



Photo: Masaru Suzuki

Spillover Effect

Study on JICA's transport Master Plans



Japan International Cooperation Agency



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Introduction

In developing country, transportation demand is increasing and high especially in large cities and JICA has been supporting the construction of transportation infrastructures such as railway, road and other transportation modes.

On the other hand, these transportation infrastructures require a large amount of financial sources for the construction and operation.

Generally, there are following sources of funds for construction and operation, but there are many difficulty of securing financial sources as before.

Government fund, ODA Loan and/or PPP finance, etc.

Farebox revenue, Non-farebox revenue and/or cross auxiliary.

In addition to the above sources, as a new source, utilizing of spillover effect generated by Infrastructures is proposed. In this purpose, this paper contains below necessary aspects of spillover effect.

- What is Spillover Effect ?
- Possible Finance Scheme utilizing Spillover Effect
- Example (Medellin in Columbia and Manila in Philippines)
- Importance of Considering the Spillover Effect at the Stage of Designing the Urban Railway Masterplan.
- Step to elaborate the Financial schemes of Urban Transport Projects incorporating Their Spillover Effects.



What is Spillover Effect?

According to Professor Yoshino,

The ultimate goal of infrastructure investment is not just developing infrastructure by constructing new roads, railways, electricity, etc. An effective infrastructure project not only constructs the infrastructure but also leads to the growth of the region along that infrastructure, such as roads, railways, water supply, electricity, etc.

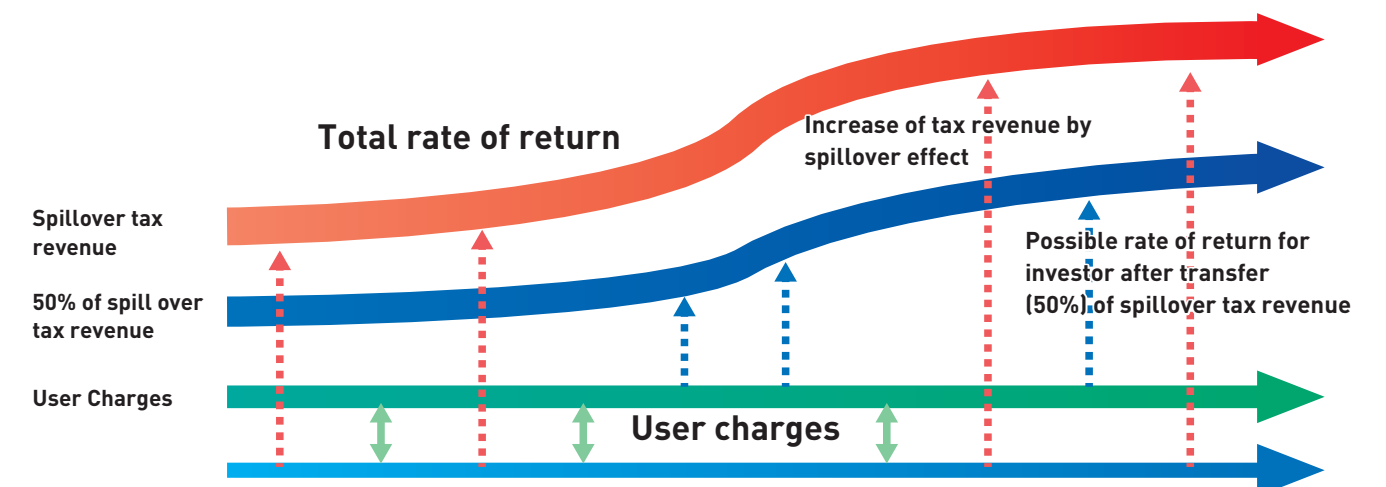
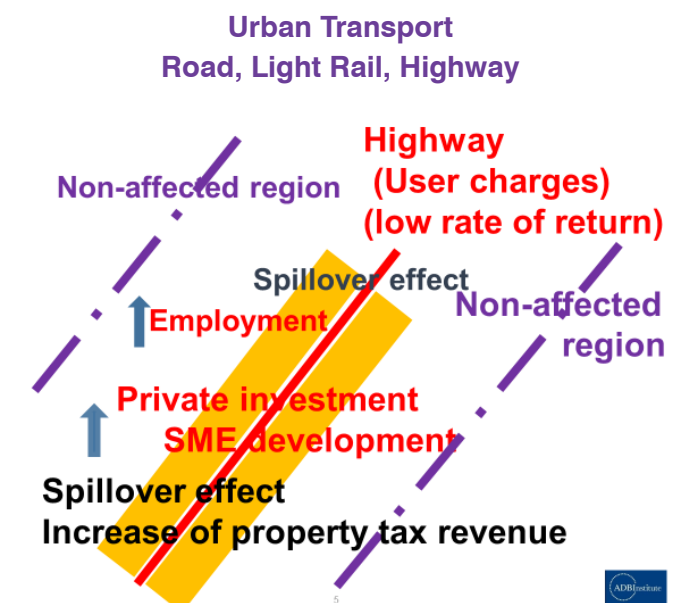
For example, transportation infrastructure attracts businesses by providing faster access to the region. New restaurants could open at new railway stations. Big opportunities for employment could be created by the new infrastructure construction. This could lead to the development of residential areas due to employment growth. New apartments could be constructed along the new infrastructure. Small businesses could start to open new shops.

