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Informal and Shared Mobility – Status, Challenges, and Opportunities in Southeast Asia

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Foreword

The informal and shared mobility sector in Low and Middle Income Countries (LMICs) presents a unique set of challenges and opportunities. This sector, often characterized by its adaptability and responsiveness to local needs, plays a crucial role in providing accessible and affordable transportation options. However, it also faces significant hurdles, including regulatory ambiguities, safety concerns, workers' rights, and a lack of comprehensive data.

The objective of this study, "Informal and Shared Mobility - Status, Challenges, and Opportunities in Southeast Asia," authored by Saksith Chalermpong, Apiwat Ratanawaraha, and Yosuke Uchiyama from the Transportation Institute, Chulalongkorn University, is to address these challenges by filling in data gaps, sharing policies and trends, and providing a clearer picture of research activities in the region. This study aims to contribute to a deeper understanding of the sector and to inform policy-making that can enhance the sustainability and equity of urban transport systems.

This publication is the third regional study commissioned by the Volvo Research and Educational Foundations (VREF). The previous studies focused on informal transport in India, authored by Rutul Joshi, and on shared mobility systems in China, titled "Status and Opportunities of Shared Mobility Systems in China," authored by Song Su, Andi Liu, and Jiahui Ma.

These studies are part of a broader program on Informal and shared mobility in low and middle-income countries (ISM Program) launched by VREF in 2022. This program seeks to strengthen equity and sustainability in urban transport by supporting research that creates new knowledge among scholars and stakeholders who govern, design, and develop informal and shared mobility systems.

The VREF ISM Program is characterized by its geographical focus on low- and middle-income countries (LMICs), comparative studies between different urban contexts, and interdisciplinary approaches to knowledge building, education, and learning. The program includes various activities such as online research forums and in-person workshops to facilitate knowledge sharing and foster communities of learning.

Additionally, this study complements the activities by the Partnership for Research on Informal and Shared Mobility (PRISM), funded by VREF and hosted by Columbia University's Climate School's Center for Sustainable Urban Development. PRISM aims to build a community of practice and a strong network of next-generation scholars and leaders to improve informal and shared mobility for just, livable, and inclusive cities. The program's holistic and interdisciplinary approach includes establishing 'living labs' in cities across the Global South, such as Accra, Bangkok, Beijing, Bogotá, Cape Town, Kumasi, Mumbai, and Metro San José.

We would like to extend our gratitude to the authors as well as the reviewer Ransford Acheampong and all participants in the study for their invaluable contributions.

We hope this study will provide valuable insights and contribute to the ongoing efforts to enhance the informal and shared mobility sector in Southeast Asia and beyond.

Holger Dalkman, ISM Program Coordinator VREF
Henrik Nolmark, Director VREF

Table of Contents

Executive Summary 9

Chapter One: Introduction 12

1.1. Background 12
1.2. Objectives 13
1.3. Scope 13
1.4. Methods 15

Chapter Two: Conceptualisation of ISM 19

2.1. ISM as defined in the VREF Programme 20
2.2. Approaches to Categorising ISM in Different Contexts 24
2.3. Beyond Categorisation of ISM 32

Chapter Three: ISM in the Southeast Asian Context 36

3.1. Mapping the context of ISM in Southeast Asia 36
3.2. Main ISM Modes in Southeast Asia 48
3.3. Taxonomic Assessment of ISM Modes 53

Chapter Four: Market Dynamics and Operational Dimensions 71

4.1. Market Dynamics 71
4.2. Business Models 73
4.3. Financing 81
4.4. Digitalisation and the Rise of Platform-based Shared Mobility 83
4.5. Electrification: Transitioning to Cleaner Mobility 88
4.6. Employment and Labour 92
4.7. Institutions and Governance 95
4.8. Safety and Security 102
4.9. Gender Equality, Disability and Social Inclusion (GEDSI) 104
4.10. Environmental Sustainability and Climate Resilience 105

Chapter Five: Research Trends in ISM in Southeast Asia 110

5.1. Academic Research on ISM in Southeast Asia 111
5.2. Key Topical Trends 121
5.3. Expert Perspectives on ISM in Southeast Asia 122
5.4. Extending Bibliometric Analysis: A Regional Perspective on ISM in Southeast Asia 125
5.5. News Media Coverage 129
5.6. Thematic Map of ISM Research in Southeast Asia 133
5.7. Research and Resource Gaps 136
5.8. Overlooked and Underfunded: The Ongoing Marginalisation of ISM Research 142
5.9. Future Research Agenda 144

Chapter Six: Summary and Conclusions 150

6.1 Introduction 150
6.2 The Status of ISM in SEA 150
6.3 Market Dynamics and Operational Dimensions 152
6.4 ISM Research Trends 153
6.5 Challenges, Opportunities, and Pathways for Transformation 154

Appendices 157

References 159

List of Tables

Table 1: ISM Categorisation of ISM in VREF Publications in the ISM Programme 21
Table 2: Seven Key Characteristics for Classifying ISM Modes 23
Table 3: Taxonomy of Informal Mobility by Cervero (2000) 26
Table 4: Three key dimensions of ISM Modes 34
Table 5: Urbanisation and Population Distribution in Southeast Asia in 2023 38
Table 6: Urban and Rural Population Changes in Southeast Asia, 2003–2023 38
Table 7: Demographic and Economic Overview of Select Countries and Cities in Southeast Asia in 2023 45
Table 8: ISM Modes in Southeast Asia: Two-Wheelers 49
Table 9: ISM Modes in Southeast Asia: Three-Wheelers 50
Table 10: ISM Modes in Southeast Asia: Four-Wheelers 51
Table 11: ISM Modes in Southeast Asia: Others 51
Table 12: Presence of ISM Modes in the Four Study Countries 53
Table 13: Defining Characteristics of ISM Modes: Operations, Payment, and Regulations 54
Table 14: Comparisons of Characteristics of ISM Modes in the Study Countries 55
Table 15: Classifications of ISM Modes in Cambodia 59
Table 16: Classifications of ISM Modes in Indonesia (Two- and Three-wheelers) 62
Table 17: Classifications of ISM Modes in Indonesia (Four-wheelers and Others) 63
Table 18: Classifications of ISM Modes in Thailand (Two- and Three-wheelers) 66
Table 19: Classifications of ISM Modes in Thailand (Four-Wheelers and Others) 67
Table 20: Classifications of ISM Modes in Vietnam 70
Table 21: Southeast Asia's RHA Market Overview 86
Table 22: Ride-hailing Services: Regulations and Policies in Southeast Asia 101
Table 23: ISM-sector Sustainability and Climate-resilience Challenges, Opportunities and Barriers in the Study Countries 109
Table 24: ISM Literature in Four SEA Countries: Summary of Bibliometric Analysis Results 111
Table 25: Publications Per Country, by Document Type 112
Table 26: ISM Academic Research Trends in SEA Identified by Experts 123
Table 27: Comparison with Behrens et al. (2021) 126
Table 28: News Media Coverage on ISMs in the Study Countries 130
Table 29: Topical Gaps 138
Table 30: Gaps in Existing ISM Research Activities and Networks 141

List of Figures

Figure 1: Geographical Mapping of Target Cities in SEA 15
Figure 2: Research Design 15
Figure 3: Classification and Overview of ISM Modes in SEA 29
Figure 4: Major ISM Modes in SEA 48
Figure 5: Organisational Structures of Individual Owner/Operator Services 74
Figure 6: Organisational Structures of Association or Owner/Operator Cooperatives 74
Figure 7: Organisational Structure for Renter Operators 75
Figure 8: Organisational Structure for Company Operator 75
Figure 9: Annual Scientific Production 113
Figure 10: Journals Publishing the Largest Number of ISM Articles, By Country 114
Figure 11: Most Relevant Authors 115
Figure 12: Affiliations Producing the Most Literature 116
Figure 13: Co-occurrence Network in Cambodia 117
Figure 14: Co-occurrence Network in Indonesia 117
Figure 15: Co-occurrence Network in Thailand 118
Figure 16: Co-occurrence Network in Vietnam 118
Figure 17: Collaboration Networks in Cambodia 119
Figure 18: Collaboration Networks in Indonesia 119
Figure 19: Collaboration Networks in Thailand 120
Figure 20: Collaboration Networks in Vietnam 120
Figure 21: Radar Chart of ISM Literature Trends 121
Figure 22: News Media Coverage of ISM in the Study Countries (2019-2024) 130
Figure 23: Thematic Map 134

List of Abbreviations

AI	Artificial Intelligence
ASEAN	Association of Southeast Asian Nations
BMA	Bangkok Metropolitan Administration
BRI	Belt and Road Initiative
BRT	Bus Rapid Transit
BTS	Bangkok Mass Transit System
CASE	Connected, Autonomous, Shared, and Electric
CSR	Corporate Social Responsibility
DUI	Driving Under the Influence
EDC	Electronic Data Capture
EGAT	Electricity Generating Authority of Thailand
ESCAP	Economic and Social Commission for Asia and the Pacific
ESG	Environmental, Social, and Governance
EV	Electric Vehicle
GDP	Gross Domestic Product
GEDSI	Gender Equality, Disability, and Social Inclusion
GPS	Global Positioning System
GSM	Green and Smart Mobility
ILO	International Labour Organization
IPT	Informal Paratransit
ISM	Informal and Shared Mobility
IWT	Inland Waterway Transport
JICA	Japan International Cooperation Agency
LAMAT	Locally Adapted, Modified, and Advanced Transport
LRT	Light Rail Transit
LTFRB	Land Transportation Franchising and Regulatory Board (Philippines)
MRT	Mass Rapid Transit
NSTDA	National Science and Technology Development Agency (Thailand)
ODA	Official Development Assistance
PPP	Public-Private Partnership
PSV	Public Service Vehicle
PUVMP	Public Utility Vehicle Modernization Programme (Philippines)

Executive Summary

Informal and Shared Mobility (ISM) plays a crucial role in Southeast Asia's urban transport systems, providing accessible, flexible, and affordable mobility options for millions while serving as a key livelihood for informal workers. ISM encompasses diverse transport modes, including motorcycle taxis, shared vans, tuk-tuks, and digitally-enabled ride-hailing services. While CASE (Connected, Autonomous, Shared, and Electric) mobility trends are gaining traction globally, ISM remains indispensable, particularly for underserved populations. This study, supported by the Volvo Research and Educational Foundations (VREF), examines the status, challenges, and opportunities of ISM in Cambodia, Vietnam, Indonesia, and Thailand. By analysing ISM across eight cities—including megacities and secondary cities—the study provides insights into the dynamics of ISM in different urban contexts.

Conceptualisation and Categorisation

ISM in Southeast Asia operates along a continuum of formality and informality, with varying levels of government oversight and digital integration. To facilitate comparative analysis, this study categorises ISM based on ridesharing vs. vehicle-sharing models, degree of digital enablement (non-digital vs. digitally enabled), and vehicle types (two-, three-, and four-wheelers). The study also examines ISM through key dimensions such as governance, regulation, financing, and technological adoption. By mapping ISM characteristics along these spectra, the study provides insights into its integration with formal transport systems and informs policy and planning strategies for sustainable urban mobility.

Current Landscape and Emerging Trends

ISM remains a vital component of mobility ecosystems in Southeast Asia, providing mobility services where formal transit is absent or insufficient. It supports economic livelihoods, particularly for informal workers, and offers an affordable transport solution for low-income populations. However, ISM faces persistent challenges, including regulatory uncertainty, inconsistent safety standards, and digital divide barriers. The sector is undergoing transformation, with digital platforms reshaping service delivery and electrification gaining traction as governments promote sustainable transport initiatives. Key trends include:

- **Digitalisation and Platformisation:** The rise of app-based ride-hailing services has formalised some ISM operations, improving service efficiency and fare transparency.
- **Electrification:** The introduction of electric tuk-tuks and e-motorcycles is expanding, though infrastructure and cost barriers remain significant.
- **Regulatory shifts:** Governments are adopting mixed approaches, with some integrating ISM into urban mobility planning while others impose restrictions.
- **Socio-economic challenges:** ISM workers often lack formal protections, while gender and disability inclusion in the sector remains limited.

Market Dynamics and Operational Dimensions

ISM is evolving rapidly, with traditional transport modes such as bicycle rickshaws declining due to urbanisation and digital competition. Digital platforms and ride-hailing applications have enhanced convenience and efficiency, but labour precarity and market consolidation pose challenges. The study identifies diverse ISM business models, ranging from individually owned vehicles to cooperative and corporate-managed fleets. Digital tools such as AI-driven ride-matching and e-payment systems improve service efficiency but also marginalise traditional operators. Sustainability concerns are pushing electrification efforts, though high costs and inadequate infrastructure hinder widespread adoption.

ISM Research Trends and Gaps

A bibliometric analysis of ISM research reveals significant variations in academic output across the region. Thailand leads in research growth, Indonesia excels in digital platform studies, Vietnam focuses on sustainability, and Cambodia, though emerging, produces highly impactful studies.

Key research gaps in the study of informal and shared mobility (ISM) include the limited safety regulations for ISM operators and passengers, which pose significant risks and remain inadequately addressed by policymakers. Additionally, there is a lack of integration between ISM and formal public transport systems, leading to inefficiencies and missed opportunities for enhancing urban mobility. Another critical gap is the insufficient research on the socio-economic vulnerabilities of ISM workers, whose livelihoods are often precarious and subject to regulatory uncertainty. Furthermore, academic research on ISM remains underfunded and fragmented, with limited engagement in policy discussions, hindering the development of comprehensive and effective solutions. Addressing these gaps is crucial for strengthening ISM's role in equitable and sustainable mobility.

Pathways for Transformation

To enhance ISM's role in urban mobility, this study proposes four key policy pathways:

1. **Improving ISM Operational Efficiency:** Strengthen governance and integration with public transport, modernise ISM fleets through financial support and infrastructure investments, and expand access to digital tools while ensuring inclusion of non-digital ISM operators.
2. **Integrating ISM with Formal Transport Networks:** Develop multimodal hubs and dedicated ISM infrastructure, implement fare integration and unified digital payment systems, and establish clear regulatory frameworks that formalise ISM without marginalizing operators.
3. **Enhancing Social and Economic Livelihoods:** Strengthen labour protections and provide social security for ISM workers, promote gender and disability inclusion through targeted policies and service designs, and bridge the digital divide by enhancing literacy programmes and ensuring equitable access to technology.
4. **Supporting Sustainable and Just Transitions:** Scale up electrification initiatives while addressing affordability challenges, align ISM with environmental goals through targeted incentives and infrastructure investments, and encourage PPPs and cross-sector collaboration to support ISM's green transition.

Chapter One: Introduction

1.1. Background

Informal and Shared Mobility (ISM) is a crucial yet often overlooked component of Southeast Asia's transport systems, filling gaps in formal transit across urban and rural areas. It provides flexible, affordable mobility for millions while serving as a vital livelihood for informal workers. ISM includes passenger transport operating outside formal regulation, such as motorcycle taxis, shared vans, and autorickshaws. It also covers shared mobility, where users share vehicles, rides, or services. "Shared" extends beyond simultaneous use, encompassing shared rides (e.g., vans, motorcycle taxis), shared vehicles with drivers (e.g., ride-hailing, tuk-tuks), and shared vehicles without drivers (e.g., bike- and car-sharing).

Meanwhile, connected, autonomous, shared, and electric (CASE) mobility trends are gaining significant attention globally. They hold great promise for fostering a more efficient and environmentally sustainable society, especially in the context of evolving public transport ecosystems. However, while CASE mobility initiatives are actively championed in developed countries, many vulnerable transport users in Southeast Asia (SEA) continue to face limited access to public transport and private vehicles, particularly in underserved urban centres and remote regions.

Across Southeast Asia, particularly in low- to middle-income countries, ISM is a critical component of both transport and social infrastructure, connecting people and places. In recent years, with advances in digital technologies and platforms, ISM in this region has become even more convenient, and an important mobility mode due to the numerous employment opportunities it creates and its economic affordability.

While conventional public transport systems—such as buses and rail—are planned, operated, and regulated by governments or public authorities, ISM is typically run by small operators or individuals, often under limited or informal regulatory frameworks. Moreover, ISM is evolving rapidly with the rise of digital platforms. App-based services such as Uber, Lyft, and Grab have transformed the landscape, integrating with, competing against, and in some cases displacing, traditional informal mobility services.

ISM systems in Southeast Asia have different trajectories because each country has a different status quo, different challenges, policies and regulations. ISM development is further influenced by factors such as modes, the number of vehicles and users, urban mobility status, and digital penetration. Current research does not provide comprehensive coverage of ISM in low- and middle-income countries in SEA. ISM in these countries is deeply connected to the everyday lives of the people who use it, and is therefore likely to have important novelties tied to local contexts that are not found in the international literature. This study, supported by the Volvo

Research and Educational Foundations (VREF), highlights the significant contributions of, and recent developments in, the informal and shared dimensions of urban mobility in Southeast Asia.

1.2. Objectives

This report is intended to contribute to the VREF's ISM Programme in low- and middle-income countries and provide state-of-the-art knowledge on the current status, challenges and opportunities for ISM systems in Southeast Asia. It also aims to organise current research activities in the region, contribute to the further development of the VREF programme, and contribute to increasing equity and sustainability in urban transport. Thus far, the ISM programme has expanded in-depth knowledge of the status of ISM, its challenges, barriers, and opportunities in the Chinese (Song et al., 2022) and Indian (Joshi et al., 2023) contexts. This study has two research objectives.

- Objective 1: To explore the current status, challenges and opportunities in the ISM sector in Southeast Asia; and
- Objective 2: To identify state-of-the-art research and policy trends affecting ISM in Southeast Asia.

1.3. Scope

This study is focused on providing a comparative analysis of ISM systems in diverse urban contexts in low- and middle-income countries in Southeast Asia. The scope of the research is limited to ISM systems that provide land-based passenger transport, with limited attention to water-based ISM modes. The geographic scope aligns with one of the key initiatives of the VREF's ISM programme, concentrating on countries classified by the World Bank Group's income levels for FY2024 (1 July 2023–30 June 2024). Four countries have been prioritised in the study, based on their economic and contextual relevance: Cambodia and Vietnam (lower-middle-income countries), and Indonesia and Thailand (upper-middle-income countries). These countries were chosen due to their income levels (which significantly influence ISM demand and supply), access to detailed and localised data, and the presence of established networks of research collaborators and policy-influencing stakeholders to serve as key informants.

Singapore and Brunei Darussalam (high-income countries), and Malaysia (transitioning from upper-middle to high income), have been excluded due to their income status. Myanmar was not included in the in-depth analysis due to challenges in obtaining reliable data amidst ongoing social unrest following the military coup in 2021. Similarly, Laos and the Philippines were not included in the detailed analysis due to data-availability challenges and the absence of robust networks for collecting information, including interviews. However, general observations

of other SEA countries, including Malaysia, Singapore, Myanmar, Laos, Philippines, and Brunei, have been included where possible to provide a broader regional context.

Eight cities in the four focus countries are examined. A geographical mapping of the target cities is provided in Figure 1. The primary focus is on the largest cities in each country: Phnom Penh, Ho Chi Minh City, Jakarta, and Bangkok. These cities represent the most dynamic ISM markets and are hubs for new services and innovation. Attention has also been paid to secondary cities: Siem Reap, Hue, Yogyakarta, and Chiang Mai. These cities are experiencing growing mobility demand due to population expansion and tourism.

This study is focused on land-based passenger transport within ISM. The relevance of informal freight and delivery services—particularly motorcycle-based parcel delivery and small-scale logistics—are recognised. However, these services fall outside the scope of the study and are not addressed in the classification system applied here.

Detailed analyses of the target cities are offered. Broader ISM issues across other urban contexts in the region are also addressed, providing a comprehensive understanding of ISM dynamics in SEA. Based on the research team's familiarity with and knowledge of the region, general observations on the state of ISM in other urban areas are also incorporated, including additional megacities like Hanoi, secondary cities such as Bandung and Danang, and smaller towns across SEA. Smaller urban areas, which are often home to the majority of each country's population, tend to face more severe public transport access limitations than larger cities. The role of ISM is particularly crucial in such locales, as lower income levels often exacerbate transportation challenges making ISM an indispensable component of daily life.

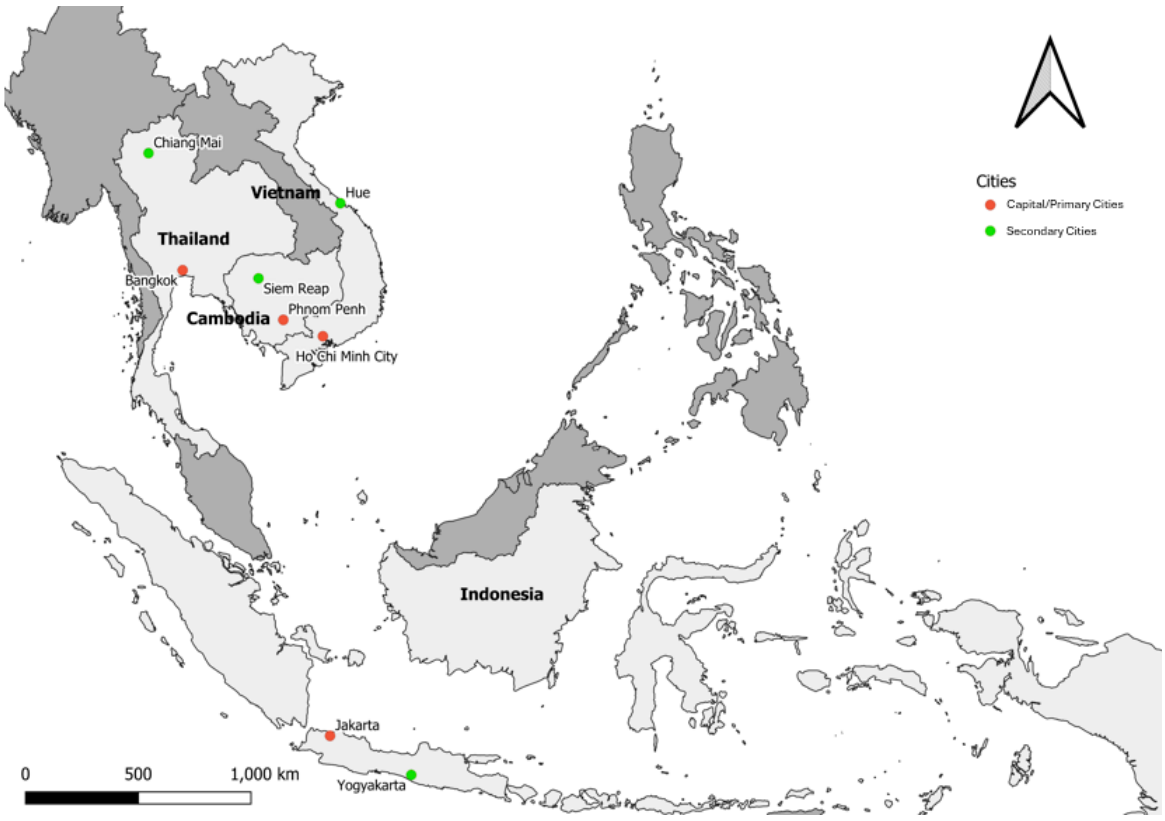

Figure 1: Geographical Mapping of Target Cities in SEA

1.4. Methods

This project employs a concurrent mixed methods approach, using data collection and analysis methods appropriate to the study's two research objectives. An outline of the applied research design is illustrated in Figure 2. The applied research design and the main tasks performed are explained below.

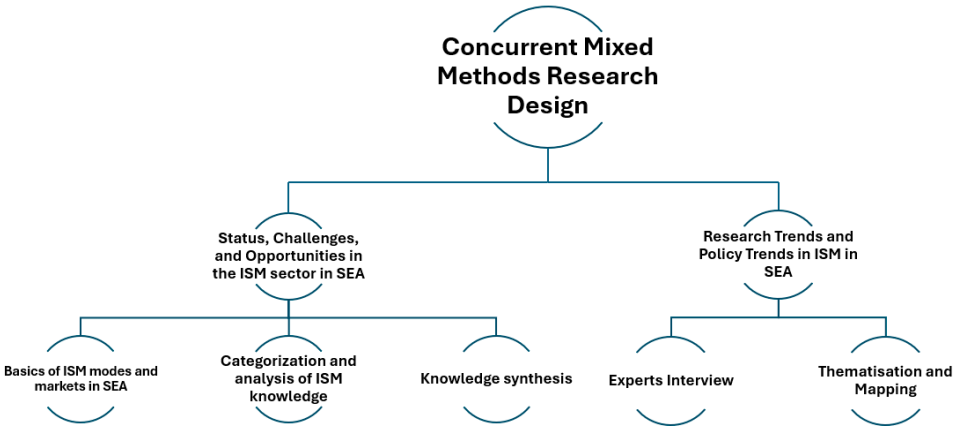

Figure 2: Research Design

Status, Challenges, and Opportunities in the ISM Sector in SEA

This study adopted a three-pronged approach to examining the current status, challenges, and opportunities in the ISM sector in Southeast Asia. In addition to secondary data analysis and literature review, insights from expert interviews were integrated to contextualise findings on the operational landscapes, regulatory environments, and socio-economic impacts of the studied ISM.

Examining fundamentals of ISM Modes and Markets in SEA Contexts

The classification of ISM modes was conducted using secondary data sourced from published reports and databases, ensuring a comprehensive overview of the different types of informal and shared mobility. In addition, the study examined the urban mobility contexts that shape ISM, analysing key factors such as demographic trends, levels and rates of urbanization, city structures, the availability and quality of other transport modes, and digital penetration rates. Furthermore, the market characteristics of ISM were explored by identifying the numbers and profiles of operators, vehicles, and users across each mode, providing insights into the composition and dynamics of the sector.

Analysing ISM

A comprehensive literature review was conducted, focusing on eight critical mobility aspects: (1) business models; (2) technological adoption; (3) employment and labour; (4) institutions and governance (regulations, policies, organisations); (5) financing; (6) safety and security; (7) gender equality, disability and social inclusion (GEDSI); and (8) sustainability and resiliency.

Where possible, data was collected and the domestic capacity for ISM research was evaluated. A bibliometric analysis was performed using Bibliometrix, a tool that enables quantitative assessments of trends in the literature, offering summaries and visualisations to highlight key insights.[1] The following types of sources were used:

- English-language publications: Peer-reviewed articles and conference proceedings indexed in global databases such as Web of Science, Scopus, and Google Scholar, alongside publications from regional alliances, such as the Eastern Asia Society for Transportation Studies (EASTS) and the Asian Transportation Research Society (ATRANS);
- Non-English-language publications: Government reports and documents sourced through academic and policy networks capable of screening and translating these materials;
- Consulting reports: Publications from international organisations, such as UN-ESCAP, JICA, and the MobiliseYourCity initiative.

[1] Bibliometrix is an open-source software leveraging the statistical computing capabilities of the R programming language (Aria & Cuccurullo, 2017).

Knowledge Synthesis

ISM systems were compared across diverse urban and institutional contexts within SEA countries. Broader comparisons were made between SEA and other global regions to contextualise findings and highlight region-specific characteristics. This integrated approach to knowledge synthesis ensured a thorough understanding of ISM, its potential, and its unique challenges in Southeast Asia.

Research Trends and Policy Trends in ISM in SEA

Interest in the informal sector of the economy has been a topic of study since the 1970s, with informal transport emerging as an important subset within this literature over time. Recently, there has been a renewed focus on the informal sector, including informal transport, driven in part by the rise of digitally-enabled "shared mobility." Informal transport services, long recognised as essential infrastructure for poor and marginalised communities, are characterised by loose regulation, easy market access, and small-scale, labour-intensive operations. These services also function as livelihood infrastructure, providing economic opportunities for many (Utomo & Mateo-Babiano, 2015). The advent of the sharing economy has reframed informal mobility as a form of public "share," expanding its conceptualisation beyond the traditional binary of formal and informal (Rekhviashvili et al., 2022; Siegmann & Schiphorst, 2016).

Informal transport is inherently adapted to local needs, varying widely across cities and regions, and in Southeast Asia, it manifests in diverse typologies. In the literature, it is referred to by various terms, including paratransit, Local Adapted Mobility and Transport (LAMAT), Indigenous Transport, and Public Utility Vehicles (Behrens, Chalermpong, et al., 2021; Cervero, 2000; Chuenyindee et al., 2022; Mateo-Babiano, 2016; Phun & Yai, 2016).

To gain deeper insights into the evolving landscape of ISM research and policy in Southeast Asia, this study employed a qualitative approach, combining expert interviews and thematic analysis.

Expert Interviews

Leveraging an established network of collaborators, interviews were conducted with experts, including researchers specialising in mobility studies across selected SEA countries, policymakers from relevant government agencies, and representatives of professional associations. Online and in person semi-structured interviews were conducted between October and November 2024. Online interviews were conducted via Zoom to ensure accessibility and engagement with participants across different locations. In person interviews were carried out during field research missions in first- and second-tier cities, including:

- Cambodia: Phnom Penh, Siem Reap;
- Indonesia: Jakarta, Yogyakarta;
- Thailand: Bangkok, Chiang Mai;
- Vietnam: Ho Chi Minh City, Hue.

Although the interviews with experts mainly helped to analyse ISM research trends and policy directions, the experts' insights did not stop there. In fact, they also contributed significantly to assessing the current situation, challenges and opportunities in the ISM field. Policymakers and mobility experts provided real-time perspectives on operational challenges, informal transport governance and regulatory changes, reinforcing findings from secondary data.

Thematic Analysis and Mapping

Data collected from the interviews were systematically analysed to uncover trends in ISM research and policy, using a four-step process:

1. Transcription: Converting interview recordings into text for analysis;
2. Open Coding: Identifying key concepts and themes emerging from the data;
3. Axial Coding: Organising themes into broader categories to establish relationships;
4. Selective Coding and Mapping: Integrating themes to comprehensively map current ISM research and policy trends.

This approach provided a structured framework for understanding the evolving landscape of ISM in SEA, highlighting both research and policy developments.

Chapter Two: Conceptualisation of ISM

Informal transport, at its core, can be defined as transport services operating without formal registration or recognition under established legal, regulatory, and institutional frameworks. These services typically lack formal documentation, licensing, and protections. Historically, these services were entirely independent of government initiation and operated beyond its direct oversight. In reality, however, varying levels of formality have been introduced, with some aspects—such as vehicles, drivers, or operations—being registered, regulated, or partially formalised by the state. Even where this is the case, informal transport workers normally receive minimal, if any, employment-based welfare or state protection.

In cities in low- and middle-income countries around the world, formal and informal modes of transport often coexist, with informal transport serving as a complement or alternative to public transport, filling transport gaps that formal transport does not reach. Informal transport plays a particularly important role in cities where public and private transport is overloaded due to rapid urban growth in the region (Sheng, 2019). Small vehicles such as motorcycles and motorised two- and three-wheelers are operated by individuals and communities to support movement to areas not reached by formal transport networks.

Informal transport services encompass a wide variety of modes, with a diverse range of vehicle sizes and passenger capacities. They include small motorcycles and tuk-tuks, larger passenger vans and minibuses, motorcycle taxis, and unlicensed ridesharing services. The levels of "informality" vary significantly as well, across modes, cities, and countries, reflecting differences in local regulations, socioeconomic conditions, and the extent of government engagement. Informal transport offers affordability and flexibility, but often at the expense of safety and reliability compared to formal transport modes.

Mixed formal and informal traffic modes (buses and ride-hailing motorcycles) in Jakarta City, Indonesia

On the other hand, the concept of "shared" in ISM extends beyond the simultaneous use of a vehicle by multiple passengers. It encompasses diverse forms, including shared rides in the same vehicle (e.g., shared motorcycle taxis, shared vans), shared vehicles with drivers (e.g., ride-hailing services, bajaj, tuk-tuks), and shared vehicles without drivers (e.g., bike-sharing, car-sharing).

The challenge of defining ISM lies in integrating its diverse, context-specific characteristics into a broader assessment framework using standardised evaluation criteria. Additionally, the flexibility and specificity of each ISM typology play crucial roles in advancing understanding of, and addressing the latest developments in, informal transport around the world. With this in mind, the classifications of ISM modes in the SEA context will be discussed in detail in the following chapter.

2.1. ISM as defined in the VREF Programme

The VREF ISM Programme recognises the highly diverse and context-specific nature of ISM, encompassing a wide range of transport modes that vary significantly across countries. This diversity makes it difficult, if not impossible, to establish a single, universal definition of ISM. Therefore, this study adopts a classification approach that reflects the rich contextual variations within Southeast Asia.

ISM exists along a spectrum, with overlapping boundaries that share both common and distinct characteristics. Within its research initiatives, ISM studies in the VREF Programme have identified two key technical dimensions—informality and shared mobility services—as central to understanding ISM typologies. These classifications have emerged through various ISM projects, providing a foundation for analysing different modes and regulatory frameworks.

A summary of the classification approaches used in VREF's ISM reports, including key terms related to the definitions of informal and shared mobility, is presented in Table 1. This synthesis is based on reports and discussion papers published under the VREF ISM Programme as of August 2024.

Table 1: ISM Categorisation of ISM in VREF Publications in the ISM Programme[2]

Publication	Authors/Year	Focus / Approach for the Categorisation
Minibus Electrification in Africa	Schalekamp et al. (2024)	**Focus:** Minibus **Key points:** - Electrification - Professionalisation and formalisation of industrial relationships
Informal and Shared Mobility: Status and Opportunities in India	Joshi et al. (2023)	**Focus:** ISM **Key points:** Two types of classification: 1) Conventional informal mobility: i) shared services: auto-rickshaw (electric/ICE); vans and maxicabs; private buses ii) point-to-point services: cycle rickshaws (pedal/electric); auto-rickshaws (electric/ICE); city taxis 2) Shared mobility: i) rental services: bicycles (pedal/electric); two-wheelers (electric/ICE); car rental – with or without driver; micromobility iv) on-demand services: cars; auto-rickshaws; two-wheelers; buses
Who Counts What? What Counts Where? A Global Scan of Data Collection Efforts in Informal and Shared Mobility." Produced in Collaboration with Agile City Partners	Abraham et al. (2023)	**Focus:** ISM **Key points:** Two types of classification: 1) Informal transport: unscheduled services without fixed routes; varying degrees of organisation between drivers and operators; varying levels of government regulation 2) Shared mobility: transport services and resources shared simultaneously or sequentially between users
Connecting Informal Transport to the Climate Agenda: Key Opportunities for Action." Produced in collaboration with World Resources Institute (WRI)	Kustar et al. (2023)	**Focus:** Informal Transport **Key points:** - Provides affordable, convenient transport in areas lacking other options - Fixed or semi-fixed routes - Employment provision - Less-regulated environment

[2] VREF, Informal and Shared Mobility in Low- and Middle-Income Countries (ISM) Accessed from https://vref.se/ism/

Shared Mobility in Low- and Middle-Income Regions	Shaheen et al. (2022)	**Focus:** ISM **Key points:** Three classifications: 1) Informal transport: low-cost vehicles filling gaps in public transport 2) Fleet sharing: short-period vehicle sharing 3) Ride and delivery services, including various vehicles for transport and courier network services
Status and Opportunities of Shared Mobility Systems in China". Produced in collaboration with World Resources Institute (WRI)	Song et al. (2022)	**Focus:** ISM **Key points:** Informal Paratransit (IPT): bike sharing, electric-bike sharing, ridesharing, etc. Shared mobility types: dockless bike sharing, courier network services Six modes include shared bikes, e-bikes, ride-hailing, MaaS, CNS, DRT
Informal and Shared Mobility: a Bibliometric Analysis and Researcher Network Mapping	Behrens et al. (2021)	**Focus:** ISM **Key points:** Paratransit categories: - Flexible transport, informal transport, shared mobility (sharing systems, ridesharing, etc.) Other dimensions include operational infrastructure, service type, route, and competition regulation

Previous VREF projects have approached ISM with varying focuses and have defined it in diverse ways. Building on these earlier efforts, seven key characteristics are identified, which can be used to classify ISM modes. Each characteristic reflects a distinct aspect of ISM mode operation. The seven characteristics are described in Table 2. These characteristics are adopted or addressed differently in different studies, with some characteristics being selectively applied or omitted depending on the context of each study.

Table 2: Seven Key Characteristics for Classifying ISM Modes

Key Points	Description
Time	Indicates whether the driver's transport activity aligns with their own objective (e.g., car/motorcycle pooling during commuting) or operates independently (e.g., car/motorcycle sharing available on demand).
Operation Target	Classifies services based on vehicle ownership, whether the vehicle is owned by the individual providing the service or by a third party.
Digitalisation	Reflects the extent of digital integration, such as the use of mobile apps and communication tools (e.g., WhatsApp, Telegram) for on-demand services.
Geographical Stickiness	Determines operational scope, from localised short-distance services (e.g., bike-hailing) to medium- and long-distance modes (e.g., vanpooling, microbuses).
Costs	Measures affordability, ranging from cost-sharing services with lower fares (e.g., pooling) to higher-priced services with stronger business elements (e.g., ride-hailing, hire transport).
Regulations	Indicates the degree of government regulation, with higher informality in less regulated systems and declining informality as regulations increase.
Operational Flexibility	Assesses the level of operational constraints, with modes like car/motorcycle sharing offering high flexibility, while gig workers (e.g., ride-hailing drivers) experience some platform-imposed limitations.

1. **Time:** This characteristic examines whether a driver's transport activity coincides with personal objectives or operates independently. For example, car or motorcycle pooling aligns with the driver's commuting objectives, operating in real-time on a shared time axis. By contrast, car or motorcycle sharing allows the vehicle to be used independently by third parties on demand, providing flexibility in timing (Behrens et al., 2021; Shaheen et al., 2022; Song et al., 2022).
2. **Operation Target:** ISM services are categorised based on vehicle ownership. Some services are operated using self-owned vehicles, while others rely on vehicles owned by third parties or fleet operators. This distinction highlights the variety of operational structures within ISM (Joshi et al., 2023).
3. **Digitalisation:** Digital technology has increasingly transformed ISM into on-demand systems. Many ISM modes now integrate mobile apps and communication tools such as Facebook, WhatsApp, and Telegram to connect drivers and users. Additionally, the adoption of electric

vehicles (EVs) in ISM and the expansion of battery infrastructure are becoming more prominent, particularly in developing countries, driving further digitalisation through innovations such as app-based charging station locators, smart payment systems, and vehicle telematics. These advancements not only enhance operational efficiency and connectivity for ISM drivers but also contribute to environmental sustainability (Joshi et al., 2023; Schalekamp et al., 2024).

4. **Geographical Stickiness:** This characteristic assesses the operational scope of ISM services. Short-distance services, such as bike-hailing, typically operate within localised communities. Vanpooling and microbuses serve medium- and long-distance travel, extending operations beyond local areas to connect peripheral and urban areas (Joshi et al., 2023; Kustar et al., 2023; Song et al., 2022).

5. **Costs:** ISM services vary in affordability. Pooling-based modes aim for cost-sharing between drivers and users, keeping fares relatively low. Conversely, ride-hailing and hired transport services involve a stronger business orientation, leading to higher fares that correspond to both increased convenience and higher operational costs (Shaheen et al., 2022).

6. **Regulations:** The degree of formality in ISM is heavily influenced by government and regulatory involvement. In highly-regulated contexts, ISM operations tend to exhibit more formal characteristics. However, in low-regulation environments informality remains prevalent, offering more flexibility but often at the expense of oversight and safety (Behrens et al., 2021; Kustar et al., 2023).

7. **Operational Flexibility:** The level of operational constraints determines the flexibility of ISM modes. Car and motorcycle sharing, or pooling, allows operators to work at their convenience with minimal constraints. Larger vehicles, such as passenger vans and minibuses, tend to operate on fixed routes. Ride-hailing and bike-hailing workers, often categorised as gig workers, operate with some flexibility but are increasingly subject to platform-driven controls that limit their independence compared to earlier informal arrangements (Behrens et al., 2021; Kustar et al., 2023; Schalekamp et al., 2024). These seven characteristics provide a comprehensive framework for understanding the complexity and diversity of ISM modes across different contexts, reflecting the dynamic interplay between informality, technological integration, and regulatory environments. This framework is reflected in this study to explore ISM modes, offering a structured approach to examining their key attributes and variations across different settings.

2.2. Approaches to Categorising ISM in Different Contexts

Building on the understanding of regulatory environments, Shaheen et al. (2022) classify ISM in low- and middle-income countries into three categories: informal transport; free and shared mobility, and ride-and-delivery services. This categorisation captures the diverse operational

models of ISM, distinguishing between traditional informal modes and emerging mobility services that leverage digital platforms.

Regional studies have further refined ISM within specific national contexts. In China, Song et al. (2022) integrate informal paratransit and shared mobility into a more comprehensive framework. Joshi et al. (2023) classify ISM in India into two broad categories based on its level of formality: traditional informal mobility and shared mobility, illustrating the country's dual transport system where formal and informal services coexist. Behrens et al. (2021) emphasise the need for clear definitions due to the overlapping and common characteristics of these modes, and Abraham et al. (2023) highlight the blurred boundaries between informal transport and shared mobility, which are often treated as distinct but functionally interconnected phenomena.

In the Southeast Asian context, understanding ISM requires examining its indigenous roots and socio-economic dimensions. Informal mobility in this region has evolved as a response to local needs, cultural practices, and economic conditions. Robert Cervero's 2000 UN Habitat report, Informal Transport in the Developing World, underscores the role of locally adapted, economically essential mobility systems in filling gaps left by formal transport infrastructure. His analysis of informal transport in Thailand, Vietnam, Indonesia, and the Philippines highlights the socio-cultural nuances of each country's ISM systems and their fluid boundaries with formal networks.

Cervero's taxonomy of informal transport is inherently flexible, accommodating additional dimensions such as the roles of supply- and demand-side actors within the system. His framework remains relevant today as ISM continues to evolve in response to technological shifts, regulatory changes, and urban expansion. An adapted summary of Cervero's (2000) taxonomy, incorporating these broader considerations, is presented in Table 3.

