction rating of transport system (based on objective user surveys)
<b>Social</b>	4. Degree to which transport planning is comprehensive	Degree cultural resources are considered in transport planning  Universal design (consideration of disabled people's needs in transport planning)
<b>Environment</b>	5. Greenhouse gas emissions form passenger travel (kg/capita)	
<b>Economic</b>	6. Investments in transport systems and infrastructure	
<b>Social</b>	7. Modal split of trips to school/Share of children driven to school by car	
<b>Economic</b>	8. Modal split public transport and NMT	
<b>Social</b>	9. Mortality effects of air pollutants	Proportion of people with health impacts related to air and noise pollution
<b>Economic</b>	10. PKT per population by mode and category wise	VKT and PKT proportion – mode and category wise
<b>Environment</b>	11. Portion of land paved for transport facilities	
<b>Social</b>	12. Transport system accessibility to other locations	
<b>Economic</b>	13. Vehicles per road length category wise	

#### 6.4. Summary of results

The analysis set out to find a common representative set of indicators from existing literature and identified guide questions. To answer (a) what key words used in sustainable transport indicators? And (b) which indicators are used to measure it? To illustrate the answers Figure 6-7 shows the top keywords and the number of indicators containing that word from academic papers. Economic indicators on

expenditures and costs are most mentioned. Environment indicators are considered next with land use and pollution indicators. And social indicators are concerned with residents, affordability, planning and equity. Figure 6-8 contains twice as many indicators and appears to have a strong focus on data collection and projections compared to the other group. ATO keywords do not appear to have social indicator and are more specific technical data points as compared to the academic indicators group. Figure 6-9 shows only 4 words are common between the two groups. The differences in both data source groups reflect the lack of common measurements for sustainability. These results, provided evidence that there are many different ways to measure sustainability.

On the question (c) what topics represent the existing body of sustainability indicators? Results from the topic models showed indicators mostly consider air pollution and emissions as well as non-motorized transportation. A closer look at the FREX, score, and lift (metadata) clarified the other important words relating to planning and walkability indicators. Additionally, the indicators on Asian Transport Outlook focused on operational indicators with most frequently used words as projections and business as usual (BAU), and the COVID pandemic impacts are also being considered. The pattern of words show different categories such as domestic/international as the scale, and also specific emission types such as black carbon, and specific vehicle type, light commercial vehicle (LCV). Whereas the academic papers considered planning. Economic indicators such as costs and expenditure, environment indicators were mentioned on greenhouse, pollutants, and noise. Related to social indicators is mentioned residents, affordability and most importantly equity. These considerations confirm the academic indicators' suitability for planning purposes.

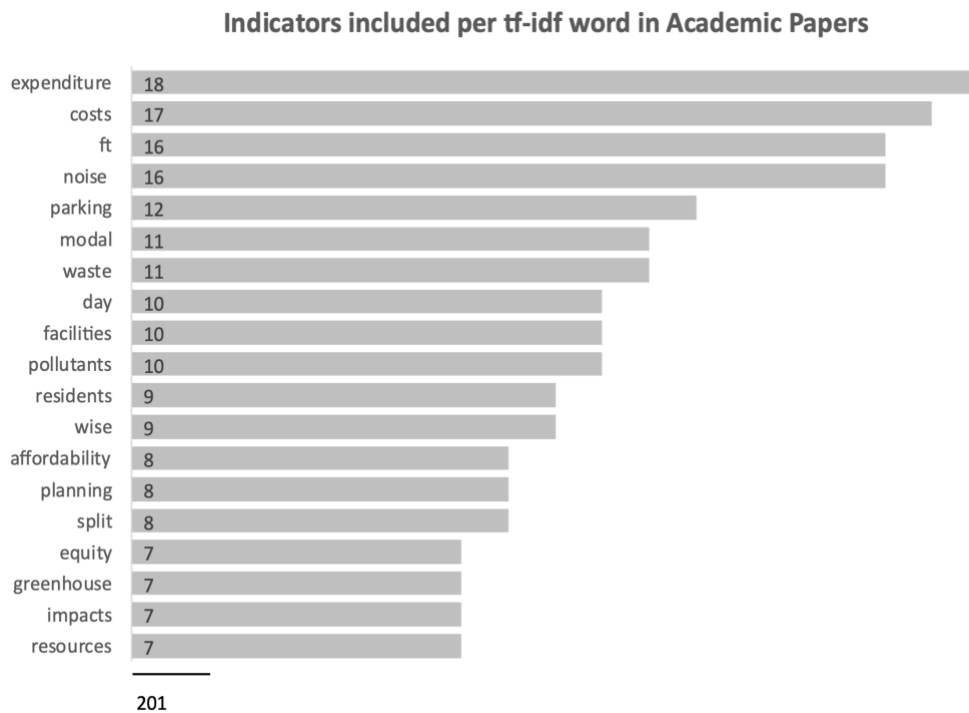


Figure 6-7 Keywords in academic papers

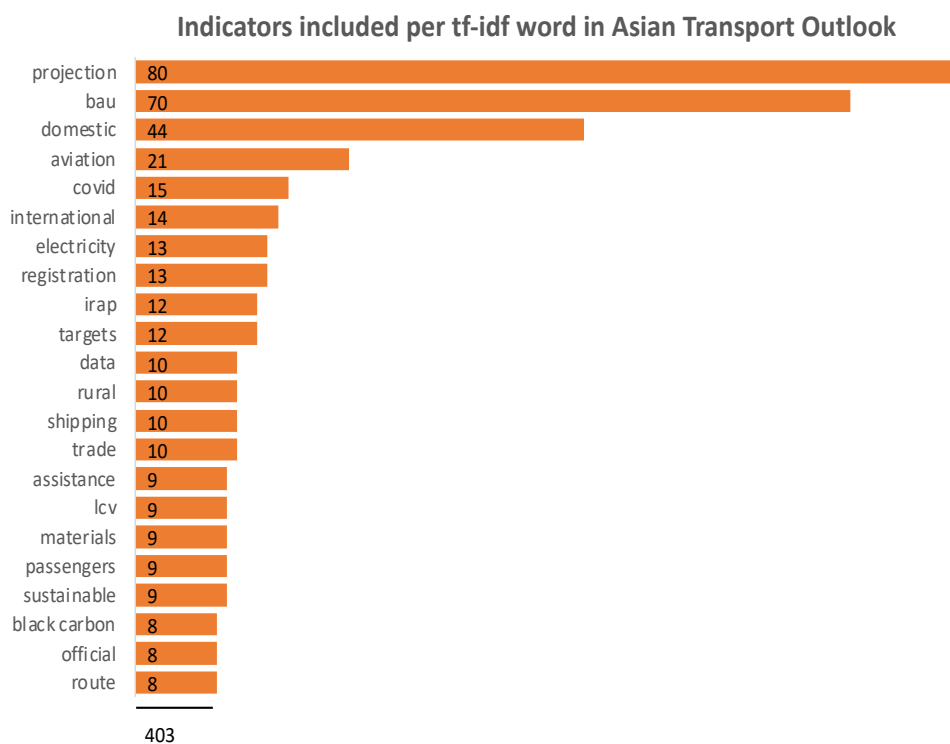


Figure 6-8 Keywords in ATO

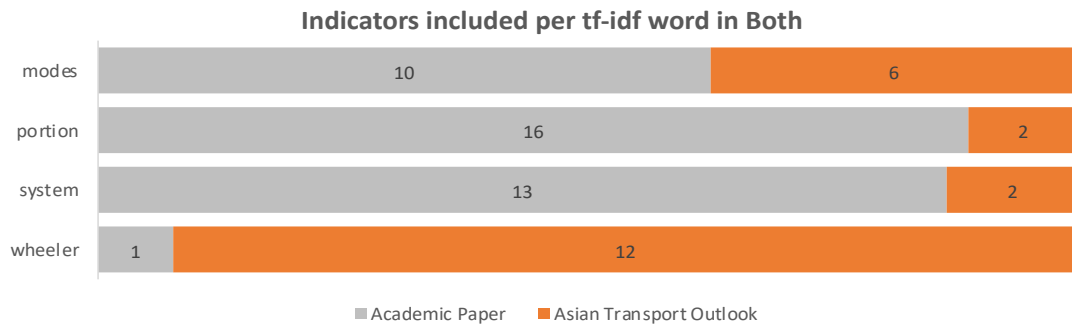


Figure 6-9 Keywords in academic papers and ATO

#### 6.4.1. Impacts of small and medium cities on text mining

Four text mining results were considered in the analysis. First is simple frequency counts visualized in the word clouds. Second is the strength of word representation in all the documents called *tf-idf*. Third is the bigram networks and fourth is the topic models, where both considered the strength of word representation. The source documents for all these analysis came from academic literature and international operational transport indicators. The results can be applicable to both developed and developing countries. However, this research is focused on applying EST indicators for small and medium cities in the context of a developing country and uses text mining to find out what can be useful and applicable for cities in preparing local transport plans.

The first impact is limiting the indicators in the filtering process. Ten indicators (four in economic and six in environment) were categorized as more appropriate for the national level than city level and are listed in Table 6-2. The economic category includes *public subsidies to transport system* where the Philippines subsidizes the metro rail lines found only in Metro Manila, which is outside the policy scope. Also noting the local transport planning policy only considers road transportation. Therefore this indicator is not in the scope of small and medium cities. Next, the *energy and monetary efficiency (utility) and transport system variety* are also in the economic category. Public transport in small and medium cities were determined by the National government and as explained in the background the consideration of transportation

planning is entirely new for local cities and there is little to no information that can be provided with regard to these indicators. With regard to the environment indicators, *emissions of air pollutants* and sources are included, where this data is in the scope of the Philippines Intergovernmental Panel on Climate Change (IPCC). Indicator on *land devoted to transport facilities* by mode can be aggregated on the national level, primarily because ports and airports are managed in the National government. The *technological maturity of the transport system* is also at the National level since vehicle technology needs to be approved by the Department of Trade and Industry (DTI) among other sectoral agencies.

The second impact is related to the topic model results where planning is an important word of Topic 3 and also a focus of the local public transport route planning policy. Finally, the third impact is visualizing the results to communicate EST to local cities using the word cloud and shortlisted indicators and these results will be discussed in the case study in Chapter 7.

#### 6.4.2. Limitations on data and analysis

Regarding the data of indicators, the study referred to the systematic review paper on urban transport and sustainability assessments by Karjalainen and Juhola (2021), the most recent peer-reviewed literature on sustainability indicators available, and collected research with titles containing indicators. A total of 22 papers were collected including the systematic review with authors and titles listed in Appendix D. On the analysis, topic modeling is an unsupervised method of analysis that is useful for placing words into categories and the resulting categories will be interpreted by the modeler. Recognizing that there may be differences in interpretation, the analysis focused on using tf-idf keywords to filter indicators. And the final selected indicators showed features of the three topics identified by the model. The author recognizes the parameters used for filtering may vary and suggests future researchers may improve upon the filtering parameters based on the sustainability priorities and goals of the

intended users. This analysis was able to demonstrate a quantitative method for selecting indicators from existing literature and considers this as a contribution to the body of academic knowledge.

## **7. Chapter VII: Case Study**

### **7.1. Overview and analysis objectives**

This chapter has two sections to examine the application of EST in the Philippines' local public transport planning using the results of defining the EST concept and selecting sustainability indicators presented in Chapters V and VI. The first part of the analysis involves an assessment of the local public transport planning manual and comparing Philippines plans and policies that can help support the data needs in route planning. Specifically, it looks at the transport route planning manual by comparing it with the city sustainability indicators identified in the previous chapter. The analysis features a review of Philippines planning guidelines vis-à-vis the selected indicator and aims to identify data points where sustainability indicators can be incorporated into the planning guidelines. The second is the case study and validation of the results using interviews with key stakeholders from the national government. The discussions from the stakeholders will be compared to clarify thematic similarities and patterns regarding the planning processes and their experiences. Success contributors and challenges to preparing the plans will be investigated. The last part is the validation of the selected indicators with transportation experts. These inputs seek to clarify the specific recommendations for the application of EST.

### **7.2. Overview of transport policy**

Transport policy documents were explored using text mining and topic modeling to find out the representative message of these documents. The analysis combines the word cloud and topic modeling used in previous empirical chapters. Five policy documents; three from the Philippines were included in this analysis. The *National EST Strategy* and *Local Public Transport Route Plan Manual Volume 1* and the *National Transport Policy* (2018) which details the implementation rules and regulations on transport and identifies coordination responsibilities among national agencies, were also included. The Philippines is a member of the Asian EST Regional Forum and have signified to support the policies of the Forum. The EST

Forum's *Bangkok Declaration for 2020 – Sustainable Transport Goals for 2010-2020* and the *Aichi 2030 Declaration on Environmentally Sustainable Transport – Making Transport in Asia Sustainable (2021-2030)*. This analysis aims to determine what topics can be derived from the policy documents, clarify the five documents' messages, and use a word cloud to visualize the most frequent words used in transportation policy. The analysis intends to verify how sustainable transport policy is communicated in the Philippines.

### 7.3. Results of transport policy analysis

#### 7.3.1. Word cloud on policy documents

The most frequently mentioned words in the documents are visualized in the word cloud in Figure 7-1. The image shows *road*, *sustainable*, *est*, *national*, *local*, *public*, *transportation*, *development*, and *strategies*. Recalling the objective of the transport modernization, words not reflected are about the drivers and operators having stable and dignified livelihoods and commuters arriving to their destinations quickly, (safely) and comfortably. Compared with the image of better normal transport, the policy documents does not use the word *people*, specifically. This research early on set the importance of mobility of people over vehicles as sustainable transport and finds the absence of reference to people in transport policies as an interesting point.



Figure 7-1 Word cloud of transport policy



This next discussion briefly looks at how “people” are considered in the five documents. Social equity, accessibility, and people are clearly mentioned in the Bangkok 2020 and Aichi 2030 Declaration from the Asia EST Forum documents. Specifically, the Bangkok 2020 Declaration expressed “*adopting social equity as a planning and design criteria (Goal 17)*” for transport development and initiatives. Social equity in this perspective considers universal accessibility and safety for all people (especially women, persons with disability and the elderly) in streets and public transportation. The Aichi 2030 Declaration sets this common vision for EST in Asia. Passenger and freight transport systems should be universally accessible and equitable for all genders, income groups, and abilities. The Philippines’ National EST Strategy emphasizes people in sustainable transport by including the *social equity and gender perspective* and *knowledge base, awareness, and public participation* as key thematic areas in the transport strategy. The three documents on EST focuses on the importance of the people and social equity in sustainable transport. The Philippines National Transport Policy (NTP) has one mention of social equity in the fiscal budget allocation (NTP, p.19). Lastly, the Local Transport Route Planning Manual describes the basic principle of a people-first priority in public transport (Manual, p.12).

Another point is the large gap in the word frequency of public and the following word counts (Figure 7-2). “Public” can refer to the sector and also and to people however. Note that the word cloud can also consider people as ‘passenger’. The word cloud is a summary of what the documents are talking about. Regarding the statistical importance of these words to the entire document, topic modeling can provide a different perspective as discussed in the following section.

