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The Future of LAMAT in Asia

(アジアにおけるLAMATの未来)

LAMAT: Locally Adapted, Modified and Advanced Transport

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Outline

1. **What is LAMAT?**
   LAMATとは?
2. **Motivation & Objectives**
   研究の背景と目的
3. **Market Share of LAMAT Users**
   LAMATの市場シェア
4. **The Future of LAMAT**
   LAMATの未来
5. **Discussion & Conclusion**
   議論、結論

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Typical Public Transport Modes in Asia

アジアの特徴的な交通手段

They are known as *Paratransit*, but we call them as **LAMAT**.

These modes are locally manufactured with minimal standard in response to local needs and each has its own unique design.

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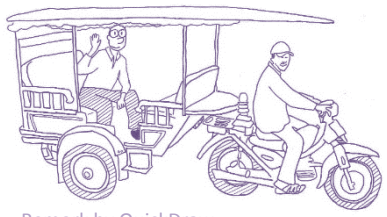
Concepts of Paratransit　パラトランジットのコンセプト

- "Paratransit" means "alongside transit," 1st used 1965 in North America.
- Its concept differs among developed and developing countries:

Developed countries	Developing countries
-In USA: Paratransit covers 1) Specific transport service for disabilities (ADA 1990) 2) Demand-responsive service -In Europe: Paratransit refers to particular transport services including dial-a-ride, jitneys, and shuttles	-There are several definitions and terms given for paratransit -Paratransit is called as "Informal transport," "Low-cost transport," "Intermediate technology," "Third world transport," and "Indigenous transport"


By GAO 2012

By Phil Chen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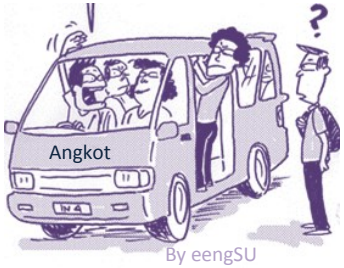

By eengSU

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Concept of LAMAT　　LAMATのコンセプト

Why LAMAT, not paratransit?

LAMAT is proposed to replace paratransit because:

- ✓ Different paratransit concepts in developed vs developing countries.
- ✓ Various terms & definitions for paratransit (e.g. informal transport).
- ✓ To cover all paratransit services in Asian developing countries.

Definition

"LAMAT is defined as indigenous public Transport mode that is Locally Adapted, Modified and Advanced for a certain transport service in a particular city or region."

Source: Phun & Yai (2016a)

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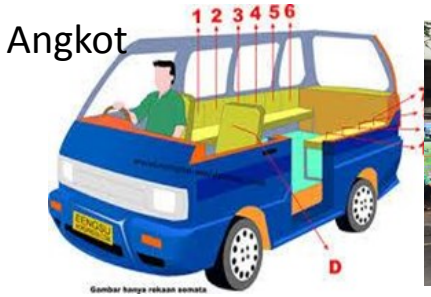
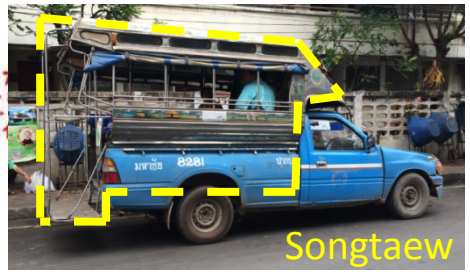
LAMAT in its Description　　LAMATの意味

L: Locally

A: Adapted—a vehicle imported without physical alteration.

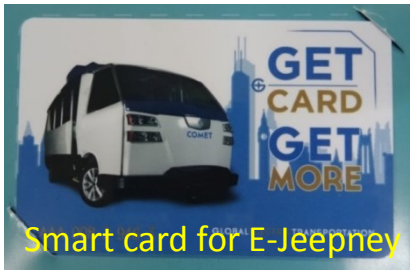
M: Modified—a vehicle that is physically modified based on local needs.





A: Advanced—a vehicle that is upgraded with available technologies.

T: Transport



Taxi-Hailing Apps

Source: Phun & Yai (2016a)

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Land-based Transport System 道路上の交通手段分類

Type	Mode	Vehicle	Capacity	Infra.	Route	Shedule	Collective Type
Public	Mass Transit	MRT (in pphpd)	10000-40000[1]	Rail	Fixed	Fixed	Shared
		LRT (in pphpd)	6000-12000[1]				
		BRT (in pphpd)	5000-10000[1]	Own lane			
Public	Special LAMAT	Large Bus	25-60	Road	Fixed	Fixed	Shared
		Taxi	3-4	Road	Flexible	On-demand	Individual
Public	LAMAT[2]	Minibus	12-24	Road	Fixed	Semi-fixed	Shared
		Microbus	4-14				
		Auto-Rickshaw[3]	2-4	Road	Flexible	On-demand	Individual
		Motocycle Taxi	1-2				
		Cycle Rickshaw	1-2				
		Animal-Cart	2-6				
		Pulled-Rickshaw	1-2				
		Bicycle Taxi	1-2				
Private	Private	Car	2-6	Road	Flexible	Personal	Personal
		Motorcycle	1-2				
		Bicycle	1-2				
Walking	Pedestrian	On-Foot	1	Sidewalk	Flexible	Personal	Personal

Focus

[1] Transport capacity in pphpd: passengers per hour per direction; Source: UITP (2015), Public Transport Trends

[2] Classification based on Phun and Yai (2016): State of the Art of Paratransit Literature in Asian developing Countries.

[3] Auto-Rickshaws at some cities (e.g., Kolkata in India) are operated on fixed-route and shared type basis.

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Summary: What is LAMAT? まとめ: LAMATとは？

What is LAMAT?

- LAMAT (Locally, Adapted, Modified and Advanced Transport) is the new term proposed and used instead of "paratransit" in Asia.

- ✓ *LAMATs are indigenous PT modes, ranging from non-motorized 2-wheelers to motorized 4-wheelers, with seating capacity ≤25.*

Source: Phun & Yai (2016a)

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Benefits of LAMAT　　LAMATのメリット

- Inadequate mass transit ➔ Citizens mainly depend on LAMAT.

- LAMAT plays a significant role in urban mobility:
  - ✓ Service coverage between private vehicles and mass transit
  - ✓ Transport service to low-incomes, students, elderly, and disabled
  - ✓ Job opportunities to the poor or low-skilled people
  - ✓ Personalized and flexible transport services, etc.
- LAMAT requires low energy & operational costs, no public subsidy, etc.

➢ *Flexibility, availability, & affordability are keys to LAMAT survival.*

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Drawbacks of LAMAT　　LAMATのデメリット

- With lack of control & regulation, LAMAT often causes:
  - Congestion (e.g., letting in/out passengers)
  - Accidents (e.g., reckless driving, violations)
  - Air/noise pollution (e.g., old vehicle, overloading)

- LAMAT is also considered as unreliable with minimal comfort, inhuman working condition, and criminal-style structure.

➢ *Because of these drawbacks, some LAMAT modes were restricted and some gradually disappeared.*

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Motivation & Objectives 研究の背景と目的

Motivation

Problems

-Drawbacks of LAMAT (jam, safety, etc.)
-Urbanization
-Economic growth } Consider mass transit
-Effects of mass transit services

Concerns

The future of LAMAT system is questionable!

Question

- Should LAMAT be removed from modernized urban transport system?

Objectives

1. *To analyze market share of LAMAT users in Asia*
2. *To discuss the possible future of LAMAT in Asia*

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JICA Person Trip Data　　JICA パーソントリップデータ

Objective: *To analyze LAMAT market share vs population & GDPPC.*

➢ About 2.7 million trips from 11 Asian cities were analyzed:

No.	Country	City	Year[a]	Population[b] (1000)	GDPPC[c] (USD)	Analyzed trips
1	Bangladesh	Dhaka	2009	14216	685	153848
2	Cambodia	Phnom Penh	2000	1149	300	40369
3	China	Chengdu	2000	4222	932	67961
4	Indonesia	Jakarta	2000	8390	790	1083280
5	Malaysia	Kuala Lumpur	1999	3902	3735	218460
6	Mongolia	Ulaanbaatar	2008	1051	2136	37784
7	Pakistan	Lahore	2010	7487	1008	126602
8	Philippines	Manila	1996	9538	1290	471035
9	Vietnam	HCMC	2003	4866	475	262375
10	Vietnam	Hanoi	2005	2160	623	188700
11	Vietnam	Danang	2008	751	1043	50509

[a]The year of data collected, one limitation of this study

Total = 2,700,923

[b]Numbers obtained from Department of Economic and Social Affairs, United Nations

[c]The GDP per Capita (GDPPC) for countries from United Nations, are used instead as GDPPC for each city appeared to be unreliable sources.

- Various transport modes were first classified into 1) Walking, 2) Own vehicles, 3) LAMAT, 4) Mass transit, and 5) Others.

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Modal Share Results

交通手段シェアの分析結果

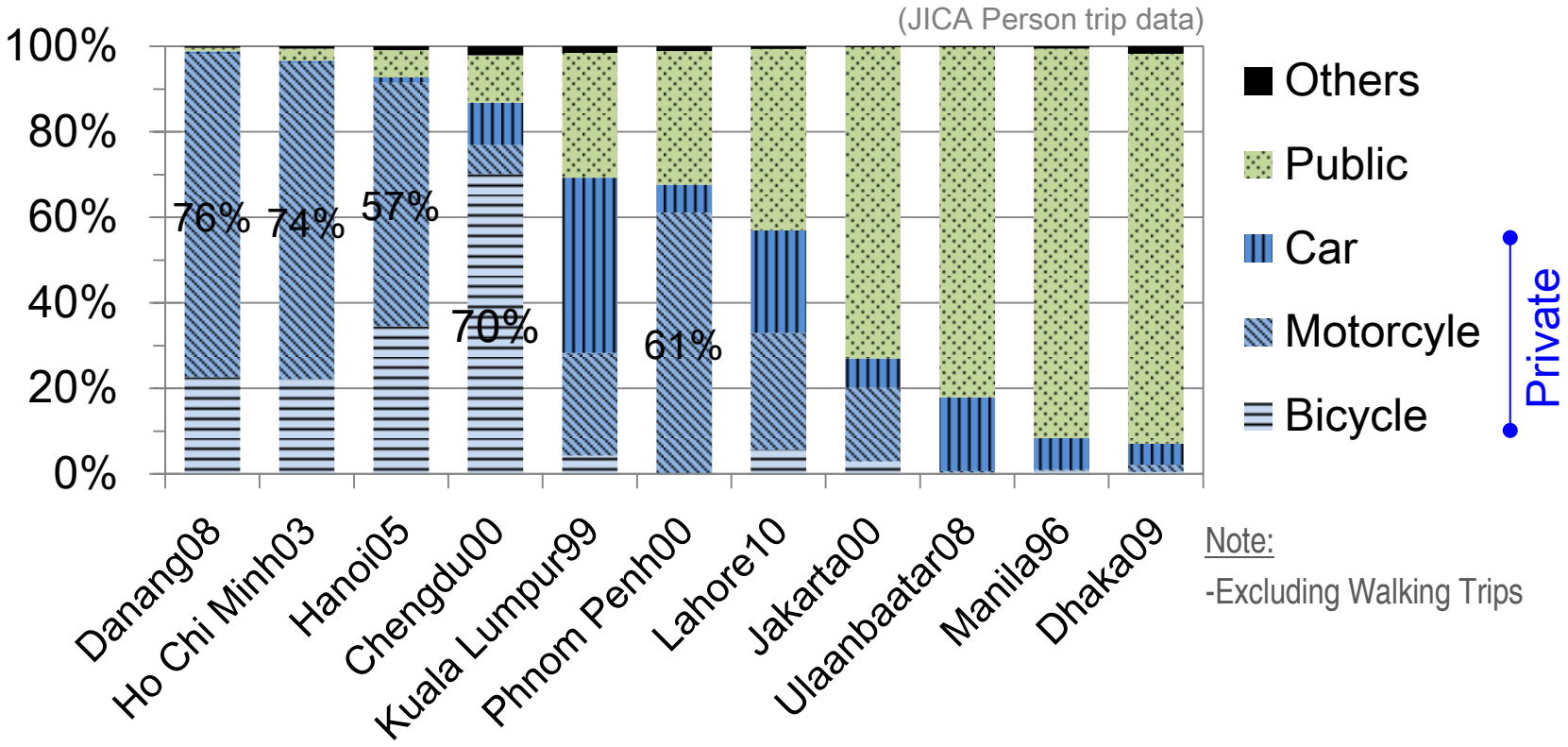

Fig. Modal share in Asian cities

- ➢ Cities of Vietnam & Cambodia had the highest share of own MCs.
- ✓ This might be due to the inadequate public transport services.