Table 3: Taxonomy of Informal Mobility by Cervero (2000)

Scales and Dimensions of Classification	**Formal**	**Informal**
Socio-economic (macro)		
Financial Status	Middle and Upper Class	Lower Class, Poor
Political Power	Strong, Empowered	Weak, Vulnerable
Credibility and Recognition	Legal, Regulated	Illegal, Unregulated
Social and Cultural Factors	Modern	Traditional
Organisational Structure	Orderly, Vertically Integrated	Less Structured, Decentralised
Resources and Investments	Intensive	Minimal
Funding and Credit Availability	Commercial Banks	Informal Loans, Personal Networks
Technological Capabilities	High Tech	Low tech
Expertise and Competence	Knowledge Based, Cognitive	Labour-Based, Adaptive, Flexible
Legal Recognition & Compliance	Registered	Unregistered
Business Model (micro)		
Supply		
Service Structure	Fixed Route, Standardised	Variable Route, Adaptive
Delivery	Main Line, Core Network	Distribution, Feeder
Scheduling	Fixed Timetable	Market Driven
Reliability	Reasonably Dependable	Adaptive
Vehicle Type	Large	Inconsistent
Ownership	Public and Private	Small to Medium
Market Perspective	Monopolist	Private
Labour	Semi-skilled	Semi- or Non–skilled
Organisation	Bureaucracy	Route Associations

Demand		
Market Focus	Mixed	Niche
Main Trip Purposes	Work, School	Mode Access
Trip Distances	Medium to Long	Short to Medium
Customer Relations	Impersonal	Interpersonal
Socio-Demographics	Low to Moderate Income	Low Income
Fare Structures	Fixed, Uniform	Variable, Differentiated

The taxonomy outlined by Cervero (2000) and other classification systems have served as foundational benchmarks for constructing a new framework for ISM in this study. These frameworks collectively highlight that the distinction between formal and informal transport is not a simple distinction but a continuum. Informality often exists within formal systems, and elements of formality can be found within informal systems, with transitions occurring through specific mechanisms. In developing countries, including those in Southeast Asia, the informal mobility sector plays a vital role in complementing or substituting for the limitations or absence of formal public transport.

While these taxonomies are valuable for encapsulating the general nature of informal mobility, they have limitations as analytical frameworks. Specifically, they lack the tools to clearly categorise actual ISM modes in each country and to measure external factors (such as the varying degrees of regulation) that influence the level of informality. Moreover, these taxonomies are often outdated. For example, informal transport no longer necessarily implies low-tech operations or low-income passengers. A comprehensive assessment of the ISM ecosystem must incorporate indicators related to supply, demand, service providers, and public stakeholders. To build a more comprehensive framework for analysing ISM, it is essential to categorize mobility services based on key dimensions that capture their operational characteristics. These include the type of sharing arrangement, the degree of digital enablement, and the physical form of the vehicles used.

1. **Type of Sharing:** This dimension distinguishes between the way mobility is shared among users:
    - Shared Ride: Passengers share the ride simultaneously, travelling together in the same vehicle towards a common destination or along the same route. Examples include motorcycle taxis, tuk-tuks[3], and vehicles accessed via shared ride-hailing services (e.g., GrabShare and Uber Pool).
    - Shared Vehicle with a Driver: Passengers share the use of a vehicle driven by a v(professional) driver, usually for a short period of on-demand service. Unlike carpooling, passengers do not necessarily travel at the same time and can hire the same vehicle individually at different times. Examples include individual ride-hailing services (e.g., JustGrab, Gocar, UberX), chauffeur rent hire, traditional taxi, remorque[4], and bajaj[5].
    - Shared Vehicle without a Driver: Passengers share the use of a vehicle sequentially rather than simultaneously and drive the vehicle themselves. Examples include bike-sharing, car-sharing platforms, and informal vehicle rentals.
2. **Degree of Digital Enablement:** This dimension differentiates between systems based on the presence or absence of digital technology:
    - Non-digital/Traditional: Systems that operate without digital platforms, relying instead on informal coordination, physical presence, or direct communication. Examples include motorcycle taxis hailed on the street and informal van services.
    - Digitally Enabled: Services facilitated through digital platforms or apps (e.g., Facebook and Telegram), such as ride-hailing services (Grab, Gojek) or app-based bike-sharing systems. In the Philippines, passengers post on Facebook groups to find motorcycle drivers or to coordinate with other passengers for shared rides.
    - In Malaysia, students organise Telegram groups to find passengers for ride-hailing trips and share costs.

To account for the diverse physical forms of ISM modes, the framework incorporates an additional classification based on the number of wheels, complementing the two key dimensions described above.

[3] Tuk-tuks are three-wheeled motorised vehicles commonly used for short-distance trips in Southeast Asia, particularly in Thailand, Cambodia, and the Philippines.

[4] Remorque is a motorcycle with an attached passenger trailer, commonly used as a short-distance transport mode in Cambodia.

[5] Bajaj is a three-wheeled motorised vehicle widely used in Indonesia and Cambodia for short trips.

- Two-wheelers: Includes motorcycles, scooters, bicycles, and e-bikes (commonly used for motorcycle taxis and bike sharing)
- Three-wheelers: Includes tuk-tuks, auto-rickshaws, and similar vehicles widely used in urban and peri-urban settings, including:
  - Industrially-manufactured three-wheeled vehicles (e.g. tuk-tuk or bajaj)
  - Motorcycles with a sidecar or modified to have a passenger seat in front of or behind the driver (e.g., remorque);
- Four-wheelers: Includes cars, vans, and minibuses (including songthaews[6]), used for ride-hailing, carpooling, and shared public transport.

A visual representation of ISM classification, integrating both the type of sharing and the degree of digital enablement, is provided in Figure 3. Additionally, it introduces an important distinction between formal, informal, and mixed modes, which is a key but previously implicit characteristic of ISM systems. This categorisation helps clarify how different ISM modes operate within varied regulatory environments.

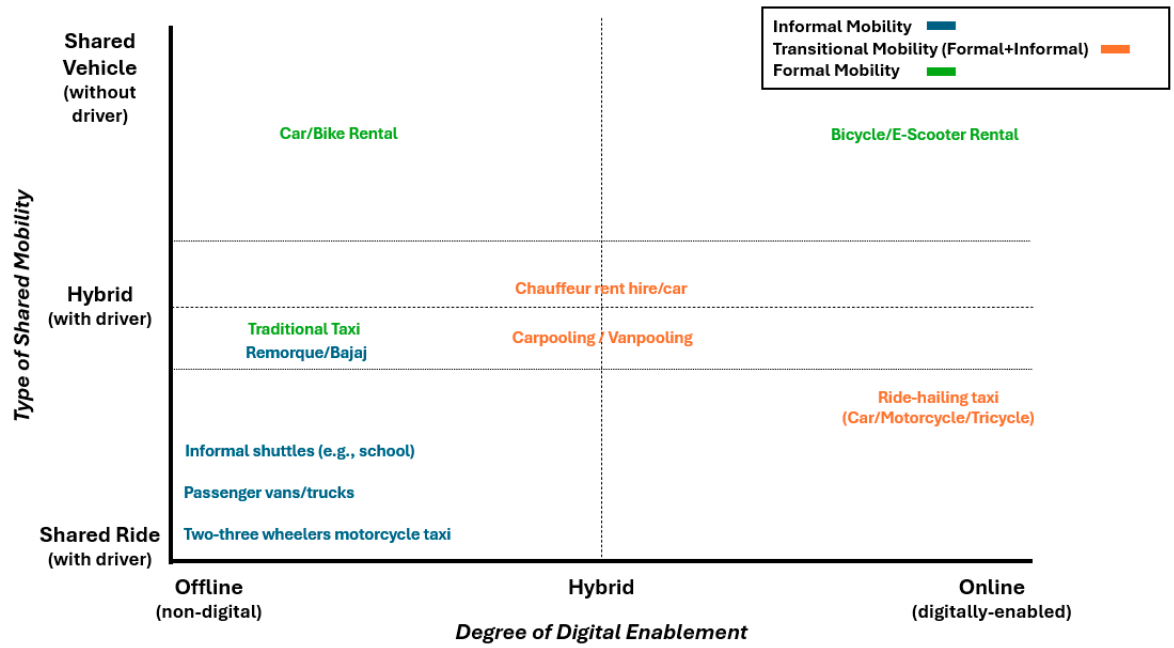

Figure 3: Classification and Overview of ISM Modes in SEA

[6] Songthaew is a shared pickup truck with two parallel bench seats in the back, operating on fixed or flexible routes in Thailand. Some songthaews are converted six-wheel trucks.

A visual representation of ISM classification, integrating both the type of sharing and the degree of digital enablement, is provided in Figure 3. Additionally, it introduces an important distinction between formal, informal, and mixed modes, which is a key but previously implicit characteristic of ISM systems. This categorisation helps clarify how different ISM modes operate within varied regulatory environments.

Alongside the two primary dimensions: type of sharing and degree of digital enablement, ISM systems also differ in their level of formality. Some ISM modes are fully informal (e.g., motorcycle taxis operating without licenses), while others are semi-regulated or transitioning towards formalisation (e.g., ride-hailing services integrating into government policies). Formality levels can influence regulation, worker protection, and integration with public transport systems. While this study does not focus on formal transport, recognising this perspective is important for clearly defining the classification and scope of ISM within the broader mobility landscape.

Building on previous studies (e.g., Joshi et al., 2023; Shaheen et al., 2022; Behrens et al., 2021), this study adopts a multi-dimensional framework that captures both fundamental differences and commonalities across ISM systems. This approach enables meaningful comparisons and deeper insights into the role of ISM in various urban and institutional contexts. By integrating type of sharing, degree of digital enablement, and vehicle classification based on the number of wheels, ISM modes in Southeast Asia can be systematically categorized into four distinct groups. Each group reflects a unique combination of shared mobility characteristics, coordination methods (digital or non-digital), and vehicle types, offering a structured yet flexible framework for analysis.

1. **Non-digital, Shared Ride**

This group includes traditional systems where passengers share a ride simultaneously without using digital platforms. Coordination is typically informal and relies on physical presence, word-of-mouth, or fixed pick-up points. Vehicle types include:

- Two-wheelers: Motorcycle taxis hailed on the street, common in dense urban neighbourhoods or rural areas with limited public transport.
- Three-wheelers: tuk-tuks and auto-rickshaws operating along informal routes or at designated stands.
- Four-wheelers: Informal van or minibus services with shared seating, often operating on fixed routes but without schedules or digital bookings.

These modes of shared mobility were common before mobile Internet became widespread and remain prevalent in smaller cities, and lower-income areas of large cities, where digital access is limited and informal networks dominate.

2. **Digitally-enabled, Shared Ride**

This group encompasses systems where passengers share a ride and use digital platforms to coordinate. Digital technology facilitates bookings, payments, and route optimisation, increasing efficiency and user convenience.

- Two-wheelers: Motorcycle ride-hailing services like Gojek or GrabBike, which are widely used for quick, affordable transport in urban areas.
- Three-wheelers: App-based tuk-tuks or similar services that allow passengers to book and share rides through digital platforms.
- Four-wheelers: Carpooling services or ride-hailing platforms, like GrabShare, that enable passengers to share a car for a journey to a similar destination.

These services are concentrated in urban centres with higher smartphone penetration and wide-spread digital infrastructure.

3. **Non-digital, Shared Vehicle**

This group involves systems where vehicles are shared sequentially but operate without digital platforms. Users access vehicles through informal arrangements or local rental providers. Cars are often rented by the day, whereas motorcycles and bicycles can often be rented by the hour.

- Two-wheelers: Informal bike rentals or shared motorcycles available in local neighbourhoods or tourist areas.
- Three-wheelers: Shared use of tuk-tuks or auto-rickshaws over time, often on an informal rental basis.
- Four-wheelers: Informal car rentals, often arranged through local operators for personal or family use.

These systems are common in areas where digital platforms have not yet penetrated or where traditional arrangements are more culturally ingrained.

4. **Digitally-enabled, Shared Vehicle**

This group encompasses digitally-facilitated systems where vehicles are shared sequentially. Digital platforms enable users to locate, reserve, and pay for vehicles, streamlining the rental process and enhancing accessibility.

- Two-wheelers: App-based bike-sharing services, including e-bikes (popular in cities with infrastructure for cycling).
- Three-wheelers: Digital platforms offering time-based rentals of tuk-tuks or similar vehicles).[7]
- Four-wheelers: Car-sharing services like Zipcar or local equivalents, where users rent vehicles for temporary use.

These types of systems thrive in areas with robust digital infrastructure and growing demand for flexible, short-term vehicle use.

Applying this categorisation framework makes it possible to highlight the diversity and adaptability of ISM systems across SEA. For instance, non-digital shared rides are mostly found in smaller towns and rural areas, while digitally-enabled shared rides flourish in urban centres. Shared vehicles, whether digitally-enabled or not, play a critical role in meeting the diverse mobility needs of local populations, especially in areas with limited public transport options.

The framework provides a foundational typology of ISM transport modes, providing flexibility that aligns with the contemporary context of mobility in SEA. Recognising the diversity and localised nature of ISM systems across countries, this typology is intended to be both complementary and adaptable, offering insights into the spectrum of ISM without enforcing rigid definitions or quantification. It serves as a guiding framework to understand the interplay between shared mobility characteristics, digital facilitation and vehicle types. Further refinement and deeper characterisation of ISM systems are explored through empirical case studies in Southeast Asia.

2.3. Beyond Categorisation of ISM

While the categorisation discussed earlier provides a useful starting point, a more dynamic framework is needed to assess ISM in Southeast Asia effectively. The diversity of ISM modes, their evolving interactions with formal transport, and the shifting regulatory landscapes require an approach that captures these complexities. This framework goes beyond mere categorisation; it serves as an analytical tool for understanding ISM in Southeast Asia. By structuring ISM along key dimensions—service operation and payment models, governance, and regulations—this framework provides a lens through which to examine the diverse and evolving nature of ISM in the region. Rather than simply classifying transport modes, it captures the interplay

[7] These types are common with no-driver.

between informality and formality, flexibility and structure, and fragmentation and integration. This approach allows for a comparative analysis of ISM across different contexts, highlighting how local socio-economic conditions, technological advancements, and regulatory landscapes shape its development. By applying this framework, policymakers, researchers, and urban planners can better assess ISM's role, identify pathways for integration, and develop informed strategies to enhance mobility solutions in rapidly urbanising and economically diverse environments.

The framework presented in Table 4 organises ISM into three key dimensions: service operation and payment models, governance, and regulations, each comprising specific criteria that define the nature and structure of ISM modes. These criteria exist along a spectrum rather than a binary classification, reflecting the varying degrees of flexibility, integration, and formalisation across different ISM services. For example, within the service operation and payment models dimension, ISM modes may range from fixed to flexible routes, stops, and schedules, reflecting their adaptability to user demand and infrastructure constraints. Similarly, payment methods may range from cash-based transactions to fully electronic systems, highlighting the degree of financial formalisation. By mapping ISM characteristics onto these spectra, the framework enables a nuanced understanding of how different ISM modes function within their specific socio-economic and regulatory contexts.

The governance and regulation dimensions further capture the degree of institutional oversight and integration into broader transport systems. Governance criteria examine factors such as policy frameworks, regulatory oversight, infrastructure support, and public participation, which shape ISM's relationship with formal transport networks and government policies. Meanwhile, regulatory criteria assess the extent to which ISM is formalised through licensing requirements, fare and schedule regulation, geographical restrictions, and access to financial and welfare support. By positioning ISM modes along these spectra, the framework provides a structured yet adaptable approach to assessing ISM's role in urban and rural mobility, identifying areas where policy interventions may enhance efficiency, accessibility, and sustainability. This analytical approach not only captures the diversity of ISM but also facilitates its comparative analysis across different Southeast Asian contexts, where regulatory environments and socio-economic conditions vary significantly.

Table 4: Three key dimensions of ISM Modes

Dimension	Criteria	Spectrum	Description
Service Operation and Payment Models	Route	Fixed ↔ Flexible	Services may follow predefined routes or adjust dynamically based on demand.
	Stop	Fixed ↔ Flexible	Passengers may board/disembark at designated stops or at flexible locations.
	Territory	Fixed ↔ Flexible	Operations may be confined to a specific area or extend beyond traditional boundaries.
	Schedule	Fixed ↔ Flexible	Services may run on a set timetable or operate on demand.
	Hailing	On-street ↔ Online	Vehicles may be hailed directly on the street or via digital platforms (e.g., apps, social media).
	Payment Method	Cash ↔ Electronic	Payments may be cash-based or processed through digital systems (e.g., mobile wallets, QR codes).
	Payment Platform	Fragmented ↔ Integrated	Users may pay for services separately or through a unified, multimodal payment system.
Governance	Policy Framework	Ad-Hoc ↔ Institutionalised	Governance may rely on informal policies or be embedded within structured legal frameworks.
	Regulatory Oversight	Local ↔ Centralised	Regulation may be managed at the city level or by national authorities.
	Legal Recognition	Informal ↔ Fully Formalised	Services may be entirely unregulated or legally integrated into public transport systems.
	Infrastructure Support	None ↔ Comprehensive	Public investment may be absent or include well-developed facilities (e.g., terminals, stops).
	Stakeholder Coordination	Weak ↔ Strong	Coordination between government, operators, and users may be limited or well-organised.
	Public Participation	None ↔ Inclusive	Communities may have no say in ISM policy or be actively involved in decision-making.
	Data and Monitoring	None ↔ Advanced	ISM operations may lack oversight or be subject to sophisticated data monitoring.
	Financial Support	Absent ↔ Robust	Governments may provide no financial assistance or offer subsidies to support ISM.
	Intermodal Integration	Weak ↔ Strong	ISM may operate independently or be fully integrated into formal public transport.

Regulations	Driver Qualifications	Basic ↔ Professional	Drivers may only need a personal licence or require a commercial permit.
	Vehicle Registration	Basic ↔ Public/ Commercial	Vehicles may be privately owned or registered as public/commercial transport.
	Operator Licences	Absent ↔ Comprehensive	Some ISM services operate without licences, while others require full authorisation.
	Fare Regulation	Unregulated ↔ Regulated	Pricing may be set freely or subject to government control.
	Schedule Regulation	Unregulated ↔ Regulated	Operating hours may be flexible or legally defined.
	Number of Vehicles	Unlimited ↔ Restricted	There may be no cap on vehicle numbers, or governments may impose strict limits.
	Number of Drivers	Unlimited ↔ Restricted	The workforce may be unrestricted or controlled through licensing quotas.
	Geographical Limitations	None ↔ Defined	Services may operate freely or be limited to certain districts or zones.
	Access to Credit	None ↔ Extensive	ISM operators may struggle with funding or have structured access to credit facilities.
	Income Tax	None ↔ Full Compliance	Earnings may be unreported or fully taxed.
	Welfare	None ↔ Comprehensive	Workers may receive no benefits or be covered by employment protections.

Chapter Three: ISM in the Southeast Asian Context

This chapter provides a detailed examination of ISM modes, markets, and the socio-economic contexts that shape their operation in Southeast Asia. It begins with a mapping of the broader context of ISM in the region, presenting an overview of demographic, economic, and urban development megatrends that shape the demand and supply of mobility. This contextual understanding, at both the country and regional levels, sets the stage for a deeper dive into ISM structures and dynamics.

In the second section, ISM modes in SEA are categorised, revealing their unique characteristics and the innovative ways they have adapted to the challenges and opportunities of urban growth. In the third section, key trends reshaping the ISM sector—from technological advancements to shifts in governance and user preferences—are examined. Finally, the multifaceted dimensions of ISM, including business and financial models, technology adoption, institutions and governance, inclusivity, and sustainability are unpacked in the fourth section.

This structured approach underscores the balance between informality and formalisation within ISM systems, emphasising their role as both practical mobility solutions and contributors to innovation. The aim of the chapter is to provide a clear understanding of the status of ISM in SEA and its potential to support sustainable and equitable urban mobility.

3.1. Mapping the context of ISM in Southeast Asia

To understand the status, challenges, and opportunities of ISM, it is essential to analyse the demographic, economic, and digital characteristics of the countries and cities under study, along with their current trends. These factors significantly influence the demand and supply dynamics of ISM systems. This section begins with an overview of the demographic and economic characteristics of selected cities and countries in Southeast Asia, followed by a regional analysis highlighting the key megatrends shaping ISM systems in the region.

Regional Overview: Megatrends Driving ISM Developments

The ISM sector in Southeast Asia is undergoing rapid transformation, shaped by a convergence of powerful megatrends that influence economies, societies, and technologies. Shifting demographics and rising urban middle classes, persistent informality, digitalisation, and the push for sustainability influence the evolving dynamics of mobility in the region. Intensifying geopolitical competition and its impact on technological adoption and energy transitions add another layer of complexity (Hafner, & Tagliapietra, 2020; Vakulchuk et al., 2020). Understanding these interconnected forces is essential for crafting inclusive, sustainable, and forward-looking mobility strategies that address the diverse ISM challenges and opportunities faced in Southeast Asia.

Demographic Shifts and Their Impact on Mobility Patterns

Southeast Asia is undergoing diverse demographic and spatial transformations that are significantly reshaping mobility demand and the ISM sector. The region is experiencing significant rural-to-urban migration, fuelling population growth in metropolitan areas. Data on urbanisation levels, population distribution, and trends in urban and rural population changes across Southeast Asia are presented in Tables 5 and 6. The region exhibits significant variation in urbanisation rates, ranging from 100% in Singapore to only 26% in Cambodia, highlighting diverse stages of urban development.

The region's demographic shifts reveal stark contrasts between growing megacities, expanding tourist hubs, and shrinking small towns and rural areas. As of 2023, approximately 55% of Southeast Asia's population resided in urban areas, with urban population growth outpacing rural population decline in most countries. For example, Thailand's urban population expanded from 22.7 million in 2003 to 38.4 million in 2023 (an increase of 15.7 million), while its rural population declined by approximately 8.9 million over the same period. Indonesia's urban population surged from 99.8 million to 164.7 million in the past two decades (an increase of nearly 65 million), while its rural population decreased by approximately 8.7 million.

This trend underscores the ongoing urban transition in the region, driven by economic growth, migration, population growth, and structural changes in employment and infrastructure development. Rapid urban population growth intensifies the need for accessible, affordable, and flexible transportation, particularly for low-income groups. At the same time, the gradual shrinking of rural populations presents challenges for sustaining affordable public transport services in these areas, potentially reinforcing reliance on informal ISM solutions. This demographic shift also increases the need for mobility services that connect rural and urban areas, as more people commute between the two for work, education, and essential services.

ISM operators could play a crucial role in meeting these needs by adopting accessible vehicles and tailored services that bridge the gaps in conventional public transport systems. In stark contrast to thriving megacities and tourist hubs, smaller towns and rural areas in SEA are grappling with population decline and stagnant economies. Limited transport infrastructure in these regions exacerbates mobility inequities.

Table 5: Urbanisation and Population Distribution in Southeast Asia in 2023

Country	Urban Population (million)	Rural Population (million)	Urbanisation Level (%)
Brunei	0.363	0.096	79
Cambodia	12.97	4.46	26
Indonesia	164.7	116.49	59
Laos	2.93	4.73	38
Malaysia	17.58	36.75	79
Myanmar	27.65	7.48	32
Philippines	55.48	59.41	48
Singapore	5.92	0	100
Thailand	38.44	33.26	54
Vietnam	39.62	60.73	39

Source: World Bank (2023) and Our World in Data (2024)

Table 6: Urban and Rural Population Changes in Southeast Asia, 2003–2023

Country	Relative Change (Urban)	Relative Change (Rural)
Brunei	45%	0%
Cambodia	80%	23%
Indonesia	65%	-7%
Laos	105%	11%
Malaysia	73%	-14%
Myanmar	35%	9%
Philippines	43%	30%
Singapore	44%	N/A
Thailand	70%	-21%
Vietnam	91%	3%

Source: Our World in Data (2024)

In the past few decades, populations in major metropolitan areas like Bangkok, Jakarta, and Ho Chi Minh City have swollen to over five or even ten million residents. These cities are centres of governance, education, and commerce, and have become magnets for citizens seeking economic opportunities. Rapid urban growth and rising incomes have driven sub-urbanisation, facilitated by aggressive expansion of highway networks. Suburban developments have expanded urban footprints, created fragmented transportation demand, and pressured public transport systems to deliver reliable services connecting suburbs with city centres.

In such megacities, ISM has emerged as a critical component of urban mobility. Insufficient public transport services and severe traffic congestion have made ISM indispensable, particularly for underserved populations. Informal modes such as motorcycle taxis, tuk-tuks, and shared vans efficiently provide last-mile connectivity in urban centres and suburbs. These services particularly thrive in areas with high population densities—which often exceed 10,000 persons per km^2—and mixed land-use patterns, which generate diverse, short-trip demand.

The demographic makeup of SEA countries is another major determinant of mobility trends. In countries like Cambodia and Indonesia, youth drive demand and supply for digitalised mobility solutions. Younger commuters, adept with technology, increasingly prefer smartphone-based RHAs over traditional ISM options. Conversely, the ageing populations of Thailand and Vietnam have distinct mobility needs, including safer and more-accessible transport.

Tourism is a major industry in Southeast Asia. Tourism destinations such as Chiang Mai, Hue, and Yogyakarta face unique mobility challenges. These cities must cater to tourists, who seek both convenient and "authentic" local experiences, while also serving the growing needs of suburban residents as urbanisation extends into peripheral areas. Tailored ISM services, ranging from traditional tuk-tuks to digitally-enhanced platforms, are increasingly being deployed to address these demands, blending functionality with cultural appeal.

Traditional ISM modes, such as tuk-tuks, songthaews, jeepneys, and motorcycle taxis are vital for providing flexible and affordable mobility solutions to the residents of small towns and rural areas with declining populations. However, declining demand and minimal investment in these areas threaten the financial sustainability of ISM services, leaving many rural residents with inadequate transport options. Without strategic intervention, mobility inequities between urban and rural regions are likely to deepen.

Rapid urbanisation across the region has outpaced the capacity of many governments to develop adequate transportation infrastructure. While efforts to expand public transport systems are underway in many megacities, the gap between demand and supply remains significant. ISM plays a vital role in addressing shortcomings, particularly in suburban and peri-urban areas where sprawling development patterns make providing adequately comprehensive public transit difficult.

Income Levels as Drivers of Mobility Demand in Major Cities

Sustained economic growth over the past three decades has elevated SEA countries into the middle-income category. While economic hubs like Bangkok and Jakarta boast disproportionately high contributions to national GDP and high per capita incomes compared to national averages. However, income growth is uneven across urban populations: income disparities persist. Income disparities directly affect mobility access. For low-income workers, many of whom have recently migrated from rural areas, ISM offers a cost-effective and accessible alternative to formal transit systems, which may be perceived as more expensive, time-consuming, or lacking in flexibility. Factors such as affordability, convenience, and travel predictability often shape mobility choices, while higher-income groups may prioritise comfort, reliability, and perceived status when opting for private transport services.

Continued economic growth in SEA, as evidenced in Cambodia, Indonesia, Thailand, and Vietnam, has fuelled the rise of a growing urban middle class with increasing disposable incomes. This demographic is driving a shift in mobility preferences, emphasising convenience, reliability, and modernity. As a result, platform-based shared mobility services, such as RHAs, are rapidly gaining popularity in urban centres. These services cater to middle-class demand for efficient and tech-enabled transport services, often displacing traditional informal modes like motorcycle taxis and tuk-tuks. Rising income levels also influence urban travel patterns, with commuters opting for faster, more comfortable, and sometimes private mobility options rather than less-predictable and/or lower-status traditional ISM modes.

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While the middle class gravitates towards formalised and digitised services, economically-disadvantaged groups continue to rely on informal transport options due to their affordability and accessibility. Where public investments in public transport infrastructure often lag behind urban growth, ISM remains indispensable to lower-income residents. Mobility solutions are needed that address both the aspirational demands of the rising middle class and the essential needs of lower-income groups, ensuring equitable access to transportation services in rapidly-changing urban economies. The economic role of ISM does not only extend beyond facilitating mobility across income groups but also serves as a vital source of employment, particularly for low-income workers who make up a significant share of the transportation sector. Motorcycle taxis, informal shared vans, and other ISM services play a dual role, meeting mobility needs while providing livelihoods for economically vulnerable populations. High levels of informal employment highlight ISM's significance as a crucial source of income. With low entry barriers, ISM offers accessible earning opportunities for individuals often excluded from formal labour markets, functioning as an essential safety net for those in precarious economic conditions.

Informal Economy Persists Amid Formalisation Efforts

Despite ongoing efforts to formalise economies across Southeast Asia, the informal sector remains a vital and enduring component of the region's economic landscape. The persistence of informality reflects structural realities within the region's economies, where regulatory frameworks and formal protections frequently fail to encompass a majority of the workforce. The informality of ISM aligns with these broader economic structures, creating a symbiotic relationship that enables ISM to thrive while fulfilling crucial mobility needs. This economic dynamic highlights the importance of ISM not only as a transportation solution but also as a socio-economic lifeline, emphasising the need for policies that balance formalisation efforts with support for the livelihoods of informal workers. As Southeast Asia's economies continue to evolve, understanding this interplay between informality and ISM remains essential for crafting inclusive and effective mobility strategies.

Interestingly, even some of the most prominent shared mobility platforms, such as Uber, Grab, and Gojek, began their operations informally, often offering services without obtaining official approval from local governments. These companies, like ISM operators, capitalised on the gaps in existing formal transport systems and the inefficiencies of regulatory frameworks, effectively operating within the informal economy in their early stages. Despite this, they managed to cultivate a perception of modernity and innovation that distinguished them from traditional ISM operators like motorcycle taxis or tuk-tuks. Their use of digital platforms, sleek branding, and promises of convenience and safety helped to project an image of professionalism and formality, even as their operations sidestepped regulatory norms.

This dichotomy in perception raises critical questions about the biases inherent in formalisation efforts. Traditional ISM is often stigmatised as unregulated and chaotic, while platform-based operators—despite their initial informality—are viewed as the harbingers of progress. This disparity underscores the need for equitable policy approaches that recognise the contributions of both traditional and platform-based ISM to addressing both mobility and livelihood challenges.

Motorcycles and the Megatrend of Motorisation

Motorisation is another megatrend shaping Southeast Asia, profoundly impacting both urban and rural areas. Among the various modes of transport, motorcycles dominate, serving as the primary means of mobility across different contexts. The region's megacities are marked by high and increasing rates of motorisation, with motorcycles dominating both private transport and public informal transport modes. Motorcycles play a dual role, serving individual needs while also forming the backbone of many semi-regulated or unregulated public transport systems. These systems, often referred to as "informal public transport," operate outside the formal regulatory frameworks yet provide essential mobility solutions in congested urban environments, offering greater flexibility and accessibility.

The dominance of motorcycles extends beyond cities to smaller towns and rural areas, where they serve both personal vehicles and shared transport options. In many rural communities, motorcycles are often used for agricultural purposes, small-scale goods transportation, and as a substitute for public transport, which is frequently absent or unreliable. They address individual mobility needs and functioning informally to provide mobility services in the absence of public transport systems. Their versatility and affordability make them indispensable in regions where formal transportation options are inadequate.

While motorcycle-based informal transport modes, in many contexts, are essential, concerns have been raised about the negative impacts of excessive ISM operations, including traffic congestion, environmental degradation, and in particular air pollution (Boquet, 2010). Safety (in terms of traffic and crime) is another pressing issue, as many informal transport modes operate with minimal oversight, leading to risks to both passengers and operators.

Digitalisation, Platformisation, and AI: Shaping the Economy and Society

The rapid digitalisation, platformisation, and emergence of artificial intelligence (AI) are fuelling a profound transformation across Southeast Asia, fundamentally altering the region's economies and societies. These megatrends are not simply revolutionising industries; they are reshaping the core structures of economic and social life, redefining how people work, interact, and access services.

The rapid adoption of digital technologies, fuelled by increasing Internet penetration and the ubiquity of smartphones, has paved the way for the rise of platform-based mobility ecosystems. Companies like Grab, Gojek, Shopee, Lazada, and LINE have grown from niche service providers to dominant players, integrating multiple services such as e-commerce, logistics, digital payments, and transportation in their platforms. The resulting digital ecosystem has enabled unprecedented levels of convenience and connectivity, creating efficiencies across sectors and transforming consumer behaviour in the process.

The integration of AI into these digital platforms is further amplifying their impact. AI-powered algorithms enable hyper-personalisation, predictive analytics, and real-time optimisation, enhancing user experience while revolutionising how businesses operate. From automating customer interactions through chatbots to optimising supply chains, AI is driving productivity gains across sectors. In society, AI technologies are shaping the labour market, introducing new opportunities while displacing traditional roles. The gig economy, for instance, exemplifies both the potential and the challenges of these trends, as flexible, tech-enabled jobs emerge alongside precarious labour conditions for gig workers.

The ripple effects of these megatrends extend deeply into Southeast Asia's socio-economic landscape. Urbanisation, rising incomes, and growing digital literacy have positioned the region as a global hotspot for digital innovation. However, these developments also create challenges,

including digital divides, data-privacy concerns, and the concentration of power among a few tech giants. These dynamics influence various aspects of life, from consumer choices to job markets, and set the stage for profound shifts in mobility systems, including ISM. As digitalisation and AI continue to evolve, their impact on SEA will be far-reaching, shaping economies, governance, and societal norms in ways that will reverberate for decades to come.

The Sustainability Turn is Here to Stay

Sustainability has firmly established itself as a key priority for businesses and governments across Southeast Asia, driven by growing environmental challenges, international pressure, and the need for long-term economic growth and resilience. National governments in the region are increasingly adopting green policies and committing to global climate goals, such as the Paris Agreement, while businesses are integrating sustainability into their operations to align with emerging regulatory frameworks, attract investment, and enhance their competitive advantage. Initiatives that promote, for example, EVs, renewable energy, and carbon-neutral urban development reflect the growing prevalence of sustainability as a mainstream agenda. However, the adoption of sustainable consumption practices remains relatively slow, often hindered by affordability concerns, limited awareness, and a lack of accessible options.

The growing emphasis on sustainability presents critical challenges and opportunities for the ISM sector. Government focuses on green mobility, including policies that promote EV adoption to reduce emissions of both air pollutants and greenhouse gases, is reshaping the operational landscape for ISM. For instance, electric tuk-tuks, electric motorcycles, and other shared mobility solutions are being actively promoted as environmentally-friendly alternatives to traditional fossil-fuel-powered vehicles. Some businesses have launched demonstration projects to promote electric vehicles among ISM drivers. These initiatives align with their ESG and CSR strategies, highlighting a commitment to environmental sustainability, social responsibility, and community engagement.

While consumers in Southeast Asia may still prioritise cost and convenience over sustainability, the broader shift driven by governments and businesses creates an enabling environment for adopting sustainable ISM solutions at scale. Over time, as awareness grows and costs decrease, consumer adoption of sustainable mobility options is expected to accelerate. For now, the focus on sustainability by key stakeholders ensures that ISM remains a crucial component of the region's transition to greener and more equitable urban mobility systems. This alignment positions ISM not only as a pragmatic transport solution but also as a significant contributor to Southeast Asia's sustainability goals.

Geopolitical Influences on Investments in Mobility and Energy Infrastructure

Global geopolitics, particularly the intensifying competition between the United States and China, is poised to significantly shape technological adoption and investment in the ISM sector in Southeast Asia. As SEA becomes a critical arena for economic and strategic influence, nations in the region find themselves navigating a complex landscape of competing interests. China's dominance in digital technology and infrastructure investments, exemplified through initiatives like the Belt and Road Initiative (BRI) and its technological giants such as Alibaba, Tencent, and BYD, have heavily influenced the region's mobility and energy ecosystems. Many ISM platforms and EV initiatives rely on Chinese-developed technologies, including EV batteries, payment systems, and AI-driven mobility solutions. Meanwhile, the U.S. and its allies promote alternatives, emphasising standards in transparency, intellectual property protections, and renewable energy technologies.

Adding complexity to this dynamic is the competition between Japan and China in the automotive and mobility sectors. Japan has historically dominated Southeast Asia's automotive market through its well-established auto manufacturers such as Toyota, Honda, and Mitsubishi, and motorcycle manufacturers like Yamaha. Japan now faces significant competition as China's EV industry rapidly rises. While Japanese automakers initially benefited from the region's preference for reliable and fuel-efficient vehicles, China's aggressive push into the EV market, supported by state-backed enterprises and subsidies, has positioned it as a formidable competitor. Chinese companies, particularly BYD and NIO, are introducing affordable and technologically-advanced EV models, alongside robust batteries, threatening Japan's long-standing leading market position. This new competition extends into the ISM sector, where China is rapidly deploying electric tuk-tuks and motorcycles, leveraging its expertise in battery technology and production scale. Meanwhile, Japan is attempting to pivot, with its auto industry exploring hybrid technologies and partnerships to maintain market share in the region's evolving mobility landscape.

This rivalry further complicates Southeast Asia's energy transition, as governments, businesses, and consumers weigh the benefits of Chinese cost-efficiency and speed against Japan's reputation for quality and durability. Policymakers in Southeast Asia are faced with strategic choices as they navigate this multifaceted competition in efforts to ensure that promote investments in ISM and energy infrastructure foster long-term sustainability, interoperability, and technological independence while balancing the influence of competing global powers.

Country overview

An overview of key demographic and economic attributes of the study's four SEA countries is provided in Table 7, offering a foundational context for analysing the diffusion of ISM in the region. This data, sourced from government agencies and international organisations, highlights the demographic trends and ISM-related indicators critical for this analysis.

Table 7: Demographic and Economic Overview of Select Countries and Cities in Southeast Asia in 2023

Country & City	Pop. Density (per sq. km)	Pop. Growth Rate (%)	Aging Pop. Rate (%)	GDP (Billion USD)	Average Monthly Income (USD)	Total Labour Force (mill.)	Unemployment Rate (%)	Informal Employment Rate (%)	Digital Penetration Rate (%)	Lengths of MRT & BRT (kms, operational + under construction)
Cambodia	86	1.2	6	31.77	223.86	9.2	0.2	88.3	57	N/A
Phnom Penh	3136	3.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	MRT: 0 BRT: 0
Siem Reap	98	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	MRT: 0 BRT: 0
Indonesia	189	1.13	7	1370	192.76	1.5	4.82	80.4	69.21	N/A
Jakarta	660.98	0.38	N/A	0.128	332.48	5.4	6.03	N/A	86.5	MRT: 71.7 BRT: 251
Yogyakarta	3170.65	0.67	N/A	0.0114	174.20	2.2	3.24	N/A	78.61	MRT: 0 BRT: 100
Thailand	129	N/A	16	514.94	2797.4	40.5	0.97	64.4	90	N/A
Bangkok	3,488	N/A	N/A	249.3	1172.1	5.8	N/A	N/A	N/A	MRT: 204 BRT: 16
Chiang Mai	89	N/A	N/A	N/A	669.5	1.1	N/A	N/A	N/A	MRT: 0 BRT: 0
Vietnam	302.75	0.85	10	429.72	300	52.4	2.28	67	78	N/A
Ho Chi Minh City	4513.07	0.71	N/A	22	N/A	4.8	2.51	N/A	N/A	MRT: 31 BRT: 0
Hue	235.8	0.54	N/A	N/A	N/A	0.6	2.51	N/A	N/A	MRT: 0 BRT: 0

Note:
- Aging Population: Population ages 65 and above (Thailand: 2023, Indonesia, Vietnam: 2024, Cambodia: 2019)
- Total Labor Force and Unemployment Rate: Indonesia: as of February 2024
  Informal Employment Rate: Thailand: 2018, Indonesia, Cambodia: 2019, Vietnam: 2020
- Cambodia: Population Growth Rate and Average Monthly Median Wages use the latest Population Census of 2019, while Digital Penetration Rate uses the latest World Bank data for 2022

Cambodia

Cambodia's emerging economy, with a GDP per capita of USD 2,429.7 as of 2023 features a predominantly low-income population for whom ISM provides an affordable mobility solution. The national average annual income of approximately USD 225 highlights the cost sensitivity of ISM services. Cambodia's population is young, with an average age of 27 years. This presents opportunities for ISM growth, particularly as digital platforms become more widespread. However, Internet penetration, at 57%, remains a challenge to expanding digital ISM solutions to rural areas. Phnom Penh, with a population density of 3,136 inhabitants per square kilometre, relies on diverse transport options, while Siem Reap, a lower-density tourism-driven city, depends on ISM due to its underdeveloped public transport infrastructure.

Cambodia has the highest rate of informal employment in the region, at 88.3% of total employment (ILO, 2024). ISM plays a significant role, as both a mobility provider and a key source of livelihood for workers in the informal sector. In Phnom Penh, ISM is critical for addressing urban transport needs, while in Siem Reap, it supports the local economy by catering to both residents and tourists. The absence of infrastructure such as MRT, BRT, and formal public bus networks outside of public-private partnership (PPP) further entrenches dependency on ISM: the country's urban and rural populations rely heavily on informal services to meet their daily mobility demands. ISM in Cambodia also sustains livelihoods in a country where formal transit options remain underdeveloped.

Indonesia

Indonesia has a GDP of approximately USD 137 billion. ISM usage across the country is characterised by significant differences. Jakarta, as the nation's economic hub, has an average monthly income of USD 332.48, exceeding the national average, and has a high population density and chronic traffic congestion. ISM provides an efficient urban transport solution while offering livelihood opportunities to Jakarta's vast informal workforce. By contrast, Yogyakarta's lower income levels and limited public transport infrastructure make ISM indispensable for meeting everyday mobility needs.

Indonesia also has a high rate of informal employment, at 81.2% of the total workforce (ILO, 2024). This extensive informal sector underpins the ISM industry, where drivers of motorcycle taxis, three-wheeled vehicles (bajaj), and other modes dominate urban transport. Indonesia's reliance on ISM reflects its dual role as a practical mobility solution and a critical economic lifeline for the country's large informal workforce. Although Jakarta has 71.7 kilometres of MRT and 251 kilometres (km) of BRT (with another 100 km of BRT under construction), ISM remains a vital feeder service. It bridges connectivity gaps, providing first- and last-mile transport for commuters navigating the city's sprawling urban environment and heavy congestion.

Thailand

Bangkok generates nearly half of Thailand's GDP (USD 125.2 billion) and has a population density of 3,488 inhabitants per square kilometre (km^2), far surpassing the national average (129 per km^2). Bangkok's population density places immense pressure on public and informal transport systems, with high- and middle-income groups heavily reliant on ISM. By contrast, Chiang Mai, with its lower population density but significant working population and a large volume of tourists, demonstrates how ISM systems can adapt to varying economic and logistical demands.

Thailand also has a high rate of informal employment, accounting for 65% of the total workforce (ILO, 2024). Many ISM operators, including motorcycle taxi (win-motosai) and tuk-tuk drivers, work within this informal sector. ISM provides essential income-generating opportunities for workers who lack access to formal labour markets. Moreover, Thailand's rapidly ageing population, at 16% (the highest among the four study countries), underscores the importance of ISM in providing accessible transport for older adults in areas where public transit is limited. This demographic trend also affects the supply side, with an increasing number of older drivers sustaining their livelihoods through ISM. Despite Bangkok's 204 km of MRT and 16 km of BRT infrastructure, ISM remains crucial for first- and last-mile connectivity, ensuring that commuters can efficiently access transit stations.