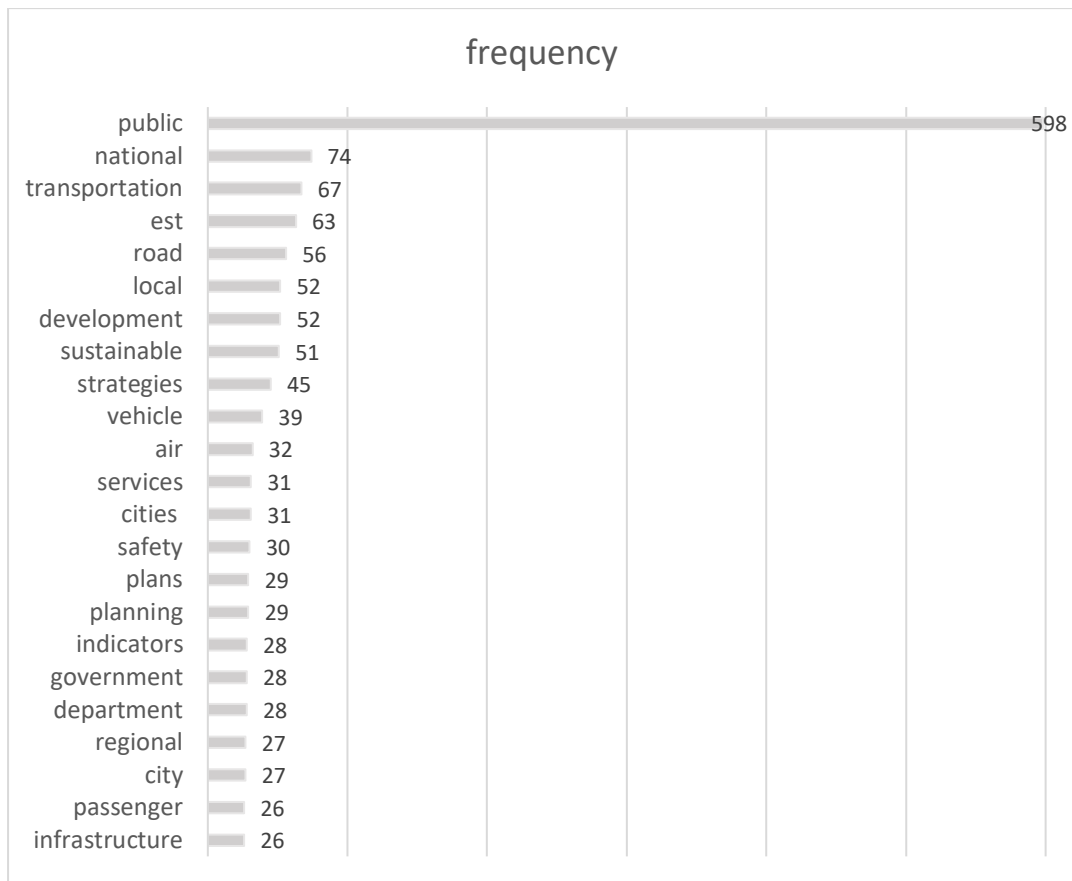


Figure 7-2 Word frequency of public transport policy

### 7.3.2. Topic model on policy documents

Following the basic pre-processing in text analysis, the five documents were converted to lowercase and cleaned; stopwords are removed and formatted into single-word tokens. Two topic models are generated from the policy documents with three documents with 100% probability on topic 1: *est*, *national*, *sustainable*, *road*, and *public* and the remaining two documents entirely on topic 2: *public*, *transportation*, *route*, *local*, *plan*. This shows the topic model (Figure 7-3) was able to make a distinction between the three policy documents that discuss EST and those two documents that refer to the local public transport planning and the National Transport Policy. Text analysis implies that the National EST Strategy and Local Public Transport Route Plan are considered representative topics for the policy documents.

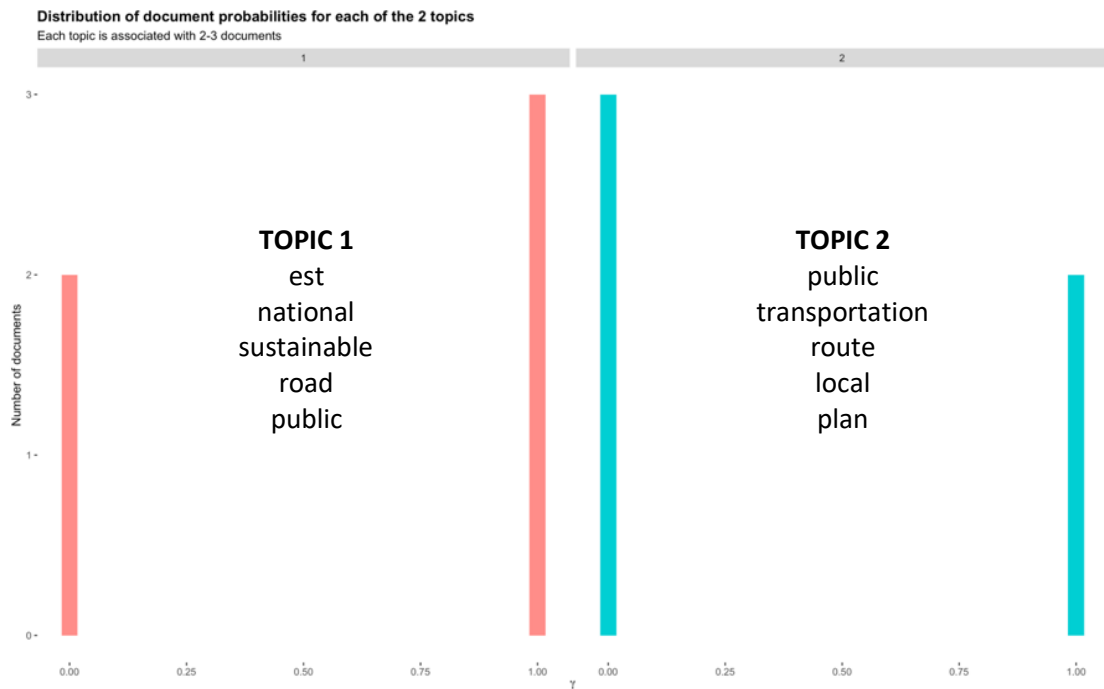


Figure 7-3 Topics of transport policy

## 7.4. Sustainability Indicators for Local Transport Planning

### 7.4.1. Overview of related plans

The basic principle of the Local Public Transport Route Plan is “*to reduce the reliance on private vehicles and move toward environmentally sound mobility solutions*”. A planning manual was provided to teach a simplified approach for corridor planning that cities can use with limited data or in the absence a comprehensive transport plan (DOTr, 2017). The manual lists minimum data requirements and formulas to identify the number of public transport (type and units) to operate with financial viability in a particular corridor. It reiterates that cities are knowledgeable and suited to identify the service routes in respect to the development needs in their localities. Based on RA 7160 or the Local Government Code of 1991, all Local Government Units (LGU) are mandated to prepare a Comprehensive Land Use Plan (CLUP) and a Comprehensive Development Plan (CDP).

- CLUP – spatial long-term framework plan that defines policy directions for managing land and water territories. Policies include: settlement, protection,

production, and infrastructure. It is the basis of the zoning ordinance and has 9 years planning time frame.

- CDP – sectoral multi-year, multi-sector plan development plan covering social, economic, physical, environmental, and institutional sectors. It allows integration with National Government plans and has a planning timeframe of 6 years.

Naturally, CLUP and CDP both have detailed technical guidelines for their preparation and compliance. In addition, cities are also requested to prepare 33 other plans prescribed by the National Government, sectoral and thematic plans, with varying manuals, listed in Table 7-1. Note this does not include the local public transport route plan, which is the focus of this research. Moreover, the Transportation Management Plan refers to a traffic (congestion) strategy to address vehicle flow in commercial areas and business districts. The Department of Interior and Local Government (DILG) recognizes a low interest in cities and municipalities for preparing the CDP, where less than 50% of have complied as of 2015 (DILG, 2017). DILG also acknowledges that local planners are challenged by the highly technical CDP planning guidelines and proposed simplified guides to be better approached by the city. The language of simplifying and integrating plans and manuals is common in Philippines planning and it is generally acknowledged that local governments have concerns on complying with the required plans.

Table 7-1 Additional plans requested from local governments

<b>National government mandated plans</b>	<b>Other sectoral/thematic plans</b>
1. Action Plan for the Protection of Children	1. Nutrition Action Plan
2. Aquatics and Fisheries Management Plan	2. Information and Communications Technology Plan
3. Annual Culture and the Arts Plan	3. Local Shelter Plan
4. Anti-Poverty Reduction Plan	4. Plan for the Elderly
5. Local Coconut Development Plan	5. Plan for Health and Family Planning
6. Local Disaster Risk Reduction Management Plan	6. Coastal Management Plan
7. Food Security Plan	7. Informal Strategic and Management Plan

8. Forest Management Plan	8. People's Plan
9. Gender and Development Plan	9. Business Plan/Strategy
10. Integrated Area Community Public Safety Plan	10. Capacity Development Agenda / Human Resource Management and Development
11. Local Entrepreneurship Development Plan	11. Transportation Management Plan
12. Sustainable Area Development Plan	
13. Local Tourism Plan	
14. Small and Medium Enterprise Development Plan	
15. Strategic Agricultural and Fisheries Development Zones	
16. Solid Waste Management Plan	
17. Watershed management Plan	
18. Ancestral Domain Sustainable Development and Protection Plan	
19. Plan for Persons with Disabilities	
20. Forest Land Use Plan	
21. Local Climate Change Action Plan	
22. Peace and Order Public Safety Plan	

Source: DILG, 2017

#### 7.4.2. Assessment of sustainability indicators

This analysis will consider existing plans and identify potential sources of data for the selected sustainable transport indicators. Table 7-2 shows the selected indicators and the corresponding topics identified in the previous chapter. This searchers for the data in related plans that can be considered as potential data sources for the indicators, when it is not found in any current plan, suggestions for data collection will be proposed.

Table 7-2 Topics and selected indicators

<b>Environmental Pollution</b>	<b>Passenger mobility and demand</b>	<b>Road network characteristics and vehicles</b>
Air and noise pollution exposure	Customer accessibility to transport system	Average speed of transport
Greenhouse gas emissions form passenger travel (kg/capita)	Degree cultural resources are considered in transport planning	Investments in transport systems and infrastructure
Mortality effects of air pollutants	Degree to which transport planning is comprehensive by considering all significant impacts and using the best evaluation practices	Modal split transit and NMT

Proportion of people exposed to vehicular pollution, and traffic noise	Modal split of trips to school/Share of children driven to school by car	Portion of land paved for transport facilities
Proportion of people with health impacts related to air and noise pollution	Overall satisfaction rating of transport system (based on objective user surveys)	Transport system accessibility to other locations
	PKT per population -mode and category wise	Vehicles per road length category wise
	Universal design (consideration of disabled people's needs in transport planning)	
	VKT and PKT proportion mode and category wise	

#### 7.4.3. Environmental pollution

The Department of Environment and Natural Resources (DENR) prepares the National Emissions Inventory every three years, with the latest data from 2018. Air pollutants monitored include carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (PM), sulfur oxides (SOx), and volatile organic compounds (VOC) and data is available by region and source. Motor vehicles contributed 74% of emissions according to the inventory (EMB, 2018). Air pollution has defined health impacts and in the absence of air quality monitoring equipment, Cities can collect the proportion of patients with respiratory related diseases using medical records from hospitals and health centers to estimate the health and mortality impacts of air pollution. The negative health impacts of noise pollution is lesser known in the Philippines wherein noise disturbances at all times of the day is considered a normal. The World Health Organization (WHO) road traffic noise is strongly recommended to be limited at 53bB (daytime) and below 45dB (nighttime) to mitigate negative health effects of noise pollution. The Philippines daytime noise pollution standards are 50dB – 75dB based on the Environmental Quality Standards for Noise in General Areas in 1980. The National EST Strategy noted the absence of institutionalized traffic noise monitoring systems in the Philippines and recommended strategies to reduce roadside noise by updating the noise standards, strict enforcement, and enhancing the LGU capacity to

enact ordinances on noise management (NEST, 2011). Previous efforts to monitor noise pollution was conducted for the Metro Manila Environmental Impact Analysis in 1997 by the University of the Philippines National Center for Transport Studies (UP-NCTS) and was followed by a study to determine noise pollution from tricycles in 2004. All noise pollution readings using an integrated sound level meter (NL-04) registered more than exceeded the standards (Vergel, et.al., 2004). WHO recommends a 35dB as the maximum noise levels to protect the health and wellbeing of students in the classroom. An assessment of elementary students exposure to road traffic noise in Cebu City recorded 36.6 dB to 80.3 dB noise pollution in the classroom (Camarillo, etl.al., 2021). Sound level meters are commercially available tools to measure noise levels which the City can consider to procure for monitoring noise pollution. Likewise, Cities can consider collecting the proportion of patients experiencing hearing related illnesses from medical centers for data collection. Noise complaints can also be considered as potential data sources. As identified by the NEST, noise pollution standards and strict enforcement should be prioritized. Related to safeguarding schools and hospitals from air and noise pollution, the transport planning guidelines recommend locating terminals more than 100 meters distance from institutional establishments (LPTRP, page 42).

Table 7-3 Transport GHG inventory data and sources (road)

Categories	Activity Data	Possible Data Sources
1.A.3. - Transport		
1.A.3.b – Road Transportation		
1.A.3.b.1 – Cars		
1.A.3.b.i.1 – Passenger cars with 3-way catalysts	Types, totals of fuel used; VKT; Types of cars, Number of cars	DOTr-MIS, LTO, LTFRB, TRB
1.A.3.b.i.2 – Passenger cars without 3-way catalysts	Types, totals of fuel used; VKT; Types of cars, Number of cars	DOTr-MIS, LTO, LTFRB, TRB
1.A.3.b.ii – Light duty trucks		
1.A.3.b.ii.1 – Light duty trucks with 3-way catalysts	Types, totals of fuel used; VKT; Types of LD trucks, Number of LD trucks	DOTr-MIS, LTO, LTFRB, TRB

1.A.3.b.ii.2 – Light duty trucks without 3-way catalysts	Types, totals of fuel used; VKT; Types of LD trucks, Number of LD trucks	DOTr-MIS, LTO, LTFRB, TRB
1.A.3.b.iii – Heavy duty trucks and buses	Types, totals of fuel used; VKT; Types of HD trucks and buses, Number of HD trucks and buses	DOTr-MIS, LTO, LTFRB, TRB
1.A.3.b.iv – Motorcycles	Types, totals of fuel used; VKT; Types of motorcycles, Number of motorcycles	

Source: Rebacar, S. et.al. 2019

The Philippines Intergovernmental Panel on Climate Change (IPCC) prepared the Guidelines for National Greenhouse Gas Inventories in 2006. The Greenhouse Gas Inventory Management and Reporting System (Executive Order 174, Series of 2014) calls on National Government Agencies to conduct, document and archive and monitor GHG inventories. DOTr issued Department Order 2018-1 to institutionalize the GHG Inventory for the Transport Sector (Air, Rail, Water, and Road). Table 7-3 shows the data requirements for the road sector. The policy is set, however several challenges were noted by Rebacar, et.al (2019) toward setting the GHG inventory to include the following: 1) high turnover of technical personnel in the Departments, 2) limited financial capacity to conduct technical capacity training on the guidelines and software requirements, 4) relatively limited technical capacity to fully understand the guidelines, 4) lack of coherent documents to operationalize Executive Order 174, 5) lack of datasets, data collection and processing, and management approaches, 6) limited alignment of data needs to the IPCC comprehensive sectoral data frameworks, and 7) lack/limited data sharing arrangements within and among institutions and the private sector.

Davao City is the metropolitan capital of the Mindanao island region. As one of the three largest and most advanced city (including Metro Manila and Cebu) they prepared a GHG emissions inventory with the support of the Institute for Global Environment Studies (IGES) in a project to support the development of a Local Climate Change Action Plan. GHG emissions from mobile sources was estimated using the



historical petroleum demand data from the Department of Energy (DOE) Mindanao Field Office. Emission factors were calculated using the IPCC 2006 Guidelines (IGES, 2020).

#### 7.4.4. Passenger demand and road characteristics

The sustainability topic on passenger mobility consider the socio-economic dimensions. Indicators on this topic features accessible and satisfactory transport systems that consider universal design (needs of persons with disabilities, PWD) also known as *inclusive mobility* and transport planning that considers cultural factors and the degree to consider significant impacts using best practice and evaluation methods. Mode split, passenger kilometer traveled (PKT) or vehicle (VKT) are common indicators on mobility and are used as intermediate indicators to quantify the final accessibility and diversity of available modes (Reisi, et.al, 2016). Litman (2011) noted some indicators to focus on vehicle travel or mobility to assess road level of service (LOS) and traffic congestion. This perspective assumes modes and traffic congestion is the main problem. A perspective on accessibility, defined as the ease of reaching activities and services is more recommended.

The National EST strategy considers an accessible city includes efficient public transport systems, traffic congestion and management, and good work-home location matching. Further explaining that a comprehensive matching of employment and housing supported by public transport systems will make it possible to reduce travel trips. Clear and proactive integration of land use policies and planning guidelines through the CLUP and CDP are necessary to meet this objective. Related to this the Ecological Profile (EP) is the city database that contains information and data sources for the five development sectors of the CDP. It includes population and social services, local economy, infrastructure and physical base, environmental management and natural resources, and institutional sectors (DILG, 2011). The EP can be a potential source of data for establishing the population, location of schools, and places for work

that can be used to characterize the potential users of the public transport system. Some data points were extracted from the EP (Table 7-4) that includes sources for road inventories and the land use profile.