✓ Less public transport services → higher share of private vehicles.

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Share of Public Transport Users　公共交通の利用シェア

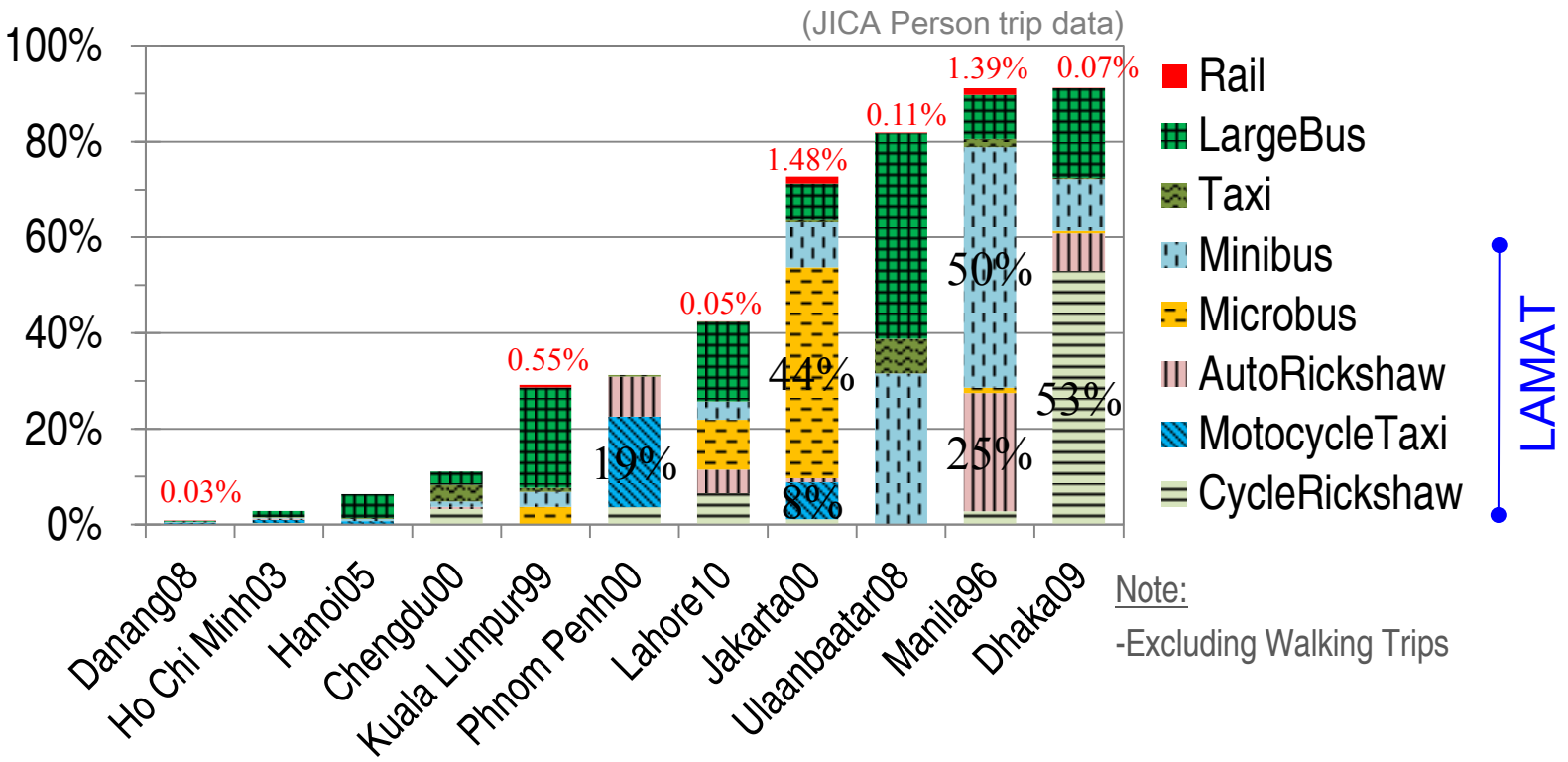

Fig. Share of public transport users in Asian cities

- Non-motorized LAMATs almost disappeared.
- Share of railways is small (0.03-1.48%), while LAMAT share is large.
  (E.g., Jakarta & Manila have railways, yet majority use LAMATs)

✓ *LAMAT services are still popular in several Asian cities.*

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LAMAT Share Vs Population Growth

LAMATの利用シェアと都市人口の関係

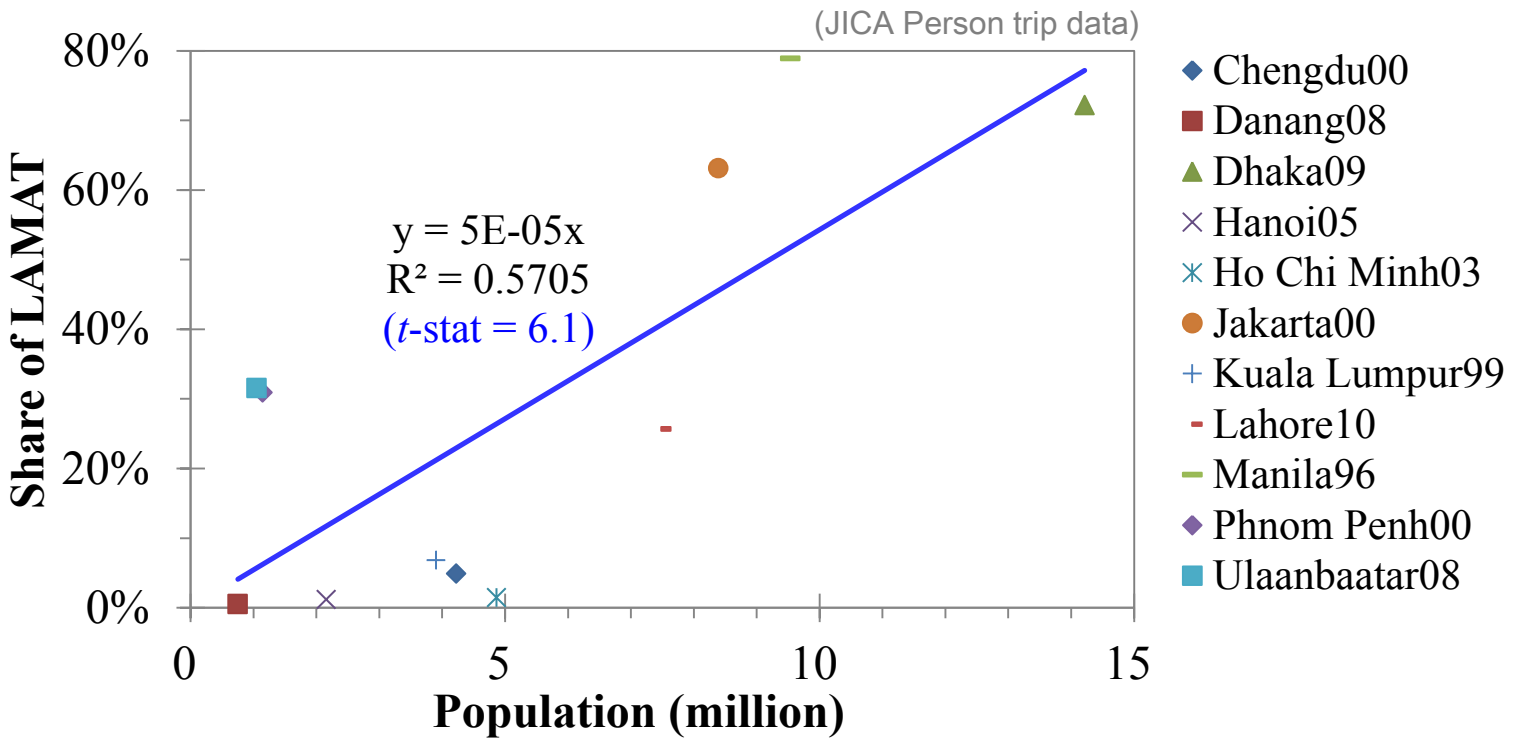

Fig. Relationship between LAMAT share and city population

- LAMAT share: 0.5%-78.9%, with average of 28.8%.

➢ The share of LAMAT increases with the city population.

✓ This might be due to inadequate mass transit system; hence, more citizens depended on LAMAT to travel.

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LAMAT Share Vs Economic Growth

LAMATの利用シェアと経済水準の関係

- Whether LAMAT is preferred in higher income city?

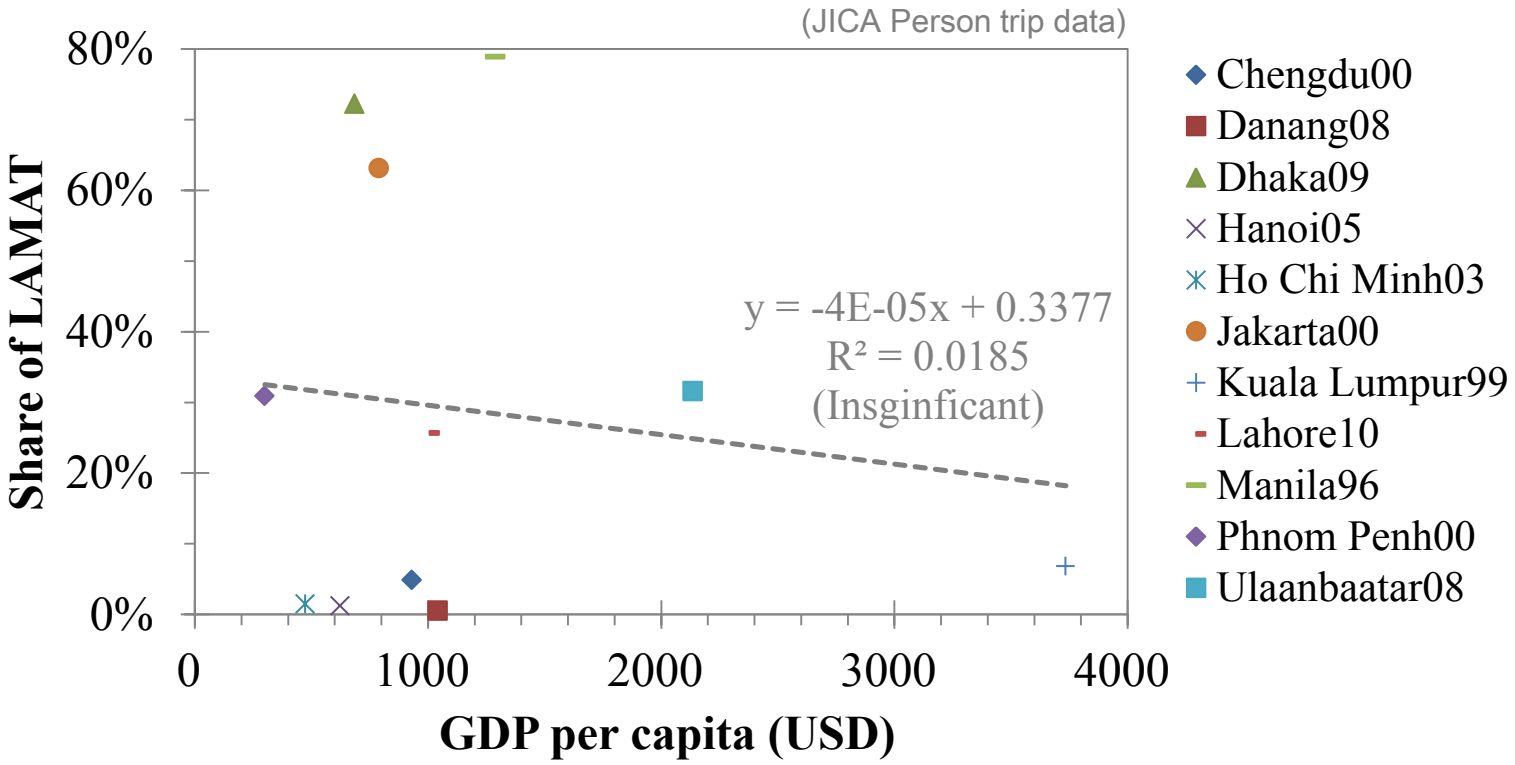

Fig. Relationship between LAMAT share and GDPPC

- ➢ LAMAT share decreases when GDPPC increases (insignificant).
- ✓ As users' income increases, LAMAT is less likely to be preferred.