Vietnam

Vietnam, with a GDP of USD 42.972 billion, illustrates the critical role of ISM in both urban and secondary cities. In Ho Chi Minh City, where the population density is 4,513 inhabitants per km^2, ISM serves as a primary mode of public transport, effectively navigating the city's high traffic volumes. In secondary cities such as Hue, ISM continues to be a vital option as the economy grows and transport needs diversify.

Informal employment makes up 67.5% of Vietnam's total workforce (ILO, 2024), much of which is closely tied to the ISM sector. For many informal workers, ISM provides a viable livelihood option, particularly for older adults may face challenges in transitioning to more formal and digitalised transport services. Meanwhile, younger drivers are increasingly integrating RHA services into their operations. This generational shift highlights ISM's adaptability to evolving labour market conditions while continuing to meet critical mobility needs. Vietnam's MRT infrastructure is still limited, with only 31 operational km in Ho Chi Minh City and no BRT systems. As a result, ISM plays a critical bridging role, connecting urban and suburban populations to key economic and social hubs.

3.2. Main ISM Modes in Southeast Asia

This section provides an overview of the main ISM modes in Southeast Asia. As illustrated in Figure 4, ISM in this region encompasses a wide array of transport options, ranging from two-wheeled vehicles to boats, with services delivered through both offline and online app-based platforms. This diversity reflects the interplay of socio-economic factors, urban transport characteristics, travel distances, and the convenience needs of each country. The unique blend of traditional ISM modes and the rapid digitalisation of transport services further enriches the region's mobility landscape.

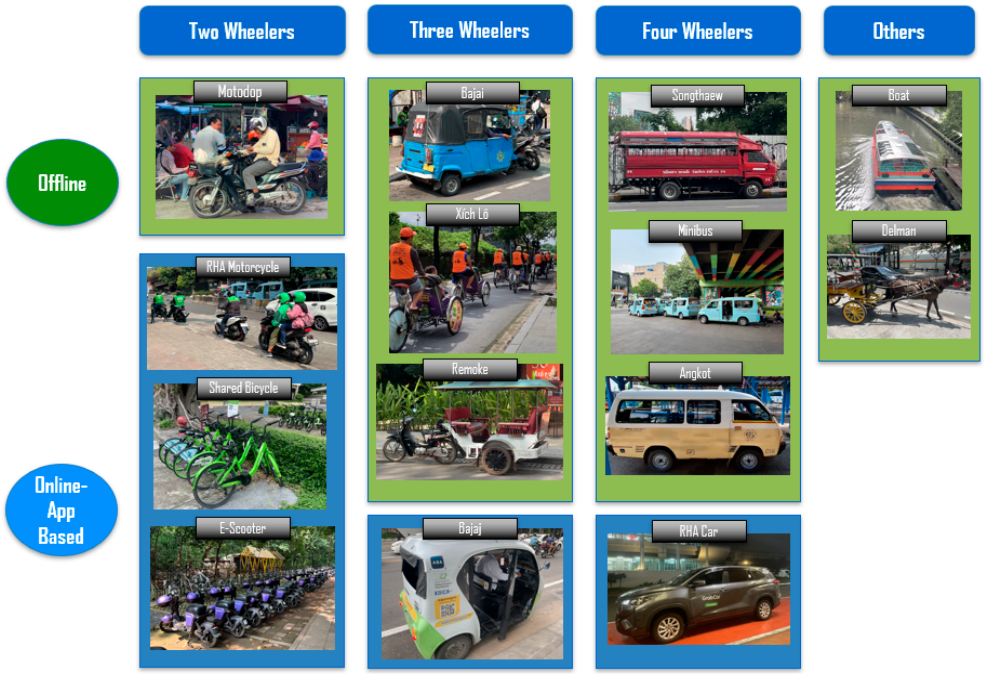

Figure 4: Major ISM Modes in SEA

Tables 8 through 11 contain summaries of key ISM modes in Cambodia, Indonesia, Thailand, and Vietnam, categorised by vehicle type: two-wheelers, three-wheelers, four-wheelers, and others. A clear distinction is made between offline modes, which rely on traditional local access methods, and app-based modes, where booking is conducted online (but the service itself operates offline). This classification highlights the evolving nature of ISM in adapting to both technological advancements and local mobility demands.

Table 8: ISM Modes in Southeast Asia: Two-Wheelers

ISM Mode	Country	Description
Offline		
Motorcycle taxis	Cambodia (Motodop), Indonesia (Ojek), Thailand (Motorsai, Win), Vietnam (Xe ôm) Philippines (skylab[8], Habal-habal)	Traditional motorcycle taxis are widely used for short-distance trips (including in feeder mode, where they connect passengers to other modes of transport) as well as for longer door-to-door journeys.
Online App-based		
RHA motorcycle taxis	Cambodia (Grab), Indonesia (Gojek, Grab), Thailand (Grab), Vietnam (Grab, Be) Philippines (Angkas)	Platforms and apps have emerged as alternatives to hailing motorcycle taxis on the street, offering enhanced on-demand convenience and transparency for both short and longer trips.
Shared Bicycle	Cambodia (Grab), Indonesia (Boseh, Bandung), Thailand (Anywheel, Pun Pun, Bangkok), Vietnam (TNGo, Danang) Singapore (SG Bike, Anywheel)	Public bike-sharing services allow users to rent and return bicycles at designated docking stations managed through an online app.
Shared E-Bicycle	Thailand (GCOO, Bangkok) Singapore (Anywheel, neuron)	In Thailand and Singapore, some platforms offer public services for sharing bicycles with electric assistance. The service is similar to that of regular bicycle-sharing services.
Shared E-Scooter	Indonesia (Beam, Jakarta), Thailand (Haup), Vietnam (VinFast) Malaysia (Beam, Kuala Lumpur) Singapore (neuron)	Shared E-Scooter is a short-term rental service for electric scooters managed by an app-based platform, offered in a "dockless" format with no fixed parking spaces. It is a shared transportation option for short-distance and "last mile" trips in urban areas.

[8] A modified three-wheeled motorcycle with an extended passenger cabin, commonly used for transporting multiple passengers over short distances.

Table 9: ISM Modes in Southeast Asia: Three-Wheelers

ISM Mode	Country	Description
Offline		
Auto rickshaws (tuk-tuk)	Cambodia (bajaj), Indonesia (bajaj), Thailand (tuk-tuk) Philippines (tuk-tuk)	Three-wheeled motorised vehicles are commonly used for short-distance travel. Known for their affordability and convenience, these taxis are popular among both locals and tourists. In Cambodia and Indonesia, they are called bajaj," while in Thailand and the Philippines, the tuk-tuk dominates urban areas, with the "Skylab" serving as a rural adaptation.
Electric auto rickshaws	Cambodia (E-bajaj)	In Phnom Penh, Cambodia, the Singapore-based ride-hailing company Tada offers online services for hailing electric bajajs and tuk-tuks.
Cycle rickshaws, Pedicabs	Cambodia (Cyclo), Indonesia (Becak) Thailand (Samlor), Vietnam (Xích Lô)	Human-powered three-wheeled tricycles are used for short-distance travel. These cycle rickshaws are a traditional and eco-friendly mode of transportation. Although their use by local residents has declined, they remain popular amongst tourists.
Motorcycle with a sidecar/trailer	Thailand (Skylab), Cambodia (Remorque), Philippines (Traysikel)	Motorcycles with attached sidecars or trailers form a three-wheeled vehicle commonly used as taxis. These vehicles are a practical solution for short-distance travel. In some areas, they are adapted to run on CNG for improved environmental sustainability.
Online App-based		
Auto rickshaws	Cambodia (Remorque) Indonesia (Becak Motor, Bentor)	Similar to offline auto rickshaws, but these motorised rickshaws, with a motorcycle towing a passenger cabin, are practical for short-distance travel in urban and rural areas. They often operate on a shared-ride basis with fares divided among passengers. Mobile apps increasingly streamline ride coordination ' for convenience and efficiency.
Electric rickshaws	Cambodia (E-remorque), Thailand (E-Tuk-tuk, MuvMi)	Similar to auto rickshaws, but using electric tricycles.

Table 10: ISM Modes in Southeast Asia: Four-Wheelers

ISM Mode	Country	Description
Offline		
Converted pickup trucks	Thailand (Songthaew, Silorlek) Philippines (Jeepney)	Converted pickup trucks, known as songthaew in Thailand, are public transport vehicles operating on both flexible and fixed routes. The silorlek, a smaller version of the songthaew, is commonly used in urban and suburban areas.
Vans	Cambodia (Passenger vans), Indonesia (Angkot, Bemo), Thailand (Passenger vans, School shuttles)	Vans operate on fixed routes between cities or within metropolitan areas and can also be pre-booked for group travel. In some regions, schools use vans or small buses to transport students. Passenger vans, such as Angko, operate on flexible routes. Vans are also widely used for airport transfers and sightseeing tours, and have been introduced as part of regional transport systems in some areas.
Minibuses	Indonesia (Midibus) Vietnam (Xe Khách)	Medium-sized buses are widely used for public transport in urban areas. In Vietnam, shared minibuses connect urban and rural regions, offering an affordable and convenient option for passengers travelling shorter distances.
Online App-based		
RHA Car	Cambodia (Grab), Indonesia (Gojek, Grab), Thailand (Grab, Bolt), Vietnam (Grab)	Online platform app-based taxi services operated by registered drivers.
Car-sharing	Thailand (HAUPCAR), Indonesia (Ha:mo, TREVO), Vietnam (SENCAR) Malaysia (Socar. TREVO) Singapore (GetGo, Blue SG, Tribe Car) Philippines (Mobii)	Shared car services, where vehicles can be hired by the hour via an app.

Table 11: ISM Modes in Southeast Asia: Others

ISM Mode	Country	Description
Boat	Thailand, Vietnam (long-tailed boats)	River and canal transport in waterfront cities.
Horse-drawn carriages	Indonesia (Delman), Thailand (Rod mah, Lampang)	Horse-drawn carriages in tourist areas.

The diverse range of ISM options across Southeast Asia reflects their adaptability to urban, suburban, and rural needs. These modes span both traditional, offline services and modern, app-based solutions, highlighting the transition from informal to more structured, tech-enabled mobility systems.

For two-wheeled vehicles, motorcycle taxis dominate the ISM landscape in urban and suburban areas. Traditional offline services—such as motodop in Cambodia, ojek in Indonesia, win-motosai in Thailand), and xe ôm in Vietnam, serve as crucial first- and last-mile transport solutions where mass transit is limited. The rise of app-based platforms like Grab and Gojek has enhanced this service with real-time ride-matching, improved convenience, and transparent pricing, particularly in dense urban centres.

Three-wheelers play a prominent role in short-distance transport, particularly in tourist areas. Iconic vehicles such as Thailand's tuk-tuk, Indonesia's bajaj, and Vietnam's cyclo are valued for their affordability and cultural significance. While traditional offline models remain popular, eco-friendly alternatives—such as electric tuk-tuks and bajaj—are emerging, particularly in Cambodia and Thailand. App-based services further integrate these vehicles into urban transport networks, enhancing efficiency and sustainability.

For four-wheeled vehicles, informal vans and minibuses, such as Thailand's songthaew and Indonesia's angkot, provide flexible transport in suburban areas and small towns with limited public transit. However, their use is declining as app-based ride-hailing services like Grab and Bolt gain popularity, offering more standardised and regulated alternatives. Additionally, shared cars and pre-booked vans are increasingly used for airport transfers and group travel, reflecting a shift towards more organised transport solutions.

Some ISM modes serve both functional and tourism-driven purposes. Boats and horse-drawn carriages, while niche in some contexts, play a significant role in local economies. Long-tailed boats in Thailand provide critical transport for river-based communities while also attracting tourists exploring Bangkok's floating markets and canal networks. Similarly, Indonesia's delman carriages remain a nostalgic attraction in semi-urban areas, blending cultural heritage with modern tourism. These modes contribute to the tourism sector's competitiveness and provide income-generating opportunities for local operators. However, their increasing popularity among tourists has raised concerns about congestion, accessibility for local residents, and environmental impact, especially in cases where boats rely on polluting engines.

Beyond individual ISM modes, the sector is evolving due to digitalisation. While offline transport remains essential, particularly in areas with low digital penetration, app-based services are expanding, enhancing convenience, efficiency, and regulatory oversight. The competition between informal operators, platform-based services, and government-regulated transport underscores the need for policies that balance innovation with accessibility. As SEA moves towards more digitalised mobility solutions, its ISM sector continues to evolve, blending tradition with modernisation to meet diverse transport needs.

3.3. Taxonomic Assessment of ISM Modes

This section offers an assessment of the presence of ISM modes in the four study countries—Cambodia, Indonesia, Thailand, and Vietnam—based on the taxonomy definitions of ISM modes presented earlier. A comprehensive overview of the ISM landscape in the four countries is provided in Tables 12 and 13. Each mode in each country is categorised according to its operating model, regulatory framework, and governance level. The findings are primarily informed by interviews with national experts.

Table 12: Presence of ISM Modes in the Four Study Countries

ISM Modes	Thailand	Vietnam	Indonesia	Cambodia
Traditional motorcycle taxi (Win)	0	0	0	0
RHA motorcycle taxi	0	0	0	-
Shared bicycle	0	0	0	-
Shared E-scooter	-	-	0	-
Tuk-tuk (motor tricycle)	0	-	0	0
Shared tuk-tuk	0	-	-	-
Pedicabs	-	0	0	0
songthaew	0	-	0	-
Passenger vans	0	0	0	0
Car-sharing	0	0	-	-
Shared minibuses	-	0	0	-
Bajaj (motor tricycle)	-	-	0	0
Cyclo (human-powered tricycle)	-	0	-	0

Table 13: Defining Characteristics of ISM Modes: Operations, Payment, and Regulations

ISM Modes	Fixed Route	Online-Hailing	E-payment	Cash Payment	Basic Licence Required	Vehicle Registration
Traditional motorcycle taxi (Win)	-	-	0	0	0	0
RHA motorcycle taxi	-	0	0	0	0	0
Shared bicycle	-	-	0	-	-	-
Shared E-scooter	-	0	0	-	-	-
Tuk-tuk (motor tricycle)	0	-	-	0	0	0
Shared tuk-tuk	0	0	0	-	0	0
Pedicabs	-	-	-	0	-	-
songthaew	0	-	-	0	0	0
Passenger vans	0	-	0	0	0	0
Car-sharing	-	0	0	0	0	0
Shared minibuses	0	-	-	0	0	0
Bajaj (motor tricycle)	0	-	-	0	0	0
Cyclo (human-powered tricycle)	-	-	-	0	-	-

Note: '0' (circle) → the feature is present / applicable; '-' (dash) → the feature is not present / not applicable

ISM has developed under specific social, economic and environmental conditions in each country, with similarities and differences. The characteristics of each country are described in this report with a focus on the urban environment, institutional context, geographical factors and their respective peculiarities. The current conditions of the existing ISM systems in first and second-tier cities in the study countries, and the challenges they face, are clarified through systematic comparative analysis. The characteristics of ISM modes in each country, in terms of urban, institutional, and geographical contexts, as well as unique features, are summarised in Table 14.

Table 14: Comparisons of Characteristics of ISM Modes in the Study Countries

Characteristics	Thailand	Indonesia	Vietnam	Cambodia
Urban Context	- Motorcycle taxi wins and songthaews continue to play a crucial role, particularly in providing first- and last-mile connectivity where mass transit options are limited - RHAs emerging as urban disruptors - Last-mile gaps persist in Bangkok	- Gojek and Grab dominate urban mobility - Bajaj serve niche needs but face competition from RHAs - Angkot is included in formal transport under the Jak Lingko project in Jakarta	- RHA-type motorcycle taxis dominate - Transition to electric micromobility gaining attention - Urban air pollution from petrol bikes remains severe	- Bajaj dominate - Limited formal transit - Public buses are underutilised due to fragmented routes and poor service integration
Institutional Context	- Fragmented governance hampers efficiency - Emerging innovative city-level systems like Khon Kaen's integration efforts - EV policy implementation	- RHAs face partial formalisation, with Gojek and Grab driving self-regulation - Local governments struggle to balance informal and formal systems	- Strong inter-ministerial coordination ensures BRT and ISM co-existence - Formalisation efforts hindered by limited capacity to enforce policies	- Minimal oversight, reliance on informal driver associations for operations - Lack of clear regulatory structure limits ISM innovation
Geographical Context	- Songthaew is heavily used in rural areas and peri-urban regions - Urban sprawl creates demand for wins as first- and last-mile solutions in Bangkok - Limited public transport beyond urban cores - ISMs are important	- RHAs support sub-urban and peri-urban travel - With expanding market share to RHAs in second-tier cities, primary demand for traditional ISMs (e.g., delman and becak) has shifted to Indonesian tourists	- High reliance on motorcycles across peri-urban and urban areas - Dense networks of ISM, but peri-urban areas lack formal transit options -Cyclo has completely shifted its usage to tourism in second-tier cities	- Rural-to-urban migration drives increased ISM dependency - Motodop lost their presence with urban competition between Bajaj and remorques
Unique Features	- Songthaews', with flexible routes and low costs, retain a strong user base in mid-sized cities - Wins expected to maintain some market presence after RHAs are introduced	- Gojek is part of the public transport and financial integration system -Unique traditional ISM modes, such as delman and becak, maintain some presence in Yogyakarta	-Vinfast driving initiatives to promote electric two-wheelers and reduce air and noise pollution. - Almost complete shift of traditional xe ôm to full RHA type	- ISM has replaced the underdeveloped public transport system - Affordability drives bajaj competition with traditional remorques

The ISM ecosystem in Thailand relies on both traditional and emerging transport solutions. While public transport in Bangkok is improving, Win remains the mainstay for commuters, especially in suburban and peri-urban areas, due to first- and last-mile connectivity challenges. On the other hand, songthaews play an important role in most urban areas outside of Bangkok, where public transport is less developed, including secondary cities like Chiang Mai and Khon Kaen. However, RHAs are rapidly spreading and disrupting the traditional transport market due to their convenience and digital accessibility. Unlike Cambodia, where there is little formal public transport or regulation of ISM, Bangkok's ISM works in tandem with advanced systems such as BTS and MRT but is underutilised due to integration challenges.

Indonesia has redefined urban ISM with Gojek and angkot seamlessly integrated through digital innovation and transport integration. Jakarta is a good example of this hybrid model, where RHAs dominate urban mobility while traditional modes adapt and remain relevant. Unlike Thailand, where digital disruption is still emerging, RHAs in Indonesia are cementing their role as an essential mobility solution, particularly in last-mile connectivity. However, their rapid expansion has led to a decline in the utilisation of traditional ISM modes such as ojek and bajaj.

Meanwhile, Vietnam is deeply dependent on traditional ISM modes such as xe ôm, complemented by RHAs. In major cities such as Ho Chi Minh City and Hanoi, internal combustion engine (ICE) motorcycles dominate urban mobility and contribute significantly to air and noise pollution. The marked shift towards e-micro-mobility highlights Vietnam's response to environmental challenges, while Indonesia's EV transition follows a different trajectory, contrasting with a slower pace of adoption. However, the efficiency of ISM as a sustainable urban mobility solution is hampered by limited integration of public transport.

Cambodia relies heavily on ISM due to the lack of an extensive formal transport system. RHA-type modes such as bajaj and remorque dominate the urban mobility landscape in Phnom Penh and serve as important alternatives to poorly-performing public buses. Interestingly, motodop presences have declined with the rise of bajaj. The RHA has also eliminated motorcycle modes, in contrast to Vietnam's growing e-micromobility initiative, although apps such as Tada have also introduced e-bajaj, for example. This highlights a major gap in sustainable innovation to address congestion and air pollution, where Cambodia's reliance on conventional modes is a major gap.

The following section explores ISM characteristics in each of the four countries.

Cambodia (See Table 15)

Cambodia's ISM sector is a dynamic blend of traditional transport modes and emerging technological solutions, catering to the diverse mobility needs of urban and rural populations. However, the sector remains largely informal, with significant regulatory and infrastructural challenges that hinder its development and integration into a cohesive transport network. See Table 15.

The two-wheeler segment in Cambodia is primarily dominated by motodops, traditional motorcycle taxis that provide flexible, point-to-point transportation. They operate applying a cash-based, hail-and-ride model without fixed routes or schedules. Users are mostly local and their numbers are decreasing due to the rise of bajaj (motorised-tricycles) and online-based ISM services, so the specific pick-up locations depend on their distribution. Operators are required to have basic driver's licences and vehicle registration. Lack of professional licensing and zadoption of commercial vehicle standards for motodops and bajaj highlights the informality of this mode. Additionally, motodop operators have no access to welfare programmes or formal credit mechanisms, leaving them economically vulnerable.

In major urban areas, particularly tourist hotspots like Phnom Penh and Siem Reap, motorcycle and electric bike rental services are also available, catering largely to tourists. App-based electric motorcycle sharing services, such as Go2, have emerged as a modern and eco-friendly alternative, offering convenience and flexibility. However, these services are still in early stages of adoption and face challenges related to scalability, regulatory support, and infrastructure development.

In the three-wheeler segment, the cyclo (human-powered tricycle) holds cultural significance, primarily serving as a tourist attraction in cities like Phnom Penh. Operating informally with cash payments, cyclos lack digital integration and regulatory oversight, functioning more as heritage symbols than practical transport modes. Motorised three-wheelers, such as bajajs, provide short-distance transport with cash and e-payment options, and are accessible through app-based hailing platforms. However, enforcement of vehicle registration and driver licensing is inconsistent, and commercial licensing is rare. Another common mode is the remorque—a motorcycle towing a passenger trailer—often preferred for group travel. Operating with minimal oversight, remorques rely on cash payments and on-street hailing, with no defined schedules or governance, reflecting their adaptability and informal nature.

Four-wheeled ISM modes in Cambodia include RHA cars and passenger vans. RHAs operate as on-demand ride-hailing services, while app-based remorques blend ride-hailing with informal street-hailing. Passenger vans follow fixed routes for intercity and peri-urban travel. RHAs and remorques require basic registration and licensing but face inconsistent enforcement, whereas passenger vans often operate informally. Governance is centralised for RHAs, while remorques and passenger vans fall under mixed central and local regulation, limiting integration into the local public transport systems. Passenger vans fill a critical gap in Cambodia's transport system and can be classified into three main types: fixed-route services, RHA-based operations, and pre-arranged rentals with drivers. Fixed-route vans, which are the most common, play a key role in connecting suburban and rural areas to urban centres, particularly for group travel and long-distance routes, though they often operate with minimal oversight. RHA-based vans, though less prevalent, provide greater flexibility for on-demand travel via digital platforms. Pre-arranged rental services cater to specific consumer needs, such as family trips. Their classification as ISM is unclear, as they primarily serve private users rather than operating as shared or publicly accessible transport services. They are not regulated or part of formal transport operations.

Cambodia's ISM sector is weakly governed, with minimal oversight, no local government involvement, and negligible infrastructure support. Across all ISM modes, cash payments remain dominant, with e-payment adoption gradually increasing among app-based services like RHAs and shared e-scooters. Integration with centralised payment systems is limited, reflecting the fragmented governance structure. Operators are treated as informal labour. They lack access to welfare benefits, credit, and consistent taxation. On the other hand, Kinship-based parking associations, like those of Phnom Penh's tuk-tuk drivers, play a key governance role, by providing self-regulation, customer allocation, and social support. While they counterbalance platform economies and weak governance, their exclusivity creates barriers to newcomers, complicating efforts to provide equitable access to the market (Jack, 2020).

The ISM sector also faces broader systemic challenges that undermine its development. Regulatory gaps, such as weak enforcement of vehicle registration and driver licensing standards, leave many operators unregulated and creating safety and accountability concerns. The absence of effective governance and integrated payment systems limits the scalability and efficiency of both traditional and modern ISM modes. Additionally, the lack of welfare programs and credit access exposes workers to economic risks without safety nets.

Limited infrastructure also creates significant barriers to ISM efficiency, accessibility, and scalability. Without adequate investment in urban infrastructure, such as dedicated lanes, well-maintained roads, and safe pick-up and drop-off points, ISM systems struggle to operate effectively. Lack of infrastructure hinders the ability of ISM systems to integrate seamlessly with formal transport modes and limits their capacity to meet growing demand, while reducing user convenience. Moreover, insufficient infrastructure increases safety risks and operational costs, further constraining the potential of ISM to serve as a viable and sustainable mobility solution.

Despite these challenges, Cambodia's ISM landscape remains adaptable and diverse, addressing the mobility needs of its population in the absence of robust formal transport systems. While innovations like RHAs show potential for modernising the sector, substantial reforms in regulation, governance, and infrastructure are essential to unlock their full potential. This statement does not mean that Bajaj is primarily meeting the needs of non-local passengers, but emphasises that motodop and remorque are still important modes of transportation for certain local residents.

Table 15: Classifications of ISM Modes in Cambodia

Main Segments	ISM Types/Sub-categories	Two-wheeler		Three-wheeler		Four-wheeler			
		Motodop (traditional motorcycle taxi)	Shared e-scooter	Cyclo (human-powered tricycle)	Bajaj (motor-tricycle)	RHA car	remorque (trailer attached motorcycle)	RHA Remorque	Passenger Van
Service Operations and Payment Models	Fixed Route	No	No	No	No	No	No	No	No
	Fixed Stop	No	Yes and No	No	No	No	No	No	No
	Fixed Territory	No[9]	Yes and No	No[10]	No	No	No	No	No
	Fixed Schedule	No	No	No	No	No	No	No	No
	Online Hailing	No	No	No	Yes	Yes	No	Yes	Yes
	On-street Hailing	Yes	No	Yes	Yes	Yes	Yes	Yes	No
	E-payment	No	Yes	No	Yes	Yes	No	Yes	Yes
	Cash payment	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
	Integrated payment platform	No	No	No	Yes	Yes	No	Yes	No
Regulations	Basic drivers' licence	Yes	No	No	Yes	Yes	Yes	Yes	Yes
	Professional driver's licence	No	No	No	No	No	No	No	No
	Basic Vehicle Registration	Yes	No	No	Yes	Yes	Yes	Yes	Yes
	Public/ Commercial Vehicle Registration	No	No	No	Yes	Yes	Yes	Yes	No
	Operator* licence	No	No	No	Yes	Yes	No	Yes	No
	Private welfare (worker)	No	No	No	No	No	No	No	No
	Government welfare (worker)	No	No	No	No	No	No	No	No
	Access to credit (gov/private/both)	P	P	P	P	P	P	P	P
	Fare	No	No	No	No	No	No	No	No
	Schedule	No	No	No	No	No	No	No	No
	Number of vehicles	No	No	No	No	No	No	No	No
	Number of drivers	No	No	No	No	No	No	No	No
Level of Governance	Geographical limitation	No	Yes	Yes	No	No	No	No	No
	Central Government	No	Yes	No	No	No	No	No	No
	City Government	No	No	No	No	No	No	No	No
	Infrastructure support	No	No	No	No	No	No	No	No
	Income Tax	No	Yes	No	No	Yes	No	Yes	No

[9] Most drivers tend to define their own zones.
[10] Most drivers tend to define their own zones.

Indonesia (See Tables 16 and 17)

The two-wheeler segment in Indonesia's ISM sector is dominated by ojeks, traditional motorcycle taxis that provide flexible, on-street hailing services without fixed routes, stops, or schedules. Ojeks operate on a cash-based model and require basic driver's licences and vehicle registration. They are largely informal, lacking professional licensing and commercial vehicle standards. Ojol (ride-hailing app-based motorcycle taxis) have emerged as a modern alternative, offering on-demand services through platforms like Gojek and Grab. These services integrate e-payment systems and feature streamlined operations supported by professional licences, welfare programs, and some government oversight. However, enforcement of vehicle and licensing standards is inconsistent, leaving regulatory gaps.

Shared bicycles, such as spekun, and shared e-bikes, including Beam, are increasingly available in urban areas, particularly around universities and tourist zones. These services rely on digital platforms and e-payment systems, with fixed stops and territories providing structured, eco-friendly transport options. However, their adoption remains limited due to inadequate infra-structure and inconsistent city-level support.

Indonesia's three-wheeler ISM modes include motorised options like bajajs (motorised tricycles) and hybrid models such as becak motor (bentor), which combine motorcycles with traditional pedicab designs. These modes primarily operate in fixed territories, with cash payments as the dominant transaction method. While basic vehicle registration and driver licensing are required, enforcement is often lax, and professional licensing is rare.

Traditional human-powered becaks remain a cultural symbol in many Indonesian cities but are increasingly marginalised, serving as niche options in certain neighbourhoods or tourist areas. Variants such as becak kayuh berkreatif, which integrate creative designs and unique features, cater to local preferences. These modes rely on cash transactions and informal governance structures, with limited integration into modern transport systems.

Four-wheeler ISM modes include RHA cars, angkots (city passenger vans), and minibuses such as Metro Mini and Kopaja. RHA cars, offered by platforms like Gojek and Grab, provide flexible, app-based services with e-payment options. These services adhere to basic regulatory requirements, including driver licensing and vehicle registration, but face challenges in enforcing professional standards and commercial vehicle compliance.

Angkots remain a staple of urban and suburban transport, operating on fixed routes with cash payments. These shared passenger vans are affordable and widely used, although they lack integration with digital payment systems and formal schedules. Minibuses like Metro Mini and Kopaja offer similar services but on a larger scale, providing critical connectivity in densely-populated areas. However, these services often operate without strict regulatory oversight, leading to safety and reliability concerns.

Other four-wheeled ISM modes include bemos (small vehicles) and delmans (horse-drawn carriages), which cater to specific local needs. While bemos offer short-distance urban transport, delmans are more common in rural and tourist areas. Both are informal, operating with minimal regulation and relying on cash payments.

Indonesia's ISM system demonstrates a mix of cash and e-payment models. While app-based services like ojol and RHA cars increasingly use digital payment platforms, traditional modes such as ojeks and angkots rely heavily on cash. Integration with centralised payment systems is limited, reflecting the broader challenges of modernizing the ISM sector.

Governance of the transport sector in Jakarta is fragmented, with central and city governments sharing responsibilities but often lacking coordination in planning, regulation, and implementation. Regulatory enforcement, particularly for vehicle and operator licensing, remains inconsistent, resulting in safety and accountability gaps.

To address first- and last-mile connectivity, initiatives like Gojek's GoRide Transit, developed in collaboration with the government, integrate ride-hailing and public transport. Infrastructure support is uneven, with public-private partnerships (PPPs) contributing to specific services, such as shared bicycles, but largely neglecting traditional transport modes.

Overall, Indonesia's ISM sector faces several challenges, including regulatory gaps, limited integration, and insufficient infrastructure. Weak enforcement of licensing and registration standards leaves many operators unregulated. The absence of integrated governance and payment systems hampers the efficiency and scalability of services. Additionally, inadequate infrastructure investment restricts the growth of sustainable modes like shared bicycles and e-bikes.

Despite these challenges, the sector offers significant opportunities for modernisation. App-based platforms have introduced greater structure and convenience to ISM, with potential for broader adoption of digital tools and welfare programmes to support operators. Traditional modes, such as angkots and becaks, can also benefit from improved regulation and targeted investments to enhance safety and reliability.

Table 16: Classifications of ISM Modes in Indonesia (Two- and Three-wheelers)

Main Segments	ISM Types/Sub-categories	Two-wheeler				Three-wheeler			
		Ojek (Traditional motor-cycle taxi)	Ojol (RHA motorcycle taxi)	Shared bicycle (Spekun)	Shared E-bikes (Beam)	Bajaj (motor tricycle)	Becak (human-pow-ered tricycle)	Becak Motor (Bentor)	Becak Kayuh Berkreatif
Service Operations and Payment Models	Fixed Route	No	No	No	No	No	No	No	No
	Fixed Stop	No	No	Yes	Yes	No	No	No	No
	Fixed Territory	Yes*	No	Yes	Yes	Yes*	Yes*	Yes*	Yes
	Fixed Schedule	No	No	No	No	No	No	No	No
	Online Hailing	No	Yes	No	No	No	No	No	No
	On-street Hailing	Yes	Yes[11]	No	No	Yes	Yes	Yes	No
	E-payment	No	Yes	Yes[12]	Yes	No	No	No	Yes
	Cash payment	Yes	Yes	No	No	Yes	Yes	Yes	No
	Integrated payment platform	No	Yes	No	No	No	No	No	No
Regulations	Basic drivers' licence	Yes	Yes	No	No	Yes	No	Yes	No
	Professional driver's licence	No	No	No	No	Yes	No	No	No
	Basic Vehicle Registration	Yes	Yes	No	No	Yes	No	Yes	Yes
	Public/ Commercial Vehicle Registration	No	No	No	No	Yes	No	No	No
	Operator* licence	No	Yes*	No	Yes	Yes	No	No	No
	Private welfare (worker)	No	Yes*	No	No	No	No	No	No
	Government welfare (worker)	Yes	Yes*	No	Yes*	Yes*	Yes*	Yes*	No
	Access to credit (gov/private/both)	P	P	No	P	P	P	P	P
	Fare	No	Yes	No	No	No	No	No	No
	Schedule	No	No	No	No	No	No	No	No
	Number of vehicles	No	No	No	Yes	No	No	No	No
	Number of drivers	No	No	No	No	No	No	No	No
Level of Governance	Geographical limitation	No[13]	No	Yes	Yes	Yes	No	Yes	Yes
	Central Government	Yes	Yes	No	No	Yes	No	No	No
	City Government	Yes	Yes	No	Yes	Yes	Yes	No	Yes
	Infrastructure support	No	Yes*	Yes and No	No	No	No	No	Yes
	Income Tax	Yes	No	No	Yes	Yes	Yes	Yes	No

Note: The asterisk indicates that the stated condition generally applies. However, exceptions may exist depending on local regulations, specific operator arrangements, or informal practices.

[11] On-street hailing only available for Grab Bike.
[12] Free service.
[13] Some restrictions on movement of territories due to competition between drivers.

Table 17: Classifications of ISM Modes in Indonesia (Four-wheelers and Others)

Main Segments	ISM Types/Sub-categories	Four-wheeler					Others
		RHA car	Angkot (passenger vans in the cities)	Car-sharing	Bemo (four-wheeled small vehicles)	Minibus (Metro Mini, Kopaja)	Delman (horse-drawn carriage)
Service Operations and Payment Models	Fixed Route	No	Yes	No	No	Yes	No
	Fixed Stop	No*	Yes	Yes	No	Yes	No
	Fixed Territory	No	Yes	No	Yes*	Yes	No
	Fixed Schedule	No	No	No	No	No	No
	Online Hailing	Yes	No	No	No	No	No
	On-street Hailing	Yes	Yes	No	Yes	Yes	Yes
	E-payment	Yes	No	Yes	No	No	No
	Cash payment	Yes	Yes	Yes	Yes	Yes	Yes
	Integrated payment platform	No	No	No	No	No	No
Regulations	Basic drivers' licence	Yes	Yes	Yes	Yes	Yes	No
	Professional driver's licence	Yes	Yes	No	Yes	Yes	No
	Basic Vehicle Registration	Yes	Yes	Yes	Yes	Yes	No
	Public/ Commercial Vehicle Registration	Yes*	Yes	No	Yes	Yes	No
	Operator* licence	Yes	Yes	No	Yes	Yes	No
	Private welfare (worker)	Yes*	No	No	No	No	No
	Government welfare (worker)	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*
	Access to credit (gov/private/both)	P	P	P	P	P	P
	Fare	Yes	Yes	No	No	Yes	No
	Schedule	No	No	No	No	No	No
	Number of vehicles	No	No	No	No	No	No
	Number of drivers	No	No	No	No	No	No
Level of Governance	Geographical limitation	No	Yes	No	Yes	Yes	Yes
	Central Government	Yes	Yes	Yes	Yes	No	No
	City Government	Yes	Yes	No	Yes	Yes	Yes
	Infrastructure support	Yes	Yes	PPP	No	Yes	No
	Income Tax	Yes	Yes	Yes	Yes	Yes	Yes

Thailand (See Tables 18 and 19)

Thailand's ISM system offers a variety of two-, three-, and four-wheeled transport options, each catering to the unique mobility demands of urban and suburban areas.

Traditional motorcycle taxis called win-motosai operate within fixed territories and have designated stations but lack defined routes or schedules. They offer flexible point-to-point services based on passenger demand. They rely on both cash and e-payment methods, primarily using commercial banks' QR codes, but are not integrated into centralised payment platforms. Professional driver's licences and basic vehicle registration are mandatory, and some operators have access to private welfare and credit systems. Governance is centralised, with geographical limitations strictly enforced. Each driver must belong to an association, known as a "win," and may only pick up passengers from locations where the association is registered. By contrast, RHA motorcycle taxis offer modern, on-demand services through online platforms with streamlined e-payment options and generally operate without geographical restrictions. While commercial vehicle registration is required, enforcement remains inconsistent, highlighting a regulatory gap in this rapidly growing sector.

Shared two-wheeler options, such as the Pun Pun bicycle-sharing system in Bangkok and shared e-scooters in Bangkok and Chiang Mai, provide flexible, sustainable transportation solutions. They operate with digital payment systems but minimal regulatory requirements, catering to localised urban needs. However, many of these services have struggled to scale their operations.

Among three-wheelers, the traditional tuk-tuk remains an enduring symbol of Thai transport, popular for short trips within fixed territories, even though their numbers have decreased as local users have shifted to other modes. Tuk-tuks accept both cash and e-payments, though they are not linked to integrated payment platforms. Regulatory compliance, including professional driver licensing and vehicle registration, is required and enforced under centralised governance.

The shared tuk-tuk (MuvMi), a modern, electric-powered alternative, incorporates app-based hailing and e-payment features, reflecting growing popularity of app-based ride-hailing services in Thailand. Meanwhile, the Skylab, a converted three-wheel motorcycle, operates primarily in rural areas within fixed territories but without defined routes or stops. Skylab operators depend on cash payments and face minimal regulatory oversight.

Pedicabs (human-powered tricycles) have largely transitioned from being a major mode of local transportation to serving primarily as a tourist attraction, offering eco-friendly and informal transport options in select areas in tourist cities such as Chiang Mai. Pedicabs operate on a hail-and-ride basis, with no significant integration of payment systems or regulations.

Four-wheeler modes include traditional vehicles, like converted songthaew (converted pickup trucks) and vans, and modern, technology-driven solutions such as RHAs and car-sharing services. RHA cars have become a popular mobility option, offering on-demand service through

online hailing and e-payment systems. These services require basic and professional driver's licences and vehicle registration, though enforcement of public or commercial registration remains inconsistent. Traditional modes such as songthaew and silorlek (smaller pickup trucks) remain critical for fixed-route transport, particularly in suburban areas and secondary cities. While songthaew typically follow fixed stops and schedules, silorlek operate with greater flexibility, serving fixed territories and relying on cash payments. Both modes are subject to vehicle registration and professional driver licensing requirements. They are not integrated with digital payment platforms.

Passenger vans are another key segment of four-wheeler ISM modes, categorised into fixed-route vans and pre-arranged vans. Fixed-route vans follow predefined schedules and stops, providing reliable services in areas with limited mass transit infrastructure. Pre-arranged vans cater to group travel and airport transfers, emphasising flexibility and convenience. Both types of van services support cash and e-payment methods but are not integrated into broader payment systems. Although they initially operated without authorisation or other regulation, passenger vans with fixed routes are now regulated, including operator licensing and adherence to schedules, reflecting their transition to a semi-formal status. The vans rely on cash payments, with minimal oversight of vehicle or driver standards, yet they address a critical gap in areas without institutionalised paratransit services.

Modern innovations include car-sharing services such as Haupcar and Ha:mo, which allow users to rent vehicles for short durations via app-based platforms. These services support e-payment systems but lack integration with other transport networks, reflecting their early-stage development. Additionally, long-tailed boats, overseen by the Marine Department, offer a region-specific solution for waterfront transport along Bangkok's rivers and canals. Operating at fixed stops, these boats are vital for both locals and tourists. However, they face challenges, including inadequate infrastructure support and inconsistent regulatory enforcement.

Across Thailand's ISM categories, payment systems vary from traditional cash-based transactions in modes like songthaew and silorlek to e-payment systems favoured by app-based services such as RHAs and vehicle-sharing platforms. Informal transport modes in Thailand are more regulated than in many other countries, with motorcycle taxis and fixed-route passenger vans operating under quota systems. However, regulatory enforcement remains inconsistent, allowing for the occasional use of unauthorised vehicles.

A notable trend within ISM is the gradual adoption of e-payment systems, driven primarily by app-based services and the government-backed digital payment system. However, traditional ISM options like motorcycle taxis and songthaews remain heavily reliant on cash, highlighting the coexistence of conventional and modern mobility solutions. Governance of ISM remains largely centralised, with limited involvement from city-level authorities or investment in infrastructure support. Employment-based welfare programs are generally limited, with some coverage by the government-backed Social Security Fund, while access to private welfare and credit systems remains uneven.