Table 7-4 Relevant data and sources

Sector	Data	Source of Data
Population and demography	Population (total, projections, distribution)	PSA, CBMS
	Population growth rates	PSA, CBMS, can be computed
	Number of employed persons by age, sex, spatial distribution and occupation	
Social sector	Mortality rate and causes	C/MHO
Education	School enrollment by place of residence of pupils	DepEd District Office
	Name and location of schools	DepEd District Office
Social welfare and development	Number of persons with disabilities by sex and type of disability	C/MSWDO
Infrastructure sector	Inventory of roads and streets by system classification and road surface	DPWH, Local Engineering Office
	Inventory of ancillary road facilities	DPWH, Local Engineering Office
	Existing modes of transportation and transportation facilities	DPWH, Local Engineering Office
	Land transportation terminal and parking facilities, by barangay	LGU
Land use	Existing general land use	LGU
	Existing urban land use	LGU

Source: Guide to Ecological Profiling, DILG, 2017

There are many development, sectoral plans and guidelines, yet the data collected or requested does not match with transport planning needs. Transportation agencies collect and publish data reports and question whether these reports can be used for modeling passenger demand. Regidor, 2019 identified the situation of transport data and statistics in the Philippines and determined whether it can be used for in-depth analysis in the current forms and unfortunately, many current reports are useful to the extent of descriptive statistics. In addition to attached agencies of the DOTr, transport data can also be collected from other National Agencies, academic institutions, and the private sector. Moreover, transport models are only available in

Metro Manila, Cebu, and Davao, making it challenging to conduct transport studies in other cities. Table 7-5 lists potential sources of transportation data in the Philippines.

Table 7-5 Sources of transportation data

	<b>Data and Reports</b>
DOTr – RTPD	Project study reports
	Summary reports of attached agencies
LTO	Motor vehicle registration (new and renewal)
	Motor vehicle by fuel use
LTFRB	Inventory of routes, regional
	Bus routes with distance
	Jeepney routes with distance
	UV Express routes with distance
DPWH	Traffic counts along national roads
	Inventory of national roads and bridges (DPWH Atlas)
MMDA	Road crash statistics – Metro Manila Accident Recording and Analysis System (MMRAS)
DOH	Online National Electronic Injury Surveillance System (ONEISS)
PNP	Road crash reports (e-blotter)
DPWH	Annual Average Daily Traffic National Roads (AADT)
NEDA	Transport-related reports commissioned
Tollway operators	Metro Pacific/Manila North Tollways Corporation; Skyway Corporation; TPLEX. Annual reports
Academic Institutions	University of the Philippines, De La Salle University, Ateneo de Manila University, Polytechnic University of the Philippines, Xavier University, and Mindanao State University transport research.

Source: Regidor, 2019.

With the absence of transport demand data, the transport route plan manual recommends primary data on passenger demand and assessment of existing public transport supply. The following data collection surveys are recommended to prepare the route plan; 1) license plate and occupancy count (passenger load) survey 2) boarding and alighting survey, 3) classified traffic volume count survey, 4) travel time survey, 5) road inventory, 6) public transport operator and driver interview surveys. The manual provides sample survey forms and calculations to assist the city in collecting this data. In addition it recommends to consider existing traffic management ordinances and plans, if available.

Table 7-6 Traffic survey and data collection

Survey	Data Collection
License plate and occupancy count (passenger load)	<ul style="list-style-type: none"> <li>• Frequency of public transportation units by mode and route per direction</li> <li>• Utilization ratio (UR) based on the number of public transportation units in operation (UR)</li> <li>• Number of round-trips (NRT)</li> <li>• Average passenger load</li> </ul>
Boarding and alighting	<ul style="list-style-type: none"> <li>• Passenger demand</li> <li>• Location of stops</li> <li>• Passenger load</li> </ul>
Classified Traffic Volume Count Survey	<ul style="list-style-type: none"> <li>• Number of vehicles that pass by a given point on a road according to predetermined vehicle classifications; this will provide information on traffic conditions in the study area.</li> </ul>
Travel time Survey	<ul style="list-style-type: none"> <li>• Determine the turnaround time (TAT) for public transportation</li> </ul>
Road Inventory	<ul style="list-style-type: none"> <li>• Determine infrastructure support for better public transportation services such as waiting sheds</li> </ul>
Public Transportation Operator and Driver Interview Surveys	<ul style="list-style-type: none"> <li>• Information on 1) operator, 2) fleet, and 3) vehicle maintenance</li> <li>• Can also be used to obtain data on the number of round-trips (NRT)</li> </ul>

Source: LPTRP, 2017. pp. 31-32

Sustainability is considered in the monitoring and evaluation of the transport system. The LPTRP Manual recognizes the National EST Strategy's definition of sustainability in the social, environment, and economic dimensions and further added quality of life, inclusiveness, and resilience. Table 7-7 shows the performance measures of the transport system as provided in the Manual. There are some similarities with the selected indicators including the following: *Economic-Quality of Life-Inclusiveness*: accessibility in terms of proximity and affordability cost of public transport and overall satisfaction of customers to the transport system. However, the Manual did not provide further details on the rationale for selecting these specific performance measurements. It appears to be used as reference as it was suggested the city may decide to include their own measures as necessary.

Table 7-7 Public transport performance measures

<b>Sustainability Aspect</b>	<b>Dimensions</b>	<b>Performance Indicators and Measures</b>
Social	Safety	Accident rate, severity ratio, number of vehicles that are 15 years old and older
	Security	Availability of CCTVs and GPS
Environment	Clean transport	Emission testing of vehicles, compliance to the Clean Air Act, compliance to the OFG
Economic	Affordable transport	Travel cost, fare rates
Quality of life	Revenue generation	Revenue per passenger per route, average monthly revenue per route, deadhead
	Comfort and convenience	Passenger load factor, seat comfort, hours of service, transfer time
	Speed	Average running speed, average dwell time, average travel time
	On-time performance	Passenger waiting time, frequency of PUVs
	Reliability	Frequency of PUVs, scheduling adherence, service reliability, Public Transport Passenger Survey
Resilience	Adaptability	Adherence to plan, flexibility ability to maintain service, quickly recover after interruption or disaster
Inclusiveness	Passenger satisfaction	Service satisfaction (through FGD, public meetings, household surveys, mailed questionnaire, telephone survey)
	Governance	Passenger commendation, complaint system
	Mobility	Ease of travel, geographic coverage of PUVs
	Accessibility	Distance from the nearest public transport terminals/stops, service frequency, PWD

Source: LPTRP, 2017. pp. 52-53

## 7.5. Synthesis of findings

Philippine cities are mandated to prepare both land use and development plans in addition to 35 other plans, including the Local Public Transport Route Plan and the Ecological Profile. However, despite the multitude of plans and data sources, there is limited data that can actually be used for transport planning purposes. Table 7-8 summarizes sustainability data recommendations and sources where the city may consider for data collection. It becomes clear that data for transport planning can only be collected through field survey.

Table 7-8 Summary of sustainability data sources

<b>Data</b>	<b>Description</b>	<b>Source</b>
Air and noise pollution exposure	Proportion of people exposed to vehicular pollution, and traffic noise. Noise pollution data can be collected	City or Municipal Health Center Noise pollution level survey
Average speed of transport	Average vehicle speed of recorded travel time along a corridor or transport route.	GPS smartphone applications (ex. MyTracks and Waze)
Customer accessibility and overall satisfaction rating of transport system	Perception on proximity and cost of public transport to the customer.	Questionnaire survey
Degree to which transport planning is comprehensive	Considering all significant impacts and using the best evaluation practices. Considering universal design inclusive mobility. Preserving cultural resources.	LPTRP Team composition Stakeholder consultation
Greenhouse gas emissions form passenger travel (kg/capita)	Estimates of emissions (CO <sub>2</sub> , NO <sub>x</sub> , PM, CO, SO <sub>x</sub> , and HC) from passenger travel. Can be calculated using fuel consumption.	IPCC Guidelines 2006
Investments in transport systems and infrastructure	Investments on public transport and infrastructure in the City.	CLUP NEDA
Modal split of trips to school/Share of children driven to school by car	Portion of school trips by public transport and private mode.	CPDO Questionnaire Survey
Modal split public transport and NMT	Portion of trips made by public transport, walking and bicycle.	Questionnaire Survey
Mortality effects of air pollutants	Proportion of people with health impacts related to air and noise pollution	City or Municipal Health Center
PKT per population by mode and category wise	PKT estimates require detailed trip characteristics and calculated through travel demand modeling and forecasting models and software. (PKT estimates are only in Metro Manila, Cebu, and Davao due to difficulty in data collection.)	Questionnaire Survey Demand Models
Portion of land paved for transport facilities	Inventory of areas available for use as transport facilities	City Engineering Office DPWH
Transport system accessibility to other locations	Proximity and cost of reaching transport systems from different locations	Field survey
Vehicles per road length category wise	Vehicle density and indicator of road congestion	Field survey

This analysis clarified two main points first, Philippines transport policies have a clear message toward environmentally sustainable transport and second, the problem of institutional capacities is not limited to the cities and the transport sector. The planning and development functions of the city were established in 1990 through the Local Government Code (RA 7160), around the same time when the sustainable development concept was started. Sustainability is represented in the different sectors of environment, economy, and society and these components are also reflected in the Philippines development and sectoral and thematic plans. This research set out to find entry points for introducing sustainability in the transport sector through indicators and data sources and it showed there are minimal usable data sources available.

Additionally, these results show that more important institutional issues are present in the planning sector. The problems of poor submission rates noted with the public transport route plan are also observed in the preparation of the CDP. In order to help local governments prepare the CDP, technical guidelines and *simplified* guidelines were prepared with the DILG through the support of international development agencies. Moreover, it appears that the efforts to support cities and municipalities to prepare local public transport plans may follow a similar path to creating simplified planning manuals and guidelines. In this context, it is easy to understand why the Local Public Transport Plan Manual is focused on identification of service routes and financial viability to operate rather than a transport demand study. It reflects the minimum data requirements to provide additional public transport services that cities have long needed. This also presents opportunities for improvement which will be studied in the next section of this analysis on the city case study and results validation with experts.

## **7.6. Case studies and validation of results**

This case study analysis with stakeholders aims to examine the thematic areas in transport route planning that EST can support. As discussed in Chapter VI, the

analysis adapts the variable-wise case study analysis of Cervero (1998), where experiences of cities and the PUVMP-NPMO were analyzed to find common patterns and reveal new perspectives in the process. This methodology modified the interview process and thematic analysis of Mateo-Babiano, et.al (2020). Interview participants were selected using the criteria of the most capable to prepare the route plan and interviews participants who were directly involved with the preparation of the local public transport route plan. Another modification is using a structured questionnaire to compare similar variables: success and challenges in the planning and comments on the usefulness of the three images of sustainability presented in Chapter V.

#### 7.6.1. Representativeness of interviews

Cities and municipalities not including Metro Manila, Metro Cebu and Metro Davao were considered for the research. The selection criteria include local governments that passed the Disaster Preparedness Audit (DPA) over five years from 2014-2018. The DPA is a mechanism for the Department of Interior and Local Government (DILG) to check the availability of land use and development plans and the cities' and municipalities' sectoral and thematic plans. According to the Transportation Department, the CLUP and CDP are the basis documents for formulating the route plan. DPA considers only the presence or absence of the plan and does not check the quality of these plans. A note on the rationale for using selection criteria is to capture cities that have experience with preparing land use plans and are knowledgeable of the mandated land use plans, sectoral and thematic plans as well. A total of 52 small and medium scale cities and municipalities were identified to match the criteria and the details are shown in the table below. The cities were contacted using government website information; only 26 provided contact information and contacted using e-mail, Facebook messenger and text messaging. A letter requesting for an interview and the guide questionnaires were sent and followed up within one month.



Six local governments were interviewed with 3 municipalities and 3 cities all coming from Luzon. A municipality from Mindanao declined the invitation citing they are still preparing the route plan and have poor Internet connection to conduct an interview. Another 5 acknowledged the request but did not respond in the follow-up. The remaining 14 local governments did not respond even with follow-up. The situation on contacting respondents is a significant challenge of the research. Added to the pandemic situation, the local and national elections were also held in May 2022 with leadership transitions taking place, possibly affecting the response rate to the request. It may also be possible local governments hesitate to respond because they are yet to have the local public transport route plan, as specified in the interview request. A penalty is being considered for those who fail to submit a route plan, although these penalties are not yet implemented. It is an unconfirmed explanation for the non-response.

Table 7-9 Selection of local governments

	<b>CITY</b>	<b>MUNICIPALITY</b>
LUZON	7	30
VISAYAS	2	8
MINDANAO	1	4
Sub-total	10	42
Total LGU	<b>52</b>	

A limitation of this selection is it does not represent the validation of local governments that do not meet these criteria. There are about 1,800 local government units in the Philippines and the interviews represent a very small number despite the efforts to contact the LGUs. The local public transport route plan requirement started in 2017 and it is an entirely new planning process for local governments to consider public transportation routes, where they have only considered traffic management. Sunio, et.al (2019) have mentioned the low submission rates of the local public

transport route plan. The submission records from the Transportation Department have showed the situation has been steadily improving, however, the approval rates are still low (Table 7-10). Nonetheless, the objective of the interview is to validate the study's results and clarify the usefulness of EST as a concept and indicator for transport route planning. In this regard, the experiences captured from the six representatives can provide clear application inputs to meet the study objectives.

Table 7-10 Route plans submitted

<b>2021</b>	<b>February</b>	<b>July</b>	<b>November</b>
Plans submitted	605	697	749
Approved	35	61	65
Operating	4	11	21

Source: PUVMP-NPMO Interview and DOTr

Discussion of the city interviews is followed by the transport expert interviews and validation of the selected sustainability indicators using the text mining and knowledge discovery presented in Chapter VI. Two transportation experts were interviewed in this study where both had participated in formulating the National EST Strategy in the Philippines. The experts are professors in urban planning and engineering. One is currently an official with the Transportation Department, and another is the current Director of the UP National Center for Transportation Studies. Both have extensive experience in transport planning and have also worked with local government units. The inputs of these experts validate the applicability of the selected sustainability indicators.

A total of 14 representatives were interviewed for this research which includes local governments, national government, and transportation experts. There were eight male respondents and 6 female respondents. Local governments were interviewed from 30-60 mins, the implementing agency was interviewed for 60 minutes and transport experts from 60-90 minutes. All interviews were conducted online using Zoom and used a combination of English and Filipino. Interviews with local governments were

introduced in a friendly manner to build rapport. When the respondent express some hesitation in answering the situation of revisions or difficulties in planning experience, the interviewer re-assured that the research objective is to find out how to support the LPTRP planning and not to evaluate the performance of the LGU. The documentation reports written in English are provided in Appendix C.

Table 7-11 Affiliation of representatives

	<b>AFFILIATION</b>	<b>CODE</b>	<b>PARTICIPANTS</b>
1	Public Safety and Order Office	C1.4	2
2	Planning and Development	C2.1	1
3	Planning and Development	C3.1	2
4	Planning and Development	M1.1	1
5	Planning and Development	M2.4	2
6	Planning and Development	M3.1	1
7	Academe and Transport Department	T1	1
8	Academe	T2	1
9	PUVMP NPMO	G1	3
<b>TOTAL</b>			<b>14</b>

### 7.7. Local government validation

Interviews with local cities and municipalities were conducted with two specific objectives: 1. To find out the local government (LGU) experiences on LPTRP and understand the process of incorporating land use and development plans in formulating the route plan; and 2. To present and validate the proposed EST concept to LGUs and to clarify the aspects of EST that can be applied to the LPTRP formulation. The thematic areas that will be confirmed include the EST definition where the discussions will identify if the understanding of the participant of sustainability is *broad* where the it comprehensively considers the environment, society and economy or *narrow* that only focuses on transport impacts on environment and resources (Litman, 2011; Zhou, et.al 2020). Referencing the discussion of the proposed EST concept model in Figure 5-2, this includes the following factors to evaluate the narrow or broad understanding.