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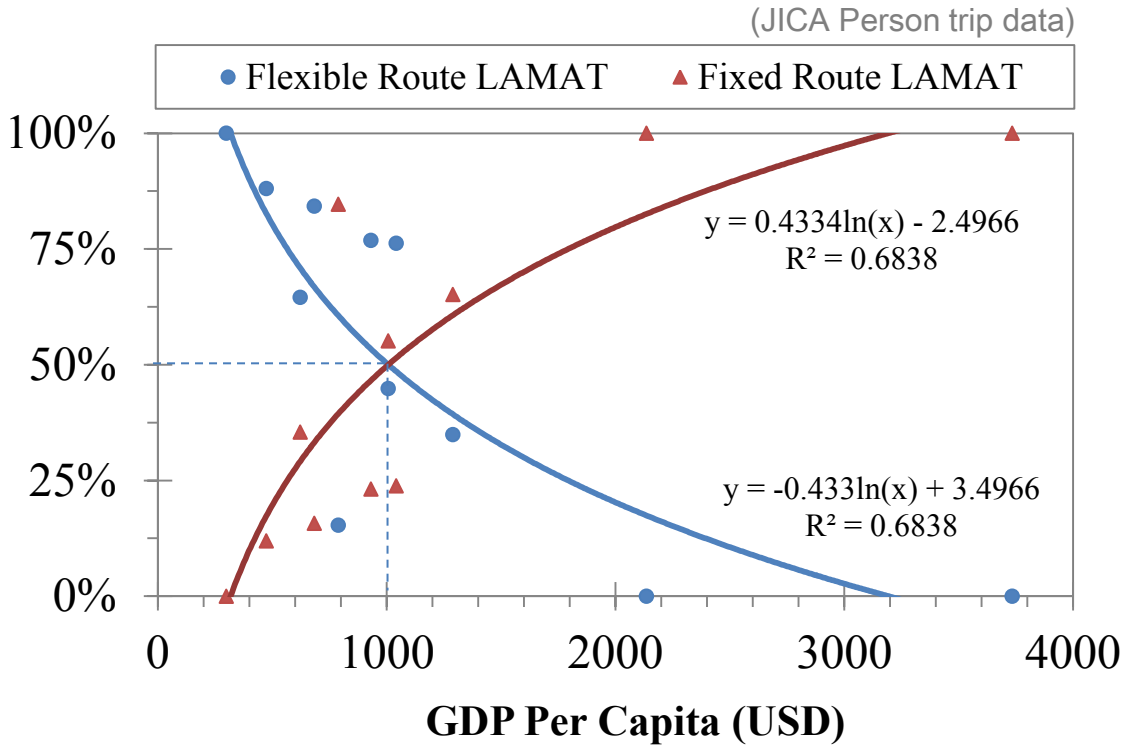
When Fixed-Route LAMAT Preferred?

固定路線のLAMATが適した時期？



Fixed Route LAMAT:

-Minibuses

-Microbuses

Flexible Route LAMAT:

-Auto-rickshaws

-MC taxis

-Cycle rickshaws

Fig. Relationship between GDPPC and flexible & fixed route LAMAT

- ➢ When GDPPC>1,000USD, Fixed Route LAMAT gains majority share.
- ✓ Fixed Route LAMAT should be considered when GDPPC becomes higher than a certain threshold (i.e., 1,000 USD).

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Summary: Market Share of LAMAT Users

まとめ: LAMATの市場シェア

This section analyzed market share of LAMAT and its relationship with city population & GDPPC:

- ✓*Non-motorized LAMATs have almost disappeared.*
- ✓*LAMAT services are popular in several Asian cities.*
- ✓*LAMAT share increased with population but not with GDPPC.*
- ✓*Fixed route LAMAT should be operated when GDPPC>1,000USD.*

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LAMATの未来

① **The government**

② **Passengers**

③ **Operators/drivers**

④ **Vehicle & Technology**

5. Discussion & Conclusion

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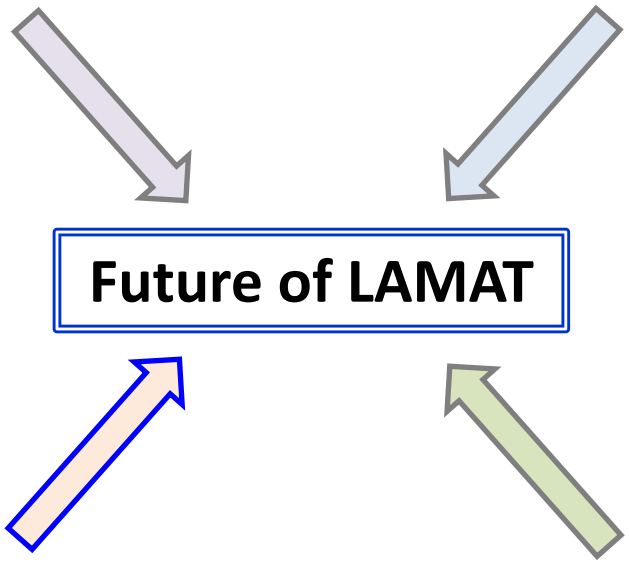
Factors Influencing on the Future of LAMAT

LAMATの将来に影響を与える要素

② Passengers
-Perceived service quality
-Traffic risk perception
-Access/egress mode
-User satisfaction
-Negative experiences
-etc.

③ Operators/drivers
-Service quality
-Drivers' quality of life
-Driver association & internal regulations
-Accessibility/Feeder services
-etc.



① The government
-Policies & regulations
-Control & management
-Environmental policy
-Traffic safety policy
-Infrastructure supports
-etc.

④ Vehicle&Technology
-Standard vehicle & design
-Fuel alternatives & EVs
-Fare systems
-Ride-hailing apps
-ICT
-etc.

Objective: *To discuss the possible future of LAMAT from 4 perspectives.*

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Government's Regulations on LAMAT in Asia
アジアにおけるLAMATの規制

Non-motorized LAMAT

- Samlor-Thips were banned in Bangkok in 1964.
- Becak is banned throughout Jakarta.
- Riksha-Walas are banned from major streets in Dhaka.
- Cycle & pulled rickshaws were banned in Pakistan in 1991.

Motorized LAMAT

- Yangon bans motorcycles & lets motorcycle taxis only in permitted areas.
- Tricycles are only seen on small/local roads in Cebu.
- Tuk-Tuks are banned from expressways in Thailand.
- Kathmandu banned Diesel Tempos (3-wheerlers).
- Jeepney modernization program in the Philippines.

➢ *Governments have restricted some LAMAT operations in urban areas due to their negative effects (e.g., congestion, safety, emission).*

Source: Various Sources

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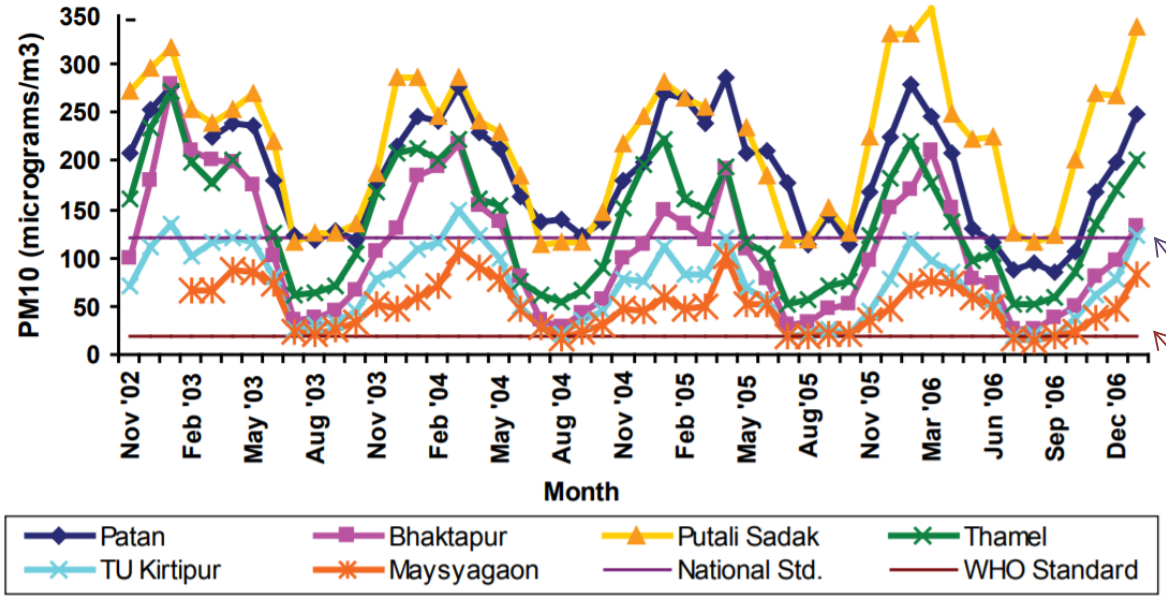
Kathmandu Banned Diesel Tempos
カトマンズにおけるディーゼル型Temposの禁止

- In 1999, Kathmandu banned diesel Tempos and second hand vehicles to combat air pollution.



- Vehicle emissions was 38% of PM10.

National Std (120µg/m3)

WHO Std (20µg/m3)

Fig. PM10 levels in Kathmandu Valley 2002-2006 (Source: MoSTE)

➢ Successfully introduce Safa Tempo (EV) by:

-Rising level of air pollution in city

-Nepal faced fuel scarcity in 1989

Source: MeYa Fact Sheet #5. (2014)

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Kathmandu to Phaseout Safa Tempos
カトマンズにおけるSafa Temposの段階的禁止

1989
- Fuel crisis, as India imposed trade embargo

1993
- 7 diesel Tempos were converted to Safa Tempos & tested successfully for 6 months

1996
- 600 Safa Tempos were introduced to replace diesel Tempos

1997
- Publish EV tax policy

2017
- There are about 1,200 Safa Tempos
- **2017.3: Gov't banned vehicles older than 20 years**, including Safa Tempos:
  - Air pollution → Reduce vehicular emission
  - Traffic congestion → Increase capacity of public vehicles (e.g., bus)
  - Traffic safety → Vehicle safety

Source: The KathamanduPost, 20170603 and http://www.onwardnepal.com

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Jeepney Modernization Program in the Philippines
フィリピンにおけるJeepney 近代化プログラム

- 2017.7: Gov't launched the "Jeepney modernization" program:
  - ✓ To ease traffic congestion
  - ✓ To reduce traffic emission
  - ✓ To comply UN safety standards

- Drivers may buy a new electric, hybrid, or Euro-4 Jeepney (P1.2-P1.6 million).