Table 18: Classifications of ISM Modes in Thailand (Two- and Three-wheelers)

Main Segments	ISM Types/ Sub-categories	Two-wheeler				Three-wheeler			
		Traditional motorcycle taxi (Win-motosai)	RHA motorcycle taxi	Shared bicycle (pun pun)	Shared E-scooter	Tuk-tuk (motor tricycle)	Shared tuk-tuk (muvmi)	Skylab (converted 2/3 wheels motorcycle)	Pedicabs (human-powered tricycle)
Service Operations and Payment Models	Fixed Route	No	No	No	No	No	No	No	No
	Fixed Stop	No	No	Yes and No	Yes and No	No	No	No	No
	Fixed Territory	Yes	No	Yes and No	Yes and No	Yes	Yes	Yes	No
	Fixed Schedule	No	No	No	No	No	No	No	No
	Online Hailing	No*	Yes	No	No	No	Yes	No	No
	On-street Hailing	No*	No	No	No	Yes	No	Yes	Yes
	E-payment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
	Cash payment	Yes	Yes	No	No	Yes	No	Yes	No
	Integrated payment platform	No	No	No	No	No	No	No	No
Regulations	Basic driver's licence	Yes	Yes	No	No	Yes	Yes	No	No
	Professional driver's licence	Yes	Yes	No	No	Yes	Yes	Yes	No
	Basic Vehicle Registration	Yes	Yes	No	No	Yes	Yes	No	No
	Public/ Commercial Vehicle Registration	Yes	Yes* (not enforced)	No	No	Yes	Yes	No	No
	Operator* licence	Yes	No	No	No	Yes	Yes	No	No
	Private welfare (worker)	Yes*	Yes*	No	No	No	Yes	No	No
	Government welfare (worker)	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*
	Access to credit (gov/private/both)	P	P	N	N	P	P	P	P
	Fare	Yes	No	No	No	No	No	No	No
	Schedule	No	No	No	No	No	No	No	No
	Number of vehicles	Yes	No	No	No	Yes	Yes	No	No
	Number of drivers	Yes	No	No	No	No	No	No	No
Level of Governance	Geographical limitation	Yes	No	Yes	Yes	Yes	Yes	No	No
	Central Government	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	City Government	No	No	No	No	No	No	No	No
	Infrastructure support	No	No	PPP	No	No	No	No	No
	Income Tax	No	Yes	Yes	Yes	No	No	Yes	No

Table 19: Classifications of ISM Modes in Thailand (Four-Wheelers and Others)

Main Segments	ISM Types/Sub-categories	Four-Wheeler							Others
		RHA car	Songthaew fixed route EG BKK (converted pick-up trucks)	Silorlek (converted small pick-up trucks)	Passenger vans fixed route	Passenger vans pre-arranged	Informal school shuttles	Car-sharing (Haupcar /Ha:mo)	Boats
Service Operations and Payment Models	Fixed Route	No	No	Yes	No	No	No	No	No
	Fixed Stop	No	No	Yes	No	No	No	Yes	No
	Fixed Territory	No	Yes	No	Yes	No	No	No	No
	Fixed Schedule	No	No	No	Yes	No	Yes	No	No
	Online Hailing	Yes	No	No	No	Yes	No	No	No
	On-street Hailing	No	Yes	Yes	No*	No	No	No	No
	E-payment	Yes	No	No	Yes	Yes	Yes	Yes	No
	Cash payment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
	Integrated payment platform	No	No	No	No	No	No	No	No
Regulations	Basic drivers' licence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Professional driver's licence	Yes	Yes	Yes	Yes	No	No	No	Yes
	Basic Vehicle Registration	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Public/ Commercial Vehicle Registration	Yes* (not enforced)	Yes	Yes	Yes	No	No	No	Yes
	Operator* licence	No	No	Yes	Yes	No	No	No	No
	Private welfare (worker)	No	No	No	No	No	No	No	No
	Government welfare (worker)	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*
	Access to credit (gov/private/both)	P	P	P	P	P	P	P	P
	Fare	Yes	No	Yes	Yes	No	No	No	No
	Schedule	No	No	No	Yes	No	No	No	No
	Number of vehicles	No	No	Yes	Yes	No	No	No	Yes
	Number of drivers	No	No	No	No	No	No	No	No
Level of Governance	Geographical limitation	No	No	Yes	Yes	No	No	No	No
	Central Government	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	City Government	No	No	No	No	No	No	No	No
	Infrastructure support	No	Yes	Yes	Yes	No	No	PPP[14]	Yes
	Income Tax	Yes	Yes	Yes	No	No	No	Yes	Yes

[14] Public-Private Partnerships

Vietnam (See Table 20)

The traditional xe ôm (motorcycle taxi) has long been a cornerstone of Vietnamese urban mobility, offering flexible, point-to-point service without fixed routes or schedules. These services operate on a cash-only basis and are typically accessed through on-street hailing. Drivers are required to possess a basic driver's licence and vehicle registration. The absence of professional licensing and commercial vehicle registration underscores the sector's informality. Notably, xe ôm drivers often lack access to welfare programmes or credit facilities, rendering them economically vulnerable.

In recent years, RHAs have revolutionised the two-wheeler ISM segment. Platforms like GrabBike and Be provide on-demand motorcycle taxi services accessible via smartphones, integrating e-payment systems for user convenience. These services necessitate basic driver's licences and vehicle registrations, with some operators obtaining additional operator licences. Despite these advancements, enforcement of public or commercial vehicle registration remains inconsistent, and drivers typically do not receive private or government welfare benefits.

Shared bicycle services, such as TNGo, have been introduced in urban areas to promote sustainable transport. These systems operate with fixed stops and territories, utilising e-payment methods. However, lack of comprehensive infrastructure support and limited integration with other transport modes have hindered their widespread adoption.

Xích Lô (cyclo or pedicab) is a traditional human-powered tricycle primarily serving tourists in cities like Hue and Hoi An. Operating on a hail-and-ride basis with cash payments, xích lô services lack formal regulatory oversight and integration with modern payment platforms, reflecting their informal status. However, the sector faces challenges due to an ageing driver population: most operators are older individuals. While younger individuals might take up human-powered tricycle operations in some contexts, this is unlikely in tourism-oriented cities, where the profession remains unattractive to the younger generation. This age demographic raises concerns about the long-term viability of xích lô in Vietnam's urban transport landscape.

Ride-hailing applications have also penetrated the four-wheeler market, offering car services that can be hailed online and paid for via e-payment systems. Drivers are required to have basic driver's licences and vehicle registrations, with some obtaining operator licences. However, like their two-wheeler counterparts, enforcement of commercial vehicle registration is inconsistent, and drivers often lack access to welfare programmes.

Xe Khách (shared minibus) serves as a vital mode of transportation, especially for intercity travel. These services operate on fixed routes and schedules, with passengers typically hailing them on the street and paying in cash. Drivers are required to have basic driver's licences and vehicle registrations, and these services are subject to central government oversight. However, the lack of integration with digital payment platforms and inconsistent regulatory enforcement present challenges.

Car-sharing services, such as SENCAR, have emerged as a modern alternative, allowing users to rent vehicles for short durations. These services operate with fixed stops and utilise e-payment systems. Drivers are required to have basic driver's licences and vehicle registrations. While these services represent a step towards modernising Vietnam's transportation landscape, they currently operate on a limited scale.

Previously Vietnam's ISM modes predominantly relied on cash payments, but e-payment options are quickly being adopted through app-based services. However, there is a lack of integration with centralised payment platforms across most modes. Regulatory oversight is primarily managed at the central-government level, with some involvement from city authorities, especially in cities with special administrative status such as Ho Chi Minh City and Hanoi. Infrastructure support for ISM modes remains limited, with no established welfare systems or credit mechanisms for operators. For instance, informal motorbike taxi drivers often lack access to social security or loans for vehicles and housing. In addition, income tax policies are applied inconsistently, further entrenching the sector's informality.

Despite these challenges, there are opportunities for modernisation and improvement. The growing adoption of ride-hailing applications indicates a shift towards more organised and efficient transportation services. Integrating e-payment systems and enhancing regulatory frameworks could further formalise the sector, providing better economic security for operators and improved services for users.

Table 20: Classifications of ISM Modes in Vietnam

Main Segments	ISM Types/Sub-categories	Two-wheeler			Three-wheeler	Four-wheeler		
		Xe ôm (Traditional motorcycle taxi)	RHA motorcycle taxi	Shared bicycle (TN Go)	Xích Lô (Cyclo or pedicab)	RHA car	Xe Khách (Shared minibus)	Car-sharing (SENCAR)
Service Operations and Payment Models	Fixed Route	No	No	No	No	No	Yes and No	No
	Fixed Stop	No	Yes and No	Yes	No	No	Yes	Yes
	Fixed Territory	No	Yes and No	Yes	No	No	No	No
	Fixed Schedule	No	No	No	No	No	Yes	No
	Online Hailing	Yes and No	Yes	No	No	Yes	No	Yes
	On-street Hailing	Yes	No	No	Yes	Yes	Yes	No
	E-payment	Yes and No	Yes	Yes	Yes	Yes	Yes	Yes
	Cash payment	Yes	Yes	No	Yes	Yes	Yes	Yes
	Integrated payment platform	No	No	No	No	Yes	No	No
Regulations	Basic drivers' licence	Yes	Yes	No	No	Yes	Yes	Yes
	Professional driver's licence	No	No	No	No	No	No	No
	Basic Vehicle Registration	Yes	Yes	No	No	Yes	Yes	Yes
	Public/ Commercial Vehicle Registration	No	No	No	Yes and No	Yes	Yes	No
	Operator licence	No	No	No	No	Yes	No	No
	Private welfare (worker)	No	Yes and No	No	Yes and No	Yes and No	Yes and No	No
	Government welfare (worker)	No	No	No	No	No	No	No
	Access to credit (gov/private/both)	P	P	No	P	P	P	P
	Fare	No	Yes	No	Yes and No	Yes	Yes	No
	Schedule	No	No	No	No	No	Yes	No
	Number of vehicles	No	No	No	No	No	No	No
	Number of drivers	No	No	No	No	No	No	No
Level of Governance	Geographical limitation	No	Yes	Yes	Yes	No	No	No
	Central Government	No	Yes	No	No	No	No	No
	City Government	No	No	No	Yes and No	No	Yes	No
	Infrastructure support	No	No	Yes and No	No	No	No	No
	Income Tax	No	Yes	No	Yes and No	Yes	Yes	No

Chapter Four: Market Dynamics and Operational Dimensions

To understand the multifaceted role of ISM in passenger transport in Southeast Asia, it is essential to analyse the market dynamics and operational dimensions that collectively shape its operation, evolution, and impact. ISM is not just a mobility solution. It is also a socio-economic phenomenon influenced by diverse factors ranging from business and financing models to technological innovation and governance frameworks. A detailed analysis of key market dynamics and dimensions that define the ISM sector is provided in this chapter, offering insights into the complexity and potential of ISM in Southeast Asia. By analysing these dynamics and dimensions, a comprehensive understanding of ISM's role as a mobility solution and as a driver of socio-economic and environmental transformation is provided in this section.

4.1. Market Dynamics

The ISM sector in Southeast Asia is undergoing profound changes, shaped by a confluence of demographic, economic, financial, technological, and governmental forces. Traditional ISM modes, long embedded in the region's urban and rural passenger transport fabric, are steadily evolving towards motorised, and digitalised alternatives. This transformation is the result of a dynamic interplay of factors that are reshaping mobility markets across the region.

Decline of Traditional ISM

Changing demographics are a major factor driving the decline of traditional ISM in Southeast Asia. The rise of a growing middle class and the influx of younger, tech-savvy populations have shifted transport preferences towards more modern, convenient, and digitally integrated mobility options. As urban lifestyles evolve, demand for slow-moving, labour-intensive ISM modes has diminished, further contributing to their decline.

At the same time, governments across the region are actively promoting more efficient and sustainable urban transport systems. Policies favouring mass transit expansion, electrification, and digital mobility solutions have placed traditional ISM at a disadvantage, accelerating its marginalisation. In some cases, these shifts have been reinforced by explicit bans—major cities such as Bangkok, Jakarta, and Ho Chi Minh City have prohibited non-motorised bicycle rickshaws (cyclo, becak) and horse-drawn carriages (delman) from operating in urban areas. These bans, combined with demographic changes and policy shifts, have significantly reshaped the landscape of ISM in Southeast Asia.

Even though human-powered tricycles continue to be used for ISM in small rural towns, typically operated by older drivers, it is unlikely that younger generations will take up this role once the current operators retire. Economic growth and rising incomes have heightened expectations for

faster, safer, and more comfortable travel options, leading to a decline in demand for traditional ISM modes that struggle to compete.

Broader government policies have also played a pivotal role in curtailing the use of traditional ISM in urban areas. Bans or restrictions on slow-moving vehicles in central business districts, coupled with investments in mass transit and other modern infrastructure, have further displaced traditional ISM modes. Moreover, traditional ISM operators' limited access to financing has hindered their ability to upgrade or adapt their equipment in response to shifting market demand.

Despite their decline in urban centres, traditional ISM modes maintain a foothold in smaller cities and niche markets. In secondary cities like Hue, Da Nang, and Yogyakarta, these modes serve distinct functions, particularly in the tourism sector. Cyclo and becak operators cater to foreign tourists seeking cultural experiences, while in cities like Yogyakarta, horse-drawn carriages remain popular with domestic visitors. Phnom Penh presents a unique case where cyclos serve both tourists and local residents, illustrating their adaptability in specific contexts.

The Rise of Modern ISM

As traditional ISM modes face decline, modern ISM services have emerged as a dominant force in Southeast Asia's mobility landscape. Digital platforms and RHAs such as Grab, Gojek, and Be have revolutionised urban transport, offering convenience, reliability, and transparency. These innovations have transformed how people access mobility services and how operators—many of whom previously worked in the informal sector—engage with customers and platforms.

The widespread adoption of digital technology—particularly smartphones and mobile payment systems—has enabled this shift. Additionally, access to financing for vehicle upgrades and vehicle purchases through platform-backed credit schemes have empowered a new generation of ISM operators. Governments across SEA have also increasingly embraced modern ISM, integrating it into formal transport policies and using it to complement public transit systems. For instance, RHAs are now key players in providing last-mile connectivity, bridging gaps between urban transport networks and peripheral areas. However, the digital divide and financial costs limit access to modern ISM services for lower-income populations, leaving room for traditional modes to persist in certain contexts.

The rise of modern ISM services is not without challenges. Regulatory frameworks remain fragmented, with many governments yet to establish comprehensive policies for ISM, particularly in ensuring passenger safety and operator welfare, let alone integrating ISM into broader transport policies addressing congestion and urban mobility. The rapid expansion of modern ISM, particularly RHAs, has disrupted traditional ISM markets, displacing drivers and intensifying competition with other transport operators. This has led to protests and, in some cases, violent clashes.

The transformation of Southeast Asia's ISM sector reflects the broader evolution of urban mobility in the region. While traditional ISM modes are declining, they persist in niche markets, whereas modern ISM is expanding, driven by demographic shifts, technological advancements, and policy interventions. These changes highlight the complex and rapidly evolving nature of ISM, presenting both challenges and opportunities as cities adapt to an increasingly urbanised and digitalised world.

4.2. Business Models

The business models of ISM in Southeast Asia are diverse and can be understood through four key dimensions: service provider ownership, revenue generation methods, operational approaches, and vehicle ownership arrangements. These dimensions shape the organisation of ISM services and influence their interaction with emerging digital platforms and regulatory frameworks. ISM ownership structures vary, ranging from individual operators, who own and manage their own vehicles, to cooperative models, where drivers collectively coordinate services and share resources. Examples of the latter include jeepney cooperatives in the Philippines and win motorsai groups in Thailand. Increasingly, corporate or platform-based ownership models have emerged, where companies such as Grab and Gojek manage fleets, either owning vehicles directly or leasing them to drivers via digital platforms. Revenue generation methods in ISM also exhibit significant variation. Many operators rely primarily on fare-based income, where earnings come directly from passenger payments, as seen in minibus services in many Southeast Asian cities. Some ISM providers diversify their revenue streams by incorporating additional services such as food and parcel delivery. In platform-based models, revenue is often structured around commission-based earnings, where drivers pay a percentage of their fares to the platform in exchange for access to ride bookings. Unlike traditional public transport, direct subsidies for ISM operations remain relatively uncommon.

Operational approaches in ISM can be broadly categorised into fixed-route, demand-responsive, and hybrid models. Fixed-route services operate along predetermined routes with set schedules, while demand-responsive services, such as motorcycle taxis managed via ride-hailing apps, provide flexible transport based on real-time passenger demand. Hybrid models combine elements of both, as seen in Bangkok's passenger van services, which follow general routes but allow some flexibility in operations.

Vehicle ownership arrangements add another layer of complexity to ISM business models. In owner-operator models, drivers personally own and maintain their vehicles, bearing all associated costs, as is common among informal taxi operators across the region. By contrast, fleet-based models involve vehicles owned by companies or cooperatives, with drivers working as employees or independent contractors, as seen in fleet-managed taxi services in Bangkok. Leasing arrangements are also becoming more common, particularly in platform-based systems, where drivers lease vehicles from companies or cooperatives rather than owning them outright. These

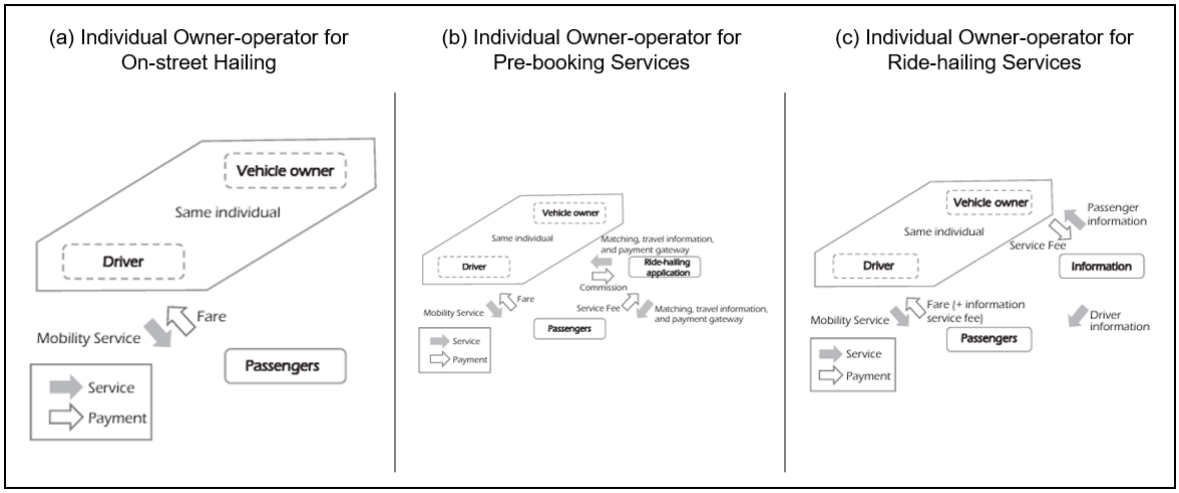

Figure 5: Organisational Structures of Individual Owner/Operator Services
Source: Adapted from Kato and Chalermpong (2024)

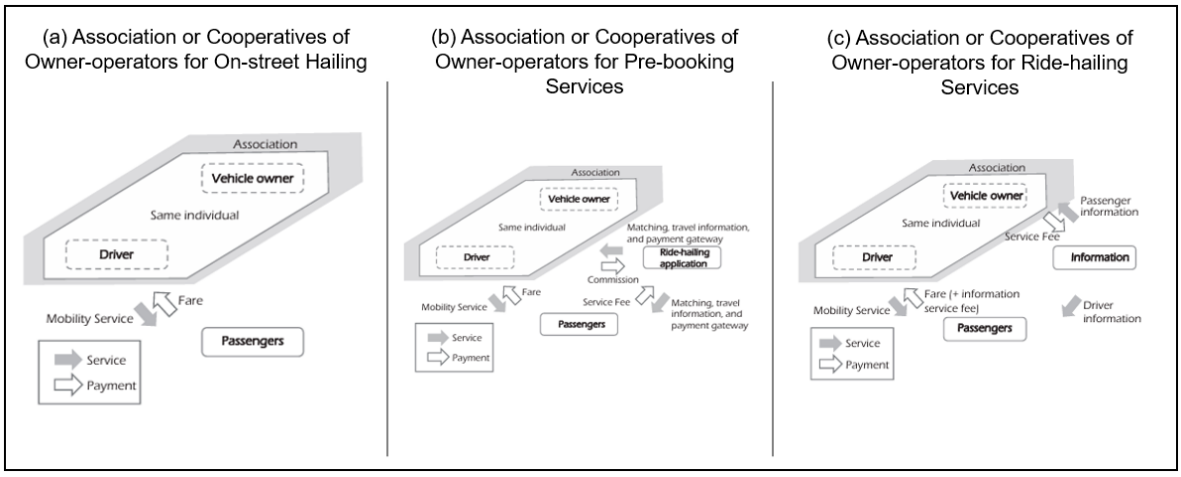

Figure 6: Organisational Structures of Association or Owner/Operator Cooperatives
Source: Adapted from Kato and Chalermpong (2024)

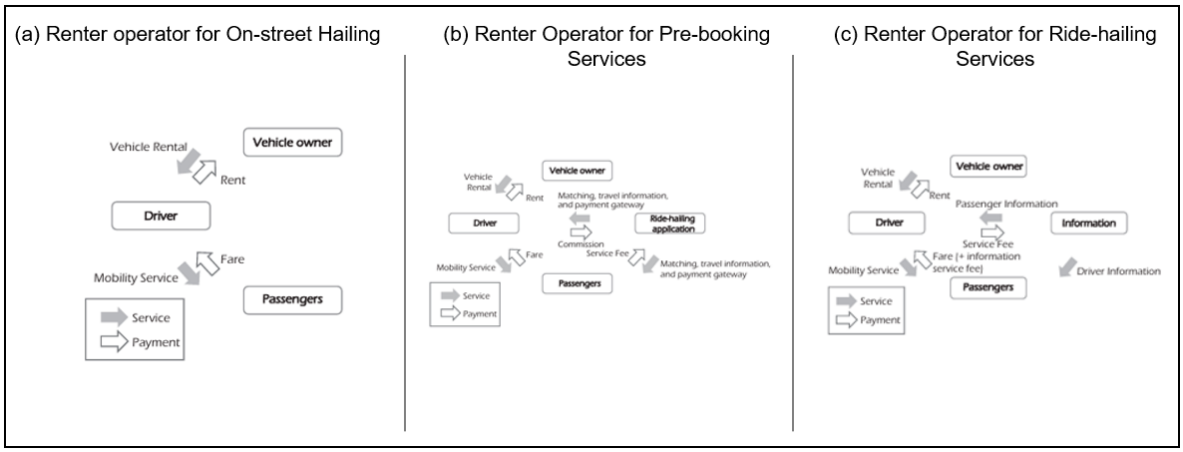

Figure 7: Organisational Structure for Renter Operators
Source: Adapted from Kato and Chalermpong (2024)

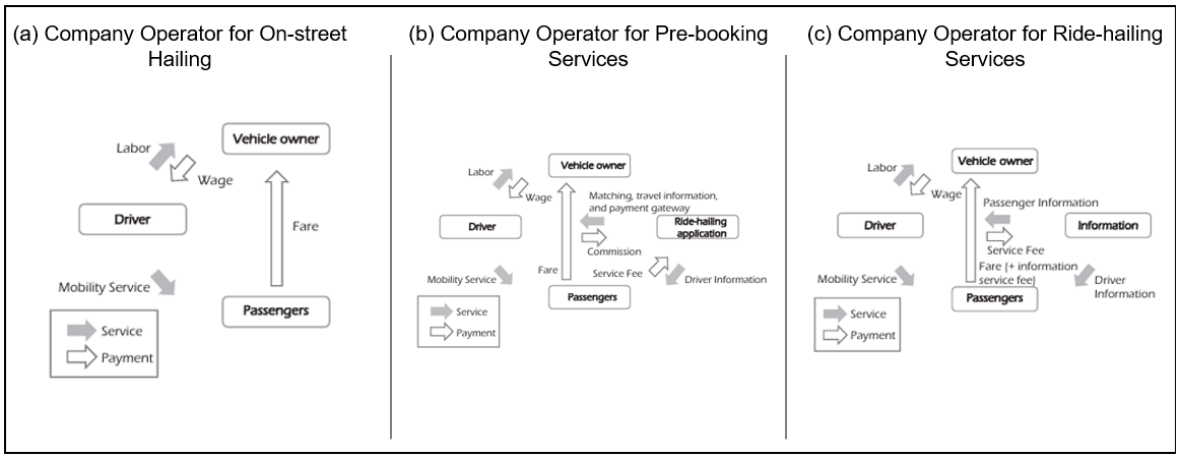

Figure 8: Organisational Structure for Company Operator
Source: Adapted from Kato and Chalermpong (2024)

Together, these elements showcase the diversity of ISM and paratransit models across Asia, highlighting their ability to evolve with technological advancements, urban demands, and regulatory changes.

The unique characteristics and innovations shaping ISM in the four study countries are described below. These country descriptions illustrate how local context drives approaches to ISM operations in SEA.

Cambodia

In Cambodia, individuals own and operate both ISM businesses and vehicles. Motodop (motorcycle taxis) and remorque (motorcycle trailers) drivers own their vehicles, which allows them autonomy but also burdens them with maintenance and operational costs. Recently, RHA platforms such as Grab and PassApp have introduced corporate ownership models that provide drivers access to shared or leased vehicles.

The revenue-generation model in Cambodia remains largely informal for traditional modes. Operators rely on cash payments negotiated directly between passengers and drivers. RHA platforms use commission-based revenue systems with integrated e-payment options, offering greater transparency and efficiency.

The ISM operational approach in Cambodia is highly demand-responsive. Traditional services provided by motodop and remorque operators lack fixed routes and schedules, catering to localised and dynamic passenger demand. RHA platforms follow a similar demand-response model, adding features like route optimisation and app-based bookings to provide a more structured and efficient approach.

Indonesia

Indonesia's ISM sector reflects a mix of individual and corporate ownership. Traditional ojeks (motorcycle taxis) and angkots (shared vans) are predominantly individually owned, with drivers responsible for vehicle operation and maintenance costs. By contrast, app-based platforms such as Gojek and Grab offer a hybrid ownership model, allowing drivers to either use their own vehicles or lease vehicles through platform-associated programmes.

The revenue model in Indonesia has evolved significantly. Traditional ojeks and angkots depend on cash-based fares, while app-based services generate revenue through commissions on rides. In addition, integrated electronic payment systems such as Gojek's Gopay not only streamline transactions but also expand revenue opportunities by creating additional income channels.

Operationally, Indonesia showcases a duality. Traditional ojeks provide flexible, point-to-point, demand-responsive services without fixed routes or schedules, while angkots operate on semi-fixed routes with informal stops. App-based platforms such as Gojek and Grab provide structured, demand-responsive services that leverage ride-matching technology, dynamic pricing, and real-time tracking for efficiency.

Thailand

Thailand's ISM ecosystem comprises a range of individual and corporate ownership models. Traditional ISM modes such as win-motosai and tuk-tuks are individually owned, with drivers bearing full responsibility for their vehicle operation and maintenance costs. App-based services like Grab and MuvMi employ corporate ownership models that include vehicle leasing and shared-use arrangements, particularly for electric tuk-tuks.

The revenue-generation model in Thailand reflects this ownership diversity. Win and tuk-tuk operators rely on cash-based transactions, though they are increasingly adopting digital payment options in urban centres. App-based platforms combine fare-based revenue with commission fees, using robust e-payment systems to streamline and formalise the revenue-generation process.

In terms of operational approaches, Thailand integrates both traditional and modern systems. Traditional win-motosais operate in fixed territories and provide point-to-point services without predefined routes or schedules. Tuk-tuks offer similar services but cater to a wider range of passengers, including tourists. App-based services like Grab and MuvMi have introduced demand-responsive operations with enhanced features such as app-based bookings, QR-code payments, and sustainability-focused EV fleets.

Vietnam

Vietnam's ISM sector relies heavily on individual business ownership for traditional modes such as xe ôm (motorcycle taxis) and xích lô (pedicabs). Drivers are autonomous and responsible for their own vehicles and associated costs. App-based platforms like GrabBike and Be offer corporate-managed models, which lessen driver autonomy. They allow drivers to choose between using their own or leasing corporate-owned vehicles.

The revenue-generating model for traditional xe ôm and xích lô drivers is cash-based, with fares negotiated with passengers on a case-by-case basis. App-based services utilise commission-based standardised revenue-generation structures integrated with e-payment systems, creating a more transparent and efficient process.

Vietnam's operational approach mirrors those of the other study countries, with traditional xe ôm providing highly flexible, demand-responsive services that rely on personal networks and localised knowledge to acquire passengers. These traditional services remain essential for older and rural populations. App-based platforms like GrabBike modernise operations through digital ride-matching, dynamic pricing, and cashless transactions, appealing to younger, tech-savvy users.

Regional overview

Across Cambodia, Indonesia, Thailand, and Vietnam, ownership models range from individual ownership in traditional modes to hybrid or corporate arrangements in app-based platforms. Vehicle ownership closely aligns with these structures, with traditional operators owning their vehicles outright and app-based platforms offering leasing or shared-use options to improve accessibility for drivers.

Revenue models are shifting from cash-based systems, which dominate traditional ISM, to commission-based models supported by e-payment integration, enhancing transparency and scalability. Operational approaches vary from highly informal and demand-responsive systems in traditional modes to app-enabled, structured services that optimise routes, pricing, and passenger convenience.

These elements collectively illustrate the adaptability of ISMs to local contexts, and their critical role in meeting diverse urban and rural mobility needs while evolving to accommodate new technologies and business frameworks.

Box 1: Motorcycle Taxis as an Illustrative Case of ISM Market Dynamics

Motorcycle taxis are a microcosm of the ISM market in Southeast Asia. They illustrate the dynamics of the broader transformation of mobility systems in the region. The market decline of traditional ISM motorcycle taxi services, the rise of app-based platforms, and the regulatory challenges accompanying these changes mirror the multifaceted forces reshaping the ISM sector as a whole. Motorcycle taxis are used here to illustrate how demographic shifts, economic growth, technological advancements, and government interventions influence the evolution of the ISM sector in specific contexts. This evolution occurs within broader mobility ecosystems, where traditional and modern systems coexist, adapt, and often compete.

Traditional Motorcycle Taxis: Origins and Characteristics

Motorcycle-taxi ISM systems, such as Thailand's win motosai, Indonesia's ojek, Vietnam's xe ôm, and Cambodia's motodop, emerged as localised, tailored, demand-responsive transport solutions in urban and rural areas. These systems are rooted in informality and are characterised by individual vehicle ownership, cash-based transactions, and minimal regulatory oversight. Their operations are deeply integrated into local communities, providing essential last-mile connectivity in large cities with metros and affordable transport for low-income populations.

Despite their informal origins, traditional motorcycle taxi systems have adapted to various socioeconomic and urban contexts. For instance, Thailand's win motosai operate under territorial cooperatives, regulating routes and driver membership by issuing operator licences (Phun et al., 2019). In Cambodia, motodop drivers operate independently, while remorque drivers belong to associations that manage parking zones and allocate customers. These organisational structures illustrate how informal systems can adopt quasi-formal practices to sustain operations in increasingly-competitive environments.

Disruption and Adaptation: The Rise of Ride-hailing Apps

The introduction of RHAs has fundamentally disrupted traditional motorcycle taxi ecosystems. RHA platforms bring technological innovation to ISM markets, leveraging digital ride matching, dynamic pricing, and e-payment systems to enhance customer convenience and business efficiency. Gojek in Indonesia, for instance, transformed the ojek market by introducing services like Go-Pay for electronic transactions and expanding into delivery and other on-demand services, thereby creating a diversified revenue stream (Ernawati & Lutfi, 2022).

In Thailand, GrabBike introduced app-based competition to the entrenched win-motosai system, reshaping customer expectations regarding pricing, service quality, and availability. Similarly, Cambodia's traditional motodop and remorque systems have faced challenges from platforms like Grab and PassApp, which offer structured and scalable alternatives. However, traditional systems continue to exist in rural and peri-urban areas with limited digital penetration, highlighting the uneven adoption of digital technologies.

Competing with Private Vehicles: An Insurmountable Challenge

While traditional and modern ISM modes often compete directly with one another, they face even greater competition from the widespread and increasing use of private vehicles in general and motorcycles in particular. In many Southeast Asian cities, private motorcycles dominate urban transport, offering unparalleled flexibility, affordability, and independence. Rising incomes, coupled with limited restrictions on private vehicle ownership, have made owning and using motorcycles a preferred transport choice for many, eroding the market share of both traditional and modern ISM.

Private vehicle ownership is stimulated by investments in road infrastructure and relatively low fuel and vehicle-maintenance costs in the region. For motorcycle taxi drivers, the rise in private motorcycle ownership reduces demand for their services, leading to fewer fare trips per day and further straining their already slim profit margins. App-based ISM platforms have attempted to address this by increasing the competitiveness of their drivers through financing schemes that support investments in vehicle upgrades and new vehicle purchases. However, this is not sufficient to balance against demand losses rooted in private motorcycle ownership. This trend underscores a significant shift in urban mobility preferences, where individual consumerism and convenience increasingly take precedence over shared solutions.

Governmental Interventions and Regulatory Implications

In some cases, government formalisation efforts have sought to regulate traditional motorcycle taxis, integrating them into urban transport plans. For example, Thailand's dual approach—labelling win-motosais as informal while profiting from their operations through licensing and territory control—illustrates the tension between informality and regulation (Sopranzetti, 2022). In Indonesia, Gojek's formalised app-based model gained government support by addressing unemployment and enhancing mobility access.

The Coexistence of Traditional and Modern ISM

Motorcycle taxis across Southeast Asia exemplify the coexistence and interplay of traditional and modern ISM. In Vietnam, for instance, platforms like GrabBike coexist with traditional xe ôm drivers, creating a competitive market that is segmented rather than uniformly consolidated. Traditional modes, while declining in major urban centres, remain vital in secondary cities and rural areas, where they cater to specific market niches and provide culturally familiar services. Traditional systems often persist due to their ability to meet the needs of low-income and underserved markets. In this way, they remain relevant despite increasing formalisation of the ISM sector. In Vietnam, for example, older xe ôm drivers leverage localised knowledge and personal relationships to retain a loyal customer base, even as younger users gravitate towards app-based alternatives (Turner & Hạnh, 2019).

At the same time, the rise of RHAs represents a paradigm shift in ISM, driving efficiency and scalability while introducing challenges such as digital divides and increased competition. Ultimately, the coexistence and adaptation of traditional and modern ISM motorcycle taxi services demonstrate the ISM sector's resilience and its critical role in meeting diverse mobility needs across Southeast Asia. This case underscores the importance of balancing innovation with inclusivity, ensuring that both traditional and modern systems contribute to a sustainable and equitable mobility future.

4.3. Financing

Financing ISM services is a complex and multifaceted topic. The inherently high level of informality, coupled with limited data availability, makes it challenging to precisely analyse income, costs, and taxation in the ISM sector. Despite these challenges, some studies provide valuable insights into ISM's financial underpinnings and their implications for sustainability and equity. Applying the distinctions of financing, funding, and delivery from the Canada West Foundation framework, as presented by Vander Ploeg (2006), provides a useful structure for understanding ISM financing in SEA.

Financing (How capital is raised)

Financing ISM involves securing the capital required for acquiring vehicles, operating rights, digital platform development, and infrastructure investments (such as designated stops or charging stations for EVs). Diverse financing models shape ISM operations in SEA. Common solutions include:

- The self-financing model, under which operators rely on personal savings or informal loans. For example, angkot and ojek drivers in Indonesia fund their vehicle purchases and maintenance out of pocket. In addition, cooperative fees and informal taxes reduce their net income, contributing further to systemic financial strain.
- Platform-based financing, which involves companies raising capital through venture funding or loans to support infrastructure and fleet expansion.
- Government and development loans for fleet modernisation and electrification. For instance, international loans have supported investments in electric bajajs in Cambodia.

The self-financed model dominates rural and semi-urban areas, where community-based resource pooling supports vehicle ownership and maintenance. However, this model often results in financial insecurity for operators, especially in unregulated markets like Cambodia, where direct fare negotiations lead to income disparities. Similarly, platform-based models bring transparency and digital integration but introduce challenges such as ambiguous taxation and volatile earnings for drivers.

Government-subsidised initiatives remain sporadic and insufficient to address high electrification costs. Internationally-supported and loan-based models, such as those funding the introduction of bajajs powered with liquefied petroleum gas in Cambodia, are more promising. These vehicles reduce operational costs and environmental impacts, demonstrating how targeted financing can transform ISM sustainability.

Despite the availability of various financing mechanisms, ISM in Southeast Asia operates within a complex financial landscape. While digital platforms have enhanced revenue collection and financial transparency, operators continue to face high upfront costs for fleet modernisation and

electrification. Access to formal credit remains limited due to insufficient collateral, and revenue streams are volatile, driven by competition and fluctuating demand. Emerging financing initiatives, such as green financing for electric tuk-tuks and bike-sharing schemes, indicate progress towards promoting sustainable mobility solutions. However, the lack of integrated research, policymaking, and advocacy on ISM financing, along with inequities in credit access, underscores the sector's fragmented and evolving nature.

Funding (Who pays and how costs are recovered)

ISM funding refers to revenue streams used to cover operating costs and repay financing debts:

- User fares are the primary funding source. In Cambodia, motodop and remorque drivers earn based on per-kilometre fares negotiated with passenger.
- Platform commissions, collected as a percentage of drivers' total revenue generated through fares, fund operations for ride-hailing services. These platforms have streamlined and increased transparency of fare collection.
- Government subsidies are limited but are occasionally used to fund electrification initiatives or feeder services integrated with public transport. However, such subsidies usually fall short of the high initial capital costs of infrastructure (including vehicle) upgrades and replacements.

The availability of venture capital and government incubation funds for startups focused on new mobility businesses enhances the potential for innovation in ISM. Mobility startups leveraging digital platforms and green technology have attracted significant venture capital investment. Companies such as Gojek and Grab have used these funds to expand their ecosystems, integrating ride-hailing with other services and piloting electric vehicle initiatives. ISM startups, such as MuvMi in Thailand, have successfully secured funding from corporate venture funds, showcasing the growing interest of established corporations in supporting innovative mobility solutions. These investments provide the capital needed for scaling operations and offer strategic partnerships that help startups integrate into larger ecosystems. MuvMi's focus on electric tuk-tuks and app-based ride-hailing aligns with broader trends in green and shared mobility, attracting corporate investors looking to expand their reach in sustainable urban transport. At the same time, government-supported programmes and incubators, such as the National Innovation Agency of Thailand and similar initiatives in other countries, provide seed funding and mentorship to emerging startups in the mobility sector.

Delivery (How the service is implemented)

Delivery focuses on how ISM services are structured and operated:

- Traditional self-operated models are still widespread. Drivers manage vehicle maintenance, routes, and fare negotiations independently, as with angkot and ojek operators in Indonesia.
- Platform-enabled delivery uses digital technology to coordinate services, fare collection, and user interaction. Platforms like PassApp in Cambodia have successfully integrated electric bajajs, lowering fares by 15% compared to traditional remorques.
- Public-private partnerships (PPPs) are hybrid delivery models that involve combined public and private efforts and sharing risks and revenues. Governments commonly provide infrastructure, such as charging stations, while private operators handle daily operations.

Emerging PPP approaches highlight the potential for scaling ISM modernisation. Though still in their early stages in SEA, PPPs effectively combine public funding for infrastructure with private-sector expertise in service delivery, creating a balanced framework for innovation and sustainability. PPPs create fertile ground for new business models that blend public and private strengths to modernise ISM, improve service delivery, and promote sustainable mobility solutions across the region.

4.4. Digitalisation and the Rise of Platform-based Shared Mobility

The adoption of advanced technologies is transforming the ISM sector in Southeast Asia. Two prominent trends shaping this transformation are digitalisation and platformisation, often complemented by the integration of Artificial Intelligence (AI), and electrification aimed at reducing greenhouse-gas emissions and enhancing sustainability. These technological advancements are also facilitating greater integration between ISM and formal public transit systems, improving multimodal connectivity through initiatives. These trends highlight the dynamic interplay of the ISM sectors.

The Rise of RHAs

High digital penetration rates have been pivotal in transforming the ISM sector in SEA. In particular, SEA boasts one of the highest smartphone penetration rates globally, with significant adoption in both urban and peri-urban areas. RHA companies such as Grab and Gojek have leveraged the smartphone digital ecosystem to redefine how informal transport modes operate, especially motorcycle taxis. These companies have introduced innovations like ride-matching, cashless payments, and real-time tracking, making ISM services more efficient, demand-responsive, and accessible to urban populations.

The widespread use of smartphones has facilitated the growth of RHAs, which has significantly impacted the ISM market by increasing efficiency and creating new income streams. Even in smaller cities, like Surabaya, Indonesia, the rise of RHAs has nearly replaced traditional ISM modes such as becak bicycle taxis (becaks) and minivans (bemos), showcasing the deep impact of digital platforms (Peters, 2020). RHAs use AI to optimise services. For instance, AI-driven algorithms used in platforms like Gojek in Indonesia and GrabBike across the region enhance route efficiency, predict demand patterns and provide personalised user experiences. In Phnom Penh, Cambodia, almost half of RHA bajaj drivers reported upgrading from traditional motorcycle taxis or remorques. This transition boosted their operational efficiency, with 40% of surveyed drivers noting a 63% increase in daily trips and customers (Phun et al., 2018). On the demand side, the decline in the number of traditional remorques has marginalised their predominantly non-smartphone-using customer base. However, ISM's digital evolution has particularly resonated with younger consumers, such as university students in Vietnam, who often engage in gig work through digital platforms. A generational divide persists. On the supply side, older drivers of traditional xe ôm services continue to rely on face-to-face fare negotiations and manual operations.

As noted above, traditional motorised ISM modes, such as motorcycle taxis, are steadily losing ground to platform-based RHAs. RHA digital platforms have gained immense popularity among locals and tourists alike, offering convenience, reliability, and accessibility. Many operators of traditional informal transport services are migrating to these platforms, with younger operators and users adopting them more quickly. However, older drivers face adaptation challenges, with some opting not to migrate at all. For instance, in Hue and Da Nang, Vietnam, RHAs dominate among younger commuters and tourists, leaving public buses primarily used by older residents. Similarly, in Indonesia, the rapid expansion of online ojek (ojol) services, supported by programs like Jak Lingko, has significantly reduced the scale of traditional ojek operations.

Industry Consolidation

The expansion of RHAs has been accompanied by a broader trend of industry consolidation, with a handful of dominant firms shaping the market. These companies benefit from network effects, where a larger base of users and drivers leads to more efficient matching, lower costs, and greater convenience, reinforcing their competitive positions. This consolidation is particularly evident in Indonesia, where major platforms have not only captured a significant share of the ride-hailing market but are also integrating with public transport systems to develop multimodal mobility networks. As Uchiyama and Furuoka (2024) find, and as summarised in Table 21, the structure of the RHA market in Southeast Asia reflects these dynamics. Regulatory landscapes and labour frameworks continue to evolve in response to platform-based mobility, shaping market competition and industry consolidation across the region.

At the same time, market structures vary significantly across different Southeast Asian countries, shaped by regulatory environments, levels of competition, and digital infrastructure. Thai-

land, Indonesia, Vietnam, Cambodia, Myanmar, and the Philippines exhibit oligopolistic market structures, where a few dominant platforms—such as Grab, Gojek, Maxim, and local competitors—control most of the market. These countries face challenges related to platform dominance, urban-rural service disparities, and regulatory delays. Meanwhile, Malaysia and Singapore are characterised by monopolistic competition, with multiple platforms competing but facing market saturation and regulatory constraints. By contrast, Brunei and Laos have monopoly structures, with Dart and LOCA as the sole operators, facing small market sizes and digital infrastructure limitations. The variation in market structures across the region reflects the role of local regulatory frameworks, digital penetration rates, and economic conditions in shaping RHA competition and expansion.