- Institutional capacity: local governments
- governance: national government and policy makers
- worldview: culture and local conditions, discipline, and behavior
- resilience: redundancy, diversity, efficiency, autonomous components, strength collaboration, adaptability, mobility, safety, and the ability to recover quickly (Zhou, et.al., 2018)

On the application, the themes include the 12 thematic areas of EST and the 10 components of the PUVMP, as discussed in Chapter V of this dissertation. The discussions reveal the extent of awareness of the representatives by asking how they are able to implement EST components into the their LPTRP and which of the sectoral plans were also considered in their planning process. On the latter, a questionnaire survey answered by respondents showed the CDP and CLUP were naturally considered. In addition the Local Disaster Risk Reduction Plan; Local Tourism Plan; Plan for Persons with Disabilities; Local Climate Change Action Plan; Gender and Development Plan; Local Shelter Plan; and lastly, Transportation Management Plan were mentioned, in order of application.

#### 7.7.1. LPTRP formulation

The first part of the interview asked the respondent to describe their participation in the formulation of the LPTRP. This is to ensure that the interview respondent is knowledgeable of the process and planning requirements. Five of the local governments assigned to prepare the LPTRP were from the City/Municipal Planning Department and one from the Public Order and Safety Office. The level of knowledge among the respondents regarding how they explained the preparation and data collection for formulating the plan were varied. Many respondents demonstrated extensive knowledge of the LTPRP process and explained how their local structures and capacities were used to create a system for preparing the plan. It was noted the

explanation of some respondents mirrored the explanation of the PUVMP-NMPO about the planning preparation and approval processes. On the other hand, some respondents expressed hesitation if they should be the ones responsible to make the local transport plan and consider a transport or traffic unit is more suitable for the role. Nonetheless, all respondents were involved in preparing the plan in the capacity of data collection, coordination among stakeholders, and writing the plan, and addressing the revisions when requested.

Regarding the status of the LPTRP, five local governments were either on the 2<sup>nd</sup> or 3<sup>rd</sup> revision of the plan. Interviewees described that the LTFRB had requested more data collection and analysis with regard to the submitted plan. It was also noted they are coordinating with LTFRB Regional Offices regarding these revisions and seeking assistance on the data collection, survey and analysis. When asked why, respondents explained that the route planning is new and very different from what they were used to doing, in addition to being highly technical, especially with the passenger demand studies. This point confirms the finding in the first part of this chapter, where there are many sectoral planning documents prepared, but none related to support the route plans. It has been established that the land use plans are the basis for preparing the LPTRP, however even local governments with complete plans for several years are having difficulty in preparing it. Another finding is that some LGUs are unclear to what will pass the LTFRB approval of the route plan. This research considers the LPTRP Manual as the basis for evaluation and approval of the plan and while the Central NPMO was interviewed for this research, it was not confirmed if the Regional Offices have different criteria or not. This point is important as the LTPRP considers the hierarchy of vehicles and the road conditions and laws on what kind of vehicles are allowed. For example, tricycles are a dominant informal type of transportation in many areas and due to the moratorium on formal public transport, it has filled the supply gap. It is also considered part of Filipinos' habitual travel patterns and can be used for areas

with poor road conditions, such as dirt roads and non-paved roads (Guillen, et.al, 2013). Tricycles are not allowed on national roads by law. However, the interviews pointed out that some areas do not even have paved roads and need vehicles working on dirt roads and mountainous terrains. If the vehicle requirements only focus on electric or hybrid vehicles, it was not clarified in the study if these modes can be used or not. It is not clear if the LTFRB will approve route plans that includes tricycles, as pointed by one transport expert during the interviews. More research can be done to clarify the passing criteria among the LTFRB.

About the one LGU that passed the LPTRP approval, the municipality has yet to receive new franchises. The respondent explained the municipality was included in the MUCEP planning area where the national government will be the one to implement route rationalization. As mentioned in Chapter I, there are activities to rationalize public transport services. The difference with this rationalization is it is linked to the Public Transport Modernization Program and uses the demand model prepared by the MUCEP in 2014. The approved LPTRP was submitted to the LTFRB and will be considered for rationalization, yet the local government is unsure when the new franchises will be provided. As identified in their demand study, many of the residents relied on *colorum* vehicles to go to their workplaces. *Colorum* is the term for vehicles illegally operating as public transport and increased to meet the supply gaps in formal transportation. The municipality complied with the requirements in order to provide safe and formal public transport to the citizens, however the bottleneck with the institutional capacities poses another challenge to meeting their goal. Ng, et.al (2020) noted this limitation on institutional coordination and capacities where Pasig City was used as a co-design study to determine the analytical, operational and political capacities of local government units. Their study considered Pasig City in Metro Manila as the model case which has planning capacities and funding available and where route planning and rationalization can be done in the Philippines. And concluded even the most capable

city could not implement their own local public transport systems due to the MUCEP rationalization.

The next discussion focused on success contributors and challenges to formulate the LPTRP. On the success factors, it includes the one-month seminar and training provided by DOTr prior to the implementation of the route planning requirement. The LTFRB Regional Offices and NPMO also provide training and support to local governments who request it. There are some concerns on limited staff available to support LGUs that was brought up in the discussions. Respondents expressed appreciation for the support they received from the LTFRB. The presence of the planning manual was also ranked in the success contributors as it provides the details on the demand studies and contents required of the plan. In addition, the respondents cited the technical capacity of their own local government, leadership support and funding availability as key factors that helped them prepare the route plan. These inputs confirmed the role of institutional capacity, LCE support, and funding support in local government planning (Tiglao and Vergel, 2007; Lidasan et.al, 2010; Regidor, 2011; Sunio, et.al, 2019).

A note on the funding availability for local governments related to environment sustainability. The motor vehicle user charge (RA 8794) collected a portion of tax from motor vehicle registration to be used for projects related to reducing vehicle pollution. This was called the special vehicle pollution control fund (SVPCF) that was previously handled by the Department of Transportation. In principle, SVPCF can be used to fund EST, for example bicycle lanes and pedestrianization in cities. A history of non-utilization, among other issues led to the complete removal of the fund. Instead, the allocation for vehicle pollution control was reallocated for road infrastructure from 2019.

The challenges experienced by local governments include the technical requirements of data collection and analysis. This is related to the capacity and manpower available in the locality. There are also constraints with consulting

stakeholders such as jeepney drivers and operators and the difficulty in gathering these groups for consultation. Public transport drivers get paid daily and missing a day of work can have consequences, which makes the situation for public consultations more difficult. Yet another challenge is the COVID pandemic. The Philippines has the strictest and longest lockdown in the world. Public transport was restricted and people's movements were strictly limited for over two years. The situation changed mobility patterns which made it difficult for the LGU to collect the necessary data.

#### 7.7.2. EST in local governments

Moving to the discussion on EST, only two local government participants had heard about the concept before and were unaware of the National EST Strategy. Participants have good recall and understanding of the data collection and passenger demand surveys discussed in the LPTRP Manual. As mentioned in the previous policy section of this chapter, the LPTRP Manual includes a short mention of EST in relation to monitoring and evaluation. It is unclear if this part was discussed with the participants during the seminar or trainings. Participants were presented with the three images of EST as discussed in Chapter V and asked to comment on how they understand. With regard to the answers, it was observed respondents had a narrow understanding of environmentally sustainable transport which focused on the vehicles impacts related to pollution and emissions. All participants understood motor vehicles produced vehicle emissions that pollute the air and considered poor conditions of public transport modes. Local ordinances to give penalties for vehicles emitting black smoke were mentioned to be implemented in some cities. The vehicle pollution control is a component of both the EST strategy and public transport modernization.

Participants were asked to comment their understanding on the proposed EST concept model. Using the model components participants discussed factors relating to their experience. First on the sustainability dimensions, all agreed that the society and economy function within the environment. Some participants commented on the impact



of culture in the social aspect. This discussion emphasized Filipinos want public transport that provides door to door services and the discussion considers it related to a lack of discipline in the behavior of commuters. The discussion tone related to discipline is considered in the negative sense especially in the frame of traffic enforcement. Recalling local governments experience in transportation focused on traffic flow management and enforcement. Public transport terminals and stops are determined by the government, without previous knowledge on transport planning and analyzing demand, the selection of these terminal locations are based on observational considerations. With the introduction of transport planning knowledge in the route planning manual, there may be opportunities to study how this perception of discipline can be considered. This observation can also be related to the habitual behavior on informal transit (Guillen, et.al., 2013). The theory of planned behavior provides the explanations why habits are difficult to change and this would include both the commuter behavior and the perception of lack of discipline on the enforcement side. Next discussion relates to resilience which can be considered in the frame of duplication or redundancy of public transport services but also considers the efficiency and safety of systems as described by Zhou, et.al (2018). The institutional governance and belief systems can also be outdated but still influence sustainability (Low, 2003). The inclusion of the governance aspect in the proposed model is confirmed important in considering sustainability for local governments discussion where governance and institutional capacity are linked in the understanding of sustainability. Compliance is a term that was raised by the NPMO interviews and also by the local government. The word compliance means to follow or to obey the request of the national policy, it is a positive word however the sentiment is considered somewhat negatively when described as the plans is made *for compliance*. The treatment of this term is part of the culture of local governments. There is an implied meaning that local governments provide the *best effort*, to mean they are following but acknowledge limitations in the capacity or the quality of the output. Like with the words discipline, compliance and

best effort, there are different cultural and governance and institutional capacity aspects that are considered to understand sustainability.

On a positive note, there are also some respondents with high sense of institutional capacity and self-sufficiency. To classify the tone in application of the local route planning process, there are also purposeful sentiments to deliver the plan so that they can provide the needed public transport services in their locality. Responses focus on self-reliance and coordination within the institutional organization and the sense of resourcefulness to get information and consult stakeholders. Noting that all respondents acknowledge the basis that local governments know more about the development areas and passenger demand than the national government and are more suitable to prepare the route plan. The analysis of these applications as compliance or purposeful is not meant to evaluate the performance of the local government. This research is not in the position to evaluate performance. Rather, the discussion is to confirm the linkages with the institutional belief system and culture and inform recommendations how targeted support can be made.

The next presented images are about the concept map and the word cloud and respondents were asked to comment their understanding and suggest some improvements to the these two images. The participants were quick to respond the concept map was hard to appreciate because of the many items and linkages being presented. However, when the connections were looked at sequentially participants confirmed EST and public transport modernization did have some similarities with the existing actions of the local governments. This was in relation to the land use and planning component as almost all participants are from the planning department. On the last image, the word cloud is clearly the most appreciated out of the three images. It was even agreed that this word cloud can be used for stakeholder and public consultations. In general, respondents were quick to agree with the sentiments of the image but also added suggestions of words that can also be included. The added

words from respondents can be found in the documentation reports, to which words like discipline, road user behavior, and infrastructures, have been discussed. Since the word cloud followed a different methodology, the inputs of the respondents were not combined with the third image. Instead the analysis notes key points from the discussion as follows. First is on what constitutes a safe public transport system. For example where it is a safe and environmentally friendly electric vehicle but cannot operate on dirt-roads and mountainous areas. The second point is the financial accessibility to these modes, where several local cities considered how the drivers and operators can afford to purchase the new environmentally friendly vehicles required to use the identified transport routes. The third point is on the set up of systems and infrastructure to enable sustainable development. These three points can also be considered in the frame of resilience, where it does not only depend on the redundancy but the capacity of the system to continue functioning.

To summarize the results in relation to the two objectives, the first goal of the interview was to find out the experiences of local cities in making the transport route plans. The experiences show that transport route planning is a very new process and the learning curve is high for the responding local governments. There is acknowledgement to comply with the route planning within available resources, however the need for additional support in terms of capacity building and a clear evaluation criteria that considers specific needs and conditions of the locality should also be considered. On the second objective, the analysis was able to confirm the thematic relevance of the EST definition in relation to the proposed concept model. Presenting the images provided a baseline for respondents to discuss sustainability and also related it to their own experiences. The closing discussions included the realization that the city is applying EST without knowing it is EST through implementing walking, cycling, vehicle pollution control, and land use planning. There is also the understanding that EST is more comprehensive than public transport modernization

program. Lastly the most important finding is that the application of EST may look differently depending on the LGU.

### **7.8. Expert validation**

There are two objectives to the validation interview with transport experts. The first is to present the selected EST indicators and potential data sources and the second is to verify the usefulness of the selected indicators in supporting the LPTRP. Thematic validation of the selected indicators is based on the best principles for transport indicators of Litman (2007). Experts mention air and noise pollution exposure is a good indicator if data is available, however, local cities do not have the tools and instruments to measure air pollution and the impacts of noise pollution are rarely discussed in the Philippines. Related to this, local governments may find it unnecessary to acquire the tools and may prioritize other equipment. On the other hand, larger cities and universities may have the tools to measure and monitor air quality. Experts agree that this indicator is difficult to measure because of data unavailability and lack of appreciation. Similarly, greenhouse gas emissions from passenger travel (kg/capita) are a good environmental indicator, yet sustainability is not only about measuring environmental impacts. Related to air and noise pollution, the cost-effectiveness of procuring the equipment is affected by the appreciation of local cities. Net effects can be differentiated and they can be functional for setting targets. Considering the general public, the economic and social impacts of GHG emissions are not understood. The Department of Environment and Natural Resources Environmental Management Bureau (DENR-EMB) and the Climate Change Commission (CCC) collects this data, yet how it is used and disseminated outside these agencies is unclear. Yet another related indicator is the mortality effects of air pollutants. Data is likely collected in urbanized cities like Metro Manila and not collected in other places. It is comparable and easy to understand as standards for air quality and how it affects health care available in studies. In terms of cost-effectiveness, it may

be neutral if the process of collection is only starting. Appreciation of the data is also a question since little literature in the Philippines has considered health impacts and transportation factors. As a functional indicator, public transport, walking, and cycling health impacts can be measured.

The average speed of transport is not a comprehensive indicator when it refers to vehicles, according to the experts. If speed is considered for the travel time of people, goods, and services, it will be more compressive. The data can provide what levels are considered acceptable for sustainability and usually available for large cities and can be compared for different modes and routes. It is easy to understand for decision-makers and the general public. Cost-effectiveness is neutral because it defeats the purpose of categorizing data if speed is the only factor. Some other features and modes need to be considered to make a useful analysis. In terms of net effects, it can be quantified and has high net effects. Functionality as performance targets is also high as it shows if the travel speeds are improving or getting worse. However, municipalities may not be collecting this data.

Customer accessibility and overall satisfaction rating of transport system data can be available but are not collected or analyzed. For example, cities can use GIS to determine access of the population to transport terminals and it can be compared with different locations and mode satisfaction. If the data is available and analyzed, it will be cost-effective and the net impacts can also be identified. The concern is the limited appreciation for transport system accessibility especially if decision-makers are only using private cars. Additionally, the public has limited awareness of 10 minutes to 15 minutes of access because of the door-to-door nature of transport services. The concept of Transport Oriented Development (TOD) is not yet promoted and appreciated in the Philippines and it is not clear if data is collected and used outside the academe. There is weak collaboration and coordination with the government where data is rarely used for policy and decision-making. Instead, qualitative assessments,

anecdotal evidence, and experiences on public transport are often considered. There is high functionality for defining targets because it considers the user's perspectives. This indicator also relies on feedback systems that focus on the acceptability of users in the level of service it provides. It is an important indicator because it provides information on what users want to keep using, and therefore sustain in the future.

The degree to which transport planning is comprehensive should be about the individuals. This indicator should consider the accessibility of all types of users and considers social equity principles such as providing information, integrated fare and payment systems, and also responsiveness to mobility needs. Incorporating good practices in transport planning makes it a comprehensive indicator. Data quality in the Philippines can be low since it is not available for transport planning and reliability is affected by the frequency of data collection. Metro Manila and Metro Davao only collect data when large projects are commissioned like those supported by development agencies. Data collection and analysis should be systematized, but data availability and access are a challenge. There are standardized data parameters on occupancy, and frequency, and these have clear units of measurement which makes it easy to understand. The experts note the issues are on data accessibility and transparency, and are not limited to the Philippines. Data availability is also a concern in Malaysia, Indonesia, and Thailand which are also part of the ASEAN region. On cost-effectiveness even if large data sets are established, unless it is used for high-value analysis such as decongestion, and faster travel time for the general public, then the cost-effectiveness will be neutral. Functionality for target setting will be high if the information is available. Cities can use it as a scorecard for setting targets at the start and accomplishments at the end of the year.