➢ Gov't supports the program by:
  - ✓ Buy an old unit at P30,000
  - ✓ Subsidy a new unit at 5%
  - ✓ Release 200,000 units in 3 years
  - ✓ Mandate drivers to form a union
  - ✓ Standardize salary for all drivers

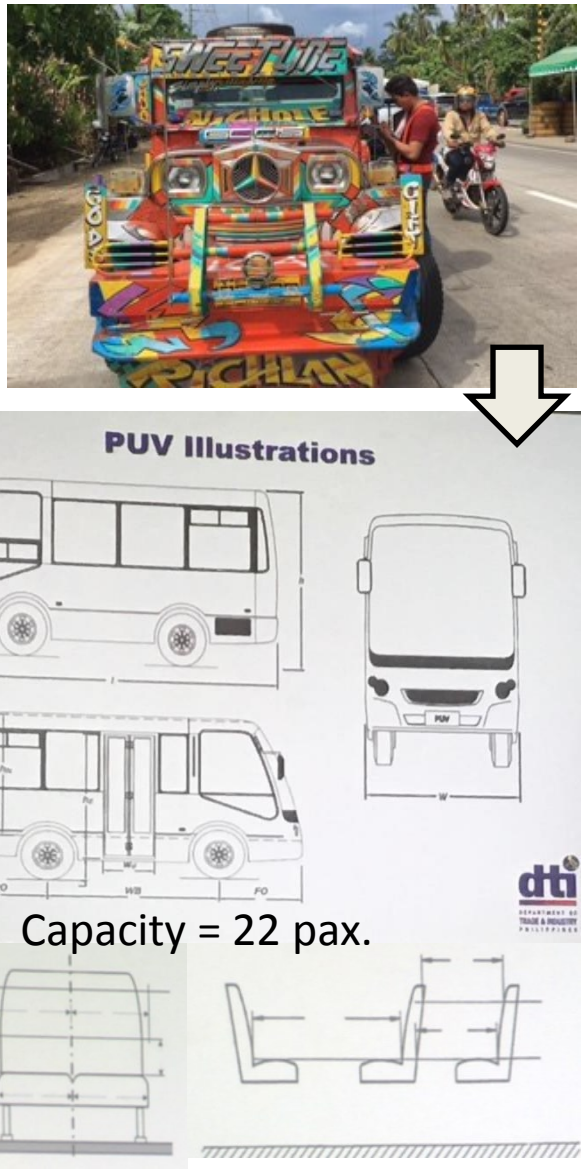

Fig. Modern Jeepney Prototype

Source: ph.news.yahoo.com 20171003

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Jeepney Modernization or Phaseout?

Jeepneyの近代化か段階的禁止か？

- About 270,000 Jeepneys registered in the Philippines.
- Traffic Crisis Act 2016 calls for phasing-out 15-year-old Jeepneys, affecting 162,500 drivers (>60%) and 45,000 operators.
- For a new Jeepney, drivers pay Land Bank P800 a day for 7 years. But drivers earn only around P600 a day!

➢ *At several cities, a series of protests against the "**Jeepney Phaseout**".*

☐ Jeepney Phaseout means:

- Jobless to drivers
- Bankruptcy for small operators
- Higher fare for commuters

Source: GMA News Online 20170207, Xinhua 20170220, ph.news.yahoo.com 20171003

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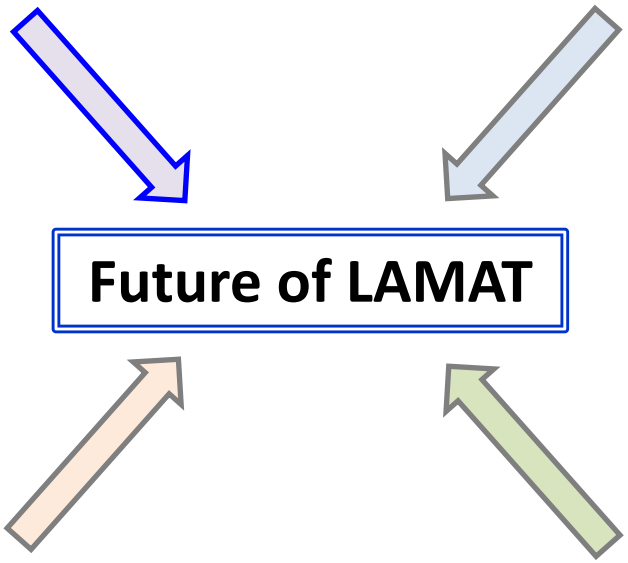

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Objective: *To discuss the possible future of LAMAT from 4 perspectives.*

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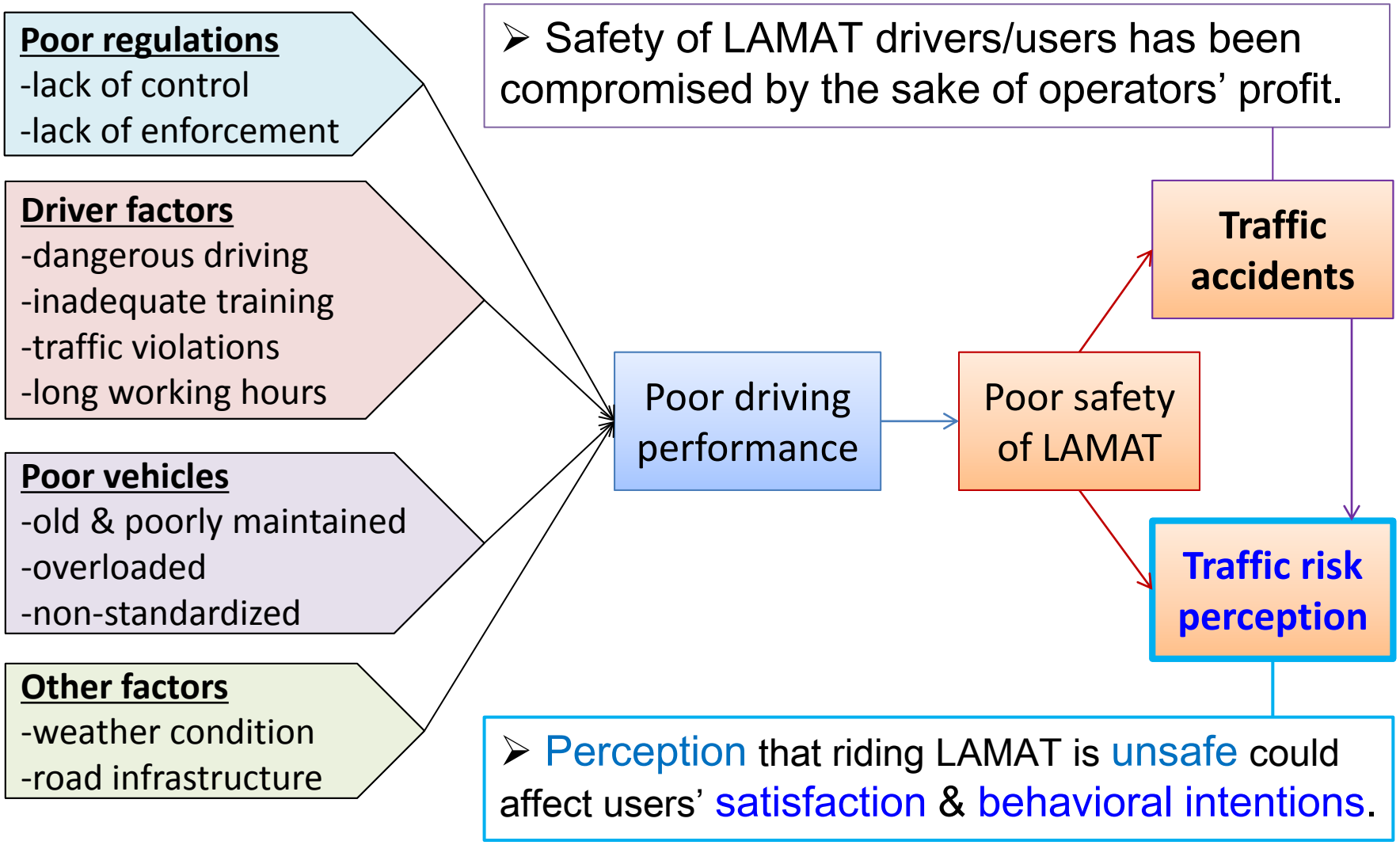
Traffic Risk Perception　LAMATにおける交通リスク

- Most LAMAT operations are unregulated and profit-based motive.



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Working Hypotheses 作業仮説

Objective: *To explore the effects of traffic risk perception on satisfaction and behavioral intentions of LAMAT users.*

Three main hypotheses:

H1: Traffic risk perception has positive effect on new PT.

Users who perceive higher risk of traffic accidents are more likely to switch to a new (safer) public transport (PT) mode.

H2: Traffic risk perception has negative effect on satisfaction.

Users less satisfy with LAMAT when they perceive higher risk of traffic accidents involving that LAMAT.

H3: Traffic risk perception has negative effect on user loyalty.

Perceiving LAMAT as unsafe would reduce users' intention to continuing using that LAMAT.

Note: Behavioral intentions = user loyalty + intention towards a new safer public transport mode.

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Structural Equation Model (SEM) 共分散構造分析

- SEM examines theoretical models by testing hypotheses, to better understand causal relationships among **interested variables**.

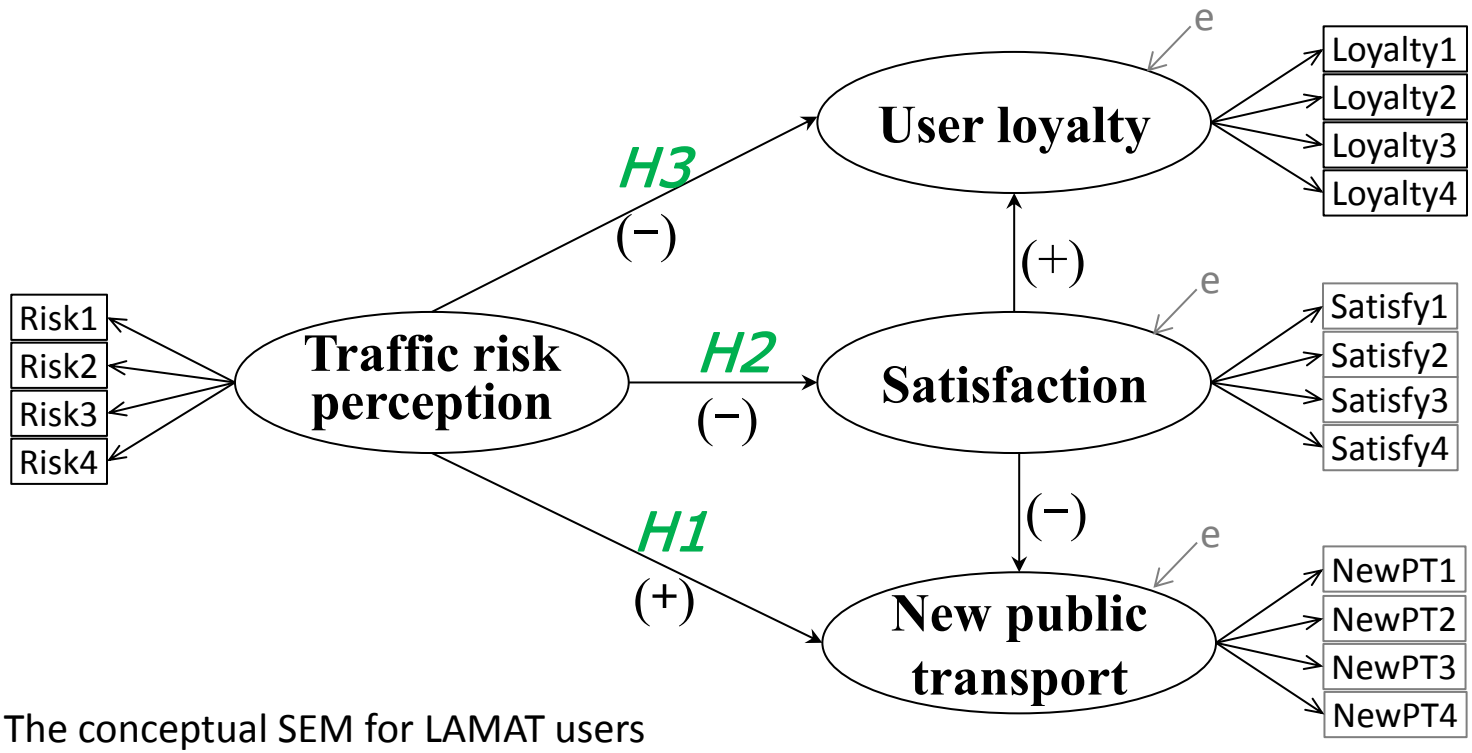

Fig. The conceptual SEM for LAMAT users

➢ The hypotheses (***H1, H2, H3***) are tested under this SEM.