Simultaneously, the emergence of super apps is redefining the mobility ecosystem, transforming platform-based transport into a broader suite of digital services. Companies such as Grab and Gojek have expanded beyond ride-hailing to incorporate food and parcel delivery, digital payments, logistics, and financial services, consolidating their influence in multiple sectors. These platforms leverage large user bases and advanced technological capabilities to provide seamless, integrated services, fostering customer loyalty through bundled offerings. As highlighted by Kato and Chalermpong (2024), super apps are increasingly blurring the boundaries between transport and lifestyle services, marking a fundamental shift from standalone mobility solutions to comprehensive digital ecosystems. This transformation is not only reshaping the transport sector but also contributing to broader shifts in economic structures and digital engagement across Southeast Asia.

Despite these advancements, challenges persist. Some markets, particularly in the Philippines, Indonesia, and Vietnam, struggle with urban-rural service disparities, where ride-hailing platforms remain heavily concentrated in major cities with limited rural penetration. In Cambodia, Laos, and Myanmar, digital infrastructure constraints hinder the widespread adoption of app-based mobility services. Additionally, high competition in Malaysia and regulatory saturation in Singapore create barriers for new entrants, reinforcing the dominance of established platforms. These variations demonstrate that while RHAs and super apps are consolidating the industry, their growth trajectories are shaped by local economic, digital, and regulatory landscapes, making Southeast Asia's platform-based mobility sector highly dynamic and complex.

Table 21: Southeast Asia's RHA Market Overview

Country	Internet Penetration (%)	Market Structure	Main Platforms (HQ/ Google Play Downloads)	Main Challenges
Thailand	85	Oligopoly	Grab (Singapore/100M+), Bolt (Estonia/50M+), airasia ride (Malaysia/10M+)	Grab dominance; delayed regulations; lack of competitiveness for small platforms
Indonesia	62	Oligopoly	Gojek (Indonesia/100M+), Grab (Singapore/100M+), Maxim (Malaysia/50M+), inDriver (Malaysia/no data)	Gojek and Grab dominance; limited rural penetration
Vietnam	74	Oligopoly	Grab (Singapore/100M+), Gojek (Indonesia/100M+), Be (Vietnam/5M+), FastGo (Vietnam)	Dependence on a few platforms; urban-rural service disparity
Cambodia	60	Oligopoly	Grab (Singapore/100M+), PassApp (Cambodia/1M+), Tada (Singapore/1M+), WeGo (Cambodia/100,000 +)	Grab and PassApp dominance; insufficient digital infrastructure
Brunei	98	Monopoly	Dart (Brunei/50K+)	Small market size; limited user base
Malaysia	97	Monopolistic Competition	Grab (Singapore/100M+), Maxim (Malaysia/50M+), airasia ride (Malaysia/10M+), GoJo (Malaysia/100,000 +) inDriver (Malaysia/no data)	High competition among multiple platforms; adapting to regulatory changes
Singapore	91	Monopolistic Competition	Grab (Singapore/100M+), Gojek (Indonesia/100M+), CDG Zig (Singapore/1M+), Tada (Singapore/1 million +) Ryde (Singapore/ 500,000 +)	Highly-saturated market; niche demand; strict regulations
Philippines	53	Oligopoly	Grab (Singapore/100M+), Angkas (Philippines/5M+), JoyRide (Philippines/1M+), OWTO (Philippines/100,000+)	High urban demand but inadequate infrastructure support
Laos	62	Monopoly	LOCA (Laos/50K+)	Limited digital infrastructure; low user awareness
Myanmar	44	Oligopoly	Grab (Singapore/100M+), Oway Ride (Myanmar/no data), FastGo (Vietnam/500K+)	Market instability due to political and economic turmoil

Source: Summarised from Uchiyama and Furuoka (2024)

Integrating ISM with Public Transit

Digital platforms have also facilitated the integration of ISM and formal public transit systems., The Jakarta provincial government launched the Jak Lingko programme in 2017 to improve urban mobility and reduce reliance on private vehicles by enhancing accessibility and promoting the use of public transport. This programme exemplifies efforts to create a unified transport network in Indonesia. Jak Lingko integrates some ISM modes, such as RHA motorcycle taxis and minibuses (angkots), with mass transit systems such as the MRT, LRT, BRT, and commuter trains, enabling seamless multimodal journeys with integrated ticketing Gojek's GoTransit feature complements these efforts and further streamlines urban travel by providing first- and last-mile connectivity, linking motorcycle taxi rides with commuter train tickets (Nainggolan et al., 2023). For more information on Jak Lingko and GoTransit, see Box 2.

Trek, in Kuala Lumpur, Malaysia, is a private-sector-led initiative that aims to integrate informal and public transport. Trek is an on-demand transport service operated by Asia Mobiliti. Trek facilitates the integration of passenger vans with the public transport network. The service provides a digital booking and payment system through an app, working alongside existing public transport to improve last-mile connectivity. By enhancing access to key transit hubs, such as MRT and LRT stations, Jak Lingko and Trek contributes to a less fragmented and more efficient urban transport network. Trek's private-sector-driven approach leverages digital technology to improve mobility solutions. If this their operational models proves successful, it could serve as a blueprint for other cities in Southeast Asia, fostering greater integration between ISM and formal public transport systems.

In Thailand, adopting QR-code payment systems has significantly transformed cashless ISM transactions. Motorcycle taxis, tuk-tuks, and other ISM modes increasingly accept QR-code payments. The widespread adoption of QR-code payment options is bolstered by government initiatives that aim to promote a cashless society. For instance, the Bank of Thailand's standardised QR code system called PromptPay has enabled merchants, including small vendors and public transport services, to receive payments directly into their bank accounts without using electronic data capture (EDC) machines. As of August 2020, over 7.4 million merchants across Thailand¾encompassing a diverse range of service providers from street vendors to motorcycle taxis¾were accepting Thai QR payments. The high smartphone penetration in SEA has enabled these digital innovations, making them widely accessible across urban centres. This advancement enhances transaction efficiency. It also integrates ISM operators into the broader digital economy, in line with Thailand's vision of becoming a predominantly cashless society.

Despite the growing popularity of digital payments, traditional cash transactions are still the norm, which hinders efficiency gains. In Thailand, integration with centralised platforms such as PromptPay has not progressed, and whereas app-based services are growing in Indonesia and Vietnam, cash payments are still common for traditional ISM modes. In Cambodia, digital payments such as ABA PAY have not been fully integrated into government policy, and the country has been slow to go cashless.

Box 2: Jak Lingko and GoTransit in Indonesia

Indonesia leads SEA in leveraging high digital penetration to transform the ISM sector. Platforms like Gojek have enhanced service satisfaction and safety by digitalising ISM operations and integrating them with public transport systems. Gojek's GoTransit feature allows users to book commuter train tickets and motorcycle taxi rides via a single app, ensuring seamless transfers between motorcycle taxis and public-transit modes like BRT, MRT, and commuter trains.

Similarly, the Jak Lingko programme in Jakarta connects various informal and formal transport systems into a cohesive network with unified payment options. This system was enabled by Indonesia's high smartphone penetration, with broad user access to digital mobility services. RHAs like Grab and Gojek have expanded into smaller Indonesian cities, replacing traditional modes with more efficient, app-based services. In Surabaya, this shift has nearly eradicated older ISM forms like becak and bemo, further illustrating the transformative power of digitalisation.

Digitalisation, platformisation, and AI integration have empowered services like Grab and Gojek to optimise operations, enhance customer experiences, and integrate informal modes with public transit. Programmes such as Jak Lingko and features like GoTransit demonstrate how technology can bridge the gap between informal and formal systems, creating cohesive urban-mobility ecosystems. However, the transition must remain inclusive to ensure that non-digital users and traditional ISM operators are not left behind in this digital revolution.

4.5. Electrification: Transitioning to Cleaner Mobility

Southeast Asia is witnessing a significant shift towards the electrification of its ISM sector, driven by environmental concerns and the pursuit of sustainable urban transport solutions. The electrification of the ISM sector in Southeast Asia is gaining traction as countries strive to address pollution, reduce greenhouse gas emissions, and achieve their sustainability objectives as part of national development policies. Rather than simply aligning with global sustainability goals, most SEA governments have actively integrated electrification efforts into their broader policy frameworks, recognising the long-term economic and environmental benefits of EV adoption. However, several challenges hinder the widespread adoption of EV technology, including high upfront costs, limited charging infrastructure, and the need for policy incentives to encourage investment. Although the initial capital costs of EVs, particularly cars, remain higher than those of ICE vehicles, their lower operational and maintenance costs in most contexts offer long-term financial benefits. To address these challenges, governments and the private sector, through domestic and regional policies and initiatives, are implementing measures such as subsidies, tax incentives, and PPP models for charging infrastructure investments, aiming to create an enabling environment for EV adoption.

While electrification of the ISM sector is in its early stages, several countries are showcasing innovative efforts to integrate electric mobility into ISM operations, each adopting unique strategies to integrate EVs into their transportation networks. Such efforts across SEA demonstrate a regional commitment to sustainable mobility, with each country tailoring its approach to local contexts and leveraging both domestic and international partnerships to advance the electrification of the ISM sector.

Cambodia

The Cambodian government has set a clear vision for adopting electric vehicles. The National Policy on the Development of Electric Vehicles (2024-2030) aims to register 770,000 EVs by 2030. To support this growth, the government has established 21 battery charging stations nationwide. As of June 2023, there were 1,614 registered EVs in the country, including 914 electric scooters and 440 three-wheel vehicles.

Electrification efforts in the ISM sector are emerging, with platforms like TADA introducing electric remorques to replace traditional tuk-tuks. Companies such as Verywords from South Korea are introducing eco-friendly mobility solutions to Cambodia, including electric motorcycles, charging stations, and battery swap systems in urban areas like Phnom Penh and Siem Reap. ONiON Mobility is a notable player in Cambodia's electric tuk-tuk market. The company has introduced the ONiON T1; an electric three-wheeler assembled locally. Priced between $4,000 and $5,000, the ONiON T1 offers a range of over 100 km per charge. ONiON Mobility plans to introduce 3,000 passenger tuk-tuks and 2,000 cargo tuk-tuks, with battery swapping stations to facilitate quick energy replenishment. While the company's primary focus is on tuk-tuks, its broader electrification efforts may also influence the future of motodops, Cambodia's traditional motorcycle taxis, which have been in decline.

Indonesia

Indonesia is actively advancing the electrification of its ISM sector through a combination of government initiatives, private sector collaboration and international investments. The Indonesian government has set ambitious targets to accelerate the adoption of EVs, aiming to register 1.8 million electric two-wheelers by 2025 and 13 million by 2030. To achieve these targets, a programme was introduced in March 2023 that offers consumers a subsidy of approximately $458 per electric motorcycle purchased. However, the programme experienced a slow start, prompting the government to consider easing eligibility requirements to boost participation.

Ride-hailing platforms such as Gojek and Grab have been pivotal in promoting EV adoption among their drivers Both companies have initiated programmes to integrate electric motorcycles into their fleets, aligning with government sustainability objectives and contributing to achieving government targets. Despite these efforts, challenges persist, including battery-life

constraints and limited charging infrastructure. Such challenges have affected driver retention in Gojek and Grab EV programmes.

Indonesia's vast nickel reserves have attracted significant foreign investment, primarily in EV battery production, a key driver of the country's growing electric vehicle industry. As nickel is essential for lithium-ion batteries, these investments have led to the establishment of battery manufacturing plants and a stronger EV supply chain, which in turn has encouraged automobile manufacturers to set up production facilities in Indonesia, reinforcing its role in the global EV market. Chinese automakers BYD and Neta Auto are expanding into the Indonesian market, with BYD planning a $1 billion automobile factory in West Java, scheduled to commence operations in January 2026. Such investments are expected to enhance domestic EV production capacity and contribute to the electrification of ISM vehicles such as angkots (minibuses) and motorcycles. Meanwhile, the adoption rate for electric buses and other public transport vehicles remains below government targets. As of mid-2024, only 124 electric buses were operational across three cities, representing a mere 0.80% of the Ministry of Transportation's 2030 target.

Thailand

Thailand is leading efforts to integrate EVs into its urban transport system, in particular through the adoption of electric tuk-tuks and motorcycles. As of 2024, MuvMi, a rapidly growing ridesharing platform, operated a fleet of over 600 electric tuk-tuks across 12 neighbourhoods in Bangkok, providing first- and last-mile connectivity. The company has ambitious plans to expand its fleet to between 4,000 and 5,000 vehicles within five years, in response to increasing demand for eco-friendly transportation options. Similarly, Grab's electric motorcycles and battery EVs (BEVs) are becoming a common sight on the streets of Bangkok, illustrating Thailand's strong commitment to sustainable mobility solutions.

PPPs that promote electric mobility are further bolstering the transition to EVs in the ISM sector in Thailand. In May 2022, the National Science and Technology Development Agency (NSTDA), in collaboration with the Electricity Generating Authority of Thailand (EGAT), The Stallions Company Limited, and China's Dongguan Tailing Electric Vehicle Company (TAILG), launched an initiative to popularise electric two- and three-wheelers among motorcycle taxi operators. Supported by the United Nations Environment Programme (UNEP), this programme is designed to accelerate the adoption of electric mobility, reduce greenhouse-gas emissions, and reinforce Thailand's leadership in sustainable urban transport innovation.

Vietnam

Vietnam's transition to electric mobility is marked by significant advancements in electric taxi and motorcycle taxi services, driven by domestic innovation and industry-driven collaborations. In April 2023, Green and Smart Mobility (GSM) launched Green SM Taxi, Vietnam's first

all-electric taxi service. The initial fleet comprised 500 VinFast VF e34 and 100 VF8 electric cars, with plans to expand operations to at least five cities and provinces within the year. Customers can book rides via a nationwide hotline or the Green SM Taxi app, providing convenient access to eco-friendly transportation.

GSM is 95% owned by the founder of VinFast, Vietnam's leading electric vehicle manufacturer. This ownership structure has effectively created a dedicated market for VinFast EVs, as Green SM Taxi operates exclusively with VinFast models. This can be seen as an internal strategic partnership, aligning vehicle production with fleet expansion. Beyond this, GSM has also collaborated with external ride-hailing platforms to extend the reach of electric taxis. In May 2023, a partnership with Be Group enabled users to book GSM's electric taxis through the Be app, integrating sustainable transport options into existing ride-hailing services.

Synergies Between Electrification and Digitalisation

Integrating digital tools with the electrification of vehicle fleets offers unique opportunities for ISM in SEA. Digital platforms, such as Gojek and Grab, facilitate fleet management, support the optimisation of charging-station placement, and enable tracking of energy use, all of which enable creating a more streamlined and sustainable transport ecosystem. Battery swap systems, like those introduced by Verywords in Cambodia, further enhance efficiency by addressing traditional recharging delays and improving delivery operations.

In urban centres, electrification combined with digitalisation strengthens ISM's role as a last-mile solution while significantly reducing ISM's environmental footprint. For instance, Gojek's digital platform could potentially integrate EV services into its GoTransit feature, creating seamless connections between electrified ISM modes and formal public transport systems.

Box 3: Verywords' Role in Cambodia's Electrification

Verywords, a South Korean battery company, is building an electric-mobility ecosystem tailored for ISM operators. Their comprehensive model includes electric scooters, battery swap stations, and waste battery recycling programs, which directly contribute to Cambodia's 2050 carbon-neutrality goal. By reducing drivers' monthly fuel costs from USD150 to USD50 and improving delivery efficiency through battery swapping, the company hopes to demonstrate the economic and operational benefits of vehicle electrification. Their aggressive investment in infrastructure aims to install 100 battery swap stations in Cambodia by 2025, primarily in Phnom Penh and Siem Reap. While challenges remain in rural areas, Verywords pilot projects in cities like Chonburi, Thailand, illustrate the potential for scaling this model across Southeast Asia, adapting urban innovations to address rural transportation needs.

In conclusion, technological advances in the ISM sector in Southeast Asia span a spectrum of approaches, ranging from traditional, non-digital operations to advanced, electrified, and smart systems. Traditional ISM modes rely on manual operations without the use of digital tools such as apps, for hailing, payments, or route management. This is evident in conventional auto-rickshaw services in smaller towns, where passengers negotiate fares directly with drivers, and routes are determined informally without digital coordination or tracking systems. By contrast, digitally-enabled systems utilise apps and other digital platforms to enhance ride-hailing, payment, and fleet management processes. Platforms like GoJek and Grab integrate features such as cashless payments, ride-matching, and route optimisation into their services. At the cutting edge, electrified and smart systems combine EVs with advanced technologies such as real-time tracking and dynamic pricing. This range of digital options illustrates the diverse ways in which technology is reshaping ISM operations to meet evolving urban mobility demands.

4.6. Employment and Labour

The labour and employment models applied in Southeast Asia's ISM sector reflect the region's diverse socioeconomic landscapes. They provide critical income-generating opportunities for low-skilled and low-income groups but expose workers to systemic vulnerabilities. The sector is characterised by four primary models—independent operator arrangements, independent contractor systems, employee-based structures, and community-led organisation—each of which presents unique advantages and challenges.

Independent Operator Model

Traditional modes of ISM, such as Bangkok's win-motosai and Cambodia's motodops (motorcycle taxis), exemplify the independent operator model. In this model, drivers generally own and operate their vehicles, working within informal systems. These workers are classified as independent, which excludes them from formal labour protections, such as social security and health insurance. Despite providing essential income for urban low-skilled workers and rural migrants, this model entrenches economic insecurity.

In Bangkok, win drivers often pay unofficial fees, commonly referred to as protection money, to local influential figures to secure operating rights in specific zones. These de facto operating rights are also informally traded, further marginalising drivers and restricting upward mobility. Similarly, Cambodia's cyclo drivers, many of whom are rural migrants, face high and rising urban living costs that erode their already low incomes, further limiting their economic sustainability (Parsons & Lawreniuk, 2017).

Independent Contractor Model

The rise of RHAs has introduced a new labour model: the independent contractor system. Drivers under this arrangement are freelancers connected to passengers via digital platforms. This system offers flexibility but often circumvents traditional labour obligations. For example, in Indonesia, RHAs use partnership agreements under Article 1320 of the Civil Code to avoid recognizing drivers as employees, thereby excluding them from benefits such as minimum wage guarantees and health insurance (Hasibuan et al., 2023).

While some drivers voluntarily register for social security under BPJS employment schemes, many remain unprotected, particularly during economic downturns. The COVID-19 pandemic, for instance, led to a 60–70% reduction in daily income for Jakarta's RHA drivers, amplifying their economic precarity (Nurhasana et al., 2021). Similarly, in Vietnam, urban motorcycle taxi markets are dominated by rural migrants, whether operating as independent contractors or as independent operators providing traditional xe ôm services. Both groups face highly competitive, unregulated environments that perpetuate income instability and restrict upward mobility.

Employee-based Model

In more regulated environments, the employee-based model offers greater economic security by providing structured benefits such as salaries, insurance, and paid leave. This model is commonly found in formal bus companies or corporate fleets. MuvMi, in Bangkok, is an example is where electric tuk-tuk drivers operate under a company platform. However, their employment status varies. Some still function as independent contractors. This duality highlights the ongoing challenges of defining employment relationships in the ISM sector.

By offering stability, this model contrasts sharply with the precarity of informal systems. It has the potential to formalise the ISM sector while addressing some of its most persistent labour vulnerabilities.

Community-led Model

The community-led model brings workers together in collective organisations, which may be legally registered as cooperatives or unions or may function as informal groupings. This organisational structure facilitates collective bargaining and the sharing of resources among members.

A notable example where informal operators are transitioning into organised entities within the formal transport sector can be found in the Philippines. Through the Public Utility Vehicle Modernisation Programme (PUVMP), the government has promoted the creation of Jeepney Cooperatives. These cooperatives successfully consolidate approximately 1,749 cooperatives with over

262,000 members nationwide. The PUVMP initiative seeks to modernise operations, enhance efficiency, and ensure adherence to regulatory standards.

Less formalised forms of collective action can also play a significant role in organising labour and advocating for ISM workers' interests. In Bangkok, informal motorcycle taxi groups at designated win stands function like associations, managing operations such as route allocation and driver rotation. They are legally registered as professional associations, but not as legal entities for transport operations. At the national level, there are a few legally-registered professional win driver associations, such as the Association of the Motorcycle Taxi Association of Thailand. This association advocates for the interests of over 6,400 members, demonstrating the potential of collective action in the ISM context. Similarly, in Siem Reap, Cambodia, the Tourist Remorque Driver Association supports women driving in the male-dominated tuk-tuk sector. The association addresses issues such as discrimination and economic instability.

In Vietnam, RHA drivers have formed informal groups to collectively address challenges such as changes in profit-sharing formulas and bonus systems implemented by platform companies. These groups primarily organise through online forums and social media platforms like Zalo and Facebook, which serve as hubs for communication, information sharing, and mobilisation. For instance, when RHA platforms adjust their policies, drivers often use these online communities to coordinate collective responses, including strikes and protests, to negotiate better terms. A study by the Friedrich-Ebert-Stiftung Vietnam Office highlights that spontaneous and informal collective actions have been a recurring response by RHA drivers to platform policy changes, underscoring the drivers' need for representation and collective bargaining to protect their interests.

Similarly, in Thailand, motorcycle taxi drivers working under ride-hailing platforms have formed informal networks to address shared concerns. These networks often emerge organically within urban neighbourhoods, where drivers collaborate on issues such as route allocation, fare disputes, and negotiations with platform companies. Social media platforms like Facebook groups and LINE chats serve as key coordination tools. They enable drivers to organise protests against unfavourable company and government policy changes, such as increased platform commission rates or regulatory restrictions. These informal groups provide a critical mechanism for drivers to amplify their collective voice and advocate for better working conditions.

Vulnerability and Entrepreneurial Spirit in the ISM Sector

Despite their diversity, all ISM models share vulnerabilities inherent to their informal nature. Welfare and support systems for ISM workers are severely lacking in most Southeast Asian countries. In Cambodia, the absence of welfare and credit mechanisms leaves many workers exposed to economic risks. The Social Security Act (B.E. 2533) in Thailand and the Manpower Act in Indonesia primarily cover formal employers, leaving ISM workers with some, but relatively limited protection. In Vietnam, the welfare system under the Labour Code 2012 also does not apply to ISM workers.

Limited regulatory oversight, lack of social security coverage, and competitive working conditions highlight the need for labour protections and structured integration into formal systems. In Indonesia, the plight of becak (human-powered rickshaw) drivers in Yogyakarta illustrates the sector's challenges and opportunities. Initially self-organised to capitalise on local tourism, many drivers faced increasing competition and declining incomes. In response, they organised to transition to unstable jobs like waste collection during economic crises (Dahles & Prabawa, 2013).

These entrepreneurial drivers' experiences underscore the resilience of informal labour while highlighting the limitations of self-regulation. Lessons from drivers' cooperative attempts to navigate economic instability offer valuable insights for both ISM workers and participants in the gig economy. As Southeast Asia's urban mobility landscape evolves, addressing challenges faced by ISM workers will be crucial.

4.7. Institutions and Governance

The institutional and governance models of ISM systems in Southeast Asia reflect the region's diversity and complexity and highlight the interplay of regulatory regimes within institutional and governance frameworks.

Institutions in the ISM ecosystem encompass not only organisational arrangements but also the underlying laws, rules, norms, and standards that shape the behaviours and interactions of stakeholders. As such, institutions provide the framework within which ISM operators, regulators, and users navigate the mobility landscape, influencing how services are structured, delivered, and governed.

Institutional models in the ISM sector are diverse and often fragmented, characterised by minimal coordination among government levels. Community-led systems are prevalent, with cooperatives or unregistered local associations filling gaps in neighbourhoods and routes that are underserved by public transit. Within these systems, communities of operators, drivers, and users establish de facto rules and norms to govern pricing, routes, service areas, and dispute resolution. Informal agreements create a self-regulated framework that sustains ISM systems in the absence of formal oversight.

Although the informal mobility sector has traditionally been market-driven, a market-dominated ecosystem has emerged in recent years, where multinational corporations and digital platforms have become key players in shaping service provision. These entities leverage advanced technologies, scalability, and financial resources, benefiting from network effects to establish dominance. They often set the agenda for mobility solutions. While local startups contribute innovation and adaptability, the sector trends towards consolidation, with large companies prevailing due to their superior resources and market influence. This market dominance of a few actors reshapes the ISM landscape, frequently marginalising small operators and traditional service providers.

Regulatory regimes interact with institutional models, including fully informal systems operating outside legal frameworks and semi-formalised arrangements offering specific ISM services. For instance, ride-hailing platforms can be subject to licensing, vehicle standards, and/or operational rules. In some cases, tiered and mode-specific regulations are applied, tailoring rules by vehicle type, digital enablement methods, or operational scope. However, many policies regulating the ISM sector are ad hoc and reactive, addressing immediate concerns such as congestion, safety, or prevention of conflicts among ISM drivers, and lack comprehensive strategies for long-term integration.

ISM system governance models vary significantly across Southeast Asia. They are shaped by institutional arrangements and the degree of regulatory intervention. In the absence of unifying national governance and institutional frameworks, local authorities often manage the ISM sector through decentralised governance. This leads to substantial variability across cities in how and the extent to which ISM services are regulated and integrated. Decentralised governance can foster innovation but can also exacerbate inconsistencies, particularly where local governments lack sufficient capacity and/or resources. By contrast, centralised governance provides national oversight, guiding ISM operations to align with broader mobility goals such as electrification, sustainability, and digital transformation. Centralised governance models often aim to standardise regulation across regions, creating consistency but sometimes failing to effectively address local needs.

Integrated governance models are emerging in some urban centres, actively linking ISM services with formal public transport systems. By leveraging ISM for first- and last-mile connectivity, these models aim to enhance accessibility and efficiency. However, integration efforts often face challenges, including resistance from informal operators, gaps in social security for ISM workers, and a lack of cohesive policies to support equitable mobility.

Collaborative governance ecosystems, though limited, are beginning to take shape, where public, private, and community stakeholders work together to address equity and sustainability concerns. These ecosystems seek to balance formalisation with the autonomy of informal operators, ensuring that ISM systems remain inclusive and adaptive while contributing to broader urban mobility goals.

The institutional and governance frameworks for ISM systems in Cambodia, Indonesia, Thailand, and Vietnam are summarised below.

Cambodia

Cambodia's ISM sector relies heavily on self-organisation, through community-based associations (particularly for remorques and motodops). Institutional oversight is minimal, with limited formal regulation and a lack of integration with broader urban mobility plans. While remorque

operators have been formally registered to some extent since 2009, motodops remain largely informal. Efforts to modernise and regulate the ISM sector are sporadic and inconsistent.

Governance is primarily informal, with paratransit associations defining operational norms and providing basic social security benefits such as accident insurance. Efforts to integrate ISM services that provide feeder services into public transport planning, such as the Phnom Penh Urban Transport Master Plan 2035, have received external support from sources such as JICA. However, progress towards formalising the ISM sector remains constrained due to weak government-led initiatives and insufficient institutional capacity.

Indonesia

Indonesia's ISM sector is arguably one of the most structured among the four study countries, blending formal and informal systems. Ride-hailing platforms operate under a partially regulated framework, where aspects such as platform licensing and fare structures are subject to government oversight, while driver employment status and insurance remain loosely regulated. By contrast, traditional ojeks continue to operate largely informally, with minimal regulatory intervention. The government encourages cooperative models to formalise ojek drivers, although the presence of cooperatives varies across regions. Regulatory frameworks for the ISM sector are more advanced in urban centres such as Jakarta and Bandung.

Indonesia demonstrates a progressive governance approach, with notable progress towards integrating ISM services into formal transport systems. The Jak Lingko program in Jakarta, for instance, links ISM services with the BRT system, improving connectivity. However, challenges persist in rural areas, including service imbalances and limited enforcement of regulations. Social security schemes like BPJS provide partial coverage for ride-hailing drivers, but traditional ISM operators often lack access to such benefits.

Thailand

Thailand's ISM ecosystem is diverse, featuring formalised systems like win-motosai registration alongside the informal songthaews. Ride-hailing platforms like Grab operate under licensing frameworks introduced in the 2000s, and traditional operators face increasing competition from digital platforms. Regulatory frameworks aim to integrate ISM with urban transit systems, although gaps remain in addressing transport poverty in low-income areas.

Governance is relatively centralised, with national agencies like the Ministry of Transport and the Bangkok Metropolitan Administration (BMA) overseeing ISM policies. While efforts to formalise and regulate ISM are more prominent in Bangkok, integration with mass transit systems remains minimal. Outside the Bangkok metropolitan area, public transport options are limited and governance frameworks are even less developed. Social security for ISM workers is incon-

sistent, with overlapping responsibilities between the Ministry of Labour and the Ministry of Social Development and Human Security.

Vietnam

In Vietnam, ISM services such as traditional xe ôm and modern ride-hailing platforms operate under a mix of informal and semi-formal arrangements. Institutional arrangements are stronger in urban areas like Ho Chi Minh City, where regulations for ride-hailing platforms are in place, but public intervention is limited in rural areas. Tiered regulations exist for digital platforms, but traditional ISM modes remain largely outside formal regulatory frameworks.

Governance is fragmented, with local governments managing ISM in urban centres. Attempts to integrate ISM with formal public transit systems have seen mixed results, with resistance from traditional operators and gaps in regulatory enforcement. Governance models are reactive, focusing on immediate concerns like congestion rather than systemic integration or equity for underserved areas.

Under Vietnam's socialist system, arrangements for transport systems are made by the State Ministry of Transport and municipal People's Committees. In Ho Chi Minh City and Hanoi, urban transport studies, budgets, and land-allocation proposals submitted by the city's District Transport Department are subject to a multi-tiered approval process involving the City People's Committee, the State Ministry of Transport, and the Prime Minister's Office. While this structured process establishes clear roles and responsibilities, it can also result in delays and bureaucratic complexity. Inter-ministerial coordination plays a role in shaping transport sustainability, but the layered approach may limit the responsiveness and adaptability of transport policies, including those affecting the ISM sector (Chin, 2013).

Regional Overview

The ISM sector across Southeast Asia has traditionally relied on community-based institutions to govern its operations. These informal institutions, comprised of self-organised groups and operator collectives, have played a critical role in setting de facto rules for pricing, routes, and conflict resolution among operators and users. While governments have over the years regulated traditional ISM services to varying degrees—most notably in Thailand through licensing and registration of vehicles, routes, and service standards—the adoption of regulatory policies has been limited. Formalisation has primarily focused on introducing ISM-specific regulations rather than integrating ISM into broader transport policies or providing institutional support to strengthen the role of ISM in urban mobility systems.

A notable shift is now occurring in how governments approach ISM governance. Recognising opportunities presented by RHAs and large ISM companies, authorities are increasingly imple-

menting regulations to directly govern these platforms, rather than relying on them to self-regulate. Focusing on RHA platforms and large ISM companies simplifies government oversight by reducing the need for direct engagement with thousands of individual operators. Indonesia, Thailand, and Vietnam have expanded their regulatory frameworks to include RHAs, focusing on licensing and service standards for platform-based operators. Similarly, digital platforms are gaining prominence in other countries in the region as key governance partners, emphasising scalability and streamlined enforcement of regulations. However, this approach risks marginalising traditional ISM operators—who lack the resources and technological advantages of corporate players—leaving them without sufficient policy inclusion or support.

The governance model in the region remains largely centralised, with national government agencies holding most of the power, especially in Cambodia, Thailand, and Vietnam. In Cambodia, local governments have minimal involvement in planning or regulating the ISM sector, relying heavily on informal, community-led structures. In Thailand, the provincial branches of the national transport regulator oversee vehicles, drivers, and operations, with limited involvement from local authorities in certain aspects of control. Vietnam, while still largely centralised, offers more room for local governments in major cities like Ho Chi Minh City and Hanoi to plan and regulate ISM, reflecting a moderate degree of decentralisation. Indonesia stands out as having the most decentralised governance and regulation of public transit, including the ISM sector. This has enabled local governments in Indonesia, particularly in cities like Jakarta and Bandung, to have greater autonomy to manage ISM and to actively work towards integrating ISM into formal transit systems through programs like Jak Lingko.

One key ISM business model that governments in Southeast Asia have increasingly focused on regulating is RHAs. RHA platforms have become a significant component of urban transport systems, prompting various policy and regulatory responses to integrate, formalise, and manage their operations. Below is an overview of relevant policy and regulatory developments in SEA, as detailed in Table 22.

Singapore: A regional leader, Singapore implemented the Point-to-Point Passenger Transport Industry Act in 2020, which requires ride-hailing operators to meet national licensing, safety, and operational standards. This comprehensive framework benefits from Singapore's strong governance capacity and ensures seamless integration of the ISM sector with public urban transport systems (Public Transport Council, 2020).

Malaysia: An early adopter of RHA regulation, Malaysia amended its Land Public Transport Act in 2017 to require ride-hailing drivers to obtain Public Service Vehicle (PSV) licences. While this approach strengthened formal oversight, it raised concern about licensing costs discouraging driver participation (Uchiyama et al., 2022). The adoption of a formal regulatory framework for ride-hailing has strengthened compliance monitoring and control. Specifically, procedures have been established to confirm that drivers are licensed, comply with vehicle inspection standards, and are insured. While these regulations are intended to ensure user safety and improve transparency and confidence in the industry as a whole, they impose high compliance costs on drivers.

Individual drivers are responsible for complying and do not receive sufficient financial support to cover the cost of compliance from RHA platform operators.

Thailand: In 2020, Thailand regulated ride-hailing services provided by informal operators like Win-motorcycle taxis, focusing on safety, fair pricing, and competition. This marked a significant policy shift, but lax enforcement has left most regulated drivers and vehicles unregistered. The policy has also created persistent tensions between formal transport platforms and informal ISM networks (Wantanasombut, 2023).

Vietnam: The issuance of Decree 10/2020/ND-CP established a clear legal framework for regulating RHAs in alignment with national transportation objectives. However, while Vietnam's centralised governance structure facilitates effective enforcement, it may also constrain the ISM sector's ability to adapt to the rapidly evolving dynamics of urban environments.

Indonesia: Regulations introduced in 2019 require ride-hailing companies to register as transport operators. Despite this requirement, challenges persist in integrating informal systems, such as ojek motorcycle taxis, with formal RHA platforms (Izzati, 2023).

Philippines: In 2015, the Philippines became the first ASEAN country to regulate RHAs. The regulation, implemented by the Land Transportation Franchising and Regulatory Board (LTFRB), codified comprehensive policies on accreditation and fare setting. However, uneven implementation, particularly in Metro Manila, highlights the difficulties of reconciling policy ambition with regulatory implementation realities (The Philippine Star, 2015).

Cambodia: Still in the process of formulating regulations, RHA platforms like PassApp and Grab coexist unregulated in Cambodia. This fosters innovation but poses safety and fair competition risks. Discussions regarding formalising the ISM sector indicate a potential for progress in adopting RHA regulations in Cambodia (Ratanawaraha & Thaithatkul, 2024).

Brunei: Regulations introduced in 2018 require ride-hailing operators to register and adhere to safety and service standards. Brunei's systematic approach is suited to its relatively small transport sector, ensuring manageable yet effective oversight (Mohamad, 2022).

Myanmar: The absence of formal RHA regulations in Myanmar is compounded by political instability and governance challenges, which hinder policy formulation and enforcement (Ratanawaraha & Thaithatkul, 2024). As a result, ride-hailing services operate in a largely unregulated environment, limiting their integration into the broader transportation system.

Laos: ide-hailing services are available only in certain urban areas, primarily through local platforms, as Grab does not operate in the country. The majority of the country continues to rely on traditional ISM modes (Ratanawaraha & Thaithatkul, 2024). The lack of a formal regulatory framework for RHAs reflects the early stage of policy development in Laos, with potential for future regulatory advancements.

Table 22: Ride-hailing Services: Regulations and Policies in Southeast Asia

Country	Key Regulation	Year Implemented	Regulatory Level
Thailand	Ride-hailing services are regulated with respect to safety, fair pricing, and competition with traditional modes.	2020	National
Indonesia	Ride-hailing companies are required to register as transport providers and comply with pricing and safety standards.	2019	National
Vietnam	Decree 10/2020/ND-CP provides a legal framework for regulating ride-hailing services.	2020	National
Cambodia	In the process of developing regulations to integrate and ensure fair competition for ride-hailing platforms.	In Progress	National
Singapore	The Point-to-Point Passenger Transport Industry Act regulates ride-hailing services and includes licensing requirements and safety standards.	2020	National
Malaysia	The Land Public Transport Act and the Commercial Vehicles Licensing Board Act have been amended to regulate ride-hailing services, requiring drivers to obtain a Public Service Vehicle (PSV) licence.	2017	National
Philippines	The Land Transportation Franchising and Regulatory Board (LTFRB) has issued Memorandum Circulars regulating Transportation Network Companies (TNCs) and their drivers, including accreditation and fare setting.	2015	National
Myanmar	Myanmar currently lacks specific regulations for ride-hailing services. Discussions regarding establishing a legal framework are ongoing.	N/A	National
Laos	No formal regulations for ride-hailing services.	N/A	National
Brunei	Brunei's Land Transport Department has introduced regulations requiring ride-hailing operators to register and comply with specific safety and service standards.	2018	National

The rapid emergence of RHAs and the varying degrees of regulatory intervention have intensified competition and conflicts between RHAs and traditional ISM operators, necessitating targeted regulatory responses.

For instance, in Indonesia, the government introduced minimum fare regulations in 2017 to balance competition between RHAs and traditional motorcycle taxis (ojek). This measure aimed to prevent RHAs from monopolising the market through excessively low pricing, protecting ojek drivers from unsustainable price competition. However, classifying RHA drivers as "partners" rather than employees has excluded drovers from social security protections, increasing labour precarity and sparking resistance movements. Consequently, ongoing regulatory efforts seek to mitigate labour precarity across both traditional ISM and RHAs and ensure a more equitable framework for ensuring the welfare of mobility service providers.

The government of Thailand formally legalised RHAs in 2021. This policy faced significant resistance from traditional motorcycle taxi (win-motosai) operators. In response, regulatory authorities implemented support measures enabling Win drivers to transition into app-based services, while requiring registered Win drivers to obtain licences. This hybrid regulatory approach has enabled RHAs to expand rapidly in urban areas while preserving the role of traditional ISM operators within the transport landscape.

In the Philippines, the LTFRB established a regulatory framework for RHAs, tightening licensing requirements for new entrants. To mitigate competition with traditional jeepneys and tricycles, authorities imposed operational area restrictions on RHAs and introduced fare-adjustment mechanisms. These measures are intended to balance market competition while ensuring the sustainability of traditional ISM operators.

These regulatory efforts illustrate how SEA governments are attempting to balance the formalisation of RHAs with broader transport objectives, such as promoting safety, fairness, and sustainability. More-developed economies, like Singapore and Malaysia, have taken proactive steps, creating comprehensive legal and regulatory frameworks. Middle-ground approaches in countries like Thailand and Vietnam reflect efforts to integrate RHAs while managing tensions with informal systems. By contrast, regulatory inertia in countries like Myanmar and Laos underscores the governance barriers to modernising mobility systems.

4.8. Safety and Security

The safety and security of ISM systems in Southeast Asia vary across modes and countries, influenced by technology, regulation, and socio-economic disparities. Traditional ISM modes, such as motorcycle taxis and informal vans, face pronounced safety challenges. For example, Vietnam's motorcycle-centric ISM system contributes significantly to Vietnam having the highest road-accident rates in the region, with motorcycles accounting for 70% of all traffic fatalities. In Thailand, motorcycle taxis and passenger vans also face significant safety challenges, with

frequent accidents attributed to reckless driving, inadequate enforcement of traffic laws, inconsistent adherence to safety measures like helmet requirements, and infrastructure inadequacies such as poorly-maintained roads, lack of designated motorcycle lanes, and insufficient safety features at intersections.

In Indonesia, harassment is a significant issue for traditional ojek passengers, especially women, who often report feeling unsafe due to the lack of accountability and oversight in traditional ISM systems. Economic pressures exacerbate risks in Cambodia, where motodop users prioritise speed and cost over safety. Furthermore, despite recent efforts to introduce licensing and training, many bajaj drivers are untrained, contributing to unsafe driving practices.

App-based ISM platforms have demonstrated their ability to address many of these safety issues, particularly in urban centres. These platforms integrate features like GPS tracking, real-time monitoring, driver identification, and rating systems, enhancing accountability and reducing risks. A study in Jakarta revealed that app-based ride-hailing users reported 50% fewer safety incidents compared to traditional ISM users. However, there are significant disparities between the presence of app-based ISM platforms in urban contexts and rural and peri-urban areas. App-based platforms require widespread smartphone penetration, adequate digital literacy, and regulatory enforcement to support their adoption.

Regulatory enforcement also varies across countries, influencing user behaviour and safety outcomes. Vietnam, for instance, is stricter than Thailand in enforcing helmet requirements for motorcycle riders. In Vietnam, passengers almost always wear helmets due to strict police enforcement. By contrast, it is common to see motorcycle taxi passengers in Bangkok riding without helmets, reflecting gaps in enforcement and public compliance. Interestingly, enforcement policies can also indirectly promote safer transportation choices. In Danang, an informant reported that as police became stricter in enforcing Driving Under the Influence regulations, more people opted to use RHA services when going out drinking. This trend underscores how consistent and effective law enforcement can influence mobility behaviour and enhance safety.

Gender-specific safety risks further constrain demand for traditional ISM services. In Indonesia, female commuters frequently cite harassment as a primary reason for avoiding traditional ojek services. To address this, Grab and Gojek have introduced gender-sensitive measures such as allowing women to request female drivers. While such measures are promising, they are not consistently implemented across SEA countries, leaving significant gaps in protection.

Technological integration is central to mitigating ISM safety risks. Digital tools enable app-based services providers to enhance oversight by tracking routes, identifying drivers, and enabling emergency responses. In Vietnam, for example, introducing ride-hailing platforms has reduced incidents of fraud and unsafe driving by requiring drivers to undergo identity verification and training. Nonetheless, these technological advancements require complementary policy frameworks to be effective. In Cambodia, regulatory gaps persist, with many app-based ISM operators operating without clear safety standards, which undermines the potential benefits of digital

technology. Harmonising regulations across regions, particularly to enforce safety standards involving licensing, vehicle inspections, and driver training, remains a critical challenge.