Investments in transport systems and infrastructure where fiscal budget investment is comprehensive in considering the needs and resources in the city. Data is available on budget breakdown and detailed price standards from the Department

of Transportation (DOTr), Department of Public Works and Highways (DPHW), and Department of Interior and Local Government (DILG). The cost-effectiveness of having the data outweighs the cost of the collection since the project development information is necessary at the approval stage. The net effects can be compared across different locations and regions. Functional targets can be set for transport systems where in the first year it will focus on capital outlay (CO) and focus on maintenance and other operating expenses (MOOE) such as renewing fleets and retrofitting infrastructure in the later years.

Modal split of trips to school/Share of children driven to school by car is more concerned with socio-economic dimensions and not environmental impacts. Data quality is limited since surveys often focus on work trips. During the pandemic even without school trips, congestion is still observed. Data on school trips can be compared because it is similar to standardized data sets on travel time and related to origin and destinations (OD). It is easy to understand as it is similar to other datasets but for a different purpose. In the Philippines case, data and analysis are not available and it is not cost-effective to collect the data due to poor appreciation. As it is not collected, it is likely starting data collection and analysis would be expensive. Ideally, this indicator would be scored high, but realistically it is low since school trips are not prioritized except if it is the main topic.

Modal split public transport and NMT is comprehensive considering non-motorized transportation (NMT) was emphasized as a viable transport option during the pandemic. Data on public transport is available in many cities, especially since the local public transport route plans (LPTRP) are being created. However, data on NMT is not collected. There is a policy for cities to provide infrastructure for NMT but few have evaluated or tried to measure the OD. Public transport data is established, and reliable NMT data is unavailable. In addition, it is difficult to access data from national agencies. Public transport and NMT data are essential for transport planning. The

benefits of having the data outweigh the cost of collection. The net effects are also high if the data and analysis are used to support the public transport system. On functionality, if the government is analyzing the data, it can be used for performance targets and monitoring. The data can show if the transport is improving with increasing ridership, for example.

PKT per population by mode and category wise is compressive since passenger kilometer traveled (PKT) considers the trip characteristics and cuts across socio-economic impacts including mode choice. Data quality is neutral because it is not available in the Philippines. If it is available then it would be comparable and easy to understand. It is difficult to collect this data, but the value of having it for recommending policies and what needs to be developed outweighs the cost. Some cities collect vehicle kilometers traveled (VKT). However, not all agencies collect and publish data that will make it easy to determine PKT. Researchers would collect data and develop a model that would determine the PKT.

The portion of land paved for transport facilities is comprehensive and the DPWH Atlas provides very good data. Standardized data is available and it is easy to understand. Access and transparency of data is a concern where recently, it has been difficult to acquire the information when using the freedom of information (FOI) portal. Cost-effectiveness is high as many proposals for road widening, maintenance, and pavement management can be done with this data. Net effects are also high in terms of impacts and functionality is also high since it is suitable for performance targets used in road inventories. Experts are split on the importance of this indicator, noting it is more of an inventory than indicating sustainability.

Transport system accessibility to other locations if considering accessibility from residence to workplace or schools, this indicator is also comprehensive. Data should be available but again, accessibility is a question. Cities should have GIS maps showing the public transport routes, especially in the LPTRP. Standardized datasets



are available and can be compared. Related to LTPRP the accessibility and transparency of data are unclear. Different local governments and agencies perform their analysis internally and competencies are unclear. Public transportation is complex and there may be confusion in implementing LTPRP related to transparency and the quality of analysis. Data collection will be cost-effective especially if it will be used to prepare the LPTRP. It can be used as a performance target when setting accessibility to 5/10/15 minutes and establishing the standard on how long should it take to access transport systems. Another perspective from the expert is it can be rephrased as “transport connectivity and service areas” where it considers connectivity, related to enhancing economic opportunities.

Vehicles per road length category-wise are not comprehensive as it focuses on vehicles and congestion. It is related to the disparity of too many private cars on the road. Data is often collected in metropolitan areas, but not from other cities. In general, standardized, reliable, and useful data is not available. Speed data is more likely collected than density. People can also understand speed more easily than density. The level of service (LOS) defined by DPHW as volume capacity ratio is not well appreciated. Transport professionals often make quick judgments on volume capacity since it is the most commonly used. However, it is not the only criterion of LOS. The accessibility and transparency of data are not clear. The cost of collection is also not practical since it can be derived from volume and speed. Since it is a car-oriented parameter it is not so effective as the usable target. Both experts agree this is not representative of sustainability. Instead, sustainability indicators should focus on how people are moving, for example, PKT is a more sustainable indicator than VKT.

To summarize, indicators on 1) customer accessibility and overall satisfaction rating of the transport system; 2) transport system accessibility to other locations; 3) investments in transport systems and infrastructure, and 4) degree to which transport planning is comprehensive can be applied in LPTRP. Useful data draws on the

availability and appreciation of the cities and agencies. While data may be available it might not be accessible to the researchers and the public, nor analyzed by the agencies for decision and policy-making. EST indicators can support the creation of local public transport route plans and the foundational understanding of EST can be improved with capacity building from academic and research institutions. The distinct features of the LGU transport systems and capacities of the cities are reflected in the kind of LPTRP they produce. Lastly, future research can explore the evaluation criteria of LTFRB and evaluators for approving the route plans as this can inform the kind of support LGUs need to pass the evaluation. Research can also look into setting the standards of LPTRP for different levels of cities and municipalities.

## **8. Chapter VIII: Conclusions and Recommendations**

### **8.1. Applying EST to the Philippines LPTRP**

The main objective of this research is the application of EST to the local public transport route planning of small cities and municipalities in the Philippines. Three objectives were examined to achieve this goal: 1) the definition of sustainability, 2) selection of indicators, and 3) application in LPTRP. The research first considered the importance of a baseline understanding of sustainability that can meet the objectives of the transportation department and used it as a starting point (Ramani, et.al, 2011; Jeon and Amekudzi, 2005) for creating a baseline of what sustainable transportation means. Sustainable transportation is clarified as one that can incorporate environmental, social, and economic impacts in a safe, efficient, and resilient transport system. On the definition of sustainability, the proposed conceptual model as presented to local government stakeholders revealed the kind of understanding available in terms of sustainable transport. The research confirmed that while there is debate on the definitions of sustainability, it is a representation of factors that consider the institutional capacities, worldviews, governance, and what is needed by the user groups (Pryn, et.al, 2015; White, 2013; Litman, 2010; Jeon, 2007; Low, 2003). Three perspectives on the Philippines' application of environmentally sustainable transport were considered. The first perspective is on public awareness of EST, where it is found limited as a result of little available information on what is environmentally sustainable transport. However, acceptance is high among respondents when existing applications such as electric jeepneys, bicycle lanes, pedestrianization, and e-vehicles were explained. COVID-19 pandemic lockdowns dramatically changed mobility in the Philippines. Public transport was halted, and it underscored the dire situation of public transport users and clarified the need to address the unsustainable mobility patterns in Metro Manila. The unexpected result of the study is the finding that EST is a primary mobility response during the pandemic. The public has a strong demand for supporting non-motorized transportation, where during the COVID lockdowns, the bicycle

commuter groups and volunteers influenced policy actions on the creation of bicycle lanes as a pandemic mobility response. This demonstrates that a knowledge base for EST may leverage the adaption of sustainable transport through public communication and demand. The second perspective is on the local government, where there is a prevalence of a *narrow* definition of sustainability observed in local government stakeholder validation. A similar finding was observed with the third perspective, the NPMO or the project managers of the local public transport plan. The study demonstrated the usability of illustrating sustainability and creating a common baseline for the local stakeholders by presenting the concept using images. It engaged the participant to express their understanding of sustainability as influenced by their institutional capacities, views, and work experiences. It is important to address that while there is policy overlap between EST and public transport modernization, action points are very limited, and this stems from the narrow understanding of EST. According to transport experts, sustainable transportation should put focus on what the users want: accessibility, reliability, efficiency, convenience, and safety, which determines whether these systems will be sustained in the future. In summary, these points are all related to the broad understanding of sustainable transportation.

Related to selected indicators, four were identified to pass the best principles for selecting indicators (Litman, 2007), as validated by transport experts. 1) investments in transport systems and infrastructure including available public transport services, route networks and infrastructure such as transit terminals help inform the basic profiling and identify needs in the planning area. These can be considered preliminary steps in preparing the route plan. Transport system 2) accessibility to other locations defined as the proximity and cost of reaching transport systems from different locations consider the social equity of transport, where it should be accessible and affordable to all, regardless of age, gender, and mobility needs and capabilities. 3) Customer accessibility and overall satisfaction rating can be applied to inform what

kind of transportation users want to continue using or sustain. This involves prioritizing the importance of customer satisfaction in evaluating public transport system performance. Transport service providers should aim to keep customers happy and attract new ones and this involves shifting from operational service indicators to people indicators (Eboli and Mazzula, 2021). The last indicator 4) degree to which transportation planning is comprehensive is defined as considering all significant impacts of sustainability and the best practices in consideration of inclusive mobility. This is the most general indicator that can be attained when following best practices in transportation planning and sustainability. Applying these to the local public transport route planning and in the three other indicators involves creating a foundation of broad understanding of sustainable transport.

In the case study validation, local cities and municipalities rely on the LPTRP manual and LTFRB support in preparing their route plan. The stakeholder validation found it is unclear to the local governments what are the parameters for passing the plan. This is coupled with difficulties in data collection and the unfamiliarity with transport planning and the learning curve for preparing transport route plans. In November 2021 only 11% of submitted route plans had been approved. Taking note, the findings of the policy assessment revealed there are limited similarities in data requirements between the LPTRP and the other thematic and sectoral plans required for local governments. In addition, transport was previously considered in terms of traffic management and was assigned to public safety and order divisions. Classifications on the understanding of EST are either foundational or there is a clear education and broad understanding of sustainability. The opposite of the spectrum is a consequential EST understanding where it is a result of non-integrated planning activities that eventually lead to some appreciation but without a complete understanding of what makes a system sustainable. A narrow view of sustainability considers environmental pollution and vehicles, this limits the appreciation for data and

analysis and may result in transport inventories and not transport plans, prepared for compliance. On the other hand, a broad sustainability understanding considers the impacts of sustainable development and the transport system. It is where local route plans are integrated with land use and development patterns not only in the existing but has a specific planned development in the future, an example is transit-oriented development. Foundational understanding ensures that planning is more comprehensive, local conditions are reflected, and solutions are integrated to result in purposeful data-based and demand-responsive route plans.

## **8.2. Recommendations for the LPTRP**

Three recommendations are proposed by this study. The first is to enhance the knowledge base of both the LTFRB and local governments in creating a broad and common understanding of sustainable transportation using partnerships with academic institutions. It can be addressed through the importance of education and building the knowledge base on sustainable transport, where having the foundational understanding of EST can also lead to meeting sustainability objectives (NEST, 2011; Regidor, 2011; Jeon, 2007). Related to policy, the role of the EST strategy should be clarified in the National Transport Policy and the Public Transport Modernization Program. This also involves a paradigm shift to prioritizing people's needs instead of motorization. Specific to the LPTRP evaluation, the Transport Department needs to first clarify the standards for passing the first stage of LPTRP and this should consider the local conditions and needs of the area. The training and capacity building was implemented for all the local governments and based on the interviews, respondents received the same training guidance and instructions across the board. The interviews revealed distinct features of the transport systems and capacities of cities and municipalities that reflect the kind of route plan they produce. Related to this another recommendation on the plan is to target the support for cities and municipalities depending on the status of their local public transport route plans.

The second recommendation is to clarify the approval requirements and develop targeted support for cities and municipalities depending on the status of their local public transport route plans. Local governments interviewed are already in the 2nd and 3rd stages of revisions of the LPTRP and this can have negative implications on the local government's resources and also the evaluators if the revision continues indefinitely. The LTFRB has already received 55% of route plans from the 1,379 local governments and this can inform what kinds of data were available in the submitted plans including the transport network profile, current demand, and proposed routes. It is recommended the LTFRB create a digitized database to build a reference for capacity and needs assessment of local governments and a route planning database that can be updated for future use.

The third recommendation is to incorporate the four selected sustainability indicators in the LTPRP manual and planning process. The LPTRP manual process can be considered in three phases. Phase 1 is the profiling stage where cities create the transport inventory of public transport services, and infrastructure, and assess the problems in their area. The indicator on investments in transport systems and infrastructure provides data on the current network profile and planned investments. Possible data sources include the DPWH Atlas, the City/Municipal Engineering records, the Executive Legislative Agenda (ELA) and the NEDA reports. Phase 2 is data collection and demand analysis, and the indicator is transport system accessibility to other locations which includes measuring accessibility by distance and cost for commuters in different residential and work areas. Noting that the LPTRP manual is focused on the financial viability of the service, it is suggested to shift or at the least consider a more people-oriented perspective. This change in perspective is very important; currently, data can only be collected through field surveys. An appreciation is essential for data to be collected and analyzed for this purpose. Performance measurements for this indicator include the level of service, land use accessibility, and

the cost of reaching activities (Litman, 2011). Phase 3 customer accessibility and overall satisfaction rating of the transport system is recommended for the monitoring and evaluation of the new services. This indicator aims to build a mechanism for customer feedback and apply it in the system to keep customers and attract private car users to shift to public transport. And this indicator can be added to the LTRP manual. The fourth indicator to which public transport planning is compressive encompasses all phases of route planning and requires a foundational understanding and good knowledge base of sustainability.

### **8.3. Recommendations for EST in other developing countries**

Developing countries can EST apply in 12 thematic areas that include both policy (soft) and infrastructure and technology (hard) measures (Table 5-1). Examples of soft measures include transport planning with *social equity and gender perspectives* and building the *knowledge base, awareness, and public participation for EST*. Hard measures include *environment and people-friendly infrastructure and development*. The study described the differences in the developing country situation with limited capacities in governance, institutional capacities, available technology, and funding. Compared to developed countries, the lack of funding and available technology is a challenge for implementing hard EST measures such as introducing electric vehicles and efficient public transport systems in the short term. Another challenge is the cultural aspect of developing Asia that considers private cars for status (Wright and Fulton, 2005). Public transport, especially 2-3 wheelers used in informal transport modes, are typically associated with the poor (Mateo-Babiano, et.al 2020; Guillen, et.al, 2013). EST can address the outdated institutional and cultural aspects through building knowledge and public awareness. One example is where the research presented bicycle lanes and the creation of attractive pedestrian and walking areas (non-motorized transportation) are part of EST thematic areas.



Moreover, global trends in COVID mobility emphasized the importance of walking and bicycling, which communicated that it is not only a mode for the poor. In the Philippines case, these actions are already embedded in the functions of the local governments and is being supported by the national government's bicycle lane policy. It can be used as a reference for other developing countries in Southeast Asia. In the medium and long-term, developing countries can strengthen institutional capacities to integrate *transport and land use planning* and create policies on *vehicle emission standards, cleaner fuels, and TDM* to prepare for implementing the electric vehicles, technology, and public transport network thematic areas.

#### **8.4. Suggestions for future research**

There are two suggested directions for future research that are related to the recommendations discussed previously. The first is to explore capacity training needs and assessment for the continuing implementation of the local public transport route plan. The limitation of this study is the access to review any of the submitted route plans. Detailed analysis of the quality of the plans and an assessment to uncover detailed reasons why plans are not getting approved needs to be further analyzed. The study can also investigate creating a transport planning database for local governments. As discussed in Chapter 7 there are 33 other sectoral and thematic plans required of local governments, due to limited time these plans were not analyzed in-depth on how they can relate to local transport plans. The second recommendation is to study the integration of the CDP, CLUP, and sectoral plans with the local transport route plan. The research built the case for the broad foundational understanding of sustainability and where the potential knowledge and data sources from different aspects of these plans need to be integrated and communicated systematically to local governments.

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## Appendices

### A. Questionnaire survey on EST

Objectives:

1. Find out in what ways can EST help achieve “better normal” in Philippines during the COVID pandemic.
2. Identify awareness and acceptance of EST in the Philippines.
3. Find out mobility options during covid19 and car ownership attitudes towards electric vehicles and NMT.