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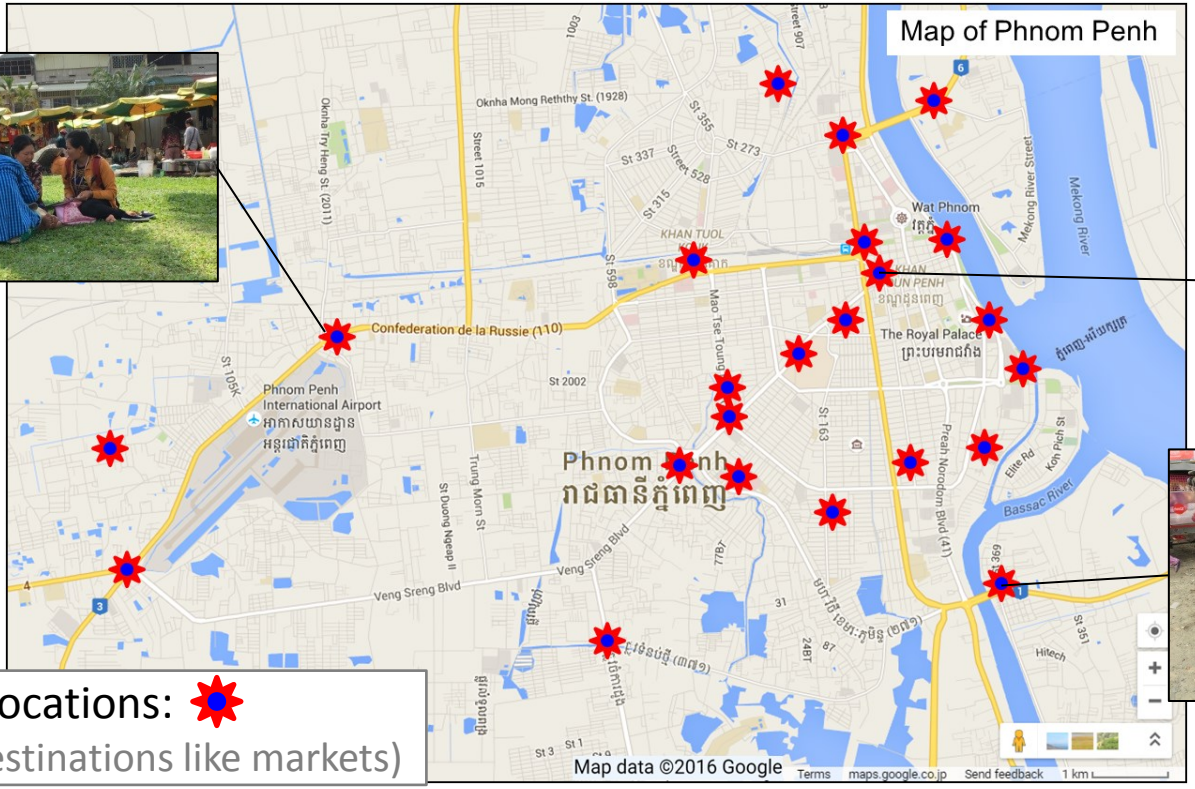
LAMAT Users' Survey in Phnom Penh

プノンペンにおけるLAMAT利用者調査

- Date: May 13-20, 2016
- Method: Questionnaire-based face-to-face interview
- 756 Respondents: 484 Motodop + 272 Remork users
- Data: Subjective responses (5-point scale), etc.
- Surveyors: 11 well-trained students

Motodop (MC Taxi)

Remork (Auto-Rickshaw)



Survey Locations:
(Major destinations like markets)

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Estimate Results of SEM　モデルの推定結果

- Latent variables are well measured by indicators ($p < 0.01$).

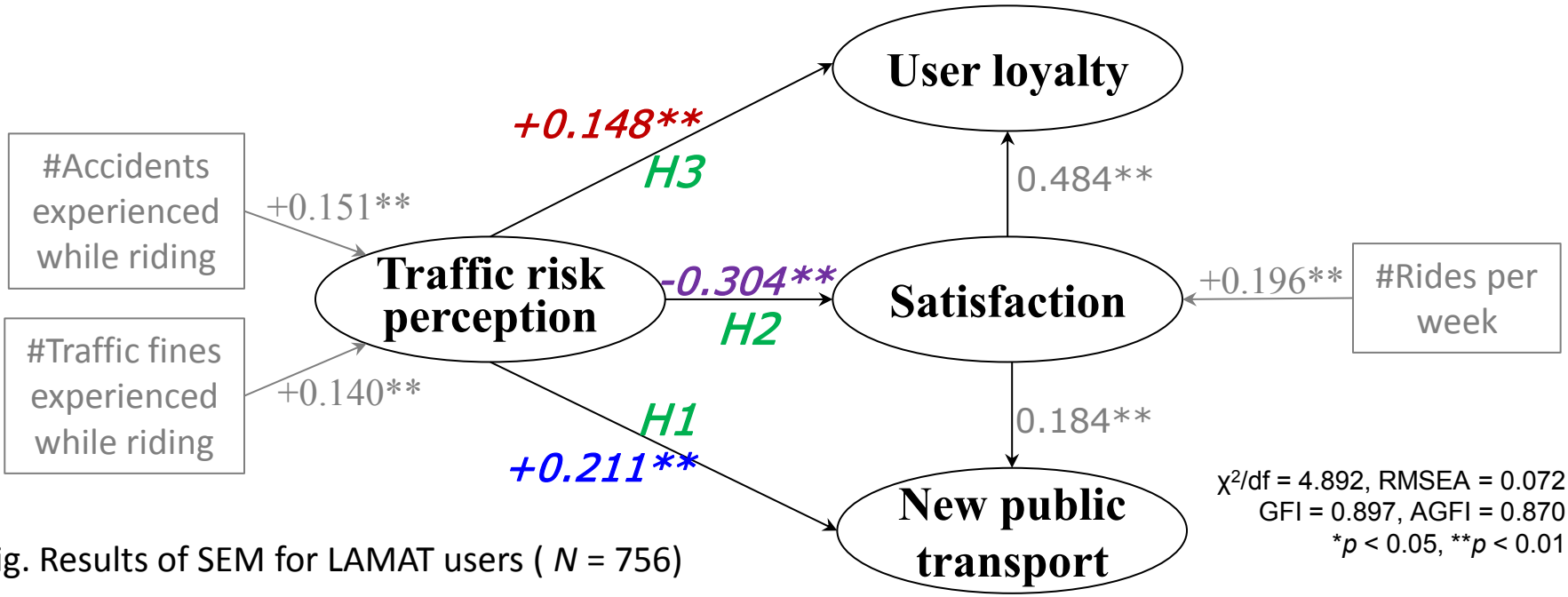

Fig. Results of SEM for LAMAT users (N = 756)

Testing hypotheses for Motodop/Remork users

Hypotheses	Expected	Findings	Judgements
H1	Positive	*+0.211***	Accepted
H2	Negative	*-0.304***	Accepted
H3	Negative	*+0.148***	**Rejected!**

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Why H3 is rejected?

なぜH3は仮説と逆の結果となったのか？

- **Finding** (***H3***): *Users seem to tolerate the risk of traffic accidents and would continue to use LAMAT services* **because**:

① Majority (56.6%) were **younger users** (age ≤ 30) and were **risk-takers**, comparing to older users (age >30) [*t*-test (696.97) = -5.4, $p < 0.001$].

② Users who **perceived higher risk** had **fewer modal choice** (77.1%).
- Poor supply of other PT modes, LAMAT services tend to be riskier.

Table. Share of "No choice" as a reason to choose LAMAT, among other factors.

		User loyalty (Total scores of 4 indicators)	
		Low (n = 30)	**High** (n = 507)
Traffic risk perception (Total scores of 4 indicators)	**Low** (n = 103)	*Reject H3* No choice 1.9%	*Accept H3* No choice 17.3%
	High (n = 434)	*Accept H3* No choice 3.7%	*Reject H3* No choice 77.1%

Note: Low is defined when the total scores of 4 indicators are 4-11, and High is defined when the total scores are 12-20.
"No choice" convers no other transport modes, no own vehicles, and no one to drive for.

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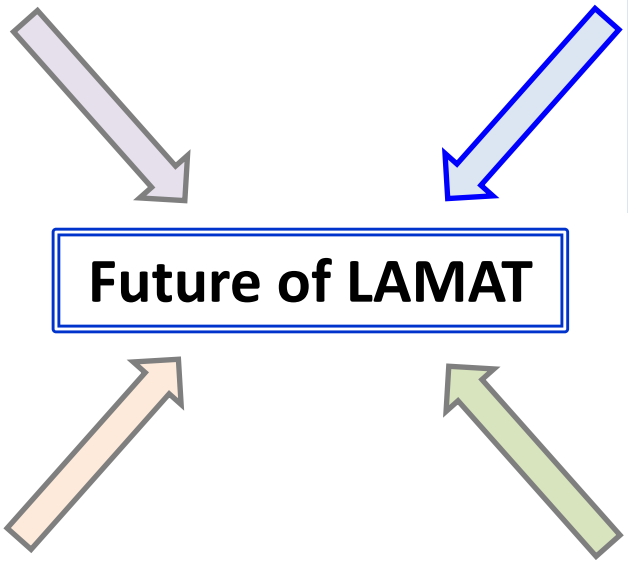
Factors Influencing on the Future of LAMAT

LAMATの将来に影響を与える要素

② Passengers
-Perceived service quality
-Traffic risk perception
-Access/egress mode
-User satisfaction
-Negative experiences
-etc.

③ Operators/drivers
-Service quality
-Drivers' quality of life
-Driver association & internal regulations
-Accessibility/Feeder services
-etc.



① The government
-Policies & regulations
-Control & management
-Environmental policy
-Traffic safety policy
-Infrastructure supports
-etc.

④ Vehicle&Technology
-Standard vehicle & design
-Fuel alternatives & EVs
-Fare systems
-Ride-hailing apps
-ICT
-etc.