The economic structure of ISM operations, and in particular financial incentives for drivers, further complicates safety challenges. In Bangkok, van drivers and other ISM operators are often paid per trip or based on passenger numbers, creating a system where longer hours and faster driving become necessary to earn a living wage. This structure not only increases driver fatigue but also pressures operators to compromise safety, such as overloading vehicles or ignoring traffic rules, to maximise income. Addressing these systemic issues is essential for creating a safer and more sustainable ISM environment across Southeast Asia (Ratanawaraha, & Chalermpong, 2018).

4.9. Gender Equality, Disability and Social Inclusion (GEDSI)

There are significant gender equality, disabilities, and social inclusion (GEDSI) challenges in ISM systems in Southeast Asia, as illustrated by specific cases in Indonesia and Cambodia. These challenges are deeply rooted in societal biases and inadequate systemic responses, which exacerbate inequalities and perpetuate the social and economic exclusion of women, persons with disabilities, and members of marginalised groups.

In Indonesia, the ISM ecosystem presents both demand- and supply-side challenges for women and persons with disabilities, particularly in urban centres like Jakarta. Women frequently encounter harassment on public transport. This limits their mobility and forces many women to rely on ISM modes such as ojek and app-based platforms like Gojek. These platforms enhance safety by offering features such as GPS tracking and driver authentication (Fitri, 2024; Hidayati, 2023). However, systemic biases persist even within these solutions, as female drivers face discrimination. For instance, many users avoid choosing women drivers for long-distance trips, citing safety concerns and perceived driving-skill deficiencies (Putra & Aristyanto, 2021).

Persons with disabilities face hurdles in accessing ISM services in Indonesia. Reports indicate that individuals with disabilities are often refused entry to RHA taxis and encounter significant difficulties when using shared minivans (angkot), which are typically not designed with accessibility in mind (Fitri, 2024). Limited access to public transport options forces many persons with disabilities to rely on private vehicles or ISM services, which, while offering greater convenience, are often costlier than public transit alternatives. Furthermore, enforcement of transport regulations remains weak, and inclusive access rights for persons with disabilities are not adequately protected. For example, in Bandung, women using paratransit services express concerns regarding inconsistent service schedules and vehicle security. Despite these problems, they continue to rely on paratransit due to limited alternatives and the inability to afford private vehicles (Tarigan et al., 2014). Although initiatives such as Jakarta's Jak Lingko programme aim to enhance inclusiveness by integrating ISM into formal transport systems, broader implementation and stricter enforcement of accessibility standards are still needed (Nani & Laksmono, 2023).

In Cambodia, the ISM sector relies heavily on marginalised youth for labour, particularly as bajaj drivers, who face precarious working conditions. Limited educational opportunities and a lack of formal safety training contribute to the prevalence of dangerous behaviours, including reckless driving, speeding, and frequent lane changes (Phun et al., 2020). These challenges compromise driver and passenger safety. Furthermore, women's participation in the ISM labour market remains minimal, widening the gender gap in economic opportunities in the sector. Cultural biases and workplace safety concerns deter women from entering the sector's workforce, and those who do are often relegated to low-wage and informal roles with minimal job security (Etherington & Simon, 1996).

Technology has offered partial solutions, as app-based platforms such as PassApp provide relatively safer and more transparent transportation choices through enhanced monitoring and driver verification. However, concerns persist about affordability and supply-side biases against marginalised groups, limiting the transformative potential of these platforms (Phun et al., 2020). The lack of comprehensive licensing programmes and safety training further exacerbates these challenges, leaving both drivers and users vulnerable. Addressing these gaps requires targeted interventions, including licensing reforms, capacity-building initiatives, and gender-sensitive employment policies.

These cases from Indonesia and Cambodia exemplify the systemic barriers and operational challenges facing GEDSI integration in ISM systems across SEA. Structural reforms, enhanced enforcement of inclusive policies, and community-driven programmes are essential to addressing inequities and ensuring safe, accessible, and equitable mobility for all.

4.10. Environmental Sustainability and Climate Resilience

The ISM sector is an essential component of urban transport systems in every country and city in Southeast Asia, but there are distinct ISM sustainability and climate-resilience[15] challenges in each country.

Cambodia

In Cambodia, integrating ISM systems with formal public transport, such as buses in Phnom Penh, is essential to reducing inefficiencies and fostering environmental sustainability. Operator income levels and instability along with lack of access to finance are barriers to modernising ISM vehicles, many of which are old and contribute significantly to emissions of urban air pollutants. The adoption of Sustainable Urban Mobility Plans holds promise for improving multimodal connectivity and addressing first- and last-mile transportation gaps. However, progress on this front

[15] Climate resilience refers to the capacity of ISM systems to withstand, adapt to, and recover from climate-related challenges, such as extreme weather events, rising temperatures, and environmental degradation, while maintaining sustainable and efficient transport services.

remains limited. Efforts to transition ISM fleets to low-emission vehicles, supported by targeted subsidies and training programmes for operators, could simultaneously address economic instability and environmental concerns. The lack of robust implementation frameworks and funding mechanisms hampers such initiatives, leaving much of Cambodia's ISM sector underdeveloped with respect to sustainability and resilience.

Indonesia

Indonesia faces significant sustainability challenges as RHAs transform urban mobility, often at the expense of traditional ISM modes like angkots. While RHAs have enhanced accessibility and convenience for millions, they have also contributed to increased motorcycle ownership, exacerbating traffic congestion, air pollution and greenhouse-gas emissions in densely-populated urban areas such as Jakarta. These trends highlight the need for regulatory frameworks that balance competition between RHAs and traditional ISM services, and ensure more cohesive, inclusive, and environmentally-friendly urban transport ecosystems.

Transitioning to environmentally-friendly vehicles, particularly electric scooters and motorcycles, represents a critical step towards mitigating the environmental impacts of the ISM sector. Several initiatives are underway to electrify RHA fleets in Indonesia, though progress remains limited. Companies like Gojek and Grab have piloted integrating electric two-wheelers into their platforms, with Gojek partnering with the state-owned electricity utility PLN to expand charging networks and provide battery-swapping stations. Grab has introduced electric scooters in collaboration with electric vehicle manufacturers, aiming to gradually increase the share of EVs within its fleet.

Despite these efforts, the high cost of EVs and the limited availability of charging infrastructure are significant barriers to the electrification of RHA fleets. The Indonesian government has introduced subsidies to accelerate electric vehicle purchases and is expanding support for battery-swapping stations to reduce operational challenges for RHA drivers. These programmes require further scaling and integration with broader urban mobility policies to achieve meaningful impact.

Thailand

In Thailand, some ISM initiatives are paving the way for more sustainable urban transport by reducing reliance on private vehicles and lowering emissions of urban air pollutants and greenhouse gases. Examples include services like MuvMi, which uses electric tuk-tuks, and the Winnonie platform, which rents electric motorcycles to win drivers. MuvMi's app-based, eco-friendly service addresses first- and last-mile connectivity, while Winnonie, initially focused on passenger transport, has shifted towards delivery operations to leverage regulatory advantages and increase cost effectiveness.

Challenges persist despite these initiatives. In particular, there is insufficient coordination of integrating ISM systems with formal public transport, which results in inefficiencies and contributes to worsening congestion and air quality in cities like Bangkok, Chiang Mai, and Khon Kaen. ISM and private vehicles often share road infrastructure, exacerbating these issues. Improving intermodal connectivity is crucial for addressing this. Integrating shared transport options such as songthaews with bus and rail networks could enhance accessibility and reduce dependency on private vehicles. Digital platforms for route optimisation and real-time coordination, as demonstrated by MuvMi, can further streamline operations and improve user experience.

The shift to EVs in Thailand's ISM sector is also promising. Increasingly, RHA and delivery drivers are adopting EVs. Large-scale players are contributing to this shift. Grab, in partnership with Strom (a Thai electric motorcycle manufacturer), has introduced electric motorcycles in cities including Bangkok, Chiang Mai, and Pattaya. This initiative is bolstered by investments in charging and battery-swapping infrastructure, making EV adoption more practical and accessible for drivers. These efforts highlight the growing role of private-sector innovation in advancing Thailand's sustainable mobility goals.

By addressing integration challenges, expanding EV infrastructure, and fostering collaboration between the public and private sectors, Thailand's ISM landscape is expected to continue evolving towards a more efficient, environmentally-friendly urban transport ecosystem.

Vietnam

In Vietnam, the widespread ownership of petrol-powered motorcycles in urban centres such as Hanoi and Ho Chi Minh City contribute significantly to air and noise pollution. Recognising the environmental challenges posed by these vehicles, the Vietnamese government has introduced policies to encourage the adoption of EVs, particularly electric two-wheelers, which are seen as a viable solution to these problems. Electric micro-mobility, as a component of ISM, has the potential to bridge the gap between existing transport services and citizens' needs, addressing critical first-mile/last-mile connectivity challenges (Huu & Ngoc, 2021).

Despite these advancements, the transition to electric motorcycles in Vietnam faces significant challenges. Affordability remains a major hurdle for many consumers, as EVs represent a substantial financial investment compared to petrol-powered motorcycles. This is especially relevant given Vietnam's average annual income, which makes petrol-powered motorcycle ownership the most affordable mode of private transport for many citizens. However, despite the higher upfront capital cost of electric motorcycles, the total costs of petrol and electric motorcycle ownership are gradually converging, offering potential economic benefits for ISM drivers who transition to more sustainable electric options.

The underdeveloped second-hand market for EVs in Vietnam poses additional challenges. Unlike conventional petrol vehicles, which benefit from a well-established resale ecosystem, EVs lack

robust resale options due to concerns over battery degradation and the absence of standardised battery replacement services. This creates uncertainty that discourages potential buyers, particularly those in lower-income groups, from investing in EVs.

Infrastructure limitations further complicate the shift to EVs. While Ho Chi Minh City and Hanoi have extensive networks of public buses, routes, and stops that are heavily subsidised, there remains a need to enhance transport infrastructure to better accommodate the evolving demands of ISM and support the transition to EVs. The existing charging network requires substantial expansion and upgrading to facilitate growing EV adoption. Rural areas, in particular, suffer from limited access to charging facilities, significantly constraining the feasibility of widespread vehicle electrification.

VinFast is a key player in Vietnam's electrification landscape. VinFast is the automotive subsidiary of VinGroup, the nation's largest private conglomerate. Since its establishment in 2017, VinFast has rapidly developed a range of electric two-wheelers and automobiles, with its electric scooter line-up catering to diverse consumer segments. VinFast has also committed to expanding its EV ecosystem by investing in expanding its manufacturing facilities and establishing a network of charging stations to enhance accessibility and alleviate consumer concerns about range and convenience. These efforts align with the central government's positive stance on e-scooters as a more environmentally-sustainable alternative to petrol-driven motorcycles, particularly for use in ISM services like motorcycle taxis.

To accelerate a sustainable transition to EVs, Vietnam must address these financial and infrastructure challenges. Developing a comprehensive strategy that includes targeted subsidies, expanded charging infrastructure, and policies that support the second-hand EV market is crucial. These measures will not only contribute to advancing the electrification of Vietnam's transport sector but also ensure that the benefits of this transition are accessible to a broader population, fostering a more inclusive and sustainable mobility future (Huu & Ngoc, 2021).

Regional Overview

ISM systems across Southeast Asia face shared sustainability and climate-resilience challenges. They would all benefit from better integration of ISM with formal transport, while addressing rising motorisation and resolving tensions between ISM and formal systems, such as competition issues. They also need to overcome barriers to electric vehicle adoption. Common to all is the necessity of infrastructure investments, policy innovation, and technology adoption to create more sustainable and resilient urban mobility networks. Key challenges, opportunities and barriers influencing the sustainability and climate-resilience of the ISM sector in the study countries are summarised in Table 23.

Table 23: ISM-sector Sustainability and Climate-resilience Challenges, Opportunities and Barriers in the Study Countries

Country	Sectoral Challenges and Opportunities	Barriers
Cambodia	Integrating ISM with public buses is critical to reducing inefficiencies and ensuring environmental and economic sustainability (Monykoran, & UNESCAP, 2022; Phun et al., 2020).	Competition between ISM and public buses; income and financing limitations for traditional ISM operators.
Indonesia	RHA services like Gojek complement public transport in Jakarta but disrupt traditional ISM modes like angkot. The structured, eco-friendly transition is needed to reduce environmental impact while integrating traditional ISM operators into the evolving urban mobility system. (Nugroho & Zusman, 2018).	Rising private motorcycle ownership; competition between RHAs and traditional ISM; limited environmental policies.
Thailand	Songthaew services in Khon Kaen reduce private vehicle use and emissions, highlighting their potential in sustainable urban mobility (Wongwiriya et al., 2020; Permana & Petchsasitho, 2020).	Traffic congestion and emissions; inadequate integration of ISM with formal transport systems.
Vietnam	E-micromobility, such as electric scooters, offers a sustainable alternative to petrol-driven motorcycles but faces affordability challenges (Huu & Ngoc, 2021).	High reliance on petrol-driven vehicles; gaps in public transport coverage; barriers to electric vehicle adoption.

Chapter Five: Research Trends in ISM in Southeast Asia

This chapter examines the evolving landscape of research on ISM in Southeast Asia, focusing on Cambodia, Indonesia, Thailand, and Vietnam. Through a comprehensive literature review key trends, thematic shifts, and patterns of scholarly attention have been identified, providing a structured overview of the research developments in the field. Emerging gaps and underexplored areas are highlighted, advancing knowledge and providing a basis for informing policies to strengthen ISM's contribution to SEA's mobility systems.

A multi-pronged approach to analysing ISM research trends was adopted in this study. Building on the bibliometric study on ISM (funded by VREF) of Behrens et al. (2021), we aimed to address gaps identified in previous bibliometric analyses. A bibliometric analysis was conducted using Bibliometrix software (Aria & Cuccurullo, 2017), focusing on articles indexed in Scopus and Web of Science to ensure validity and facilitate identifying key experts for interviews. This analysis provided insights into main research outputs, including annual scientific publications, influential journals, authors, affiliations, and collaboration networks.

Recognising the limitations of relying solely on English-language sources, additional literature was incorporated to complement the bibliometric findings and fill critical gaps. Native speakers—master's students and graduates from Thailand, Indonesia, Vietnam, and Cambodia—were engaged to collect and analyse literature in the local languages of the study countries. Additionally, given the influence of Japanese transport technologies and JICA collaborations on Southeast Asian infrastructure, supplementary materials in Japanese were included. This multilingual and interdisciplinary approach ensured a comprehensive understanding of ISM research and its context, capturing detailed insights into the status, challenges, and opportunities for ISM in each of the study countries.

Furthermore, the analysis included a review of news-media coverage to complement scholarly research. News articles offer timely, real-world accounts of ISM operations, policy changes, and public perceptions, providing insights not previously captured in academic literature. By examining both published journal articles and news media, the study bridges academic rigour with practical, real-time observations, offering a holistic understanding of ISM in Southeast Asia.

This chapter first presents a bibliometric study of academic research on ISM in Southeast Asia, identifying key trends, collaboration networks, and thematic developments. It then examines expert perspectives, providing deeper insights into how research trends intersect with policy initiatives and on-the-ground realities. Additionally, an analysis of news media coverage highlights real-time discussions surrounding ISM operations, policy developments, and public perception in the region. The chapter then extends the bibliometric analysis to offer a broader regional perspective, followed by a thematic mapping of ISM research. Finally, the chapter summarises existing research and resource gaps and outlines a future research agenda, aiming to guide both academic inquiry and policymaking to strengthen ISM's role in the region's mobility systems.

5.1. Academic Research on ISM in Southeast Asia

This section provides an overview of academic research on ISM in the four countries: Cambodia, Indonesia, Thailand, and Vietnam. Both academic and practical research outputs related to ISM are assessed. The analysis examines the scale of research activity, its academic impact, and patterns of author collaboration, allowing for comparisons across countries. The aim is to identify key research trends and knowledge gaps through a bibliometric approach that captures key bibliometric insights, including academic trends, regional and global productivity analyses, and emerging themes within collaborative research networks. These insights highlight progress made and focus areas of ISM-related research, and shed light on gaps warranting further investigation. The results of the bibliometric analysis, offering a comparative perspective on the state of ISM research in the region, are summarised in Table 24.

Table 24: ISM Literature in Four SEA Countries: Summary of Bibliometric Analysis Results

Country	Timespan	Documents	Annual Growth Rate	Avg. Citations/ Doc	Keywords	Authors	Single-authored Docs	Co-authors/ Doc
Cambodia	1996:2024	27	4%	17.19	126	78	6	3.33
Indonesia	2001:2025	338	0%	13.42	1088	975	43	3.45
Thailand	2003:2024	182	19.06%	12.6	622	529	25	3.43
Vietnam	2001:2025	305	2.93%	16.78	1031	961	41	3.66

The bibliometric analysis reveals significant differences in research growth, activity, and impact. Thailand exhibits the highest annual growth rate in ISM-related publications of 19.06%, signalling robust and expanding ISM research activity. Cambodia, with a growth rate of 4%, reflects the country's emergence as an increasingly-important research area, albeit from a smaller base. By contrast, Indonesia shows no growth (0%), suggesting that ISM research on the country may have reached a mature stage with a steady flow of publications. Regarding research quality and impact, Vietnam leads with the highest average number of citations per publication (16.78), indicating its research outputs are highly impactful and influential. The analysis uses the average number of citations each country's papers receive to indicate research impact in the global academic domain. Cambodia also demonstrates the highest average citation rate (17.19), highlighting that despite its relatively small volume of studies, its research is impactful and has practical relevance, potentially shaping ISM policies and practices. Indonesia (13.42) and Thailand (12.6) follow closely in citation averages, reflecting solid academic contributions, albeit with slightly lower impact compared to Vietnam and Cambodia.

These insights underscore the varying stages of ISM research development across the region, with Thailand leading in growth, Vietnam excelling in research quality, and Cambodia making strides as an emerging focus area with highly impactful studies. Indonesia, while mature in its research stage, continues to contribute significantly in volume and breadth.

5.1.1. Research Productivity

Analysing research productivity from a regional and global perspective is important for assessing the academic contribution of countries and identifying areas where researchers are making progress. We have assessed data on research productivity, based on the number of scholarly publications, average number of citations and growth rates in each country. In particular, Indonesia and Vietnam have larger numbers of academic publications, but there are marked differences in the quality and focus areas of their respective research. Cambodia lags behind in terms of quantity of publications but has made progress in certain research areas with high impact. The quantity of publications, disaggregated by document type, for each of the study countries is shown in Table 25.

Table 25: Publications Per Country, by Document Type

Country	Article	Book	Book Chapter	Conference Paper	Review Paper
Cambodia	18	1	1	1	6
Indonesia	250	14	20	30	24
Thailand	138	12	8	9	15
Vietnam	223	17	17	17	29
Total	629	44	46	57	74

The analysis of document types across the four SEA countries highlights a significant variation in the diversity and volume of ISM-related literature. Indonesia has the largest number of academic articles (250), reflecting its established research base and focus on publishing in journals. Vietnam and Thailand also demonstrate substantial academic contributions, with 223 and 138 academic articles, respectively, alongside diverse publications such as books, book chapters, conference papers, and review papers. This indicates a balanced approach to both theoretical and practical ISM research.

Research on ISM in Cambodia, by contrast, reflects a relatively small number of publications (27), including 18 academic articles and a few books, chapters, and review papers. This limited volume underscores the nascent stage of research on ISM in the country.

The evolution of annual academic production related to ISM in the four Southeast Asian countries from 1990s to 2024 is shown in Figure 10.

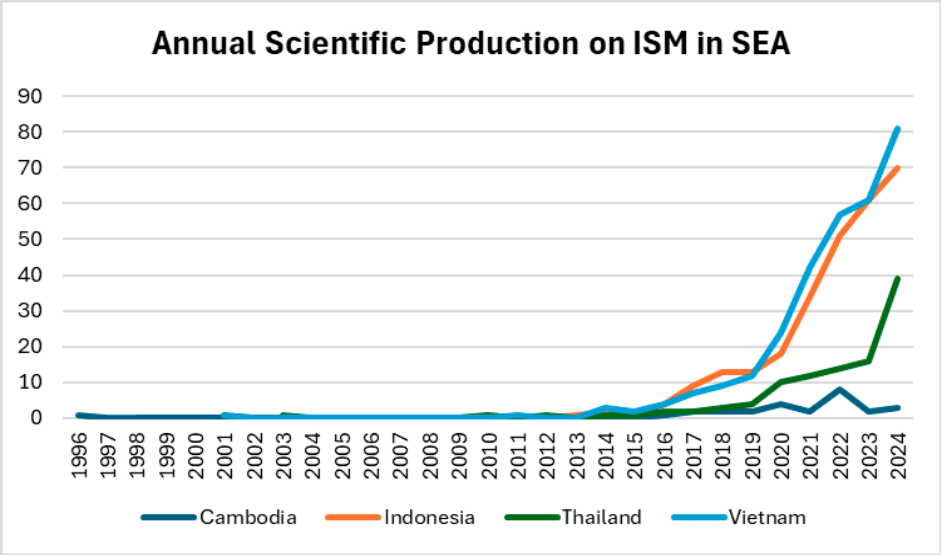

Figure 9: Annual Scientific Production

Indonesia and Thailand have shown rapid increases in output since the late 2010s, driven by accelerated urbanisation and transport infrastructure development. This growth reflects a keen interest in addressing the sustainability and efficiency of urban transport systems. Indonesia, with consistently high production levels, demonstrates a mature research landscape with steady contributions. Similarly, Thailand's robust publication growth underscores its active role in shaping the ISM research and policy discourse.

Vietnam has also performed well, with notable spikes in research output (particularly in 2020) and a consistent focus on sustainability and green mobility. This reflects Vietnam's growing engagement with ISM as a critical component of its urbanisation and environmental goals. By contrast, Cambodia exhibits low and sporadic growth, highlighting challenges such as limited academic resources and a lack of strong policy support for sustainable transport.

These trends reflect differing levels of research activity, resources, and policy priorities across the region. While Indonesia, Thailand, and Vietnam are actively shaping the ISM discourse, Cambodia faces hurdles in achieving consistent and impactful contributions to the field.

The main academic journals publishing articles relevant to ISM in the four countries are indicated in Figure 11.

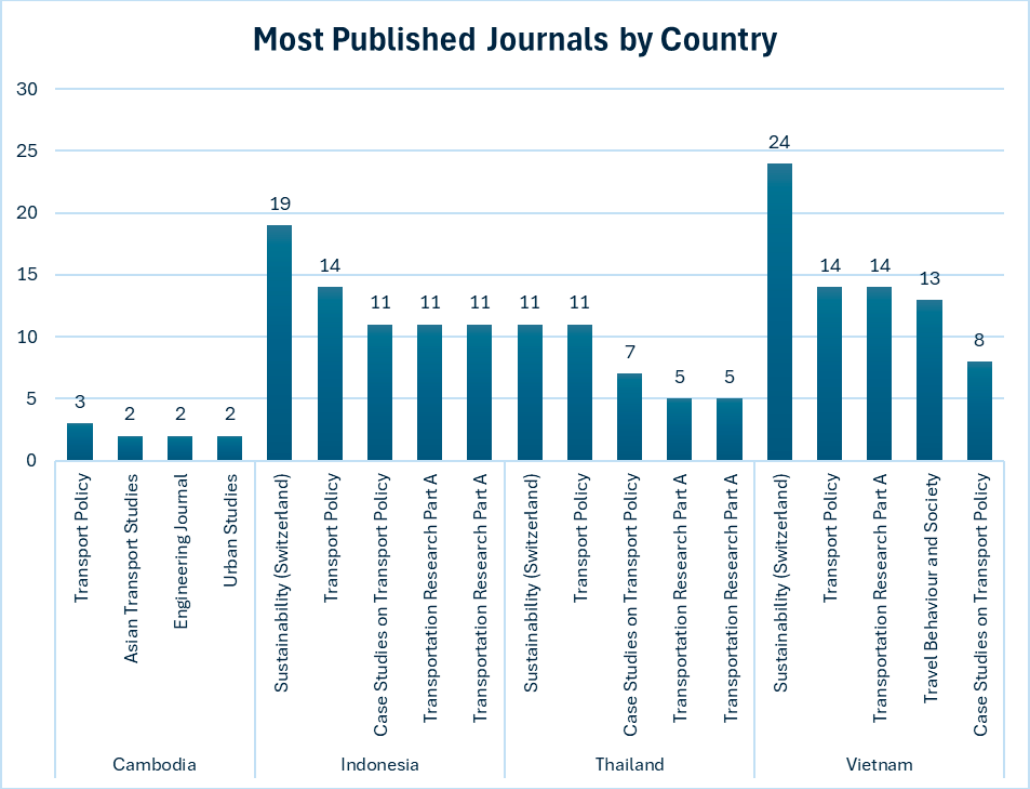

Figure 10: Journals Publishing the Largest Number of ISM Articles, By Country

Research articles on ISM in Indonesia and Thailand are frequently published in peer-reviewed journals such as Sustainability (Switzerland) and Transport Policy, indicating a strong focus on the intersection of environmental concerns and urban transport. Additionally, journals emphasising policy-making and empirical analysis, such as Case Studies on Transport Policy and Transportation Research Part A, are prominent, reflecting the emphasis on evidence-based solutions and strategic planning. In Cambodia, while the volume of scholarly articles remains relatively low, journals addressing regional transport issues play a crucial role. These publications often focus on region-specific infrastructure challenges, highlighting the practical realities of urban transport and the pressing need for targeted policy interventions. The prominence of these journals underscores the varying research priorities across the region, with Indonesia and Thailand advancing broader theoretical and global discussions, while the discourse in Cambodia is focused on local and infrastructure-driven concerns.

Leadership in the field is visualised in Figure 12, in which key ISM-related researchers in the four countries and their respective number of publications are identified.

Figure 11: Most Relevant Authors

In Indonesia and Thailand, several prolific authors have made significant contributions to ISM research, focusing on policy approaches and sustainability in urban transport. Their work has advanced both theoretical and practical understanding, addressing issues such as the development of urban transport infrastructure, the impacts of ISM drivers, and the complementarity as alternative public transport across regions. These researchers play a critical role in shaping urban transport systems and influencing policy directions within their countries.

By contrast, Vietnam and Cambodia have a more limited pool of key authors and a narrower range of research methodologies. The literature in these countries often draws on the expertise of influential researchers from other countries, reflecting a reliance on external knowledge networks. However, international interconnectedness enables leading researchers from across the region to contribute to a broader interdisciplinary understanding of sustainable transport, fostering knowledge exchange and collaboration that benefits Southeast Asia as a whole.

The research output by major research institutions is depicted in Figure 13. Universities and research institutions in Indonesia and Thailand play a central role in the ISM field.

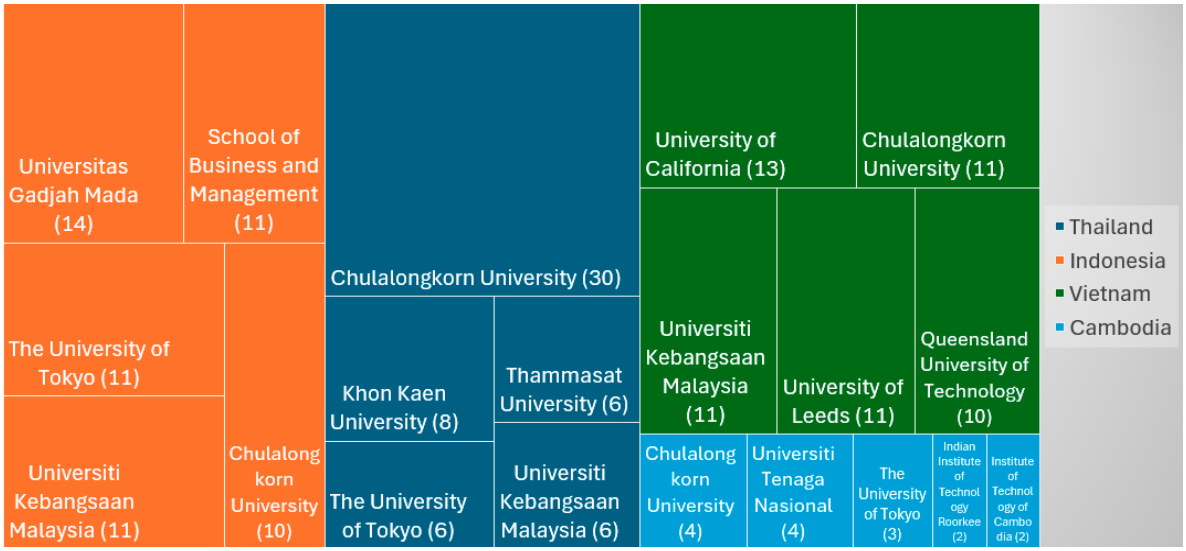

Figure 12: Affiliations Producing the Most Literature

These institutions have developed strong national and international academic networks, conducting extensive research on transport policy and environmental impact assessments. In Vietnam, research on ISM is undertaken both independently by local universities and in collaboration with European and US institutions, reflecting a diverse and global academic engagement.

By contrast, due to its underdeveloped research infrastructure Cambodia relies heavily on a limited number of foreign institutions for collaborating on ISM-related research. Despite these challenges, interest in sustainable urban transport linked to ISM is increasing in Cambodia, supported by regional policy initiatives. This growing attention is expected to drive the expansion of research infrastructure and foster stronger international collaborations in the future, contributing to a more robust knowledge base for ISM in the region.

5.1.2. Collaboration Networks

The co-occurrence and academic collaboration networks identified through the bibliometric analysis of key research themes in each country offer valuable insights into the academic interconnections and research priorities within and beyond the region. By examining correlations and trends in ISM-related research across the four Southeast Asian countries, we have uncovered the contexts in which ISM research is interconnected and identified critical areas requiring further exploration. Additionally, our analysis of research collaboration patterns highlights the role of inter-country and inter-institutional linkages in advancing research on ISM, demonstrating how these networks contribute to the development of knowledge and policy in this crucial area.

The co-occurrence network of keywords in research in the field of ISM are shown in Figures 14 through 17 The figures highlight the different areas of interest in each country.

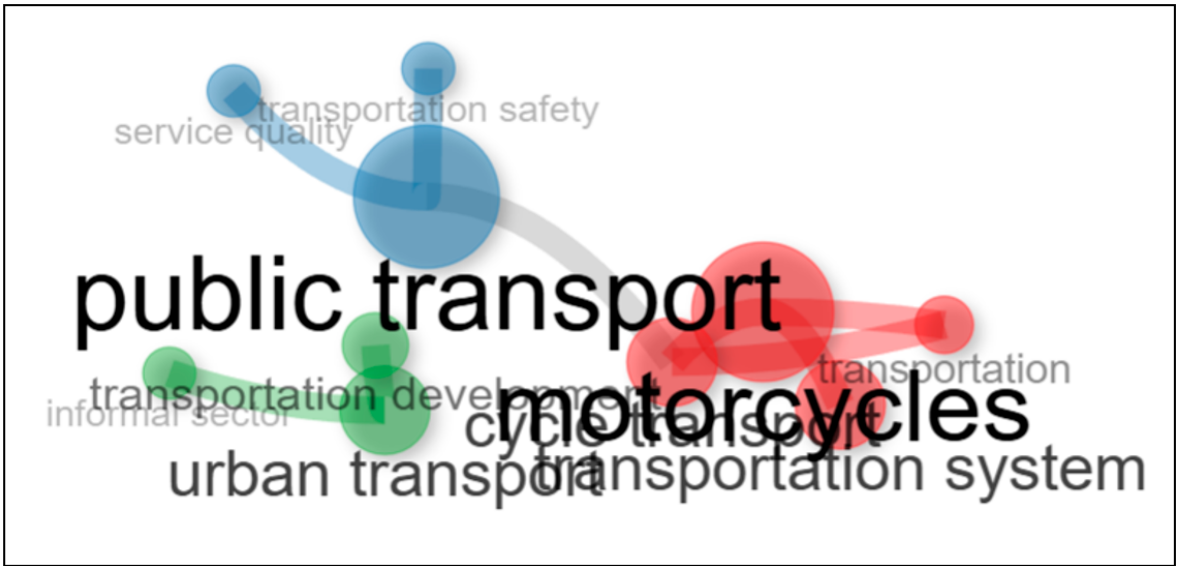

Figure 13: Co-occurrence Network in Cambodia

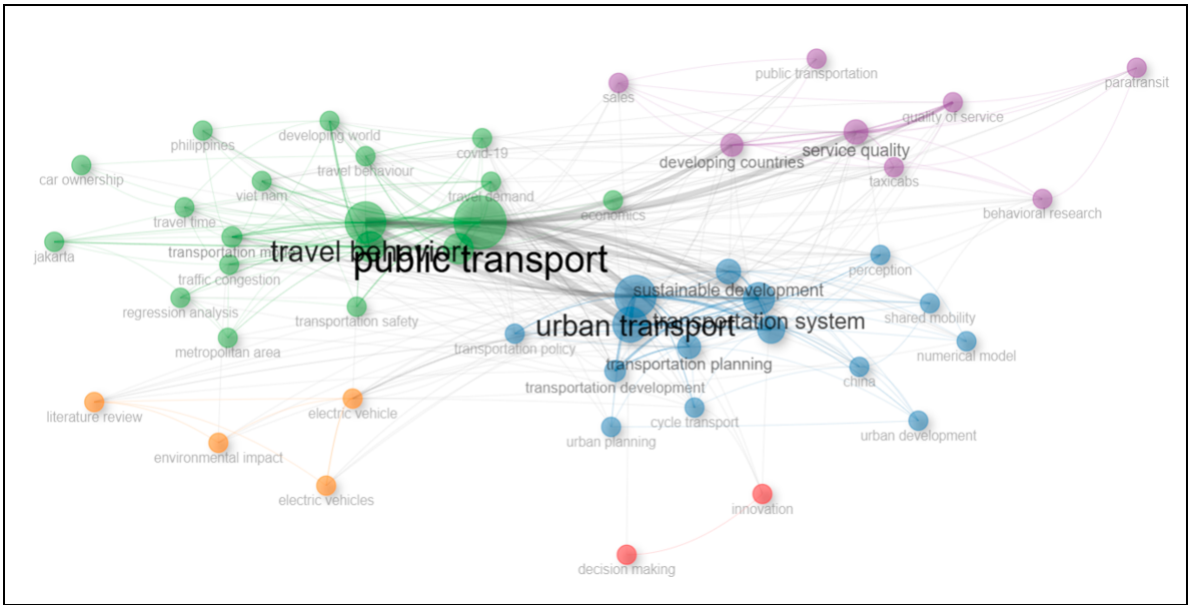

Figure 14: Co-occurrence Network in Indonesia

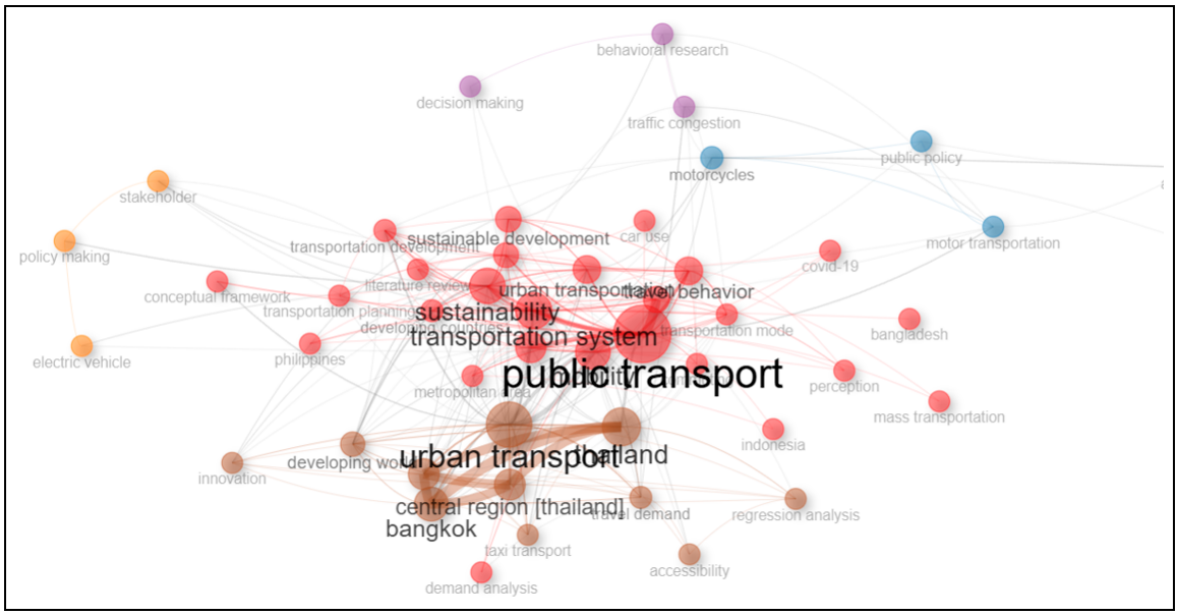

Figure 15: Co-occurrence Network in Thailand

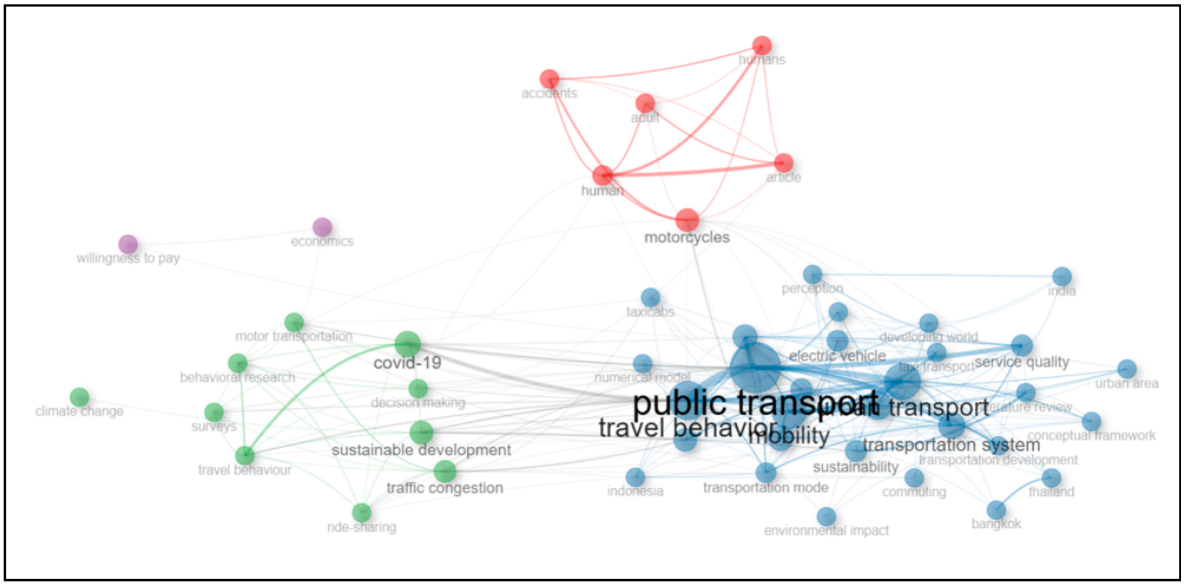

Figure 16: Co-occurrence Network in Vietnam

In Thailand and Vietnam, keywords such as sustainability and urban mobility frequently co-occur, highlighting a strong emphasis on environmental sustainability and sustainable transport solutions. In Indonesia, policy-oriented keywords like policy and governance dominate, reflecting a focus on institutional frameworks, transport infrastructure design, and policy interventions. Research in Cambodia, with fewer co-occurring keywords, primarily centres on topics related to specific ISM modes and fundamental infrastructure improvements.

These co-occurrence patterns reveal how ISM is perceived as a response to local transport challenges as well as how these perspectives shape the broader trajectory of transport infrastructure development across the region.

Research collaboration networks in the four study countries are shown in Figures 18 through 21.