*Filipinos are experiencing the “new normal” due to COVID pandemic. This survey aims to find out how the COVID-19 pandemic has changed the way Filipinos are traveling. The survey also asks about awareness on environmentally sustainable transportation (EST) and what kind of transport Filipinos want to experience as “better normal” in the future.*

*It will take around 10-15 minutes to answer this questionnaire.*

*Please be assured the responses in this survey will be used for academic research purposes only.*

#### PART 1: RESPONDENT’S PROFILE

**Email address**

**Name** (Optional)

**Age**

**Gender**

- |           |                      |
|-----------|----------------------|
| 1. Male   | 3. Other             |
| 2. Female | 4. Prefer not to say |

**Where do you live?** (Dropdown list 82 Philippine provinces)

**What is your profession?**

- |                        |                        |               |
|------------------------|------------------------|---------------|
| 1. Company employee    | 3. Part-time worker    | 6. Student    |
| 2. Government employee | 4. Housewife / husband | 7. Unemployed |
|                        | 5. Self-employed       | 8. Other      |

**Are you able to work from home?**

- |        |          |
|--------|----------|
| 1. Yes | 3. Other |
| 2. No  |          |

**Does your household own a car?**

- |        |       |
|--------|-------|
| 1. Yes | 2. No |
|--------|-------|

**Does your household own a motorcycle?**

- |        |       |
|--------|-------|
| 1. Yes | 2. No |
|--------|-------|

## **PART 2: TRIP INFORMATION**

*Please describe how COVID -19 pandemic changed the way you travel and your opinions about your travel in the future.*

### **1) Before the COVID-19 Pandemic, how frequently did you go out of your residence?**

- |                              |                                  |
|------------------------------|----------------------------------|
| 1. More than 5 times a week  | 5. Less than a few times a month |
| 2. 3-4 times a week          | 6. I do not know                 |
| 3. 1-2 times a week          |                                  |
| 4. About a few times a month |                                  |

### **2) Based on your answer in item 1), what is the main transport mode you used to travel?**

- |                                   |   |
|-----------------------------------|---|
| 1. Rail (LRT/MRT/PNR)             | 9. Tricycle/Pedicab                       |
| 2. HOV/UV Express                 | 10. Walking                               |
| 3. Bus                            | 11. Private Motorcycle                    |
| 4. Jeepney                        | 12. Bicycle                               |
| 5. Grab share                     | 13. Private Car                           |
| 6. Motorcycle taxi                | 14. Carpooling (Company or private group) |
| 7. P2P                            | 15. Other                                 |
| 8. Grab/Car/GrabTaxi/Regular Taxi |   |

### **3) Did you use a second mode? If yes, which mode?**

- |                                   |   |
|-----------------------------------|---|
| 1. Rail (LRT/MRT/PNR)             | 9. Tricycle/Pedicab                       |
| 2. HOV/UV Express                 | 10. Walking                               |
| 3. Bus                            | 11. Private Motorcycle                    |
| 4. Jeepney                        | 12. Bicycle                               |
| 5. Grab share                     | 13. Private Car                           |
| 6. Motorcycle taxi                | 14. Carpooling (Company or private group) |
| 7. P2P                            | 15. Other                                 |
| 8. Grab/Car/GrabTaxi/Regular Taxi |   |

### **4) What factors are you concerned about when using public transport in your city? (Please check all that apply)**

1. Availability of public transport service
2. Service delivery (i.e. driving behavior)
3. Travel time
4. Safety
5. Security
6. Cost (i.e. transport fare)
7. Cleanliness
8. Sufficient pedestrian/walking spaces to have social distancing
9. Connections to first/last kilometer of the trip to my destination
10. Ease of access for elderly, persons with disability (PWD), pregnant women, and persons with small children
11. Possibility of COVID19 infection
12. I never use public transport. I am not concerned with any of these factors.

### **5) Based on COVID19 situation, please select which statement you agree with about using public transport in your city? (Assuming social distancing is observed and people are wearing masks)**

1. I will use public transport the same way as before the pandemic.

2. I will use public transport and strictly observe social distancing and wear personal protective equipment (PPE).
3. I will use a private car instead of public transport.
4. I will use a private motorcycle instead of public transport.
5. I will use a bicycle instead of public transport.
6. I will walk to my destination instead of using public transport.
7. I will use public transport because I have no other choice.
8. I will never use public transport.

**6) Do you plan to buy a private car within the next 12 months?**

1. Yes
2. No
3. Other

**7) If yes, did the COVID19 pandemic influence your decision?**

1. Yes. I am worried about the risks in taking public transportation.
2. No. I planned to purchase a car even before the COVID19 pandemic.

**8) Have you ever considered buying an electric car or hybrid vehicle?**

1. Yes
2. No

**9) What factors are you concerned about when considering to buy an electric or hybrid car?**

1. Cost of purchasing a electric vehicle
2. Lack of charging stations in the city
3. Safety
4. Flooding in the city
5. Difficulty in registering the motor vehicle at LTO (Land Transportation Office)
6. Maintenance and warranty of the electric vehicle
7. Lack of information about electric and hybrid cars in the Philippines
8. Not applicable. I am not considering to purchase a private car or any vehicle.

**PART 3: ENVIRONMENTALLY SUSTAINABLE TRANSPORT AWARENESS**

*Environmentally Sustainable Transport (EST) gives "specific vision for future transportation, it is expected to increase awareness and choose transport activities and lifestyles with reduced environmental loads" (Source: env.go.jp).*

**10) Have you ever heard about "environmentally sustainable transport" before?**

1. Yes
2. No

**11) If yes, where did you hear about it?**

1. Government (ex. DOTR, MMDA, LGU)
2. Media (ex. TV, radio, newspaper, Google)
3. Social media (ex. Facebook, Instagram, Twitter)
4. Academic (ex. class/lecture, academic journal, conference/webinar)
5. Friends, family, social circles
6. While traveling in other countries
7. I have not heard about it before

**12) Please look at the images showing examples of EST in Philippine Cities and kindly answer the next questions based on your impressions about EST.**

## ENVIRONMENTALLY SUSTAINABLE TRANSPORT (EST) IN THE PHILIPPINES



\*Private sector initiative

Example no.1

### E-SAKAY ELECTRIC JEE

- MERALCO\* e-jeepney route Buendia to Mandaluyong Cit Jupiter Street
- Fare: 9-15 pesos (automatic)
- 40 passenger capacity
- Priority seats for elderly, PW pregnant women
- Drivers receive monthly sala boundary system)
- 100km travel on full charge ( hours charging)
- CCTV camera, GPS, WIFI o
- **Zero emissions / no air pol**

Source: Philippine News Agency (PNA)  
PNA. 2019. "E-jeepneys ply Makati-Mandaluyong rc  
2019. Accessed at <https://www.pna.gov.ph/articles>

## ENVIRONMENTALLY SUSTAINABLE TRANSPORT (EST) IN THE PHILIPPINES

Example no.2

### ILOILO CITY PROTECTED BIKE LANES

- 23 km of bikeways located in Diversion road and other roads in the City of Iloilo. Since 2012.
- Iloilo City and DPWH plan to add 20 km to connect bike lane network as response to COVID19 pandemic.
- Called the "Biking heaven of the Philippines"

Source: Iloilotoday.com  
Iloilo Today. 2020. "Iloilo City gears to double bike lanes". 28 May 2020. Accessed at <https://www.ilolotoday.com/iloilo-city-double-bike-lanes/>  
Iloilo Today. 2020. "Iloilo City to connect all bike lanes". 18 June 2020. Accessed at <https://www.ilolotoday.com/iloilo-city-connect-bike-lanes/>



## ENVIRONMENTALLY SUSTAINABLE TRANSPORT (EST) IN THE PHILIPPINES

Example no.3

### ELECTRIC VEHICLE ASSOCIATION OF THE PHILIPPINES (eVAP)

- Established by private sector in 2009 to promote electric vehicles.
- Supported by DTI-BOI and DOE
- Collaborates with government agencies to create enabling environment for e-vehicles in the Philippines.
- Has 500 Industry partners and organized 8 e-vehicle summits



Source: eVAP Accessed at <https://www.evap.com.ph/>

## ENVIRONMENTALLY SUSTAINABLE TRANSPORT (EST) IN THE PHILIPPINES

Example no.4

### PASIG TRANSPORT BIKE SHARE



- Pasig Transport "develops and manages sustainable transport solutions for the city."
- Bike share program also provide racks and bike lanes throughout City.
- Pasig City observes car-free Su in selected roads.

Source: Pasig Transport. Accessed at <https://www.facebook.com/PasigTransport>

**13) Based on EST best examples in the Philippines please select how you agree with the following statements: "I will use public transport more than I usual if it has similar features as the electric jeepneys".**

- |                      |                   |
|----------------------|-------------------|
| 1. Strongly Disagree | 4. Agree          |
| 2. Disagree          | 5. Strongly Agree |
| 3. Neutral           |                   |

**14) "I will enjoy public transport if it has similar features as the electric jeepneys".**

- |                      |                   |
|----------------------|-------------------|
| 1. Strongly Disagree | 4. Agree          |
| 2. Disagree          | 5. Strongly Agree |
| 3. Neutral           |                   |

**15) "I will consider riding bicycle and walking more than usual if it has similar features as the EST examples."**

- |                      |                   |
|----------------------|-------------------|
| 1. Strongly Disagree | 4. Agree          |
| 2. Disagree          | 5. Strongly Agree |
| 3. Neutral           |                   |

**16) "I will consider using my private car / motorcycle less if my city provides electric jeepney, bike and walking facilities like the EST examples."**

- |                      |                   |
|----------------------|-------------------|
| 1. Strongly Disagree | 4. Agree          |
| 2. Disagree          | 5. Strongly Agree |
| 3. Neutral           |                   |

**17) "I will consider an electric/hybrid vehicle over petrol/gasoline engine/conventional vehicle in the future."**

- |                      |                   |
|----------------------|-------------------|
| 1. Strongly Disagree | 4. Agree          |
| 2. Disagree          | 5. Strongly Agree |
| 3. Neutral           |                   |

**18) "I think EST should be considered by my local government."**

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

**19) Please imagine your ideal vision of “better normal” transport in your city. Which of these statements reflect your image of the “better normal” the most?**

1. I can drive my car comfortably to any destination without worrying about traffic congestion.
2. I can take public transport to any destination with convenient and minimal transfers.
3. I can ride my bicycle to any destination without worrying about my personal safety.
4. I can walk around the city safely, securely, and without worrying about air pollution.
5. I can walk around the city and take public transport easily as an elderly person, person with disability (PWD), pregnant woman, or with small children.
6. All of the above describes my ideal vision of “better normal”.
7. None of the above describes my ideal vision of “better normal”.

**20) Please describe in 1 sentence your image of “better normal” transport in your city.**

## B. Guide questionnaires

### Expert Interview Questions

#### Application of environmentally sustainable transport (EST) to the LGU local public transport route plan (LPTRP)

##### Background:

Sustainability has no common definition in literature, and similarly, diverse indicator sets have also been proposed for sustainable transport. The research aims to discuss the applicability of the EST concept and indicators to support local cities in preparing public transport route plans. To explore a representative indicator set, text mining and topic models were used to investigate latent relationships of words mentioned in sustainable transport indicators. Results showed three themes: 1. Environmental pollution, 2. Passenger mobility and demand, and 3. Road network characteristics and vehicles (Figure 1) are most relevant. Indicators containing the most important words were selected, and potential data sources were listed (Table 1).

The objectives of this expert interview are as follows:

1. To present the selected EST indicators and potential data sources to experts and
2. To verify the usefulness of the selected EST indicators in supporting LPTRP.

##### Questions:

- 1) Please provide your impressions on the 13-indicator data and potential sources (Table1) considering the principles for selecting indicators below (Litman, 2011).

<i>a. Comprehensive</i>	Considers social, economic, and environmental impacts
<i>b. Data quality</i>	Reliable and useful data is available
<i>c. Comparable</i>	Standardized data is available
<i>d. Easy to understand</i>	Useful for decision-makers and understandable for the public
<i>e. Accessible and transparent</i>	Indicators, data, and analysis is clear and available to all stakeholders
<i>f. Cost effective</i>	The value of having the information outweighs the cost of data collection
<i>g. Net effects</i>	Differentiate between net (total) impacts and shifts of impacts to different locations and times
<i>h. Functional</i>	Suitable for establishing usable performance targets
- 2) Please provide your impressions on the applicability of the selected indicators in the local public transport route planning. Have the indicators been described adequately? Are all possible data sources considered?
- 3) Based on your expert opinion and experiences do you think the EST concept and indicators will be able to support the local public transport route planning of cities in the Philippines? Please cite an example.
- 4) Final thoughts and closing. What are your thought on sustainable transportation? Please share your definition of sustainable transport.

Thank you very much for your valuable inputs.



Reference:

Litman, T. (2011). Developing Indicators for Comprehensive and Sustainable Transport Planning. Victoria Transport Planning Institute.

### **Key Informant Interview with LGUs on Environmentally Sustainable Transportation (EST) and Local Public Transport Planning (LPTRP)**

*Objectives:*

- I. To find out the LGU experiences on LPTRP and understand the process of incorporating land use and development plans in formulating this Plan.
- II. To present and validate the proposed EST concept to LGUs and to clarify the aspects of EST that can be applied to the LPTRP formulation.

*Part I:*

1. Please introduce yourself: full name, position/office.
  - a. What is the scope of your work and responsibilities? (2-3 key responsibilities or deliverables)
2. Please provide 2-3 key experiences or thoughts on the LPTRP.
  - a. What is your participation on the LPTRP of your LGU?
  - b. What is the status of LPTRP in your LGU?
  - c. What are the success and challenges formulating the plan?
3. Please provide 2-3 key success stories or challenges.
  - a. What factors can we attribute to the success of the LPTRP in your LGU?
  - b. What are the challenges with LPTRP and how are these being addressed?
4. Please fill out the survey form below:

*The survey will only take 5 minutes to answer. Please fill out the form on or before **July 1, 2022**.*

*Online Survey Form: <https://forms.gle/6c15rz12CzbfUDZj9>*

*Thank you very much for your kind cooperation.*

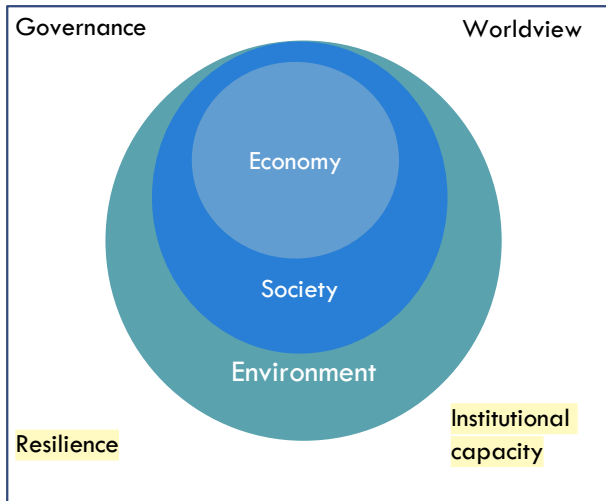
*Part II: The images will be explained during the interview.*

Please examine and consider the figures presented below in answering the next questions.

1. The concept of sustainability and sustainable development was introduced as development that meets the needs of the present and future generations (WCED, 1987). Sustainability and EST has no common definition (Jeon, 2007; Litman, 2007). It is often defined based on the needs and capacity user group.

The research proposed a conceptual model in Figure 1.

- a. Please comment your understanding of what is EST based on the figure.



*Figure 1 Proposed conceptual model of EST*

2. The research proposed a concept map with the linkages of EST and the Public Utility Vehicle Modernization Program in Figure 2.
  - a. Please comment your understanding of EST based on the image.
  - b. Do you agree that with the linkages used in the map?
  - c. Are there other linkages between EST and LPTRP that can be added?





*Figure 3 Image of "better normal" transport in the Philippines*

4. The research presented three images to represent sustainable transportation. Please provide your impressions if the images were useful to convey the definition of EST.
  - a. Do you agree with the images presented?
  - b. What can be improved on the images presented?
5. Final thought and closing

**Thank you for participating in this interview.**

References:

- Jeon, C.M. (2007). Incorporating Sustainability into Transport Planning and Decision Making: Definitions, Performance Measures, and Evaluation. Dissertation. Georgia Institute of Technology.
- Litman, T. (2007). Developing Indicators for Comprehensive and Sustainable Transport Planning, Transportation Research Record 2017, Transportation Research Board ([www.trb.org](http://www.trb.org)), 2007, pp. 10-15.
- World Commission on Environment & Development (1987). Our Common Future. Oxford University Press, Oxford.