Objective: *To discuss the possible future of LAMAT from 4 perspectives.*

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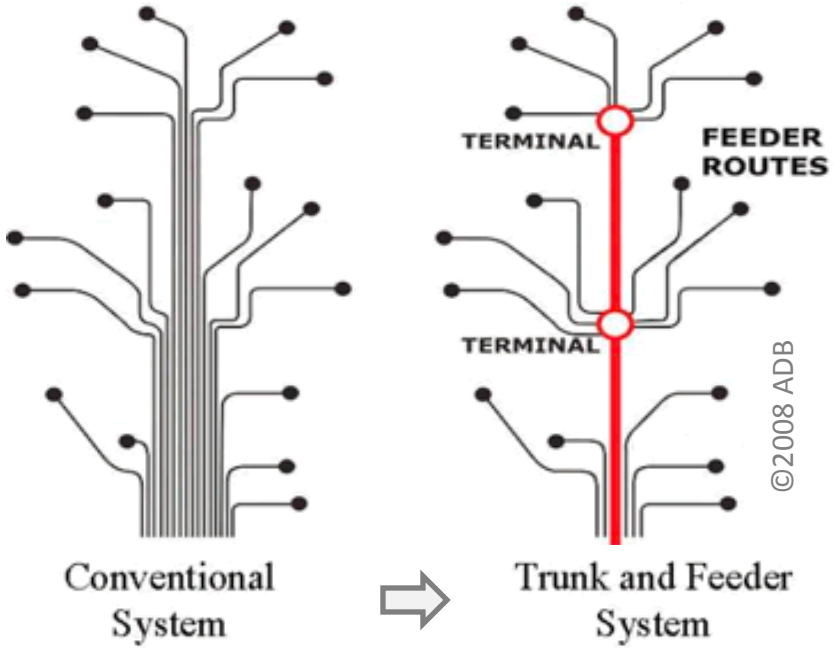
Accessibility to Mass Transit System
大容量公共交通システムへのアクセス性

- Ridership of mass transit in most Asian developing countries has failed to meet the forecasted level due to:
  - Limited network of the mass transit,
  - Competition with other public transport modes, and
  - Lack of accessibility to a station of mass transit.

- Developing cities considers the model of Trunk-Feeder (TF) system.

- *Possibly to include **LAMAT as feeder** to TF system, with two issues:*
  - Negotiations with LAMAT operators
  - Costs related to LAMAT formalization



Source: Wibono and Chalermpong (2010), Ferro & Behrens (2015)

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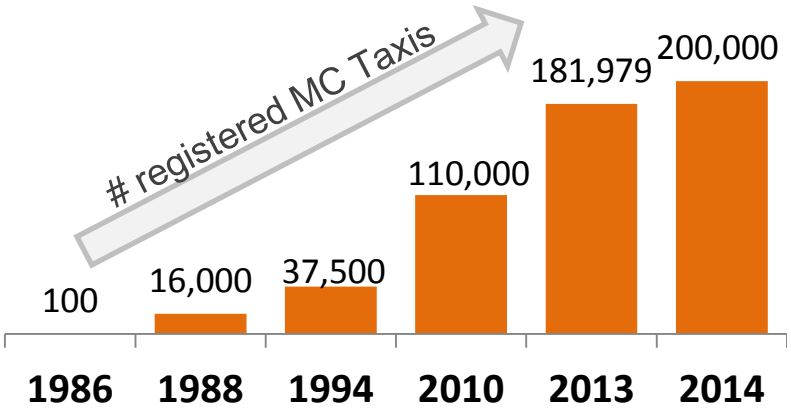
Motorcycle Taxis in Bangkok

バンコクにおけるバイクタクシー

- Emergence of MC Taxi services because of:
  - The Soi network (long, narrow, dead-end, no sidewalk)
  - The solution for traffic gridlock in city
  - Shift from water-based to land-based city, etc.

- Growing importance of MC taxis:



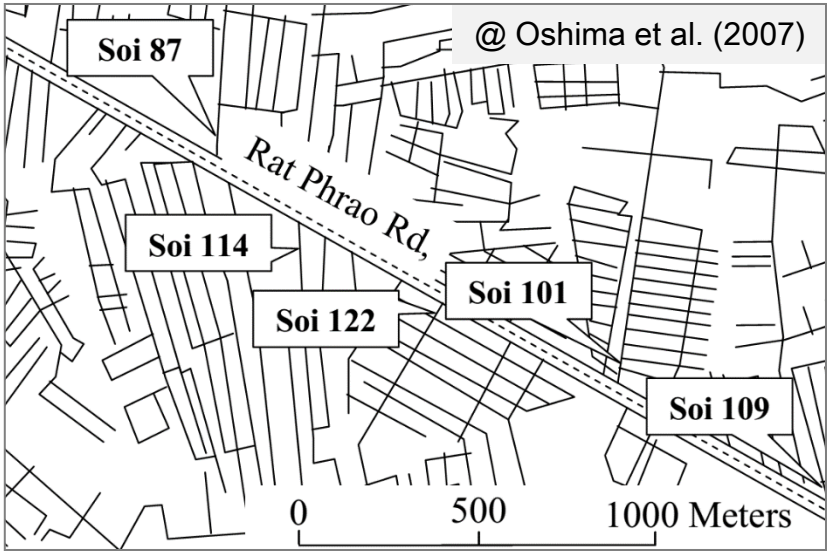


Fig. Soi network in Bangkok

➢ *MC Taxis fill the accessibility void created by a rapid urban expansion that is not matched by supply of main trunk systems.*

Source: Ratanawaraha and Chalermpong (2017)

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Bangkok's MC Taxis: "The Feeder Army Ants"
バンコクにおけるバイクタクシー

- MC Taxis feed main trunk systems:
  - Mass transits (Rails, BRT)
  - Public buses
  - Minibuses & Microbuses
    (Silors, Passenger Vans, Songtaews)

- Walking & bicycling are not comparative, MC Taxis will remain the essential feeder transport.

by Oshima et al. (2007)

➢ *Lack of integration makes MC Taxis even more indispensable as feeder from the Sois.*

Source: Ratanawaraha and Chalermpong (2017)

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Feeder Intention of LAMAT Drivers in Phnom Penh

プノンペンのLAMATドライバーのフィーダー輸送に関わる意識

Public bus service

Feb. – Sept. 2014: 1 line (7.5km)
Sept. 2014 – present: 3 lines (51.5km)
Fare: 1500 KHR (~ 0.4USD)

About 30% of bus users previously traveled by LAMATs.
The government has no specific solution to affected drivers.
LAMATのドライバーは路線バスに並行する経路の旅客を失った

- ***Objective:*** *To investigate the attitudes of LAMAT drivers towards the bus and their intention to operate as its feeder service.*

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LAMAT Drivers' Survey in Phnom Penh
プノンペンにおけるLAMATドライバーへの調査

- Date: December 19-23, 2014
- 186 Respondents: 80 Motodop & 106 Remork drivers
- Data: Subjective responses, working conditions, etc.
- Surveyors: 4 well-trained students