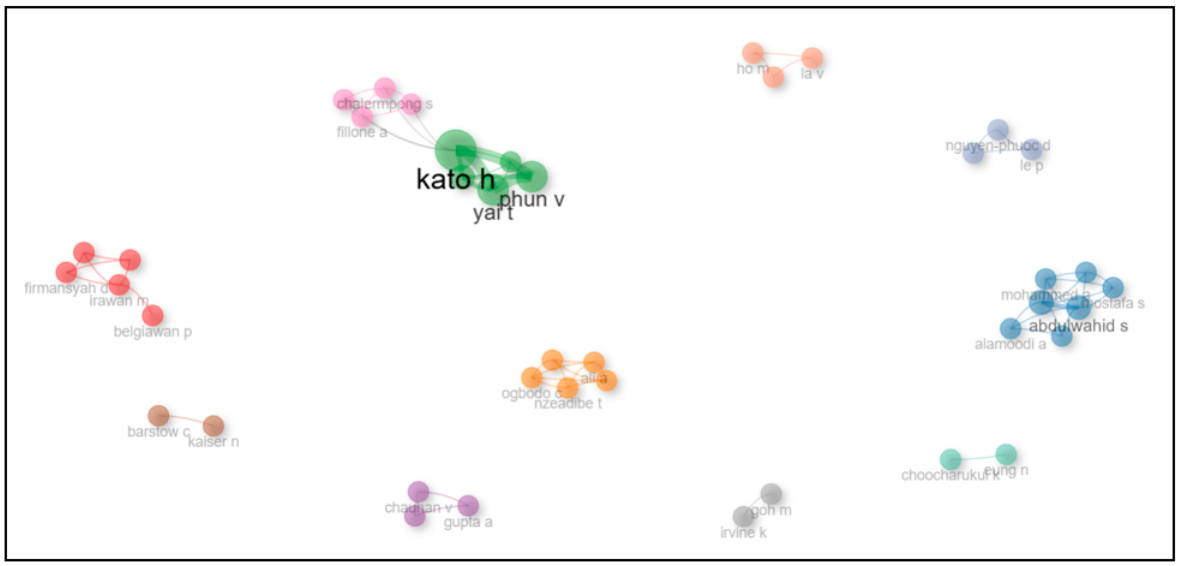

Figure 17: Collaboration Networks in Cambodia

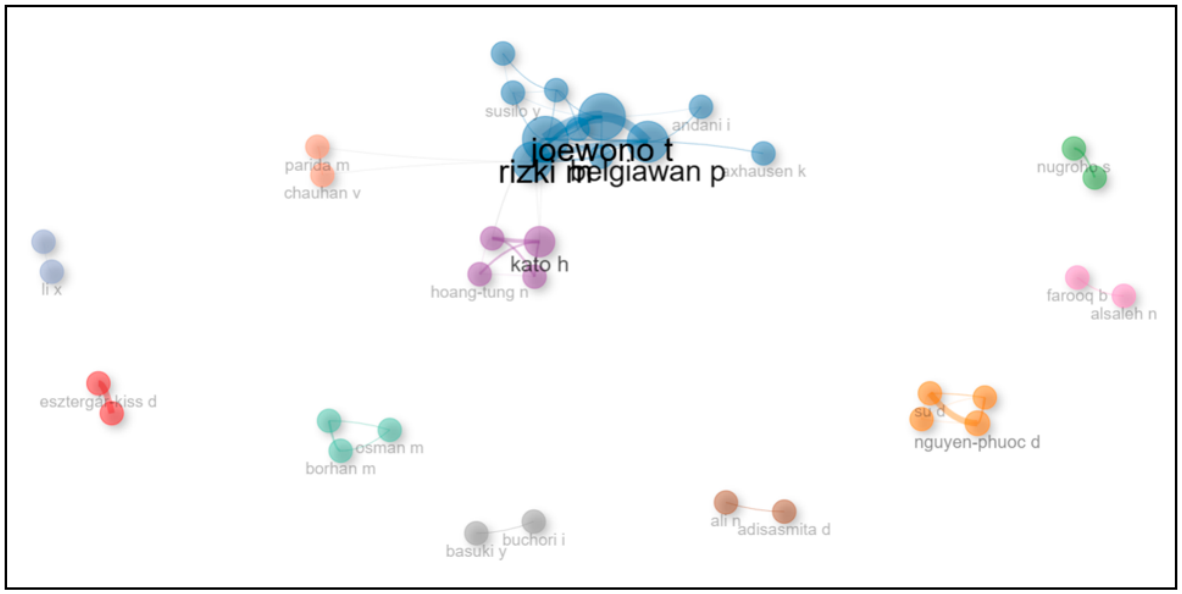

Figure 18: Collaboration Networks in Indonesia

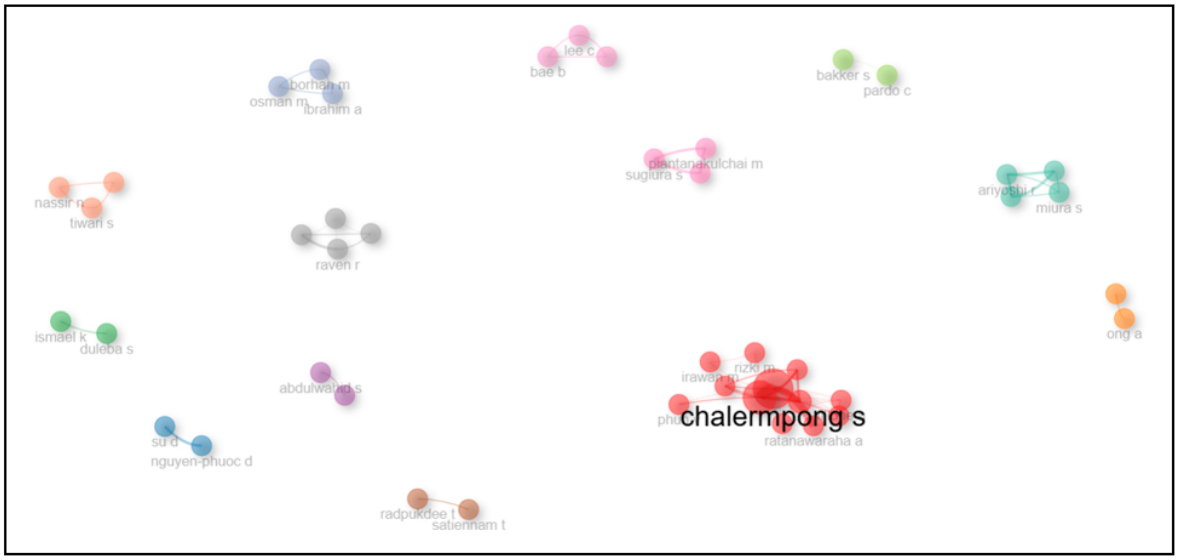

Figure 19: Collaboration Networks in Thailand

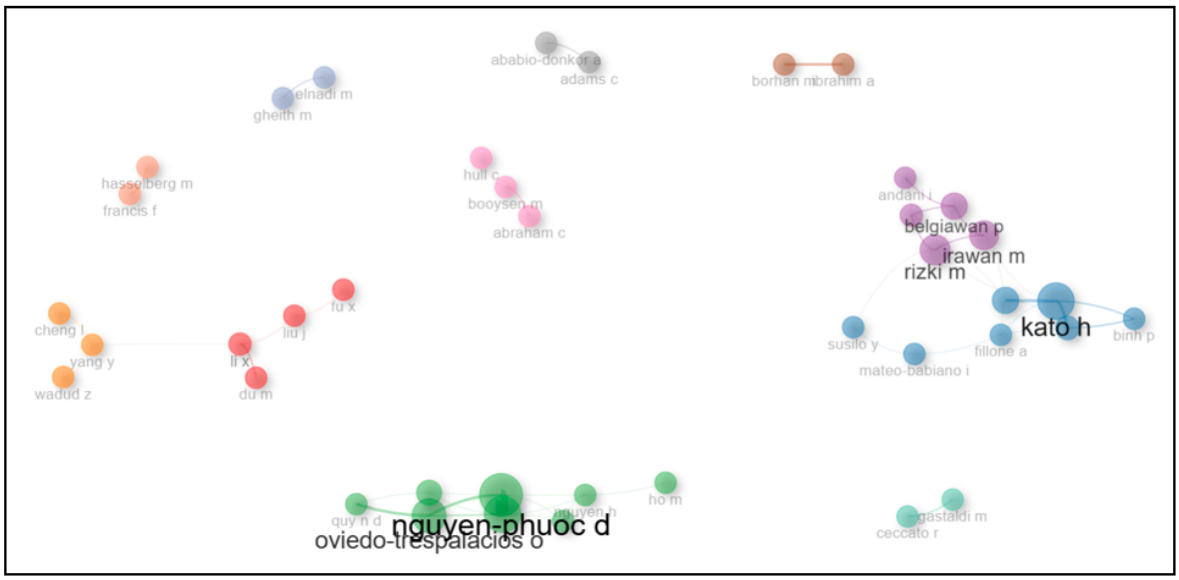

Figure 20: Collaboration Networks in Vietnam

In Cambodia, domestic research collaboration is minimal, and international researchers often conduct their studies independently, with limited integration of local perspectives. This lack of collaboration reflects varying priorities and approaches to ISM research across the region.

Academic collaboration between Indonesia and Thailand stands out as particularly strong, with active international exchanges facilitating the sharing of research knowledge and contributing to the development of a robust international knowledge base in the field of ISM. Vietnam has established regional cooperation with neighbouring Asian countries, fostering significant knowledge exchange within the region. While European and US research institutions contribute extensively

to the literature, collaboration with local researchers in Vietnam remains limited, highlighting a potential area for growth.

National and international cooperation networks underscore the importance of collective efforts to address transport challenges. They emphasise the need for enhanced collaboration to develop sustainable solutions for the region's mobility systems.

5.2. Key Topical Trends

Academic research on ISM in Southeast Asia has evolved with distinct focal areas in each country, shaped by their unique socio-economic, technological, and institutional contexts. The radar chart in Figure 22 illustrates the extent of research covering eight primary themes dominating ISM research in Cambodia, Indonesia, Thailand, and Vietnam: business models, technology adoption, employment and labour, institutions and governance, financing, safety and security, disability support and social inclusion, and sustainability. These themes highlight the transport and social challenges specific to each country, as well as the progress of academic inquiry into these issues. The chart reveals nuanced and in-depth research trends that extend beyond what is captured in the bibliometric analysis, providing valuable insights into the evolving landscape of ISM research in the region. The numbers represent the number of studies found in each category, reflecting the extent of research coverage on these topics.

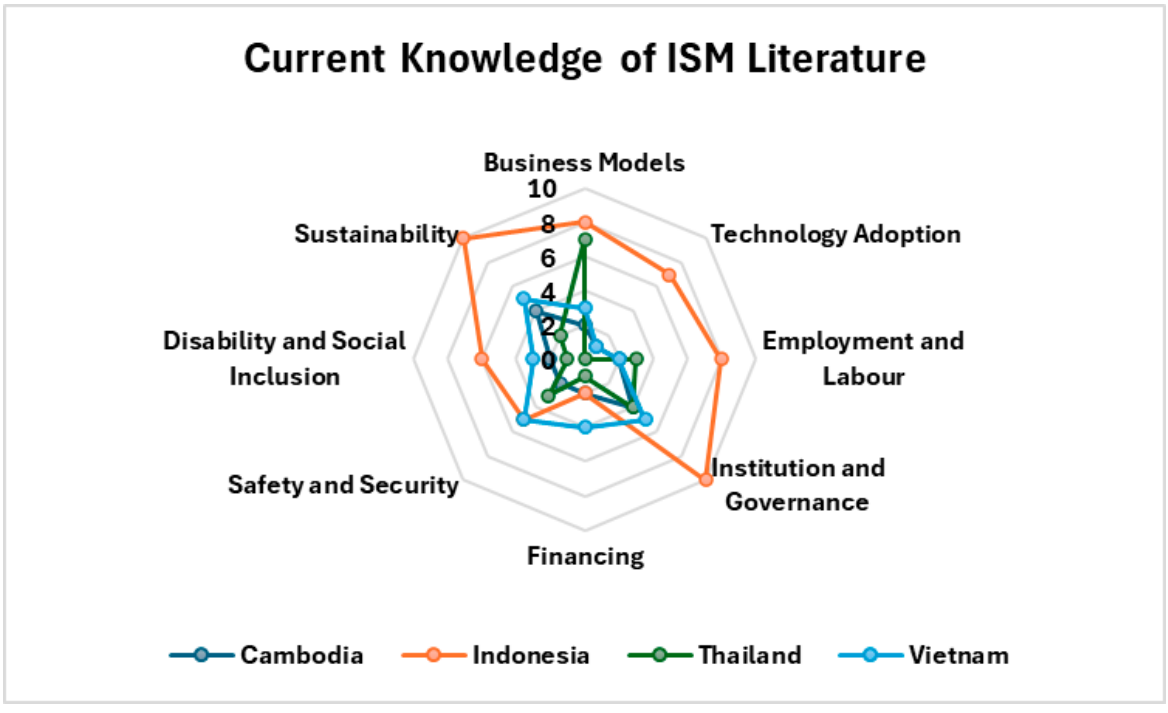

Figure 21: Radar Chart of ISM Literature Trends

In Cambodia, ISM research remains relatively limited but has begun addressing themes such as safety, security, support for people with disabilities, and social inclusion. Studies emphasise the challenges faced by marginalised communities in accessing transport and the role of ISM in bridging the rural-urban transport divide. Research on traditional ISM modes offers unique insights into Cambodia's cultural and economic contexts, providing opportunities for further exploration.

Indonesia has emerged as a leader in ISM research, particularly in research on business models and technology adoption. The widespread integration of ride-hailing platforms into the country's urban transport system has spurred studies on operational efficiency, market scalability, and the digital transformation of traditional ISM modes. These developments position Indonesia as a fertile testing ground for innovative ISM technologies and operational models.

In Thailand, research efforts are concentrated on institutional and governance challenges, as well as employment and labour issues. A significant focus is on regulatory hurdles in integrating ISM into formal transport systems. Additionally, studies on working conditions and labour rights for ISM workers, particularly in the gig economy, highlight the socio-economic impacts of ISM's evolution in urban and semi-urban settings.

In Vietnam, the focus on financing and sustainability is rapidly expanding. Urbanisation and economic growth have driven the development of financial mechanisms to support ISM operations, alongside initiatives for environmentally-sustainable transport solutions such as EVs. These studies form a critical foundation for understanding innovation in and the resilience of ISM systems in Vietnam's urban areas.

Across SEA, common research trends include the transformative impact of digital platforms on ISM systems, a growing emphasis on sustainable transport, and the socio-economic significance of ISM. However, critical gaps remain in areas such as developing safety standards, equitable transport access across social strata, and the seamless integration of ISM with formal transport systems. Addressing these gaps is essential for tackling changes in the region's transport challenges and shaping future research and policy directions for ISM in Southeast Asia.

5.3. Expert Perspectives on ISM in Southeast Asia

Building on the findings from the bibliometric study, this section incorporates insights from interviews with experts, including university faculty, government officers, and institutional consultants, who have been actively engaged in ISM research across Cambodia, Indonesia, Thailand, and Vietnam. The interviews provided additional context and depth, highlighting key research trends that shape ISM in the region. The expert perspectives complement the bibliometric analysis by addressing how ISM systems are adapting to technological innovations, labour dynamics, urbanisation, and policy interventions. Together, these findings offer a comprehensive understanding of the evolving research landscape and serve as a foundation for advancing future

research and practical applications in the field. The academic research trends identified by these experts are summarised in Table 26.

Table 26: ISM Academic Research Trends in SEA Identified by Experts

Country	Research Focus Areas	Key Trends Identified	Expert Insights	Areas Needing Further Research
Cambodia	Role of ISM in urban and rural connectivity, safety and licensing issues, electrification challenges, digital platform impact	Shift towards digital platform use in urban ISM, growing interest in EV adoption despite barriers	ISM's role in underserved regions is crucial, but operators often lack licences and insurance Electrification remains limited due to affordability issues	Cultural and economic significance of ISM modes, safety standards and user intentions in the context of electrification
Indonesia	Digital transformation, platform-driven ISM, gig economy dynamics, green mobility, integration with public transit	Super-apps enhancing ISM efficiency, disconnect between green mobility initiatives and empirical studies, digital ecosystem dominance	Platforms like Gojek and Grab dominate ISM, enhancing efficiency but creating worker instability Experts call for gig worker protections and sustainable ISM models	Policies for equitable gig economy practices, research on traditional ISM modes alongside digital innovations
Thailand	Regulation challenges, socio-economic impacts of ISM, electrification, platformisation, integration with formal systems	Emerging focus on electrified ISM modes, user behaviour studies for adopting electric ISM vehicles policy impacts on ISM regulation	Experts emphasise EV policies targeting motorcycle taxi drivers and their transition to electric bikes. ISM's role in last-mile connectivity is undervalued in urban planning.	Precarity of ISM workers, labour rights in the context of ISM, regulatory mechanisms for sustainable electrification
Vietnam	Electrification, social inclusion, platformisation, multimodal integration, empowerment through informal associations	Digital penetration improving ISM efficiency, need for policies supporting green ISM and multimodal systems	VinFast leads electrification but faces cost barriers. Informal driver associations offer mutual aid and advocacy, highlighting empowerment potential.	Socio-economic impacts of EV adoption, integration strategies for informal systems, solidarity within ISM worker communities

In Cambodia, the ISM sector is relatively small and less studied compared to other countries. Academic literature in Khmer is almost non-existent, apart from student theses, with most research conducted in English or French and often relying on reports from JICA and UN-related agencies. Studies have traditionally framed ISM as a response to the lack of formal transport systems, but the rise of digital platforms has begun transforming traditional ISM operations. This shift has influenced passenger safety and willingness to use ISM services, although many operators still lack proper licensing and insurance. Recent research has focused on the electrification of ISM modes, though traditional vehicles remain the preferred choice due to lower costs. Studies also emphasise ISM's role in providing connectivity in urban areas like Phnom Penh and in underserved rural regions, highlighting its potential to bridge mobility gaps.

In Indonesia, ISM research leads the region, particularly in exploring the digital transformation driven by platforms like Gojek and Grab. These platforms have revolutionised traditional ISM services through dynamic pricing, routing algorithms, and customer feedback systems, improving operational efficiency but exacerbating income instability for drivers. Research on workers' rights, primarily conducted by sociologists, has gained traction, stressing the need for policies that balance efficiency with protections for ISM workers.

The integration of ISM into formal transport systems, exemplified by Jakarta's Jak Lingko network, marks a milestone in ISM empowerment. However, experts call for more discussion on the sustainability and scalability of such models. In the green mobility sector, empirical efforts to integrate ISM with public transport have advanced, though research reflecting these efforts remains limited. Indonesia continues to serve as a testing ground for innovative ISM technologies and operational models.

In Thailand, research traditionally focused on regulatory challenges and the socioeconomic impacts of ISM, but has recently shifted towards electrification and platformisation. Studies explore the factors driving motorcycle taxi drivers to adopt EVs, including government EV promotion policies and market support. However, these studies often fail to contextualise findings within the broader ISM literature, reflecting a common trend in Southeast Asia of prioritising regulatory and technological perspectives over systemic vulnerabilities.

Experts emphasise the challenges of integrating motorcycle-centric ISM systems into formal transport networks. Despite ISM's vital role in last-mile connectivity, it is undervalued in urban planning frameworks, and fragmented policies hinder formalisation efforts. Labour dynamics also present significant concerns, with ISM workers often facing precarious employment and limited access to social security and fair wages. Researchers stress the need for more empirical and theoretical studies examining ISM from workers' — particularly ISM gig workers'— perspectives.

In Vietnam, ISM research is gaining momentum, focusing on electrification, social inclusion, and platformisation, with active participation from the private sector. Companies like VinFast are leading electrification initiatives, although high costs and inadequate infrastructure pose chal-

lenges to widespread adoption. Experts also highlight the partial integration of informal modes, such as xe ôm, into formal transport networks, calling for more structured multimodal policies.

Digital penetration in ISM is another significant area of study, with platforms improving efficiency through GPS tracking and automatic fare calculation. Experts underscore the importance of informal associations among ISM drivers, which provide mutual aid and advocacy. Sociological research into these associations could shed light on how ISM workers empower, and build resilience in, their communities.

Across Southeast Asia, common research themes include the impact of digital platforms, the focus on sustainability-oriented transport, and the socio-economic role of ISM. However, significant gaps remain in addressing safety standards, equitable access to transportation, and the integration of ISM with formal systems. Bridging these gaps will require coordinated research and policy efforts tailored to the unique contexts of each country, enabling ISM to fulfil its potential as a sustainable mobility solution in the region.

5.4. Extending Bibliometric Analysis: A Regional Perspective on ISM in Southeast Asia

This study builds on the seminal work of Behrens et al. (2021), which mapped researcher networks and clarified the scope of ISM and shared mobility. Their work was instrumental in clarifying the scope of ISM and shared mobility, offering valuable insights into global publishing trends, thematic foci, and collaborative research networks. The Behrens et al. study established a critical framework for understanding developments in the field, particularly in regions such as Europe, East Asia, and North America. While recognising the comprehensive nature of the Behrens et al. research, this study seeks to complement and expand upon their findings by addressing key gaps. Specifically, Behrens et al. focused exclusively on English-language academic publications and adopted a global perspective, leaving scope for more in-depth, region-specific investigations and the integration of perspectives captured in local-language publications.

This study contributes to a more nuanced understanding of ISM research in Southeast Asia by incorporating multilingual literature reviews, encompassing key languages relevant to Southeast Asia, alongside a robust bibliometric analysis. Comparisons and complementarities between this study and the study by Behrens et al. (2021) with respect to objectives, data sources, publication languages covered, geographical focus, methodology, and key themes are summarised in Table 27.

Table 27: Comparison with Behrens et al. (2021)

Aspect	Behrens et al. (2021)	This study
Objective	To provide a global bibliometric analysis of ISM, focusing on publication trends, collaboration networks, and thematic gaps.	To expand understanding of ISM in Southeast Asia, integrating local contexts and multilingual sources to address regional gaps.
Data Sources	Scholarly articles from Scopus and Web of Science.	Scholarly articles from Scopus, Web of Science, and locally-sourced literature.
Publication Languages Covered	English only.	English, Thai, Indonesian, Vietnamese, Khmer, and Japanese.
Geographical Focus	Global, with significant emphasis on Europe, East Asia, and North America.	Southeast Asia, focusing on Cambodia, Vietnam, Indonesia, and Thailand.
Methodology	Quantitative bibliometric methods, focusing on collaboration and citation networks.	Mixed methods combining bibliometric analysis, local literature synthesis, and expert interviews.
Key Themes	Shared mobility (e.g., bike-sharing, ride-hailing) with less emphasis on informal modes.	Broader ISM focus, encompassing both traditional and digitally-enabled modes.
Research Gaps Identified	Geographical and thematic gaps, in particular underrepresentation of research on informal transport	Gaps in local knowledge, socio-economic dimensions, and policy evaluations specific to Southeast Asia.

Building on the foundational work of Behrens et al. (2021), in this study we introduce several novel aspects that enhance our understanding of ISM, particularly in the context of Southeast Asia. Through a bibliometric-analysis-based methodology, we present the following key contributions:

We shift the focus from global trends to Southeast Asia, examining ISM in Cambodia, Vietnam, Indonesia, and Thailand in detail. By prioritising region-specific nuances, we capture socio-economic and cultural factors influencing ISM systems in these countries. These aspects are often overlooked in global studies. Expanding on Behrens et al. (2021), this study incorporates local-language sources (Thai, Vietnamese, Khmer, and Indonesian) alongside Japanese materials. This multilingual approach enriches the analysis, capturing critical local insights on ISM practices and policies that might otherwise be overlooked.

By integrating expert interviews and local stakeholder perspectives, this study bridges the gap between academic analysis and policymaking. The findings contextualise bibliometric trends within Southeast Asia's unique regulatory, technological, and socio-economic landscape, offering actionable recommendations for stakeholders.

While Behrens et al. focused primarily on shared mobility (e.g. ride-hailing and bike-sharing) and emphasised the need for ISM integration, electrification, and regulation from a global perspective, the scope of this study includes research on traditional ISM modes in greater detail. We explore research on interactions between digital platforms and non-digital systems, highlighting the coexistence and integration of diverse ISM systems in Southeast Asia. By adopting a pragmatic, localised approach, we address the importance of non-digital ISM in secondary cities and rural areas, offering policy recommendations that balance regulation with flexibility and promote social inclusion, particularly for older people and gender equality.

In this study we also introduce new methodological approaches to address the limitations of previous bibliometric analyses. First, by combining bibliometric analysis with qualitative data from expert interviews, this study offers a more holistic understanding of ISM research trends and challenges. The integration of qualitative and quantitative methods facilitates a richer synthesis of insights. By explicitly comparing global findings with the Southeast Asian context, we illustrate how local and global trends intersect, diverge, and influence one another. Applying this dual lens enables a nuanced understanding of ISM as both a local phenomenon and a component of the global mobility system.

The findings of our bibliometric study and those in the Roger Behrens et al. study both overlap and differ. A key area of convergence is the emphasis on under-researched regions and cities. Both studies identify geographical research gaps, but at different scales. Our bibliometric study focuses specifically on Southeast Asia, pointing to the under-researched status of secondary cities and peri-urban contexts in Cambodia, Vietnam, Indonesia, and Thailand. Behrens et al. highlight global gaps, particularly in sub-Saharan Africa and Western Asia, where informal transport remains prevalent yet poorly studied. Both studies confirm that regions heavily reliant on informal mobility systems tend to receive disproportionately less research attention relative to their importance.

Both studies also stress the significance of research on informal transport systems. Our bibliometric study highlights research on traditional modes such as tuk-tuks in Thailand, bajaj in Indonesia, and motorcycle taxis across Southeast Asia, while Behrens et al. include paratransit, informal for-hire transport, and shared taxis. Both reports acknowledge that informal transport serves as a critical bridge in areas where formal transit systems are insufficient. Similarly, research on the rise of digital platforms, like Grab and Gojek in Southeast Asia and ride-sourcing services like Uber globally, is acknowledged in both studies. Our bibliometric study emphasises research on digitalisation's growing role in improving efficiency and user convenience while raising concerns about labour precarity and inequities. Behrens et al. also highlight the global dominance of digital platforms, particularly in China and the United States. Both studies recognise

that research findings indicate that technology is transforming informal transport systems while presenting new challenges.

Integration of ISM systems with formal transport emerges as another shared theme. Our bibliometric study calls for hybrid governance models that integrate ISM with formal transport to improve first- and last-mile connectivity, while Behrens et al. highlight integration with mass public transport as a key research priority. However, the studies diverge significantly in their scope, research focus, and identified priorities. Our bibliometric study adopts a regional lens, concentrating exclusively on Southeast Asia, with detailed analyses of cities like Bangkok, Jakarta, and Ho Chi Minh City. By contrast, Behrens et al. take a global approach, comparing innovations in the Global North, such as bike-sharing and car-sharing, with informal modes like paratransit in the Global South.

The two studies also differ in their assessment of research collaboration. The bibliometric study finds limited collaboration within Southeast Asia, with most research being nationally focused and fragmented. By contrast, Behrens et al. identify strong global collaborations, particularly between China and the United States, and note significant research networks across East Asia. Topical focus further separates the two studies. Our bibliometric study finds more studies on socio-economic dimensions of informal mobility, such as labour precarity, gender inclusivity, and the potential of electrification to drive sustainable transitions. Meanwhile, Behrens et al. report that shared mobility systems—such as bike-sharing, car-sharing, and ride-hailing—command the most attention globally, while informal for-hire transport remains under-researched relative to its prevalence.

Gaps identified in the two studies reflect these differing scopes. In our bibliometric study we highlight gaps in understanding non-digital ISM systems, the dynamics of secondary cities, and rural contexts, along with the role of ISM in tourism. Behrens et al. focus on global thematic disparities, noting that informal public transport is under-researched compared to the abundance of studies on shared-mobility services. These differences extend to their research agendas. In our bibliometric study we propose a regional agenda tailored to Southeast Asia, focusing on scalable green mobility solutions, inclusive policies for marginalised groups, and the integration of ISM with tourism strategies. Behrens et al. propose a more global agenda, emphasizing priorities such as integrating informal systems with formal public transport, digitalising operations, and electrifying transport fleets.

In summary, both studies highlight the critical role of research on informal mobility, the transformative potential of digital platforms, and the need for better integration with formal systems. However, they differ significantly in their geographic scope, research collaboration trends, and thematic priorities.

5.5. News Media Coverage

In this section, we provide an understanding of the ISM market by examining the characteristics of key actors and urban mobility dynamics, as depicted in national and international news articles. Media coverage plays a crucial role in shaping public perceptions and policy discussions on ISM. It influences regulatory approaches, investment decisions, and societal attitudes towards ISM. By analysing media narratives, we identify which aspects of ISM receive prominent attention and which remain overlooked in different national and urban contexts. The review involved collecting, screening, and analysing relevant news items in English and local languages, using queries based on ISM modes specific to each country. The analysis focused on media trends from 2020 to 2024.

Initially, 134 news articles mentioning ISM were collected across the four study countries, distributed as follows: Cambodia (21), Indonesia (35), Thailand (47), and Vietnam (31). Following thorough screening, 69 articles were deemed relevant for detailed analysis. They were distributed as follows: Cambodia (16), Indonesia (17), Thailand (20), and Vietnam (16).

We recognise that there is much greater coverage in local-language media across these countries. Local-language media sources could provide a richer and more localised perspective on ISM. However, due to the time and resource constraints, our analysis was limited to a small number of local-language articles. Despite this limitation, we have made every effort to capture the key trends and issues reported in the sources that were studied. Future research could build upon this by incorporating more local-language media to present a more comprehensive picture of ISM in the region.

We identified six recurring themes in media coverage across the study countries: regulation and market competition; green mobility and sustainable transport; labour market and social security; roles of ISM in the modern world; safety and expansion of public services, and; female social inclusion. These themes highlight the key narratives shaping public and policy discourse around ISM. Breakdowns of the number of articles and the specific topics covered under each theme are provided in Figure 22 and Table 28, offering a detailed overview of how ISM is portrayed in the media in the study countries.

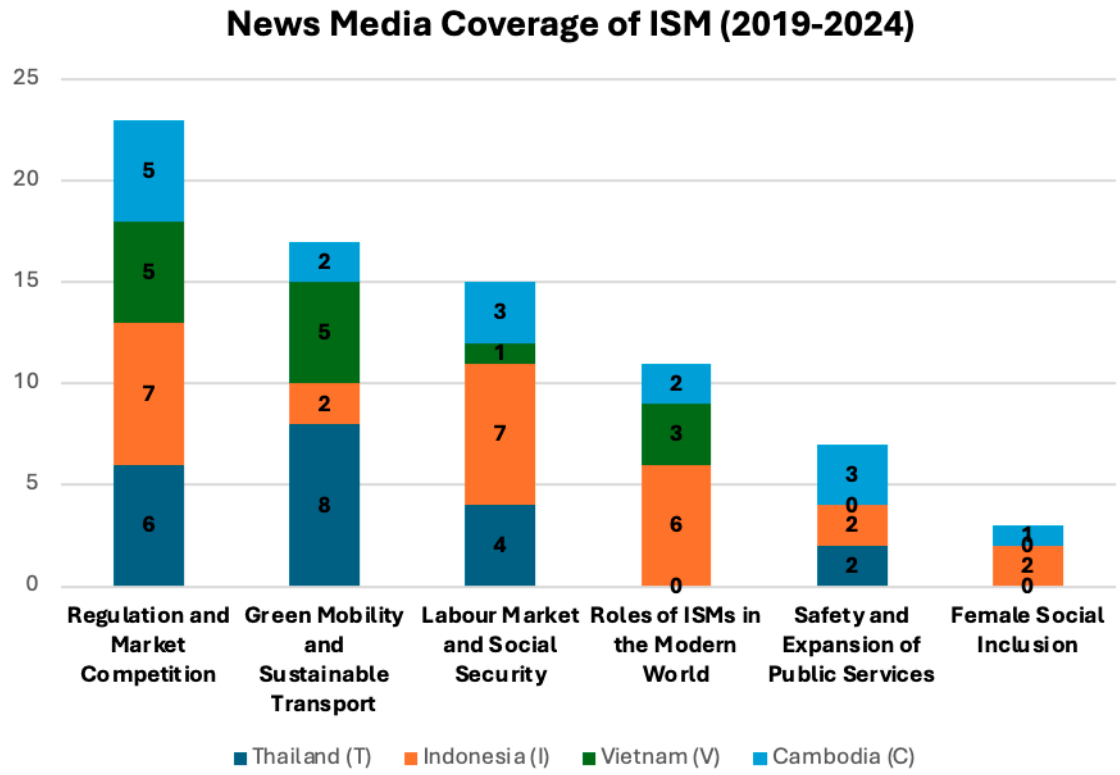

Figure 22: News Media Coverage of ISM in the Study Countries (2019-2024)

Table 28: News Media Coverage on ISMs in the Study Countries

Themes	Country	Key Points	Main References
Female Social Inclusion	Indonesia	Female drivers in Indonesia, through Jak Lingko[16], achieve economic independence despite gender-based prejudice, becoming role models. CCTV cameras are installed to ensure female passenger safety.	CNN Indonesia (2022) medcom.id (2022)
	Cambodia	Moto Girl Tour and Siem Reap Remorque Driver Association provide women with opportunities in tourism while combating gender bias.	M Today (2023)

[16] The system integrates public transport in Jakarta and aims to connect informal ISM such as angkot and minibuses with public transport at a unified fare.

Safety and Expansion of Public Services	Thailand	Calls for a government-led bike-taxi app in Thailand to ensure passenger safety and fair pricing, while licensing and vehicle registration regulations are being strengthened.	The Phuket Express (2024); Thaiger (2024, July 20)
	Cambodia	In Cambodia, road safety challenges persist with low helmet usage among tuk-tuk drivers. Grab trains tuk-tuk drivers to prevent human trafficking.	Reuters (2020, January 17)
Roles of ISM modes in the Modern World	Indonesia	Traditional ISM modes like bajaj and becak face cultural preservation challenges as they compete with new transportation modes in Indonesia, with drivers advocating for e-becak and subsidies.	DPRD Provinsi DKI Jakarta, (2024) RRI, (2024) krjogja.com (2024)
	Vietnam	In Vietnam, cyclos are transitioning to tourism while eco-friendly options like electric buggies are promoted, supporting sustainable urban tourism.	VN Express (2016) Vinpearl (2024)
	Cambodia	In Cambodia, tuk-tuks remain a culturally significant mode of transport, though competition with new mobility apps has intensified.	Khmer Times (2023, Sep 6) The Phnom Penh Post (2019)
Labour Market and Social Security	Thailand	52.3% of Thailand's workforce is in the informal sector, with limited social security, especially in urban areas. Gig workers receive limited social protection.	Bangkok Post (2021); Bangkok Post (2023, December 19)
	Indonesia	Jakarta ISM drivers in Indonesia face low wages and unstable conditions, leading to calls for fairer pay structures. The government plans new labour protection regulations.	Detik Finance (2024) Reuters (2024)
	Vietnam	Vietnamese ISM workers struggle for stable incomes and expanded social security, seeking labour rights protections.	VN International (2023)
	Cambodia	Cambodian ISM workers, especially tuk-tuk drivers, lack social security. The pandemic reduced tourism and income stability, impacting loan repayments.	M Today (2023) VOD (2024, May 1)

Green Mobility and Sustainable Transport	Thailand	Thailand is promoting electric tuk-tuks and other green mobility options like Green Win to reduce emissions.	Bangkok Post (2024, April); Hua Hin Today (2022)
	Vietnam	Vietnam expands green transportation through EV taxis and public bicycle-sharing initiatives to support zero-emission targets by 2050.	Vietnam Plus (2023) VN Economy (2023)
	Cambodia	Cambodia incentivises EV adoption by reducing import taxes, aiming for increased EV market share by 2030.	Khmer Times (2023, August 13)
Regulation and Market Competition	Thailand	Legalised ride-hailing in Thailand spurred competition with traditional motorcycle taxis, and global platforms like Grab dominate, intensifying price competition.	Bangkok Post (2023) Thaiger (2024)
	Vietnam	Vietnam's ride-hailing market, led by Grab and Be, faces regulatory changes affecting costs, with competition intensifying among old and new drivers.	Vietnam Briefing (2021) VN Express (2024)
	Cambodia	Cambodia's local ride-hailing platforms face competition from Grab, which holds a significant market share.	Khmer Times (2023, September 6)

A total of 155 references were analysed, with findings and issues extracted across eight main themes: business models; technology adoption; employment and labour; institutions and governance; financing; safety and security; disability support and social inclusion, and; sustainability.

The distribution of references varies across countries, reflecting differing ISM dynamics and research focus areas. Cambodia has 19 references, emphasizing safety challenges and the role of ISMs in promoting social inclusion in rural and underserved areas. Indonesia accounts for the largest share, with 56 references. Research is driven by Indonesia's vibrant ISM ecosystem, including the proliferation of ridesharing platforms and innovative business models. Thailand contributes 22 references, primarily addressing the socio-economic impacts of institutions, governance, and employment and labour, reflecting efforts to integrate ISM into the formal transport system. Vietnam offers 28 references, with a strong focus on financial mechanisms and sustainability initiatives aligned with urbanisation and green mobility goals.

In our review, we not only charted the progress of ISM research in these four countries but also identified critical ISM challenges, such as inadequate safety regulations, the precarious nature of ISM labour, and the slow adoption of digital technologies in certain cities and regions. At the same time, we highlighted emerging trends, including the growing focus on sustainability, the integration of digital platforms, and the need for inclusive policies that prioritise social equity. These insights provide a nuanced understanding of the current state of ISMs and future opportunities for the sector in Southeast Asia.

5.6. Thematic Map of ISM Research in Southeast Asia

To explore the current situation and challenges of ISM in SEA, we conducted expert interviews in Cambodia, Indonesia, Thailand, and Vietnam (see Appendix 1). Based on these interviews, we identified key trends and issues related to ISM. The following five main themes and associated sub-themes were identified: evolving ISM landscapes; ISM's economic bottlenecks; regulation and policy disconnects; and; cultural legacy vs modern needs. We have prepared a thematic map of the specific wording of the interviews that led to the identification of these five themes and sub-themes (see Figure 24). A systematic visualisation of each theme and through specific examples from the interviews, the current situation and ISM challenges as seen from multiple perspectives are provided in this map. The map helps to deepen the understanding of ISM in the SEA region and provides a basis for future discussions.

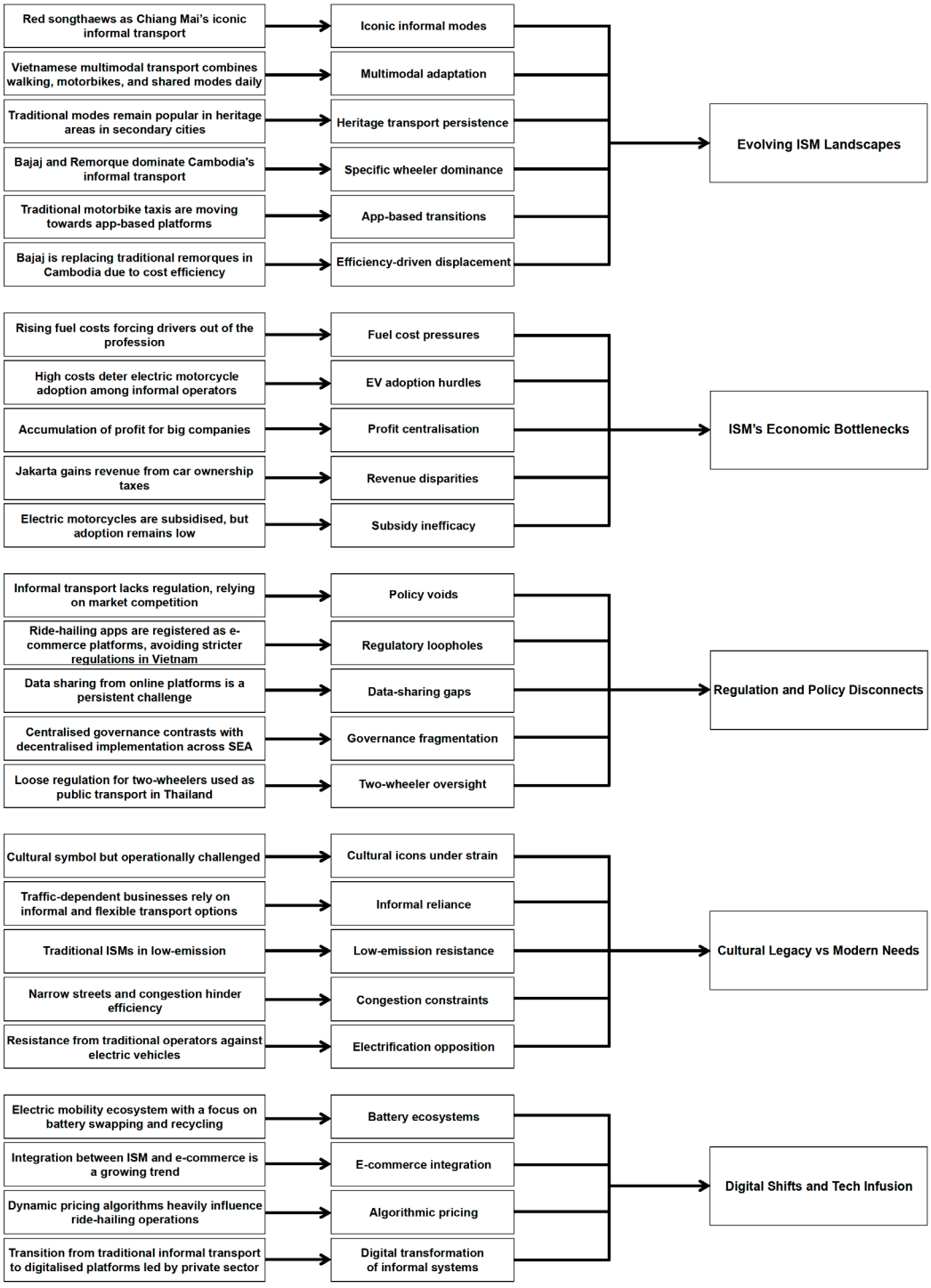

Figure 23: Thematic Map

Evolving ISM Landscapes

The landscape of ISM in SEA is evolving, reflecting the unique cultural and economic needs of the region. For instance, the red songthaew in Chiang Mai, Thailand, has become part of daily life for both locals and tourists and is considered a symbol of local culture that goes beyond mere transportation. Meanwhile, "multimodal adaptation," a flexible combination of multiple modes of travel such as walking, motorcycles, and ridesharing, is common in urban areas in Vietnam. Experts appreciate this as "a natural adaptation to the diverse mobility needs of the city." In rural cities like Siem Reap, where traditional ISM modes still play a vital role in providing mobility, the transition to new technologies is often slow due to economic background and cultural factors. In Cambodia, three-wheeled vehicles such as the bajaj and remorque are favoured for their cost-effectiveness and lower fuel consumption, which experts in Cambodian an ISM sector highlight as a key competitive advantage in the market. Furthermore, market competition and a focus on efficiency are gradually displacing traditional modes. There is a shift towards app-based services, and the use of platform-based services is increasing rapidly, especially among the younger generation. Experts are concerned about this change, saying that while convenience is increasing, traditional modes of travel are losing their competitiveness in the market.

ISM Economic Bottlenecks

The ISM sector faces economic challenges. In particular, rising fuel prices are putting pressure on drivers' livelihoods. In addition, the transition to EVs is hampered by high initial costs and depreciation risk. Even where government subsidies exist, they do not function well, and experts stress that the subsidies do not match the realities of driver situations. Another issue cited is the concentration of profits by platform companies. Experts in Indonesia say that "platforms siphon off most of the profits, resulting in an unfair distribution of revenue to drivers." This profit structure problem is a threat to the sustainability of the ISM sector. In Jakarta, Indonesia, it has also been pointed out that while the local government is receiving significant revenues from the private car tax, ISM revenues are not adequately redistributed, deepening income inequality among transport workers.

Regulation and Policy Disconnects

Lack of regulation and policy are major barriers to the further development of the ISM sector. Many experts criticised their government's failure to consider informal transport as a formal means of public transport and the "absence of a policy framework, which encourages excessive competition among operators." The current situation in Vietnam, where ridesharing companies avoid traffic regulations by registering as e-commerce service providers, is problematic. An expert pointed out that "loopholes in regulations are working in favour of the companies and competition is losing its fairness. In addition, the lack of data sharing among platforms is hindering the improvement of transportation efficiency. Some experts stated that "if data

were shared among platforms, traffic congestion and efficiency issues would be closer to being solved." Others said that regulations are fragmented across the Association of Southeast Asian Nations (ASEAN) region and that "the lack of a unified framework hinders consistency within the region."