## C. Documentation reports

Key Informant Interview  
LTFRB interview via Zoom

July 15, 2021 (6:00 – 7:00 PM PST 7:00 – 8:00 PM JST)

**Topic:** Local Public Transport Route Planning Component of the PUVMP

**Objective:** To understand the status of the LPTRP. To identify the progress, success stories, and challenges toward providing need-based public transportation services with local governments.

- 1. Please introduce yourself: full name, title, and position.**
  - a. How long have you been working on the LPTRP and the PUVMP, specifically?**
  - b. Which components of the LPTRP are you currently involved in?**

Background of PUVMP NMPO in LTFRB

- The PUVMP National Program Management Office was established in August 2019.
- The NPMO has a Central Office and Regional Management Offices.
- The NPMO is tasked to implement the PUVMP components relating to Route Rationalization (Nationwide) and LPTRP (except MUCEP area)

Hussain, Zebonezza

- Project Lead National Program Management Office of PUVMP in LTFRB (August 2019 – Present)
- NPMO conducts the evaluation and review of LPTRP

Bermudez, Yannie

- Supervising Transportation Development Officer for LPTRP
- Checks and supervises LPTRP
- Part of LTFRP before joining the PUVMP NPMO

Estipona, Maan

- LTFRB Technical Division
- Handles and monitors submission of LPTRP
- Collects and manages database
- Involved in the capacity building program for LGUs conducted in 2018

- 2. Please provide 2-3 key points or learnings.**
  - a. What is the LPTRP objective, goals, plan submission, and award process?**
  - b. How is the LPTRP different from the previous public transport route planning process?**

Hussain, Z.

- The previous public transport processes called route measured capacity (RMC) evaluated individual route proposals to operate public transport and is managed by the Road Transport Planning Division (RTPD).
- PUVMP which includes LPTRP and Route Rationalization, is a set of reform policies to consolidate and operationalize public transportation in the Philippines.

- Prior to implementation, LGUs were capacitated to prepare LPTRP. A total of 1379 out of 1575 LGUs participated in the capacity building program in 2018. This included training on conducting traffic studies and on ground surveys. The LGU will collect and provide a complete set of data for the new or rationalized routes or suggest retaining routes they find viable in the survey.
- This plan is submitted to the DOTr or to LTFRB depending on the classification of Province, City, or Municipality. LTFRB evaluates the plans and provides comments to the LGU to revise or finalize their submission. If the set parameters are passed, NPMO will recommend the issuance of the Notice of Compliance (NOA) to the LGU.
- The province will formulate a Sanggunian Resolution. Public hearings and stakeholder consultations will be conducted.
- Upon the approval and endorsement of the Ordinance, the LTFRB will publish a memorandum circular (MC) of the approved routes, mode, and fleet size to operate in route.
- Crafting the LPTRP and Rationalization is not an easy task. Through the Regional PMO, new and developmental routes were opened by LTFRB. Some of the (news) reports of new routes were opened because of LPTRP, covid routes, or efforts of LTFRB to rationalize and open new routes.

Bermudez, Y.

- Participatory planning is highlighted to involve what plans the public want to see in the city.
- Public hearings are conducted with operators and other stakeholders.
- Emphasized that all plans are connected.

Estipona, M.

- Need to highlight the difference of LPTRP/Route Rationalization is the bottom-up approach. Commuting public and other stakeholders are consulted, and the LGU addresses their concerns. City Planning Officers are also involved in the process. LPTRP encourages LGUs to do participatory planning and stakeholder consultation to address concerns of cooperatives and other stakeholders.
- LTFRB and DOTr receives requests to open routes from private sectors.
- DILG is involved as jurisdiction for LGUs to encourage them to submit and finalize their LPTRP.
- The Joint Memorandum Circular (JMC) directs LGUs to formulate and submit the LPTRP for LTFRB approval and implementation, through an issuance of Memorandum Circular for the issuance of public transport franchises.

#### **c. What are the unique features of the LPTRP that support sustainability?**

Hussain, S.

- LPTRP can be evaluated, and additional units can be proposed by the LGU, if needed.

Bermudez, Y.

- The LGU can update the LPTRP from 6 months to 3 years.
- Project the possible development in the city and align it with the plans.

Estipona, M.

- JMC stated LGU should update LPTRP once every 3 years.

#### **d. What is the status of LPTRP submission/approval?**

**e. How many new LPTRP routes have been awarded and are currently operating?**

Bermudez, Y.

- Submission as of July 9:
- 697 LGU submitted LPTRP for evaluation (different revision levels)
- 61 LGU Notice of Compliance
- 2 MC for new franchised routes
- 11 routes with 6 operators and 68 OFG compliant units (DO 2017-11)

**3. Please provide 2-3 key success stories or challenges.**

- a. Is there any implementing agency, project partner, or LGU, that you can consider as a "local champion" for LPTRP?**
- b. What factors can we attribute to the success of the "local champions"?**

Hussain, S.

- General Santos is the first LPTRP awardee. They upgraded tricycle routes into Jeepney routes using LPTRP.

**c. What are the challenges with LPTRP and how are these being addressed?**

Bermudez, Y.

- The pandemic is a major challenge. It resulted in abnormal demand.
- Capacity building attendees were not the technical people needed.
- Change of LCE, continuity, staff life cycle and no turnover, are also part of the institutional challenges.
- The Regional PMO receives requests for workshop or assistance to prepare surveys and capacity building from LGUs.

Estipona, M.

- Pandemic shifted resources from LPTRP, and the demand is different from normal because of the lockdowns
- After approval, LGU need to submit hard copy of approved LPTRP to DILG. The DILG can assist with funding or extension to submit deadline.
- LTFRB and Regional Offices provides technical assistance for crafting the LPTRP.

**4. Please provide 1-2 key points.**

- a. What new perspectives did you gain from the LPTRP?**

**5. Final thoughts or closing.**

Hussain, S.

- LGUs view LPTRP for compliance, moving forward more appreciation would be good.
- Constant coordination from the LGU, insight and coordination; how vital it is for the development of the city, these need to be appreciated by the LGU.

Estipona, M.

- Not one-size fit all, its case-to-case basis

End of documentation report.

## **Documentation Report**

City of Balanga, Bataan (4<sup>th</sup> class component city)

City Public Safety Office (CPSO)

July 1, 2022 1:00 – 1:30 Philippine Standard Time (conducted on Zoom)

Topic: Key Informant Interview with LGUs on Environmentally Sustainable Transportation (EST) and Local Public Transport Planning (LPTRP)

Resource Persons:

1. Engr. Dennis B. Mariano (Department Head)
2. Mr. Florante Caguioa (Assistant Operations Officer - CPAOO)

Key discussion points:

### **I. Formulating the LPTRP**

- Engr. Mariano has been with the City of Balanga from 2007. He leads the City Public Safety Office (CPSO) and manages over 200 personnel. CPSO has two functions: traffic management and security management in government offices.
- He explained their LPTRP formulation started in 2019 and have been coordinating with the LTFRB Regional Office on the submission and was halted because of the pandemic. Engr. Mariano recognized the volume of vehicles and pedestrians are now increasing from the last 2 years and it is a good time to restart the plan. They are coordinating with the LTFRB Regional Office in San Fernando for reorientation. Once the route plan is approved by LTFRB, it will be presented to the Sanggunian Panlungsod for approval. Once approved, the new routes will be implemented in the city.
- Many challenges were experienced during the pandemic, the city could not update data because of pandemic restrictions. Now that face-to-face meetings are allowed, they are looking forward to finishing the route plan.
- Mr. Caguioa clarified the route plan has been revised twice, where the LTFRB has requested more data to be added. The success of preparing the route plan is attributed to the coordination of different city departments in data sharing. Through a collective effort, they finished the first draft and sent it to region 3 for evaluation. Another challenge is that the city is not familiar with route planning, and they did not know if what they prepared will pass the evaluation.
- Engr. Mariano added the size of Balanga City is small and the road network is easy to assess. It was easy for them to collect data on the volume of vehicles. Moreover, the Local Chief Executive (LCE) created a technical working group and writeshop committee (Executive Order No. 1 Series of 2019) comprising of different departments to formulate the route plan. This facilitated data sharing and coordination that led to the success of formulating the plan.
- Yet another challenge is the availability LTFRB Regional Office personnel to assist with the formulation of the plan. Balanga City studied General Santos City's route plan and looked at how they collected their data and completed the LPTRP.



## II. Discussions on EST and LPTRP

- Engr. Mariano commented environmentally sustainable transport uses renewable energy like electric vehicles, it decreases the use of vehicles through walking and cycling, and it transforms people's mindsets to give importance to the environment by knowing the impacts and importance of reducing carbon emissions.
- Related to walking and cycling, he added the city is incorporating bicycle lanes and pedestrian walkways in line with DILG MC. No. 2020-100 (Guidelines for the establishment of a network of cycling lanes and walking paths to support people's mobility).
- Additionally, he explained the importance of selecting vehicle modes to cater to trip destinations, road hierarchy and different user's needs where time and speed of transport modes are also important considerations.
- On the word cloud, Engr. Mariano commented all words impact users and the community and are important for sustainability. Mr. Caguioa commented "infrastructure" should also be added, citing the importance of road networks and bicycle lane infrastructure mentioned previous discussions.
- Commenting on the 3 images, Engr. Mariano noted the road user's contribution to sustainability was lacking, and this should be represented with the word "discipline".
- To close the discussion Engr. Mariano mentioned it is important for all cities to have an LTPRP to maximize resources. The LPTRP will provide the community an effective, safe, and convenient public transportation system that also considers environmental sustainability.
- Lastly, Mr. Caguioa added modern jeepneys are available in the province. Traditional jeepneys are considering upgrading with Euro4/5 engines due to the competition, where passengers are choosing modern jeepney for convenience. They are hoping for more modernized jeepneys with the approval of their LPTRP.

End of documentation report.

## **Documentation Report**

Municipality of Carmona, Cavite (1<sup>st</sup> Class Municipality)

Planning and Development Office

July 14, 2022 10:00 – 11:00 Philippine Standard Time (conducted on Zoom)

Topic: Key Informant Interview with LGUs on Environmentally Sustainable Transportation (EST) and Local Public Transport Planning (LPTRP)

Resource Person:

1. Ms. Mildred M. Purificacion (Planning Officer)

### **I. Formulating the LPTRP**

- Ms. Purificacion is a member of the LPTRP Secretariat in the Municipality of Carmona. She has almost 30 years of experience in planning. She is involved with various aspects of LPTRP including data collection, analysis, writing, stakeholder and public consultations, and coordination with national and other relevant agencies.
- She also participated in the training provided by DOTr and LTRFB. Traffic and police officers were assigned to participate, originally. She expressed interest to attend because of transportation and land use planning's linkages. She notes in-depth knowledge about the Municipality's profile, resources, and needs are essential for preparing the local public transport route plan. The comprehensive land use plan and ecological profile are important to be aligned with the LPTRP.
- Data collection, analysis, and formulation was done by the Municipality with the help of DOTr's capacity training seminar. The Public Employment Service Office (PESO) hired students to collect field data over one month period and tasked to conduct license plate surveys, boarding and alighting, traffic counts. They considered one month to show the real issues and situation in the Municipality especially with special events taking place.
- The Municipality does not want to make a route plan only for compliance and they are proud to have accomplished the LPTRP within their own capacity. Preparing the LPTRP was a difficult process, and they were successful in completing it because they had the land use plans, and complete data available.
- Carmona LPTRP 2019-2023 was approved in 2019. Based on LPTRP process, the next step is to create a Local Ordinance approving the route plan. Ms. Purificacion clarified they conducted several public and stakeholder consultations and was later approved by the Sanggunian.
- New franchises have not yet been awarded. The Municipality was later informed that they are part of the MUCEP (Metro Manila Urban Transport Integration Study – MMUTIS- Update and Capacity Enhancement Project). This means the submitted LPTRP will be considered for the route rationalization to be done by DOTr.
- The Municipality is continuing to develop and the demand for public transportation is growing. Without new franchises, colorum services started to fill the gaps in public transportation. It is a delicate issue because people need public transport services to get to work in Metro Manila and colorum are the ones providing it and not formal

transportation. If the colorum vehicles are apprehended, then it is an inconvenience to the commuting public in addition to the drivers and operators. There is also a concern that apprehension can create corruption, which makes it a difficult and sensitive issue.

- Tricycles are also dominant in the central business district are often the cause of traffic congestion because that is where the people are. The Municipality has ordinances to restrict tricycles in the main highways (as per national law) but there are limited options for public transportation. The Municipality arranged terminals outside the business district to accommodate them. Ideally, there should not be too many of them, however tricycles are operated by the poor and if it is removed then drivers and operators will lose their livelihood.
- Road safety is another concern. Road accidents are considered in the Municipal crime rates, and this gives a negative impression to investors. There is a need to address road accidents and safety concerns on vehicles. The Municipality can enact ordinances for vehicle requirements. Ultimately, the LTO has the power to give registration for these vehicles. When the local and national policies are contradictory it is very difficult to manage the situation.
- Local governments are the frontliners who know the problems of the municipality. Regulations at the national level would be better coordinated with the stakeholders. Ms. Purificacion understands the MUCEP integration is very important a mass transport system. She stresses the need to consult with the local governments to consider the land use development and infrastructure plan with the proposed route alignment of the national government in the MUCEP.

## II. Discussions on EST and LPTRP

- Commenting on concept model of EST, she stresses sustainability means a good plan. Sustainability is not a compromise. Good planning and allotting development locations for the next years considers what kinds of investments will come and the negative externalities that will also happen. For example, the creation of a shopping mall is a good investment that will generate income but can also create traffic congestion. Traffic congestion reduces the fuel economy of vehicles and affects the health of commuters through vehicle emissions and pollution. This touches on the three pillars of sustainability.
- Related to the concept map Ms. Purificacion views EST as more comprehensive than Public Transport Modernization Program. EST includes land use planning which is very important. LPTRP is only part of the masterplan, there are more information that needs to be considered including road inventories, road conditions, and especially drainage profiles. She mentioned the LPTRP of Carmona added these components and adjusted some requirements of the LPTRP Manual that were not applicable in the municipality.
- EST thematic areas are very comprehensive and important. One concern is the capacity to implement vehicle emission standards. Ordinances on emissions are approved, but it should consider the kinds of vehicles available. Carmona has electric tricycles and has facilities for charging. In general, there is limited information is available on electric vehicles at the policy level.

- The Municipality also has bike lanes in accordance with Department Order No. 88 S. 2020 that all new roads should have bike lanes. There should be more considerations for facilities because of the heat and difficulty in using the bicycle in certain areas. It should also be connected to pedestrian walkways.
- There are many policies handed to local governments to implement and local governments are trying hard to comply. However, there are situations that is not applicable to what the local government needs. It would better if the policies are consulted with local governments before being implemented.
- On the word cloud, Ms. Purificacion suggests including “inclusive”, “infrastructure”, “smart transport”, “strategic planning”, “affordability”, “inventory”, “monitoring and evaluation”, “technology”. A better transport system would have seamless transportation modes and transfers like a subway system. It should also be affordable.
- The transit system should be changed and improved. Bike lanes are also part of a sustainable transport system. All these components should be considered in the LPTRP. Bottom-up planning from local to national government and public consultations are also very necessary.
- The three images were all useful in conveying the message of EST. Ms. Purificacion sees the concept model is the umbrella (master) and the contents are the concept map and the word cloud. It will depend on the user which points to add and what is applicable. Local governments should explore and understand the situation in their areas and adjust the plan to their needs.

End of documentation.