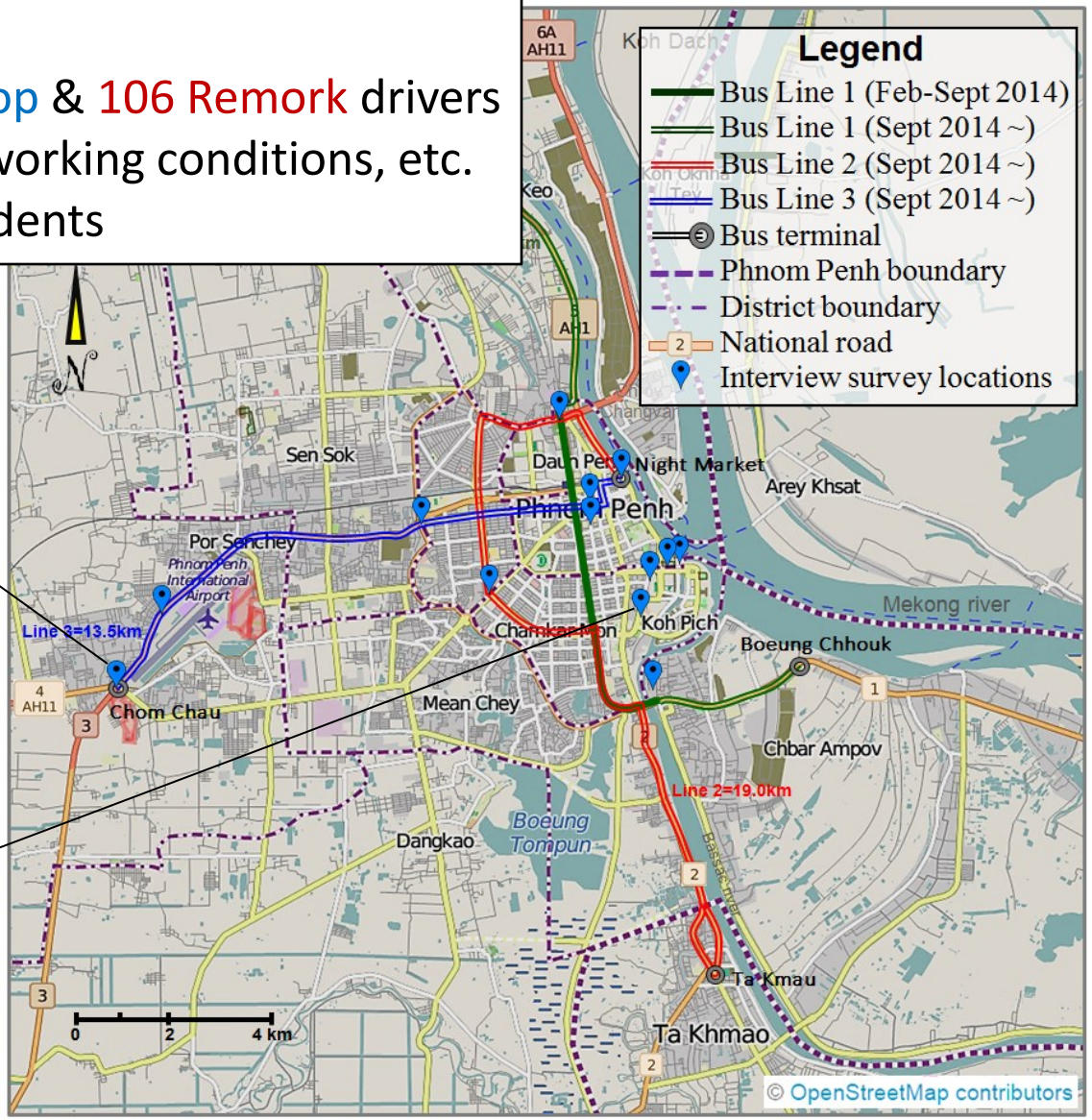

Fig. Map of Phnom Penh

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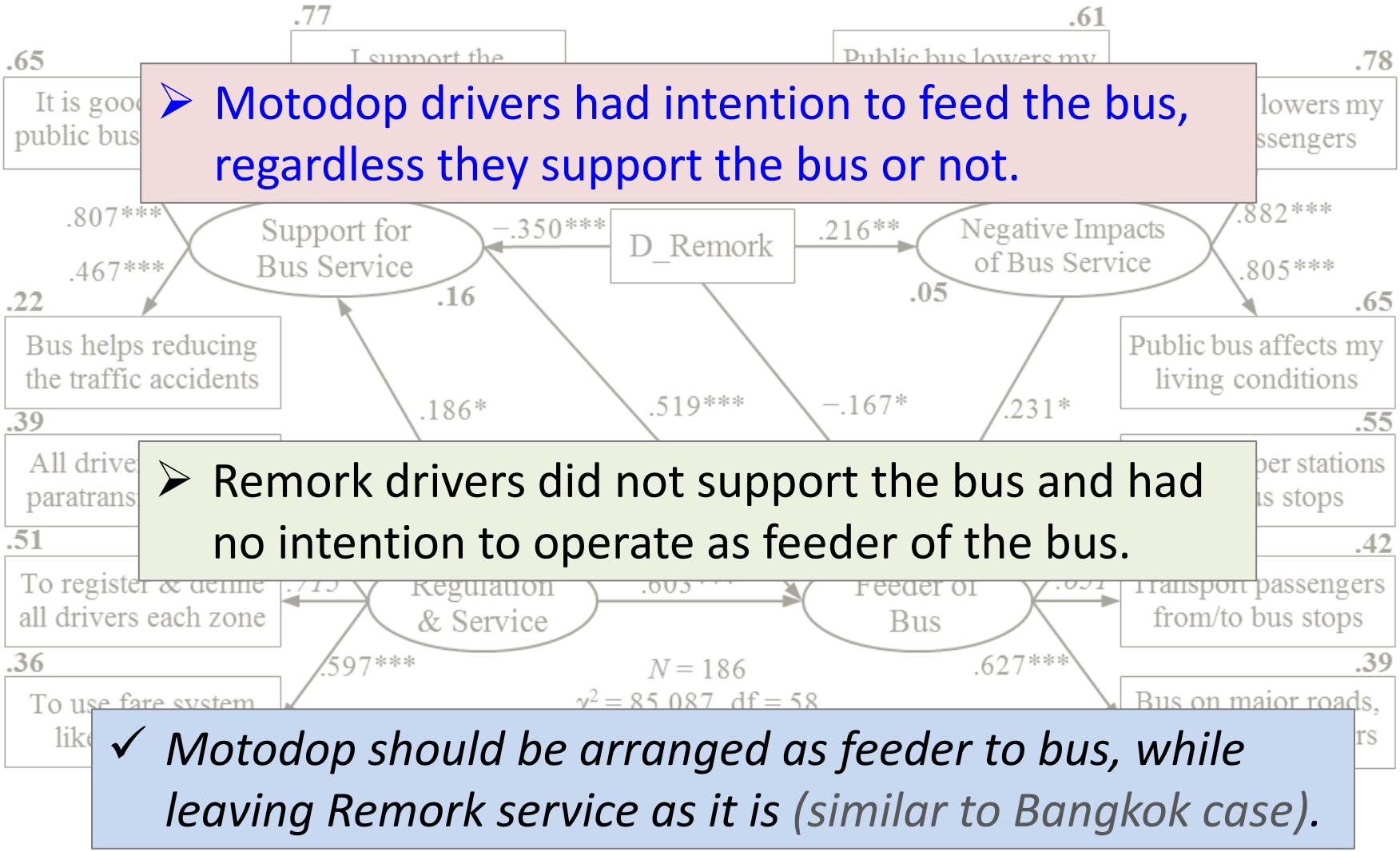
Source: Phun and Yai (2016b)

SEM Results 構造方程式モデリングの結果

- SEM is applied to test hypotheses. Overall model fit is good.



➢ Motodop drivers had intention to feed the bus, regardless they support the bus or not.

➢ Remork drivers did not support the bus and had no intention to operate as feeder of the bus.

✓ *Motodop should be arranged as feeder to bus, while leaving Remork service as it is (similar to Bangkok case).*

Fig. Results of SEM for LAMAT drivers ($N = 186$)

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Source: Phun and Yai (2016b)

Factors Influencing on the Future of LAMAT

LAMATの将来に影響を与える要素

② Passengers
-Perceived service quality
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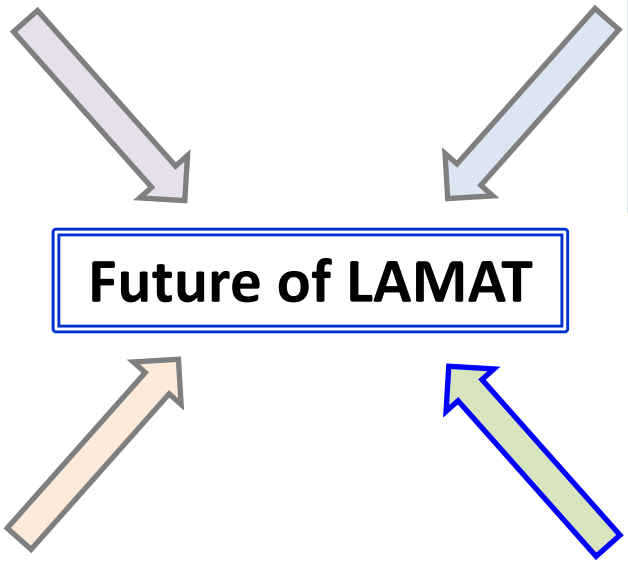
-etc.



① The government
-Policies & regulations
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-Traffic safety policy
-Infrastructure supports
-etc.

④ Vehicle&Technology
-Standard vehicle & design
-Fuel alternatives & EVs
-Fare systems
-Ride-hailing apps
-ICT
-etc.

Objective: *To discuss the possible future of LAMAT from 4 perspectives.*

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Standard & Electric LAMAT: Evolution of Rickshaws

標準化/電動LAMAT: リキシャの進化

Cycle Rickshaw

Cambodia

Philippines

Auto Rickshaw

Thailand

Electric Rickshaw

- *New std design to cope with emission and safety issues*

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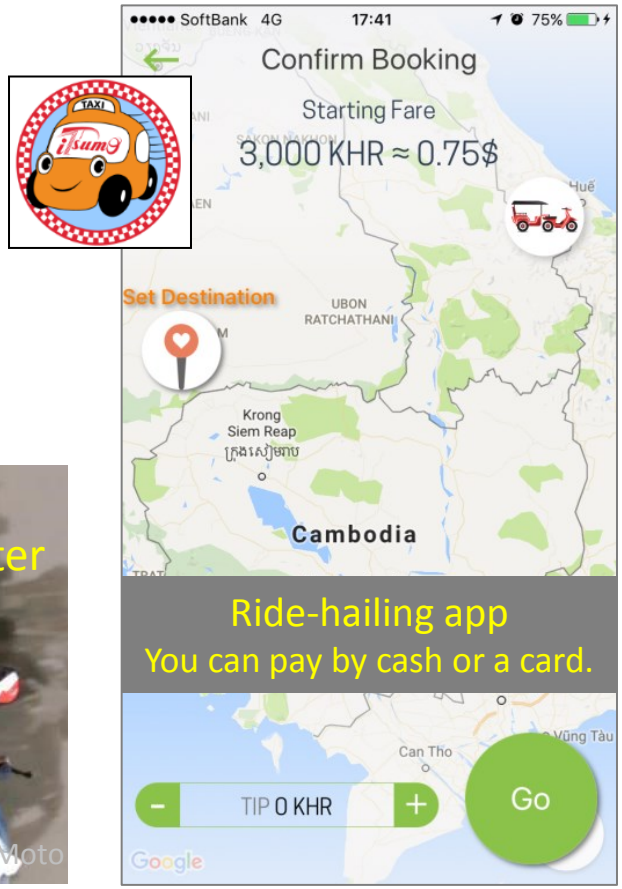
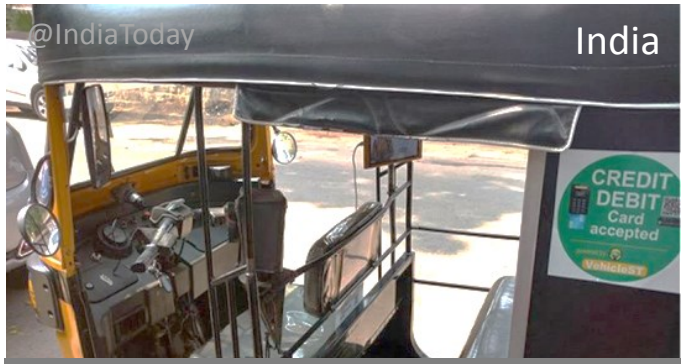
LAMAT Fare System　　LAMATの運賃制度

- Better LAMAT fare (collecting) systems have been implemented.

Multiple rides
Multiple modes





Auto-Rickshaws accept debit/credit card

➢ *LAMAT fare becomes standardized through a better fare system.*

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LAMAT Ride-Hailing Apps　　LAMAT配車アプリ

- World's dominant ride-haling apps: Uber covers 107 countries.

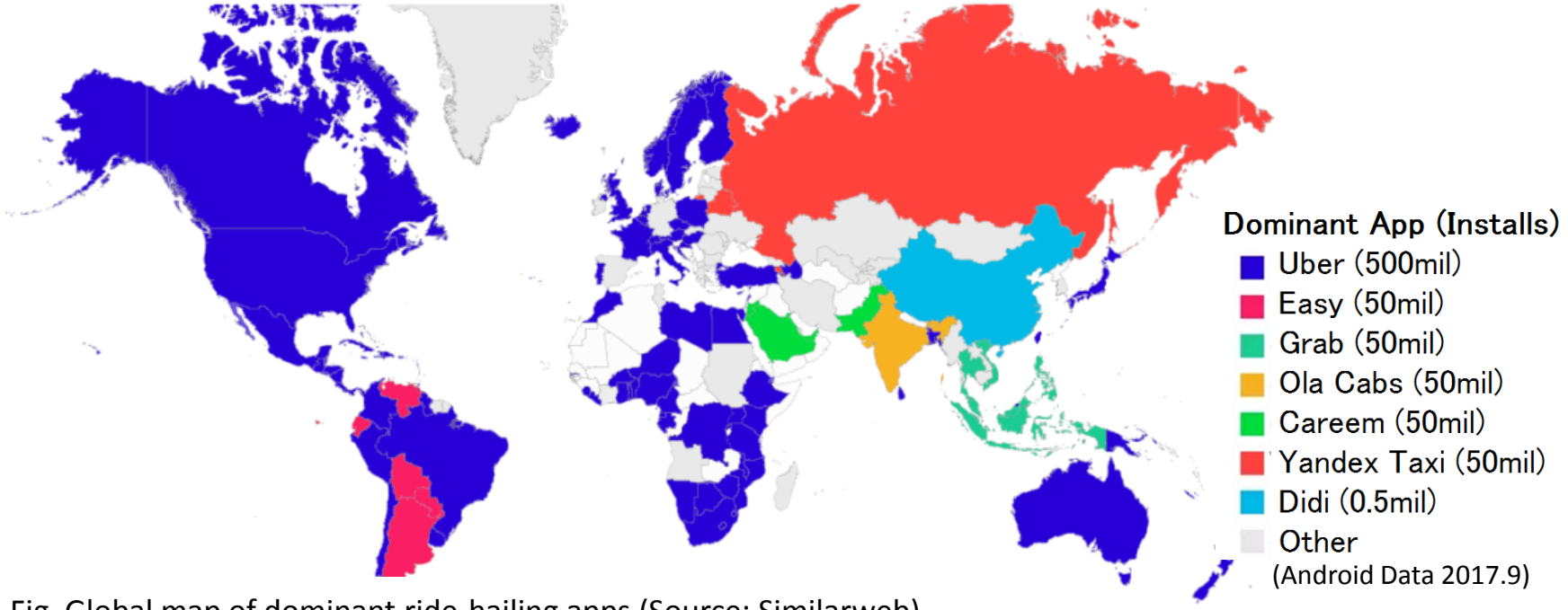

Fig. Global map of dominant ride-hailing apps (Source: Similarweb)

- Recently in Asia, more ride-hailing apps for Taxis, Auto-Rickshaws, and Motorcycle Taxis.