Cultural Legacy vs Modern Needs

ISM operators oscillate between providing cultural value and addressing modern transportation needs. Chiang Mai's songthaews and Yogyakarta's delmans are symbols of local culture, but they face traffic congestion and efficiency challenges. Experts say that while it has cultural value, it needs to be improved in terms of efficiency. In response to the shift to low-emission modes of transportation, they say that in secondary cities, "traditional vehicles are not profitable, but they are not easy to change because they are part of daily life." It is also clear that traffic congestion and narrow roads cause inefficiencies, and this is currently hindering the introduction of new transport modes. Experts indicate that a major barrier to the widespread use of EVs is that traditional operators are opposed to them because they are expensive and difficult to maintain.

Digital Shifts and Tech Infusion

The introduction of digital technology is bringing new transformations to the ISM sector. As one expert noted, fare calculation and route optimisation through apps have significantly improved service efficiency and customer satisfaction. On the other hand, some point out that dynamic algorithmic pricing destabilises drivers' income. Installing battery replacement stations is considered key to the widespread adoption of EVs, and many commented that "once the infrastructure is in place, drivers will be more receptive to the EV conversion." In addition, ISM is being redefined as part of the digital economy as it becomes increasingly integrated with e-commerce and public transport. The transformation of informal transport systems into digital platforms suggests that new business models may be formed.

5.7. Research and Resource Gaps

Based on a comprehensive review of literature, including news articles, academic papers, and expert interviews, we have identified two primary types of gaps that constrain the potential of ISM to address pressing mobility challenges in Southeast Asia: research gaps and resource gaps. These gaps limit both the scope and impact of research, hindering the development of informed policies and innovative practices that could enhance the ISM sector's transformative potential.

Research gaps pertain to the fragmented nature of existing studies, which often fail to provide a cohesive understanding of ISM's hybrid characteristics in policy and regulation. While there is growing academic and practical interest in ISM, discussions on its socio-economic and envi-

ronmental impacts remain incomplete. Additionally, there is a lack of comparative studies that examine ISM across countries or regions, leaving significant questions about the broader role of the ISM sector in delivering sustainable mobility unaddressed.

Resource gaps refer to the limited research activities and weak connectivity among scholars, practitioners, and policymakers in the field. The absence of robust funding mechanisms, access to data, and institutional support exacerbates these challenges, particularly in low- and middle-income countries where ISM systems are most prevalent. This lack of resources restricts the scale of research and limits opportunities for collaboration and knowledge sharing, impeding efforts to build a comprehensive understanding of ISM.

Despite its critical role in addressing the mobility needs of local communities across Southeast Asia, ISM research remains constrained by these knowledge and resource gaps. Addressing these gaps is essential for fostering a more inclusive and sustainable mobility landscape, enabling ISM to better meet the diverse needs of Southeast Asia's rapidly urbanising societies.

5.7.1. Research gaps

To structure the identified gaps, we adopted the Pyramid of Research Gaps framework proposed by Miles (2017), which categorises research gaps hierarchically to reflect their foundational and practical deficiencies. The **theoretical gap** refers to the absence of a conceptual framework or sufficient theoretical understanding of a given topic. It lies at the base of the pyramid. This gap often underpins other issues, highlighting the need for new models to explain phenomena. Above it is the **population gap**, which reflects insufficient representation of specific demographics or groups in research, such as marginalised or underserved populations like rural communities and minority groups. Addressing this gap is crucial to building a more inclusive understanding of ISM.

The **methodological gap** identifies deficiencies in the approaches and techniques employed in past research. For example, some studies rely on outdated methods or fail to adopt innovative approaches to address emerging questions. Closely related to this is the **empirical gap**, which highlights a lack of sufficient data or case studies in specific research areas, including the absence of longitudinal data necessary to support or validate findings. Further up the pyramid, the **practical knowledge gap** underscores the disconnect between theoretical knowledge and its application in real-world contexts, reflecting a failure to translate research insights into actionable solutions for policymakers and practitioners.

The **knowledge gap** refers to a lack of understanding or information regarding a specific subject, leaving fundamental questions unanswered and obstructing further progress. At the top of the pyramid is the **evidence gap**, which represents the absence of available research data or empirical evidence in certain areas. This gap points to critical voids where no prior data collection or analysis has occurred, further limiting progress.

Addressing these gaps is essential to developing a holistic understanding of ISM and crafting effective, regionally-tailored policies and innovations. The detailed examples of these gaps across different countries, offering deeper insights into unique challenges and opportunities in Southeast Asia are provided in Table 29. By filling these research gaps, the region can better integrate ISM into sustainable urban mobility solutions. Notably, theoretical gaps specific to Southeast Asia are excluded from this analysis, as the report prioritises practical and policy-oriented objectives.

Table 29: Topical Gaps

	Cambodia	**Indonesia**	**Thailand**	**Vietnam**
Evidence Gap	Limited standardised data on most ISMs affecting their evaluation	Fragmented data on traditional ojeks and angkots, particularly in secondary cities	Lack of demand data on skylabs, songthaews, and app-based tuk-tuks	Sparse data on xe ôm and xe khách operations, especially in rural areas
Knowledge Gap	Poor insights into the cultural and economic importance of ISMs	Insufficient analysis of transitions from informal ojeks to app-based services like ojol	Limited integration of ISM with formal systems and electrification impact studies	Weak understanding of the role of RHAs in formal transport system integration
Practical Knowledge Gap	Lack of strategies for scaling shared mobility programmes rather than informal transport	Limited strategies for integrating ISM into first- and last-mile solutions	Weak implementation of digital payments in traditional ISMs	Weak policy execution for e-payment integration with xe ôm services
Methodology Gap	Need for robust methods to study ISM in underserved regions	Few longitudinal studies track regulatory changes in ISM sectors after implementing the Jak Lingko project	Absence of standardised evaluation frameworks for ISM performance	Lack of comparative methodologies for urban and rural ISM evaluation
Empirical Gap	Sparse studies on the role of ISMs in tourism and rural connectivity	Minimal exploration of environmental and labour impacts of ISMs	Limited research on the socio-economic impacts of traditional 3- and 4-wheeler ISMs such as skylabs and songthaews	Few studies on ISM emissions and labour equity issues
Population Gap	Limited focus on how ISM serves low-income rural populations	Neglect of marginalised groups, including informal ISM workers.	Underrepresentation of women, the elderly, and rural populations in ISM studies	Under exploration of gender dynamics and ISM roles in secondary cities

The **evidence gap** highlights the lack of basic data on ISM in many countries, hindering the ability to systematically assess ISM use and impacts. In Cambodia, there is little standardised data on ISM modes, making it difficult to evaluate their role in the transportation system. Indonesia faces fragmented data on ojeks and angkots in secondary cities, while Thailand lacks usage and operational data for Skylabs and songthaews (modes specific to rural areas). Similarly, Vietnam lacks detailed data on the use of xe ôm and xe khách in rural areas. This absence of fundamental data and statistics poses significant obstacles to policymaking and infrastructure planning.

The **knowledge gap** reflects a limited understanding of how ISM integrates with formal transport systems and adapts to new technologies. In Cambodia, the cultural and economic roles of ISM remain underexplored, while Indonesia lacks studies on the transition from ojeks to app-based ojol. In Thailand, there is little research on the effects of electrification and technological innovation on ISM, and in Vietnam, the integration of RHAs into the official transportation system is not well understood. Lack of knowledge impedes efforts to incorporate ISM into sustainable urban transportation strategies.

The **practical-knowledge gap** stems from the lack of implementation strategies in areas such as digital payments and first- and last-mile connectivity. In Cambodia, there is no established strategy to expand shared mobility. Indonesia lacks concrete strategies for integrating ISM into first- and last-mile connections. In Thailand, digital payment systems are yet to be widely adopted in traditional ISM modes, while Vietnam faces challenges in policy implementation for the digital integration of xe ôm. This gap limits opportunities to enhance the convenience and sustainability of ISM systems.

The **methodology gap** reflects the absence of standardised evaluation frameworks to measure ISM performance and effectiveness. In Cambodia, methodologies for researching ISM in underserved areas remain underdeveloped. Indonesia lacks longitudinal studies to evaluate the impact of regulatory changes, while Thailand lacks a framework for regional comparisons. Similarly, researchers in Vietnam do not have a methodology for assessing ISM modes in urban and rural areas. These limitations make cross-country and regional comparisons challenging.

The **empirical gap** underscores the scarcity of research on the socioeconomic and environmental impacts of ISM. In Cambodia, there are few studies on the role of ISM in tourism and local connectivity. Indonesia lacks research on ISM environmental impacts and working conditions. Thailand has limited studies on the socioeconomic effects of Skylab and songthaews, while Vietnam has little empirical evidence on ISM emissions and labour equity. Addressing these gaps is essential for understanding the broader impacts of ISM.

The **population gap** points to the lack of studies focusing on specific populations that rely on ISM, such as rural, low-income, and female users. In Cambodia, there is little information on how low-income rural populations use ISM. In Indonesia, the impact of ISM on vulnerable groups, such as informal workers, remains unexamined. Thailand has insufficient research on how ISM serves

women and the elderly, while Vietnam lacks research on the relationship between gender and ISM in small cities. Addressing these gaps is critical to improving ISM across Southeast Asia.

5.7.2. Resource Gaps

The primary challenges in advancing ISM research in the region stem from the lack of reliable data and actionable knowledge. The diversity of contexts across Southeast Asia further complicates efforts to formulate a unified, general theory of ISM. As a result, we focused in this study on addressing region-specific issues and resolving practical challenges through data-driven insights. By leveraging existing knowledge, we aimed to provide actionable guidance to a wider audience, bypassing the need for new theoretical frameworks at this stage.

Existing activities and networks supporting ISM research and development in Southeast Asia reveal significant regional imbalances and critical gaps that hinder the sector's growth and integration. In this section we examine the disparities in activities and networks related to ISM research, focusing on research productivity, inter-institutional collaboration, thematic priorities, and integration into policy across the four study countries (see Table 30). Our analysis underscores the need for enhanced inter-regional collaboration, institutional capacity building, and targeted thematic research. Addressing these gaps is essential for overcoming challenges and unlocking the full potential of ISM in the region.

Table 30: Gaps in Existing ISM Research Activities and Networks

Aspect	Cambodia	Indonesia	Vietnam	Thailand
Top Authors	Limited outputs, led by Kato H. and Phun V. (3 papers each).	High output from Rizki M. (11 papers) and Jatmiko Y. (10 papers).	Nguyen-Phuoc D. leads with 8 papers, focusing on sustainable urban transport.	Dominated by Chalermpong S. with 12 papers; strong contributions from Ratanawaraha A. (9 papers).
Institutional Strength	A few contributors, led by foreign universities such as Chulalongkorn University and Universiti Tenaga Nasional.	Universitas Gadjah Mada dominates (14 papers); some contributions from the University of Tokyo.	Most contributions are from universities in North America and Europe, such as the University of California (13 papers) and the University of Leeds (11 papers).	Chulalongkorn University leads with 30 publications, followed by Khon Kaen University (8 papers).
Research Themes	Sparse research on ISM; focus primarily on tourism-related transport modes and rural mobility.	Themes on digital platforms, socio-economic impacts of ISM, and electrification of ISM modes.	Emphasis on environmental sustainability, urban planning, and resilience in transport systems.	Focus on urban ISM, first/last-mile solutions, and digital integration (e.g., app-based transport).
Collaboration Networks	Fragmented network; minimal collaboration within ASEAN or internationally.	Active clusters around Rizki M.; stronger ties within ASEAN than with global networks.	Small clusters, led by Nguyen-Phuoc D.; limited ASEAN integration, reliant on international projects.	Dense clusters centred on Chalermpong S., dominated by national collaborations
International Access	Dependent on NGOs and international aid for research; minimal integration with global networks.	Collaborations focused on ASEAN and limited partnerships with European or North American institutions.	Engaged with higher institutions in North America and Europe and global organisations; weaker ties within ASEAN.	Good connectivity to Japanese universities; moderate engagement with European partners.
Policy Integration	Minimal use of academic findings in policymaking; reliance on external advisories.	Some integration of findings into national policies, especially electrification and digitalisation.	Limited translation of research into policies, with a focus on academic output.	Research partially informs policy but lacks strong feedback mechanisms for continuous improvement.
Key Gaps	Severe lack of resources, partnerships, and institutional strength	Weak international academic partnerships	Poor collaboration within ASEAN research networks	Limited international research impact

Cambodia faces the most significant challenges among the four countries, with very low academic productivity and fragmented research networks. Institutions such as the Institute of Technology of Cambodia have made limited contributions to the ISM literature, while most research initiatives depend heavily on external aid organisations and foreign universities. Both national and international collaboration networks are sparse and largely disconnected from regional and global ISM research developments. The country's lack of institutional capacity and infrastructure hinders the translation of academic findings into practical policy solutions, exacerbating the informality and underdevelopment of the ISM sector.

Indonesia has a vibrant national research ecosystem, led by prominent institutions such as Universitas Gadjah Mada, Universitas Indonesia, and the Bandung Institute of Technology. Networking within ASEAN is relatively strong, with key researchers such as Rizki M. and Jatmiko Y. driving progress. However, international partnerships outside the region remain limited, restricting access to broader academic and policy dialogues. While some research outputs have influenced domestic policies, particularly in electrification and digital platform innovation, inconsistencies in regulatory enforcement and the absence of formal mechanisms to bridge research and policymaking continue to pose challenges.

Thailand has demonstrated high academic productivity in the field of ISM, with significant contributions from institutions such as Chulalongkorn University. National collaboration networks are well-developed, led by key researchers. However, Thailand's influence on international research remains limited. There is a need to strengthen connections with global academic networks. Despite a wealth of research findings, these are not fully utilised in policy formulation due to the lack of robust feedback mechanisms between academics and policymakers. This gap reduces the potential to effectively promote sustainable ISM practices.

ISM research in Vietnam is marked by emerging themes such as environmental sustainability and urban resilience, with substantial contributions from foreign institutions like the University of California and Queensland University of Technology. However, national and international academic networks remain fragmented and poorly integrated into ASEAN-level collaboration. Despite active participation in international projects, research findings are not consistently incorporated into national policy discussions. The absence of a robust national knowledge-sharing framework limits Vietnam's ability to address ISM challenges comprehensively and effectively.

5.8. Overlooked and Underfunded: The Ongoing Marginalisation of ISM Research

Despite their critical importance to the future of ISM, the aspects of ISM systems described above remain severely under-researched. The marginalisation of ISM in Southeast Asia's research landscape can be attributed to a confluence of systemic biases, entrenched paradigms in transport education, and narrowly-defined funding priorities. This neglect not only leaves ISM at the periphery of academic and policy discussions but also hampers the development of inclusive and sustainable urban mobility frameworks.

A key factor behind the lack of attention to ISM research is the agenda-setting power of policymakers and donors, who overwhelmingly prioritise large, transformative, and visible projects. Government-funded research tends to focus on high-impact infrastructure investments such as highways, rail systems, and urban megaprojects that align with national development goals and political imperatives. These projects often serve as tangible symbols of modernisation and progress, making them attractive for governments eager to showcase development achievements. ISM systems, which are decentralised, less capital-intensive, and operate informally, do not align with these high-profile priorities. When ISM does appear in government-led research, it is often in the context of regulation and formalisation, aiming to control and standardise rather than integrate and modernise. In countries where external funding plays a significant role, research agendas are similarly skewed. Overseas foundations, official development assistance (ODA), and bilateral support programmes typically emphasise broad themes such as sustainability, urbanisation, and poverty alleviation. While these agendas occasionally intersect with ISM, the focus is often tangential, as the primary objectives of these organisations seldom lead to prioritising the unique dynamics of informal mobility systems. Instead, attention is often drawn to globally-trending topics such as EVs or smart urban technologies, which are perceived as more innovative and scalable.

Another major factor contributing to limited research being performed on ISM is the outdated paradigms that dominate transport education in the region. Historically, transportation-related academic programs have focused on highway engineering and traffic management, leaving little room for broader discussions on informal systems and their role in urban mobility. Although there has been a gradual shift towards incorporating public transport and sustainability into curricula, much of this focus centres on the electrification of private vehicles, reflecting a car-centric worldview. At the same time, another academic movement champions non-motorised transport such as walking and cycling, often bypassing motorcycles: the dominant mode of both private and public transport in ISM across Southeast Asia. This omission is striking, given the central role motorcycles play in the region's transport systems, from providing last-mile connectivity to serving as a key mode in shared mobility services.

The challenges of studying ISM are further compounded by systemic financial constraints faced by academics in the region. University professors and researchers often struggle to secure funding for independent research and must rely on commissioned projects to supplement their incomes. These commissioned projects, however, are typically funded by governments or external organisations with narrowly-defined agendas, leaving little flexibility to explore unpopular and underfunded topics like ISM. The result is a research environment heavily weighted towards conventional, top-down solutions, with ISM often viewed as a problem to be regulated rather than a system to be supported and improved.

This confluence of factors—skewed funding priorities, outdated academic paradigms, and systemic funding limitations—creates an ecosystem that is unresponsive to the complexities and potential of ISM. While ISM systems are crucial for addressing the transport needs of Southeast Asia's growing urban and peri-urban populations, their exclusion from research priorities leaves

critical gaps in knowledge and innovation. Without dedicated efforts to understand and support ISM, the region risks perpetuating inequitable and unsustainable mobility systems.

5.9. Future Research Agenda

The following agenda outlines suggested areas for advancing ISM research in the region. While not exhaustive, these suggestions aim to provide a framework for researchers and policymakers, who can adapt and prioritise topics according to the specific contexts of their cities and countries.

Integration of ISM Systems with Public Transport: Models and Pathways

ISM systems often operate parallel to formal public transport, creating challenges in service coordination, fare structures, and infrastructure sharing. Future research could investigate mechanisms for integrating ISM with formal systems, particularly in urban centres where first-mile/last-mile connectivity is critical. This includes:

- Unified Payment Systems: Exploring the potential for single-payment platforms that allow seamless transfers between ISM and public transport, focusing on examples such as Jakarta's "Jak Lingko" initiative.
- Infrastructure Sharing: Analysing how ISM can share physical infrastructure such as terminals, dedicated lanes, and charging stations with formal transport systems to improve efficiency and reduce redundancy.
- Transferable Lessons: Conducting comparative analyses of successful integration models in SEA cities like Bangkok or Ho Chi Minh City and global examples from cities in Latin America or Africa.

Digital Transformation and Data Governance

The digitalisation of ISM has transformed its operational dynamics, but challenges such as digital inclusion, data privacy, and monopolistic tendencies remain. Research could focus on:

- Efficiency Gains and Worker Welfare: Assessing how digital platforms have improved route optimisation, reduced idle times, and impacted earnings for drivers and operators.
- Governance Frameworks: Developing policies for data sharing and privacy that balance innovation with the protection of user and operator rights, addressing concerns of platform dependency.
- Barriers to Adopting Digital ISM Solutions: Identifying obstacles such as digital illiteracy, lack of smartphone penetration, or resistance from traditional operators.

Sustainability and Just Transitions

As countries in Southeast Asia grapple with the dual crises of urban congestion and environmental degradation, ISM could play a significant role in enabling sustainable transport transitions. Key research areas include:

- Electrification of ISM: Examining the feasibility of electrifying motorcycles, tuk-tuks, and other ISM vehicles, including cost-sharing models for operators and governments. Lessons can be drawn from Cambodia's and Thailand's electric tuk-tuk programmes or India's three-wheeler electrification projects.
- Lifecycle Emissions Analysis: Comparing ISM emissions with those of formal transport modes to identify opportunities for reducing both greenhouse gas (GHG) emissions and local air pollutants, enhancing sustainability.
- Incentive Mechanisms: The design of policy incentives such as subsidies, tax breaks, and green zones that promote the adoption of cleaner ISM technologies.

Gender and Social Inclusion in ISM

ISM plays a critical role in addressing the mobility needs of marginalised groups, but significant inclusivity gaps persist. Research could focus on:

- Designing Inclusive Policies: Exploring how ISM can better serve women, the elderly, and people with disabilities through initiatives like women-only ride-hailing services or adaptive vehicle designs.
- Digital Divide: Examining how technology-driven ISM business models can exacerbate inequities and proposing interventions to ensure equitable access.
- Urban-Rural Dynamics: Studying the role of ISM in providing mobility options for rural communities, particularly in areas where formal transport is unavailable or unreliable.

Economic Resilience of ISM Stakeholders

The economic vulnerability of ISM operators and drivers highlights the need for robust support mechanisms. Research could delve into:

- Financial Vulnerability: Studying income insecurity, access to credit, and welfare mechanisms for ISM operators, particularly in the aftermath of economic shocks such as the COVID-19 pandemic.
- Employment Models: Investigating gig-economy employment in the ISM sector, focusing on worker protections and the potential for formalising operator relationships with digital platforms.
- Resilience Strategies: Evaluating how ISM systems have supported economic recovery in peri-urban and rural regions, identifying best practices for replication.

Regulation and Governance Frameworks

The coexistence of formal and informal mobility systems creates regulatory challenges. Research in this area could examine:

- Formalisation without Overregulation: Exploring frameworks that preserve the flexibility of ISM services while ensuring safety and reliability. For example, licensing and insurance schemes tailored to informal operators.
- Comparative Models of Governance: Studying cases that illuminate drivers of success and failure in platform-led self-regulation and government regulation.
- Local Adaptation: Investigating how governance models can account for local socio-economic and cultural contexts to avoid one-size-fits-all approaches to governance and regulation.

Role of ISM in Urban and Rural Connectivity

ISM provides critical mobility solutions for first- and last-mile connectivity in urban areas and acts as the backbone of mobility services in rural regions. Future research could focus on:

- Urban and Peri-Urban Integration: Evaluating how ISM interacts with urban expansion and facilitates connectivity between peri-urban, suburban, and city centres, reducing transport inequalities.
- Rural-Urban Mobility Flows: Examining how ISM links rural populations to urban hubs, focusing on commuter patterns, affordability, and the role of informal mobility in bridging the accessibility gap.

Impact of Emerging Technologies on ISM

Emerging technologies such as AI, Internet of Things, and blockchain could revolutionise ISM systems. Research could investigate:

- AI and Route Optimisation: Exploring how AI-driven tools can enhance operational efficiency and reduce congestion.
- Blockchain for Transparency: Studying the potential for blockchain to improve trust in ISM transactions, including payment tracking and driver ratings.
- Readiness for Automation: Assessing how autonomous vehicles might disrupt ISM markets and how to prepare for transitional impacts of automation on labour markets.

Climate Resilience and ISM

As climate change intensifies, ISM can play a role in increasing the climate resilience of transport systems. Research directions include:

- Disaster Response: Investigating how ISM systems adapt to and recover from natural disasters, including their role in evacuation and relief logistics.
- Adaptive Infrastructure: Proposing designs for ISM infrastructure that are resilient to climate-induced disruptions, such as flooding and heatwaves.

Comparative Studies Across Low- and Middle-Income Countries

Cross-regional studies offer opportunities to contextualise Southeast Asia's ISM dynamics within global trends. Research could explore:

- Learning from Africa and South Asia: Identifying lessons from regions with similar socio-economic contexts but different governance and technological landscapes.
- Transferability of Innovation: Examining the transferability of innovations, such as vehicle electrification and platform integration, across diverse settings.

Overlaps Between Delivery Services and Passenger ISM

The increasing convergence of delivery services and ISM for passenger services in Southeast Asia raises critical research questions, such as:

- Understanding Shared Platforms: Investigating how food and package delivery services coexist on ride-hailing platforms and the implications of multi-service models for operational efficiency and labour conditions.
- Impact on Fleet Utilisation: Assess the extent to which vehicles used for passenger transport, including motorbikes, cars, and EVs, are also utilised for deliveries.
- Infrastructure Utilisation and Sharing: Study how delivery services can share existing urban infrastructure, such as bike lanes, EV charging stations, and parking spaces, with passenger transport services.

Financing Models for ISM Development

Sustainable financing is critical for ISM growth. Research could analyse:

- Microfinance Models: Examining how different forms of credit, such as microloans, leasing schemes, and cooperative financing, can empower ISM operators to invest in better vehicles or technology.
- Public-private Partnerships: Investigating how governments and private firms can co-fund ISM infrastructure and services.
- Economic Impact Analysis: Quantifying the broader economic benefits of investments in ISM, particularly for alleviating poverty and for urban development.

Role of Informality in Urban Mobility Futures

Informality is both an ISM challenge and asset. Future research might examine:

- Adapting Informality: Investigating how informal systems can coexist with formalised transport under smart city frameworks.
- Harnessing Flexibility: Proposing ways to leverage the adaptability of informal systems while addressing inefficiencies and safety concerns.

These examples of research topics reflect the complexities of ISM in Southeast Asia. Exploring them could contribute to formulating a roadmap for addressing challenges while harnessing opportunities. By focusing on integration, innovation, inclusivity, and sustainability, policymakers and researchers can position ISM as a cornerstone of equitable and efficient mobility systems in the region.

Such research also has the potential to extend beyond regional boundaries, generating insights and best practices that are adaptable to similar contexts elsewhere in the world. Countries with rapidly-urbanising cities and informal transport networks could draw valuable lessons from Southeast Asia. By prioritising these key principles such as inclusivity, sustainability, regulatory adaptability, and technological integration, ISM can shape equitable, accessible, and efficient mobility systems, setting precedents for urban transport planning in diverse socio-economic and cultural settings. Through this, Southeast Asia's ISM innovations could serve as key components of an international template for addressing informal transport challenges, contributing significantly to global mobility development.

Chapter Six: Summary and Conclusions

6.1 Introduction

As Southeast Asia's urban landscapes continue to transform, ISM remains a vital yet often overlooked component of the region's transport systems. This final chapter synthesizes the key findings of the report, offering an assessment of ISM's current status across economic, technological, and regulatory dimensions. It examines how the sector is responding to rapid digitalization, environmental challenges, and shifting policy landscapes, while also addressing the persistent gaps in governance, infrastructure, and social equity. By outlining both the challenges and opportunities that shape ISM's future, this chapter highlights potential pathways for enhancing its efficiency, sustainability, and inclusivity. Through an analysis of market dynamics, policy frameworks, and emerging research trends, it reinforces ISM's essential role in Southeast Asia's mobility networks and its potential to evolve into a more integrated, resilient, and equitable transport solution.

6.2 The Status of ISM in SEA

This report analyses the status of ISM modes, markets, and socio-economic contexts in Southeast Asia, focusing on Cambodia, Indonesia, Thailand, and Vietnam. The analysis reveals the significant role ISM plays in bridging mobility gaps, supporting economic livelihoods, and adapting to the evolving transportation landscape.

ISM in Southeast Asia encompasses a wide range of transport options, from motorcycle taxis and tuk-tuks to shared vans and riverboats, operating under varying levels of regulation, from fully informal street-hailing services to app-based RHAs that integrate digital payment systems. Motorcycle taxis remain the most dominant ISM mode, providing first- and last-mile connectivity where formal transit is absent or insufficient. Digitalisation has led to the rise of RHAs, such as Grab and Gojek, which have formalised and expanded the reach of traditional motorcycle taxi services. Tuk-tuks, bajajs, and cycle rickshaws are crucial in urban and tourist areas, with electric variants emerging in some cities as part of sustainability initiatives. Vans, minibuses, and songthaews provide shared transport services, particularly in suburban and peri-urban areas, while water transport remains a key ISM mode in some riverine cities, and horse-drawn carriages continue to serve niche tourist markets.

ISM in the region is shaped by demographic and economic trends, including rapid urbanisation, income disparities, and high levels of informal employment. As metropolitan populations grow, ISM fills the gaps left by insufficient formal transit networks, especially in suburban areas where mass transit access is limited. Lower-income groups rely heavily on ISM for affordable mobility, while rising middle-class populations are shifting towards app-based and private transport options. The ISM sector provides crucial income opportunities for workers excluded from formal job markets. In countries like Cambodia and Indonesia, informal employment rates exceed 80%, reinforcing ISM's role as an economic safety net. Technology is transforming ISM operations, particularly through app-based platforms that improve service efficiency, fare transparency, and regulatory compliance. RHAs such as Grab, Gojek, and Be are displacing traditional motorcycle taxis, offering a structured alternative with digital payment integration. Shared micromobility solutions, including e-scooters and bike-sharing schemes, are emerging but face challenges related to infrastructure and adoption rates. Digital payment adoption is increasing, but cash transactions still dominate traditional ISM operations, limiting full formalisation.

ISM exists along a continuum between informality and formalisation, with varying degrees of regulatory oversight. National and local governments often lack coordinated regulatory frameworks, leading to inconsistent enforcement of licensing, fare structures, and operational standards. ISM plays a vital role in first- and last-mile connectivity, but integration with mass transit systems remains limited, reducing overall efficiency. Many ISM operators lack access to proper parking, road safety measures, and designated pick-up/drop-off points, leading to congestion and safety concerns. ISM workers, particularly those in traditional street-hailing services, often lack social protections, stable incomes, and access to credit or welfare programmes. Environmental concerns and global sustainability initiatives are beginning to influence ISM operations. Governments and private companies are introducing electric tuk-tuks, e-motorcycles, and shared EV fleets, but adoption remains limited due to cost and infrastructure constraints. ISM modes contribute significantly to urban congestion and pollution, prompting calls for cleaner and more efficient alternatives. Government-led efforts to promote sustainable mobility, including EV subsidies and regulations, could reshape ISM's long-term trajectory.

The global competition between China, Japan, and Western nations influences investment in Southeast Asia's ISM and mobility sector. China's influence is evident through its dominance in ride-hailing platforms, battery technologies, and EV manufacturing, while Japan continues to play a significant role in the region's automotive sector, particularly in hybrid vehicle technologies and conventional public transport solutions. Geopolitical shifts, including trade policies and energy transitions, will impact ISM through investments in mobility infrastructure, energy supply chains, and digital transformation. As Southeast Asian cities continue to grow and modernise, ISM will play a crucial role in shaping future mobility landscapes. Policymakers and stakeholders must navigate the complexities of digital transformation, urbanisation, and economic development to create an equitable, resilient, and sustainable ISM ecosystem that benefits both commuters and service providers alike.

6.3 Market Dynamics and Operational Dimensions

Southeast Asia's ISM sector is a dynamic and evolving space, characterised by diverse systems but also common regional trends. Each country showcases uniquely-adapted solutions that address local needs. Technological adoption in general—and in particular the adoption of digital technologies—has been transformative, with smartphone penetration enabling the rapid growth of app-based platforms. These platforms have enhanced user convenience through digital payment systems, ride optimisation, and first- and last-mile connectivity. The electrification of vehicle fleets is an emerging trend, as governments and private players invest in EVs such as motorcycles, tuk-tuks and electric cars. However, infrastructure and financing challenges slow the progress of both app-based ISM services and vehicle electrification in small towns and rural areas. Digital tools improve operational efficiency and pave the way for integrating ISM services with formal transit systems.

Business models across the region vary significantly, ranging from traditional manual and cash-based systems to platform-driven, commission-based revenue-generating structures. Despite the dominance of cash payments in rural and smaller urban centres, e-payment systems are expanding, particularly in urban areas served by digital platforms. Traditional operators are often self-financed, while app-based platforms leverage venture capital and partnerships for scalability. PPPs are increasingly prominent, combining government funding for infrastructure with private-sector implementation. Regulatory inconsistencies and limited access to subsidies and finance hinder the modernisation of traditional ISM fleets.

Governance remains fragmented, with regulatory frameworks differing across countries. Centralised approaches dominate in most countries, while Indonesia's system is more decentralised, enabling city-level initiatives that integrate formal and informal modes. Weak enforcement of regulations, particularly regarding vehicle licensing and safety, persists across the region, leading to gaps in accountability and compliance with safety standards. Efforts to streamline governance are evident in app-based platforms, which simplify regulatory oversight but risk marginalising smaller operators.

Gender equality, disability inclusion, and social inclusion (GEDSI) remain significant challenges. Women face barriers to participating in the ISM workforce and are disproportionately affected by safety issues such as harassment. Initiatives like Jakarta's gender-sensitive ride-hailing services provide localised solutions, but their scale and impact remain limited. Accessibility for persons with disabilities is another critical gap, with few ISM systems designed to accommodate

their needs. The digital divide exacerbates exclusion, as rural and elderly populations often lack access to smartphone-enabled services. Some progress is being made through literacy programmes and targeted initiative.

Sustainability and climate resilience are gaining attention, with vehicle electrification initiatives aligning with regional goals to reduce greenhouse-gas emissions. While app-based platforms contribute to achieving environmental goals by optimising ridesharing and promoting EV adoption, traditional ISM modes often lack the infrastructure and investment needed to foster a green transition. However, the fragmented governance and lack of comprehensive infrastructure support remain obstacles to broader implementation of sustainable and electrified transport systems.

Safety is a pervasive concern, particularly in motorcycle-heavy ISM systems. Traffic fatalities involving motorcycles are alarmingly high. Systemic economic considerations lead drivers to adopt unsafe practices, such as overloading vehicles and speeding. App-based platforms mitigate some such risks through GPS tracking, driver identification, and real-time monitoring, but these benefits are limited to urban areas. In addition, these benefits may be partially offset by unsafe work habits promoted by the apps, such as excessively-long work hours that compromise driver alertness and overall safety. The enforcement of safety regulations, such as laws requiring the use of helmets, varies significantly across the region, with Vietnam demonstrating stronger adherence to compliance monitoring and controls than, for example, Thailand. Women face greater safety risks, especially in traditional ISM systems, though app-based services are beginning to address these issues with dedicated safety features.

6.4 ISM Research Trends

ISM continues to be a crucial yet under-researched component of Southeast Asia's transport landscape, shaping mobility patterns and urban transport systems across the region. In terms of ISM research trends, Thailand leads in research growth, Vietnam in citation impact, Indonesia in research volume, and Cambodia as an emerging research area with highly impactful studies. Each country follows a distinct research trajectory, with Indonesia focusing on digital platforms, Thailand on regulation and electrification, Vietnam on sustainability and multimodal integration, and Cambodia on safety and social inclusion.

Despite increasing research attention, gaps persist in data availability, policy integration, and comparative studies. While digitalisation has improved ISM efficiency, it has also raised concerns over labour precarity and monopolisation by platform-based services. Media analysis highlights key public concerns, including electrification, affordability, and ISM's role in urban mobility. However, policy responses remain inconsistent across countries, often lacking alignment with research insights.

6.5 Challenges, Opportunities, and Pathways for Transformation

The ISM sector is crucial in addressing mobility gaps in Southeast Asia. It is a dynamic and evolving element of urban transport, influenced by rapid technological advancements, urbanisation trends, and the complexities of institutional and governance frameworks. The ISM sector is confronted by significant challenges, each of which also presents substantial opportunities. These challenges can be addressed, and opportunities can be harnessed by advancing four core urban mobility objectives: (1) enhancing operational efficiency, (2) achieving seamlessly-integrated and comprehensive transport systems that provide mobility access for all, (3) improving economic and social welfare of ISM labourers and (4) fostering equitable transitions to environmentally-sustainable transport technologies and systems.

Analysing these objectives and the challenges and opportunities associated with each can illuminate a pathway for shaping ISM into a sustainable and inclusive component of urban mobility solutions. By harnessing technological innovation, adopting supportive government policies, and applying innovative business models, ISM has the potential to become an efficient, sustainable, and equitable transportation mode, meeting the diverse needs of Southeast Asia's rapidly-urbanising societies.

Improving ISM Operational Efficiency

ISM in Southeast Asia faces significant operational inefficiencies due to fragmentation, outdated fleets, regulatory costs, and infrastructure deficits. Most ISM operators function independently, leading to poor coordination, inefficient routes, and inconsistent fare structures. Limited access to financing prevents fleet upgrades, while regulatory compliance costs often burden small operators rather than incentivizing modernization.

Digital platforms have helped optimize ISM services by improving routing, pricing, and customer reach. However, challenges such as low digital literacy and access to smartphones hinder adoption, particularly among older operators and in rural areas. The lack of dedicated lanes, parking spaces, and charging infrastructure further limits ISM efficiency.

Despite these challenges, opportunities for transformation exist. Electrification, supported by policy incentives and private-sector investment, is expanding, particularly in urban centres. Digital platforms continue to drive efficiency, though better integration with formal transport networks is needed. Tailored strategies for urban and rural areas, combined with supportive policies and infrastructure investment, can improve ISM's effectiveness as a mobility solution.

Integrating ISM with Urban Mobility Systems

ISM plays a crucial role in connecting underserved areas to formal transport networks, yet integration challenges persist. Inconsistent regulations, lack of physical infrastructure, and fragmented urban transport planning prevent ISM from effectively complementing MRT and BRT systems. The absence of designated ISM lanes, multimodal hubs, and fare integration leads to inefficiencies in first- and last-mile connectivity.

Regulatory ambiguity also complicates ISM integration. While some countries have introduced policies to formalize ISM, others lack clear frameworks, creating uncertainty for operators. Additionally, the rise of digital platforms has disrupted traditional cooperative structures, increasing competition among drivers while limiting worker protections.

Potential solutions include expanding multimodal hubs, aligning regulations to support ISM's role in urban mobility, and promoting digital tools that enhance coordination between ISM and formal transit. Strengthening infrastructure and policy linkages can improve system efficiency and accessibility while maintaining ISM's affordability and flexibility.

Improving Economic and Social Welfare for ISM workers

ISM operators and users face economic instability, digital exclusion, and limited social protections. Many operators struggle with fluctuating incomes, rising operational costs, and competition from formal transit systems. Digitalization has improved efficiency but also widened inequalities, as those with limited digital literacy or access to technology are left behind. Women, the elderly, and persons with disabilities face additional barriers, with ISM services often failing to meet their needs.

The formalisation of ISM presents both challenges and opportunities. While increased regulation can improve service standards and worker protections, it may also marginalize informal operators who lack the resources to comply. However, growing recognition of ISM's role has led to policy shifts, such as subsidies for electric vehicles, gender-inclusive initiatives, and training programs to improve digital literacy.

Policymakers should avoid overly favouring digital platforms at the expense of traditional ISM and strive to integrate and uplift both sectors as components of a cohesive mobility ecosystem. Efforts to close the digital divide, support fair wages, and integrate ISM into broader mobility frameworks can enhance both economic security for operators and access for users. Strengthening worker advocacy, investing in inclusive transport solutions, and preserving traditional ISM modes where relevant can help ensure that ISM remains a vital part of the transport system.

Fostering Just Transitions for ISM

Southeast Asia's ISM sector must navigate the transition toward sustainable and just mobility systems. Electrification offers an opportunity to reduce emissions and lower long-term operating costs, yet affordability and infrastructure challenges remain. Current policies primarily target urban areas, leaving rural ISM operators with limited access to clean transport options.

The formalization of ISM, while necessary for long-term sustainability, must be implemented carefully to avoid excluding vulnerable operators. Disjointed policies, insufficient funding, and technological disparities between urban and rural areas further slow progress. Meanwhile, ISM operators remain highly vulnerable to economic shocks, fuel price fluctuations, and climate-related disruptions.

Despite these challenges, regional efforts to promote electrification, improve regulatory frameworks, and expand digital access are creating pathways for transformation. Public-private partnerships, investment in green technologies, and consumer shifts toward sustainable transport options are driving change. By leveraging these opportunities, ISM can evolve into a more efficient, inclusive, and environmentally sustainable mobility solution for Southeast Asia's rapidly growing cities.

Appendices

Appendix 1: List of Expert Interviewees

Country	Cities covered	Name	Affiliation
Thailand Vietnam	SEA in general, Thailand, Viet Nam	Professor. Dr. Atsushi Fukuda	Nihon University, Japan
Thailand Vietnam	SEA in general, Thailand, Viet Nam	Dr. Tuenjai Fukuda	Asian Transportation Research Society (ATRANS), Thailand
Indonesia	Jakarta	Dr. Diatyka Widya Permata Yasih	Universitas Indonesia, Indonesia
Indonesia	Jakarta	Dr. Riani Rachmawati	Universitas Indonesia, Indonesia
Indonesia	Jakarta	Mr. Iqbal Habibi	University of Linggabuana PGRI Sukabumi
Indonesia	Yogyakarta	Professor. Dr. Muhammad Zudhy Irawan	Universitas Gadjah Mada, Indonesia
Vietnam	Vietnam in general, Ho Chi Minh City	Associate Professor. Dr. Vũ Anh Tuấn	Vietnamese-German University, Vietnam
Vietnam	Vietnam in general, Ho Chi Minh City, Hanoi	Associate Professor. Dr. Nguyen Hoang Tung	University of Transport and Communications, Vietnam
Vietnam	Ho Chi Minh City	Dr. Hue-Tam Jamme	Arizona State University, the United States of America
Vietnam	Da Nang Hue	Dr. Duy Nguyen Phuoc	Danang Polytechnique University, Vietnam
Vietnam	Vietnam in general, Ho Chi Minh City	Mr. Clément Musil	MobiliseYourCity Asia, Asian Development Bank, Vietnam

Cambodia	Phnom Penh Siem Reap	Dr. Phun Veng Kheang	Institute of Technology of Cambodia, Cambodia
Cambodia	Phnom Penh Siem Reap	Dr. Saum Narith	Institute of Technology of Cambodia, Cambodia
Cambodia	Phnom Penh Siem Reap	Mr. Andy Chun	VERYWORDS, Cambodia
Cambodia	Phnom Penh	H.E. Ambassador. Pou Sothirak	Cambodian Center for Regional Studies (CCRS), Cambodia
Cambodia	Phnom Penh	Mr. Him Raksmey	Cambodian Center for Regional Studies (CCRS), Cambodia
Cambodia	Phnom Penh	Mr. Him Rotha	Cambodian Center for Regional Studies (CCRS), Cambodia
Cambodia	Phnom Penh	Mr. Etienne Chenevier	CityStar, ABA Bank, Cambodia

Appendix 2: Number of Interviews with ISM Drivers (Field Research)

Country	**City/Region**	**No. of Interviews**	**Key ISM Modes Covered**
Thailand	Bangkok, Chiang Mai	2	songthaew (1), RHA car (EV) (1), van operator (1)
Vietnam	Ho Chi Minh City, Hue	6	Traditional xe om (1), RHA motorcycle taxis (2), RHA car (2), EV taxi (1)
Indonesia	Jakarta, Yogyakarta	5	Ojek (2), Delman (1), Cyclo (1), Becak (1)
Cambodia	Phnom Penh, Siem Reap	15	Motordop (3), remorque (3), Bajaj (3), Cyclo (3), RHA car (3)

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