## **Documentation Report**

City of Legazpi, Albay (1st Class Component City)

City Planning and Development Office

July 5, 2022 10:00 – 10:30 Philippine Standard Time (conducted on Zoom)

Topic: Key Informant Interview with LGUs on Environmentally Sustainable Transportation (EST) and Local Public Transport Planning (LPTRP)

Resource Person:

1. Engr. Joseph B. Esplana is the head of the CPDO in Legazpi City with over 10 years of experience in this role.

### **I. Discussions on EST and LPTRP**

- Engr. Esplana commented on the proposed concept model of EST. Where the economy is an enabler of society (actors) and aims to improve the quality of life. These dimensions interact with environment where there is concern for limited resources. Good governance is necessary to creating resilient communities. This can be done by building the capacities of the people and society. Regarding worldview, lessons from other countries can be adapted.
- The concept map resembled a problem tree image where the EST thematic areas represent transportation problems. These concerns are incorporated in the transportation subsector in the infrastructure chapter of Legazpi City's Comprehensive Land Use Plan (CLUP) 2019-2028. It was acknowledged, EST thematic areas are part of the CLUP, although it is not mentioned has "EST".
- Commenting on the word cloud, additional words can be considered to represent a better future. These include the "ease of mobility", shifting to "fossil fuel to non-fossil fuel", and "franchising".
- To further comment on franchising, the City handles tricycle franchises and fare setting. Jeepney and buses are with the National government. Should the Local Government Code also devolve this to cities further institutional development and coordination is needed. There is a concern on intra and intercity routes that needs to be studied more clearly.
- It was noted bicycle lanes are also being provided in the city. Walking and cycling are among the examples of environmentally sustainable transport.
- In closing, it was agreed the 3 images provided ideas about sustainability and the suggestions will be considered in improving the images. On the results of the study, it would be good to recognize different cities have different capacities. There have been many policies (ex. Memorandum for provision of bike lanes) that are devolved but not yet implemented. Rather than more policies, capacity building should also be considered

End of documentation report.

## **Documentation Report**

City of San Fernando, Pampanga

City Planning and Development Coordinator's Office (CPDCO)

June 27, 2022. 11:00 – 12:00 Philippine Standard Time (conducted on Zoom)

Topic: Key Informant Interview with LGUs on Environmentally Sustainable Transportation (EST) and Local Public Transport Planning (LPTRP)

Resource Persons:

1. Arch. Ferdinand S. Remo (Architect IV)
2. En.P. Aries Ivan Viray (Planning Officer)

Key discussion points:

### **I. Formulating the LPTRP**

- Arch. Remo introduced the status of the LPTRP. The route plan is being revised according to the LTRFB comments. San Fernando City is looking into procuring a consultant to assist in preparing the necessary transport surveys and calculating the required units. He attributes planning success on LGU funding, LPTRP Manual and the training seminars.
- Since it is the first-time cities are required to make a route plan, main challenges are on the highly technical requirements for collecting data and estimating passenger demand. By including the LPTRP in the Annual Investment Program (AIP), technical support can be accessed.
- Arch. Remo recalled his experience attending the LPTRP capacity building training where LTRFB suggested a Traffic Engineering Department should perform data collection surveys needed to formulate the route plan. He noted San Fernando City Public Order and Safety Coordinating Office (POSCO) undertakes traffic and public order management, and they are focused on traffic enforcement. Unclear which Department should formulate the route plan, it was assigned to CPDCO.
- EnP. Viray provided the context for procuring external technical support in the short term. San Fernando City is moving toward data-centric plans and programs, not only with the route plan but also with Comprehensive Land Use and Development Plan (CLUP/CDP). City planning needs to focus on improving data availability and using data to support decision-making. The main challenge is that these capacities are not yet available and will take time to build on their own. Recalling his experience in the National Economic and Development Authority (NEDA), many city plans are prepared for compliance. A lack of integration was observed where many documents are not comprehensive and disjointed.
- The LPTRP establishes passenger demand, it needs to be comprehensive and consider future development. Related to this, public participation in providing free rides (libreng sakay) is a noted success to continue access to public transportation during the pandemic. Although it is unclear if these routes recommended by DOTr, and private sector are based on demand studies.

- Another consideration is on continuity of plans and policy directions. San Fernando will transition to new leadership on July 1, and there are possibilities where plans need to be revisited or revised.

## II. Discussions on EST and LPTRP

- The proposed conceptual model of EST was presented, where sustainability does not have one common definition and it is generally understood sustainability includes environment, society, and economy. Arch. Remo commented it was the first time to hear about the concept of EST. While En. P Viray has familiarity with the concept.
- In applying the proposed model in the Philippines, he emphasized the role of culture in the social dimension as a factor that influences behaviors related to transportation. Filipinos want door-to-door services provided by tricycles and jeepneys. It is difficult to enforce fixed stops because passengers want to be picked-up and dropped-off exactly to specific areas. Mechanisms to change this behavior need to be in place so that higher capacity transport modes like railways can be implemented.
- Another point is on institutional capacity. Using the COMET jeepney as an example, the government needs to provide more support for availing electric vehicles for public transportation. It is not enough to say the operating cost of e-vehicles are cheaper compared to diesel-engines. Government needs to extend support and improve access to e-vehicles to the drivers so that they can be widely available.
- Asked how the city is incorporating these concerns into the LPTRP, it was clarified that the current version of the route plan is more a transport route inventory. Capacities in the City is very limited, the POSCO was only established five years ago. Without a dedicated transport engineering office, this responsibility was assigned to the Planning Office.
- Many of the public transport services have been operating even before San Fernando became a city. Since the LPTRP requirement is very new, the City needs to first become familiar with existing conditions and build technical capacities to formulate a route plan.
- The concept map linking components of sustainability with EST and LPTRP was presented. En.P Viray considered resilience of public transport and provided an example in San Fernando's situation. Jeepneys and tricycles are the main public transport in the city. There are no city buses operating. Jeepneys and tricycles continued to operate however, public transport restrictions and high fuel prices have caused individual drivers to stop operation on their own.
- He further explained environment dimension is the main factor because it needs to be available for future generations. San Fernando's vision is a "model city of countryside development", a 1<sup>st</sup> class city with urban activities and considering agriculture. Innovations can be adapted by society to achieve better air quality and reduce noise pollution in the future.
- The word cloud of 'better normal transport' was presented and participants commented on the image's message. Arch. Remo observed the city is already

implementing actions related to EST without being aware it is part of sustainable transport.

- Commenting on the three images presented, both resource persons agreed the proposed conceptual model and the word cloud was easy to understand and appreciate. The word cloud is easy enough to understand even for the public, to better communicate EST. The concept map on the other hand, is too wordy, confusing, and hard to appreciate.
- It was agreed that sustainable transport is not only about traffic and movement of vehicles but also on taking care of the environment. Public transportation is considered the cheaper mode and not the convenient mode. The future direction of San Fernando LPTRP is to come up with a new way to transport people with lesser air and noise pollution, and this is especially important since the roadways are passing residential areas.
- San Fernando will soon be updating the CLUP/CDP and will include public consultations in the workshops and plan formulation. This will also consider different sectors, such as jeepney drivers, to get the other sides of the story.
- San Fernando is also coordinating with DOTr on active transportation, which is related to EST. Funding opportunities for bicycle lanes and open spaces will be discussed. It would be good if the DOTr can continue supporting local governments in capacity building and also funding. Not all local governments have similar capacities in manpower and finances. Adjacent municipalities also need to be supported, or else the desired outputs may not be achieved.

End of documentation report.



## **Documentation Report**

Municipality of Santol, La Union (4<sup>th</sup> Class)

Municipal Planning and Development Office (MPDO)

July 1, 2022. 10:00 – 10:30 Philippine Standard Time (conducted on Zoom)

Topic: Key Informant Interview with LGUs on Environmentally Sustainable Transportation (EST) and Local Public Transport Planning (LPTRP)

Resource Person:

1. Engr. Ronald Toyaoan (MPD Coordinator)
2. Ms. Gladys Mae Nillo (Planning Officer)

Key discussion points:

### **I. Formulating the LPTRP**

- The participants are Engr. Toyaoan, head of the Municipal Planning and Development Office and Ms. Nillo, a Planning Officer. Both joined MPDO in the last year (2021) and are in charge of writing and revising the local public transport route plan.
- Santol's LPTRP is currently being revised to address comments from the LTFRB. Ms. Nillo is currently working on the 3<sup>rd</sup> draft revisions for the plan. Both participants were not able to attend the seminars and training provided by LTFRB, as they joined the office after the trainings were conducted.
- Engr. Toyaoan explained the LTFRB comments are related to demographic profiling, surveys, and the proposed routes. They are using survey data collected in 2019, by the previous LPTRP responsible officer. He noted COVID restrictions prevented them from conducting further surveys.
- Ms. Nillo added they are coordinating with LTFRB on the revisions through face to face and online meetings. She explained the plan formulation, especially with the demand formulas, is a trial-and-error process for them. LTFRB representatives were able to advise them and clarify their questions, which was very useful in the formulation process. Although, consultation time is limited since LTFRB is also supporting other local governments.
- On the success of formulating the route plan, they are motivated to get the Notice of Compliance and award for the routes. Ms. Nillo cited their willingness to complete the plan despite the challenges. They are motivated to obtain new public transport service routes for Barangays that have no public transport options.
- Many developments have already been built and need to be served with public transportation. Santol has mountainous areas and public transport is a necessity to connect upland barangays with the municipal centers. Jeepneys and tricycles are the only modes operating.

## II. Discussions on EST and LPTRP

- Commenting on the EST concept model, Ms. Nillo said it clarified it is centered on economic growth that benefits society and considers the impacts of transport on the environment.
- About the concept map and EST strategies, their main concern is on public transport. It is a major contributor to pollution and one way to lessen pollution is through modernization of public transport.
- On the final image she agrees with the word cloud and thinks it represents words that can influence people to use public transportation by making it safe, accessible, and convenient. Where an environmentally sustainable transport should be safe, convenient and environment friendly.
- Regarding how EST has been incorporated in the route plan, Ms. Nillo explained the goal of their LPTRP is to provide access to two barangays where there are no existing modes of transportation. Townspeople currently walk or use private motorcycles for mobility, and it is important for them to provide access and safe public transportation. Added there is uncertainty if the modern vehicles can be used in mountainous and hilly terrains in their municipality.
- On closing, they are looking forward to receiving the notice of compliance of LTFRB and being able to have the two new public transport routes.

End of documentation report.

## **Documentation Report**

Municipality of Vintar, Ilocos Norte (1<sup>st</sup> Class)

Municipal Planning and Development Office (MPDO)

June 28, 2022. 10:30 – 11:00 Philippine Standard Time (conducted on Zoom)

Topic: Key Informant Interview with LGUs on Environmentally Sustainable Transportation (EST) and Local Public Transport Planning (LPTRP)

Resource Person:

1. Mr. Robbie R. Benigno (Statistician II)

Key discussion points:

### **I. Formulating the LPTRP**

- Mr Benigno works on data management and analysis in the municipality. He serves as the captain of the LPTRP formulation, overseeing data collection, analysis and writing the plan. The route plan was submitted last 30 April 2022 and has already received comments from the LTFRB. The municipality is working on revisions related to profiling and additional data requirements.
- Tricycles and motorcycles are the dominant transport modes in the Municipality, with its mountainous terrain and mostly earth and gravel-roads. Public transport services are mostly jeepneys and tricycles, with passing provincial bus routes to and from Metro Manila.
- Vintar's route plan proposed 3 inter-LGU jeepney routes that will cater to the barangays especially those in mountainous areas.
- Vintar Municipality is one of three LGUs in Ilocos Norte who successfully completed a transport route plan. The province has 21 municipalities and 2 component cities for a total of 23 LGUs. This success was attributed to the available manpower and technical capacity of the MPDO who were self-sufficient in collecting passenger data and conducting fieldwork on their own. Additionally, the presence of the LTPRP Manual and the month-long training were essential reference materials for them.
- A significant challenge is on highly technical requirements of the route plan, where it is difficult for an ordinary planner to implement. The LPTRP is different from the normal activities of the LGU, and the manual comprises of many formulas and analysis. The learning curve to understand it is quite high.

### **II. Discussions on EST and LPTRP**

- The following discussions features Mr. Bengino's comments on the presented images related to EST. On the proposed conceptual model, he provided very insightful explanations regarding the four pillars supporting the dimensions of economy, society, and environment.
- Related to governance, EST as a service should conform to regulations, laws, and policies in the government. For worldview, transport should conform to standards set

in developed or developing countries. For resilience EST should consider climate change and fuel emissions, including alternative fuels, where most of the vehicles now is dependent on fossil fuels. Other technologies can also be explored. On institutional capacity, we must consider the welfare of individuals involved in transport systems, drivers, and passengers or the commuting public.

- Asked if the concept map will help to understand EST, it was noted it was difficult to look at in the first impression.
- Analyzing the image, Mr. Benigno provided his thoughts to improve on it. He agrees that EST in the Philippines has thematic areas related to public transport modernization. And it is linked with the three dimensions of sustainability.
- Concerns were raised on the link between LPTRP and economic sustainability. Local Public Transport Route Plan is the basis for banks to grant loans for drivers and operators to buy modernized vehicles required to open the routes. It would be difficult to achieve EST without the LPTRP. The economic aspect needs to have more linkages that can be explored in the concept map.
- On the word cloud image, standout words are “safe, public, transportation”, however the respondent does not agree these automatically mean EST. Vehicles can be safe but also too dependent on fossil fuels, or it can be safe, but not cannot accommodate many passengers.
- He suggested “versatility” of public transport can be added. Particularly, Vintar needs vehicles that can traverse the mountainous portions and the rugged terrains.
- In consideration of the geographical characteristic of the Municipality, an environmentally sustainable transport was described as one that complies with standards, considers passenger demand, uses alternative fossil fuels and electric vehicles. Another environmental consideration is that engines should not be harmful to the environment, and usability should last a long time. Economic considerations are on affordable fare-setting.
- In summary, EST would have versatile vehicles that are compliant with standards, use alternative fuels, and are affordable.
- To close the discussions, Mr. Benigno explained LPTRP can be a good way to implement the EST concept. However, the diverse requirements of each LGU may not conform to what is expected as EST, and the implementation may look different.
- Lastly, LPTRP is a very difficult plan to implement. National data shows only a few LGUs were able to submit the plan despite having the capacity trainings. The National government assumes LGUs are capable to formulate the plans on their own, but not all LGUs have departments and manpower to prepare such a technical plan. The higher agencies need to provide more technical assistance for LGUs.

End of documentation report.

## D. List of academic papers

Author <i>Listed by first Author</i>	Title	No of Indicators	Area
Alonso (2015)	Comparative analysis of passenger transport sustainability in European cities	9	Europe-Spain
Buenk (2019)	A Framework for the Sustainability Assessment of (Micro)transit Systems	50	Global
Castillo (2010)	ELASTIC – A methodological framework for identifying and selecting sustainable transport indicators	15	Europe-UK
Gillis (2016)	How to Monitor Sustainable Mobility in Cities? Literature Review in the Frame of Creating a Set of Sustainable Mobility Indicators	22	Global
Haghshenas (2012)	Africa's urban sustainable transportation in comparison with other regions of the world	9	Global
Jain (2017)	Sustainable mobility indicators for Indian cities: Selection methodology and application	31	India
Jeon (2005)	Addressing Sustainability in Transportation Systems: Definitions, Indicators, and Metrics	175	North America
Jounard (2010)	Transport project assessment methodology within the framework of sustainable development	19	Europe-France
Karjalainen (2021)	Urban transportation sustainability assessments: a systematic review of literature	44	Global
Litman (2007)	Developing Indicators for Comprehensive and Sustainable Transport Planning	39	Australia
Mameli (2014)	Can National Survey Data be Used to Select a Core Set of Sustainability Indicators for Monitoring Urban Mobility Policies?	13	Italy
Mameli (2014)	A participative procedure to select indicators of policies for sustainable urban mobility. Outcomes of a national test	13	Italy
Moavedi (2013)	Conceptualising the Indicators of Walkability for Sustainable Transportation	34	Malaysia
Munira (2017)	Examining public perception over outcome indicators of sustainable urban transport in Dhaka city	14	Bangladesh
Nadi (2017)	Review of methods and indicators in sustainable urban transport studies overview from 2000 to 2016	5	Global
Nathan (2013)	Urban Transport Sustainability Indicators – Application of Multi-view Black-box (MVBB) framework	54	India

Rajak (2016)	Sustainable transportation systems performance evaluation using fuzzy logic	60	Global
Reisi (2014)	Transport sustainability index: Melbourne case study	9	Australia
Santos (2013)	The use of sustainability indicators in urban passenger transport during the decision-making process: the case of Rio de Janeiro, Brazil	20	Brazil
Sdoukopoilos (2019)	Measuring progress towards transport sustainability through indicators: Analysis and metrics of the main indicator initiatives	47	Global
Shah (2013)	Diagnosing Transportation Developing Key Performance Indicators to Assess Urban Transportation Systems	19	Global
Shiau (2013)	Developing an indicator system for local governments to evaluate transport sustainability strategies	21	Taiwan