➢ *Ride-hailing apps have a big influence on LAMAT market.* *(Future work)*

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Summary: The Future of LAMAT　まとめ: LAMATの未来

This section discussed the future of LAMAT from:

① The government (Nepal and Philippines cases)

- ✓*Convert diesel to Safa Tempos and then phaseout Tempos ≥ 20 years.*
- ✓*Phaseout Jeepneys ≥ 15 years and then modernize Jeepneys.*

② Passengers (Cambodia case)

- ✓*Uses continues to use unsafe LAMAT because of few modal choices.*
- ✓*Users tend to shift to safer PT mode when that mode is available.*

③ Operators/Drivers (Thailand and Cambodia cases)

- ✓*MC taxi drivers provide accessibility to mass transit in Bangkok.*
- ✓*MC taxi drivers had intention to feed public bus in Phnom Penh.*

④ Vehicle & Technology (Asia cases)

- ✓*More standard designs of LAMAT vehicles and E-LAMATs.*
- ✓*Better LAMAT fare system and more popular LAMAT ride-hailing apps.*

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Outline

1. What is LAMAT?
2. Motivation & Objectives
3. Market Share of LAMAT Users
4. The Future of LAMAT
5. **Discussion & Conclusion**
   議論、結論

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Discussion: When LAMAT Should Be Removed?

議論: LAMATをいつ禁止すべきか？

Each LAMAT mode has different characteristics:

- Benefits: Service coverage, transport needs, job opportunities, etc.
- Drawbacks: Causes of traffic congestion, accident, emission, etc.

Should LAMAT be removed from modernized urban transport system?

Conditions	Remove?	Gov't's counter-measures
Benefits < Drawbacks	**Yes**	-Phase out
Benefits ≥ Drawbacks	**No**	-Modernize or -Sustain with: 1-Improvement 2-Environmental friendly 3-Gov't & Formalization 4-Harmonization

➢ *Future LAMAT relies on the tradeoffs between benefits & drawbacks, as well as the government's counter-measures.*

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Discussion: Potential Issues Without LAMAT
議論: LAMATを禁止した場合の問題点

- Removing LAMAT might help reduce the traffic issues. But this also causes several potential issues:
  - Joblessness (e.g., Phaseout affects 162,500 Jeepney drivers, Philippines; MC taxi drivers to feed bus to secure jobs, Cambodia),
  - Service void (e.g., MC taxis fill accessibility void in Sois, Thailand),
  - Accessibility (e.g., MC taxis feed trunk system from Sois, Thailand),
  - Transport poor (e.g., Few choices, users chose LAMAT, Cambodia), etc.

- Despite gov't's supports (e.g., subsidy), modernizing LAMAT might cause joblessness & bankruptcy to many operators & drivers, who could not afford to upgrade/buy new vehicles (e.g., Philippines, Nepal).

➢ *Removing the current LAMAT may cause several potential issues (e.g., jobs, service void).*

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Discussion: The Future of LAMAT in Asia
議論:アジアにLAMATの未来

In the long term:

Philippines

- Currently about 270,000 people drive Jeepneys.
- ➢ When the economy grows, more people will get other **jobs** rather than drivers, *until then* Jeepneys may be removed.

Bangkok, Thailand

- MC Taxis are well suited with Soi network in Bangkok.
- ➢ When gov't makes a huge investment on **Soi network** improvements, *until then* MC Taxis may be removed.

Phnom Penh, Cambodia

- Motodop & Remork are popular, 3 lines of public bus (51.5km).
- ➢ When there will be sufficient **public bus services** (and railways), *until then* Motodop & Remork may be removed.

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Conclusion 結論

This study analyzed the market share of LAMAT and discussed the possible future of LAMAT in Asia.

- ✓ LAMAT remains popular in several Asian cities. As individual income increases, LAMAT is less likely to be preferred.
- ✓ Gov'ts restricted some LAMATs, causing serious traffic issues.
- ✓ LAMAT users intended towards a safer PT mode. LAMAT Drivers intended to feed mass transit to maintain jobs.
- ✓ LAMAT has been modernized (Vehicle std) & adapted new technologies (EVs, Fare system, Apps) to offer a better service.

➢ ***LAMAT should not be simply removed for now***. *LAMAT should be sustained for a period of time to supply jobs & inevitable transport needs, until the issues (e.g., Jobs, transport needs) are sufficiently addressed.*

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Future Works 今後の作業

- The future of LAMAT is uncertain.
- More researches to discuss the future LAMAT in Asia:

  1) Attractiveness of LAMAT pick-up locations near mass transit stations: Case of MC taxi wins in Bangkok,

  2) Effects of ride-hailing apps on LAMAT market,

  3) Etc.

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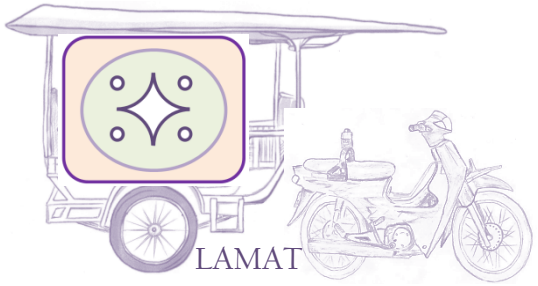

Thanks for Your Attention!

ご清聴ありがとうございました。

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Appendix

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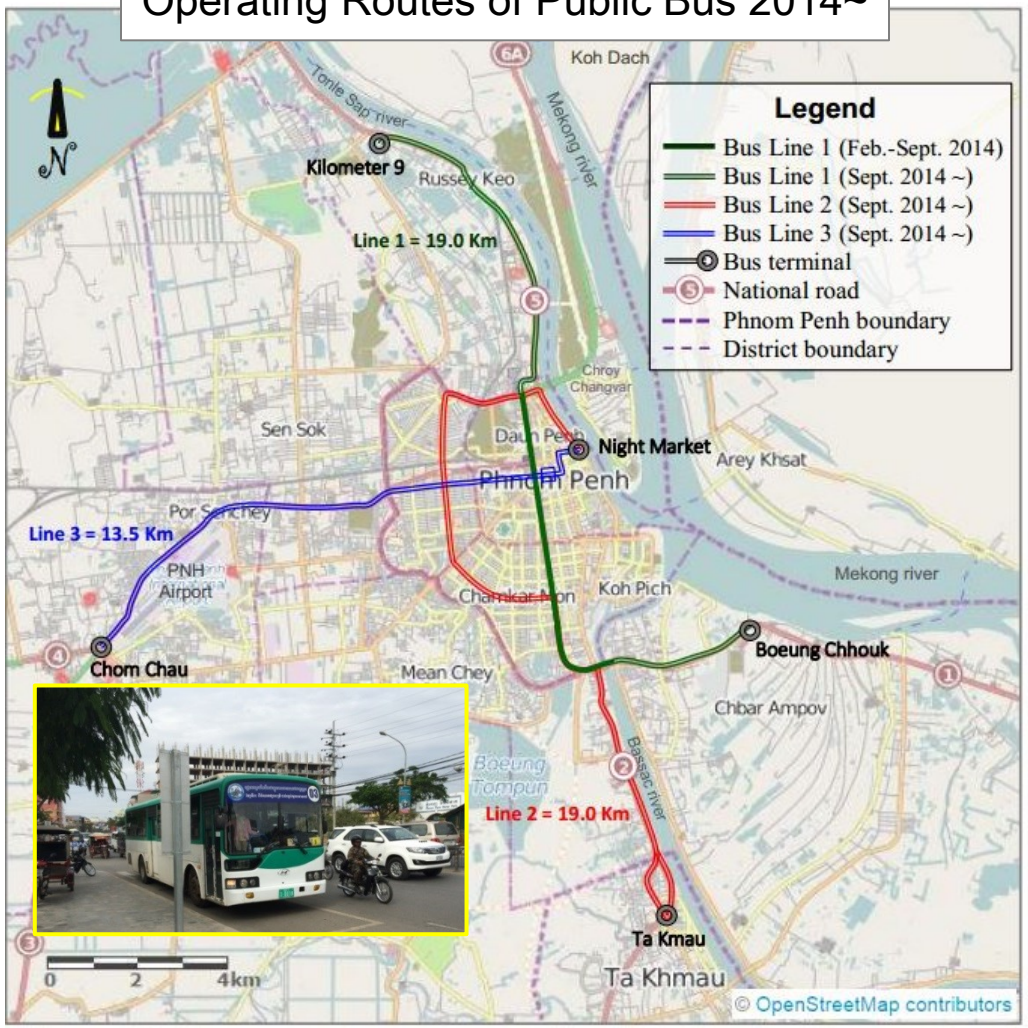
Public Transport Modes in Phnom Penh

プノンペンの公共交通

LAMAT modes

Operating Routes of Public Bus 2014~



- **Motodop** and **Remork** (**2/3wheelers**) are the most popular and active public transport modes in Phnom Penh.

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Measurement Models- Users' Traffic Risk Perception

- Each indicator is from the 5-point (1: Very Unlikely, 3: Neither, 5: Very Likely)

Table Summary statistics of SEM variables ($N = 756$)

Questionnaire items (Abbreviation)	Mean SD	All users	Motodop	Remork
Traffic risk perception				
I feel that there is a high risk of traffic accidents when riding Motodop/Remork (Risk1)	Mean	3.53	3.75	3.14
	SD	1.22	1.12	1.30
I often warn Motodop/Remork drivers to drive more carefully (Risk2)	Mean	3.62	3.82	3.27
	SD	1.18	1.11	1.23
Motodop/Remork operations often cause traffic accidents (Risk3)	Mean	3.15	3.26	2.96
	SD	0.85	0.79	0.92
Overall, Motodops/Remorks are safe from traffic accidents (Risk4)	Mean	3.11	2.89	3.50
	SD	0.91	0.92	0.73
New public transport				
Citizens require a new public transport mode, which is flexible, safe, and comfortable (NewPT1)	Mean	4.04	4.05	4.04
	SD	0.86	0.84	0.91
It is good to have a passenger van offering a new public transport service in the city (NewPT2)	Mean	4.39	4.39	4.38
	SD	0.78	0.76	0.81
I intend to travel via the passenger van (NewPT3)	Mean	4.34	4.38	4.28
	SD	0.79	0.75	0.86
I will recommend others to use the passenger van (NewPT4)	Mean	4.18	4.18	4.17
	SD	0.82	0.81	0.83

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Measurement Models- Drivers' Feeder Intention

- Each indicator is from the 5-point (1: Very Unlikely, 3: Neither, 5: Very Likely)

Table Descriptive statistics of the variables for SEM ($N = 186$)

Variables	Mean	SD	Min	Max
Feeder of Bus				
I want proper stations near bus stops	4.05	1.14	1	5
Transport passengers from/to bus stops	3.67	1.20	1	5
Bus on major roads, my service at others	3.84	1.26	1	5
Support for Bus Service				
I support the continuum of bus	2.96	1.55	1	5
It is good to have public bus in the city	3.02	1.45	1	5
Bus helps reducing the traffic accidents	3.90	1.02	1	5
Negative Impacts of Bus Service				
Public bus lowers my monthly income	3.54	1.36	1	5
Public bus lowers my daily passengers	3.58	1.36	1	5
Public bus affects my living conditions	3.25	1.44	1	5
Regulation & Service				
All drivers to have paratransit uniform	4.46	1.08	1	5
To register & define all drivers each zone	3.97	0.99	1	5
To use fare system like taxi-meter	3.53	1.60	1	5
Vehicle Size				
D_Remork (1 if a driver of Remork, 0: Otherwise)	0.57	0.50	0	1

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(Phun and Yai, 2016b)

LAMAT to Feed Future Railway in Phnom Penh

- In 2014, JICA study team recommended Automatic Guided Train (AGT).

Source: PPUTMP Project Team (JICA, 2014)

Figure 11.2-2 Route Alternatives for East-West and Southwest Transport Corridors

Urban Transport Plan

2014 **Begin City bus**

2016 *(Short-term)*

Parking & Traffic management

2020 *(Medium-term)*

Begin Rail transit

2025

2035 *(Long-term)*

Rail transit system is planned at the highest transport demand along four transport corridors with bus system and para-transit as feeders of the rail transit. Development of the mode interchange area, which

➢ *JICA has considered role of LAMAT as a feeder to future railways.*

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