An effective infrastructure investment means not only the physical quality of the infrastructure but also how infrastructure helps to develop the region and the impact on employment and poverty alleviation in the region. An effective infrastructure investment could have a significant impact on income inequality mitigation. Transportation infrastructure allows local products, for example, agricultural products, such as rice, vegetables and meat, to be transported to consumers faster. Farmers could sell their crops to cities, where demand is located, that are connected by road and railways, which will bring income to rural farmers. Fishermen could sell their fish to cities by use of infrastructure much faster than before. This could lead to the growth of local production and exports. These are some examples of the spillover effect of infrastructure.

Spillover Effect of Investment on Transport Infrastructure

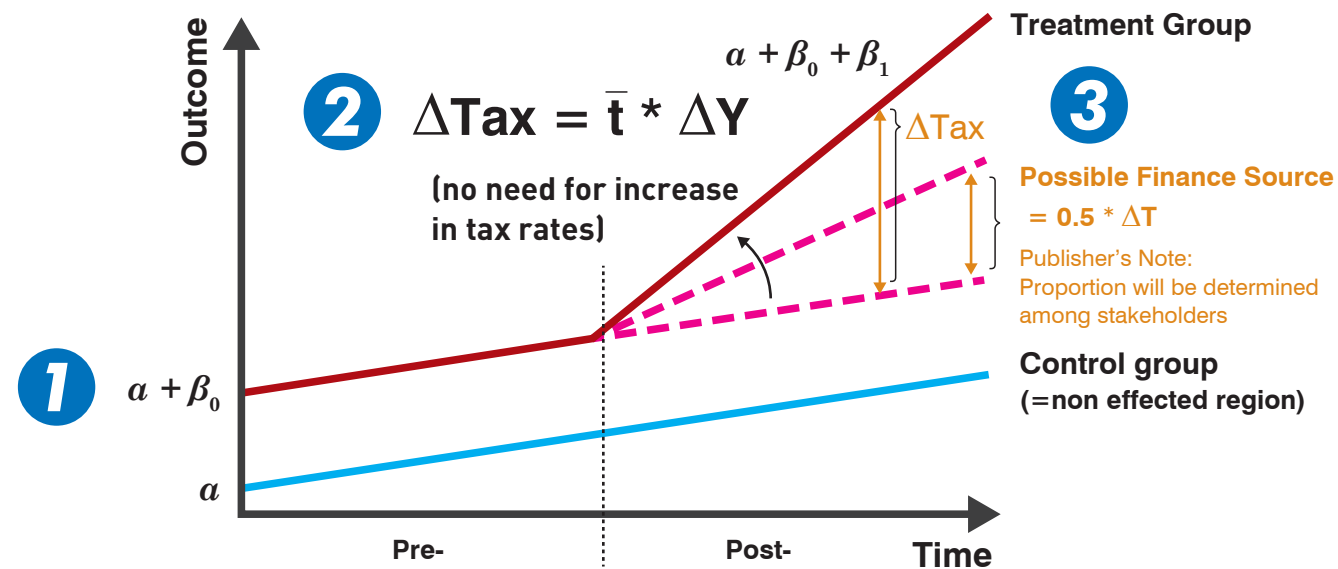
Positive economical benefits triggered by transport infrastructure development in surrounding area around transport infrastructure;

e.g. Tax increase, land price increase, regional GDP increase etc.



Possible Finance Scheme utilizing Spillover Effect

Spillover effect, the tax increment by infrastructure development, could be shared with owner and/or investor of the infrastructure, and be utilized as alternative finance source in the place of conventional subsidy system.



$$Outcome = a + \beta_0 D + \beta_1 D \times T$$

Where: $D = 1$ (treatment group) $T = 0$ (pre-treatment period)
 $D = 0$ (control group) $T = 1$ (post-treatment period)

Spillover Effect of Investment on Transport Infrastructure

- 1 Development Effect by Investment on Transport Infrastructure (ΔY)
- 2 Increase of tax revenue as appearance of Spillover Effect (See the red solid line)
- 3 Revenue sharing from tax increment (ΔTax) with Owner and/or Investors (=Subsidy) by 50%end

Modified by the Publisher based on the following sources:

1. Naoyuki Yoshino, Matthias Helble, and Umid Abidhadjaev (2018), *Financing Infrastructure in Asia and the Pacific: Capturing Impacts and New Sources*, Asian Development Bank Institute.
2. Yoshitsugu Hayashi, KE Seetha Ram, and Shreyas Bharule (2020), *Handbook on High-Speed Rail and Quality of Life*, Asian Development Bank Institute.

Example: The case of the STAR Highway in the Philippines

The Southern Tagalog Arterial Road (STAR Highway), Philippines, Manila

Tax Revenues in three cities

Yoshino and Pontines (2015)
 ADBI Discussion paper 549



Table: Calculated Increase in Business Tax Revenues for the Beneficiary Group Relative to Nonbeneficiary Group 4 (P million)

Region	t-2	t-1	t	t+1	t+2	t+3	t+4
Lipa City	134.36	173.50	249.70	184.47	191.81	257.35	371.93
Ibaan	5.84	7.04	7.97	6.80	5.46	10.05	12.94
Batangas City	490.90	622.65	652.83	637.89	599.49	742.28	1,208.61

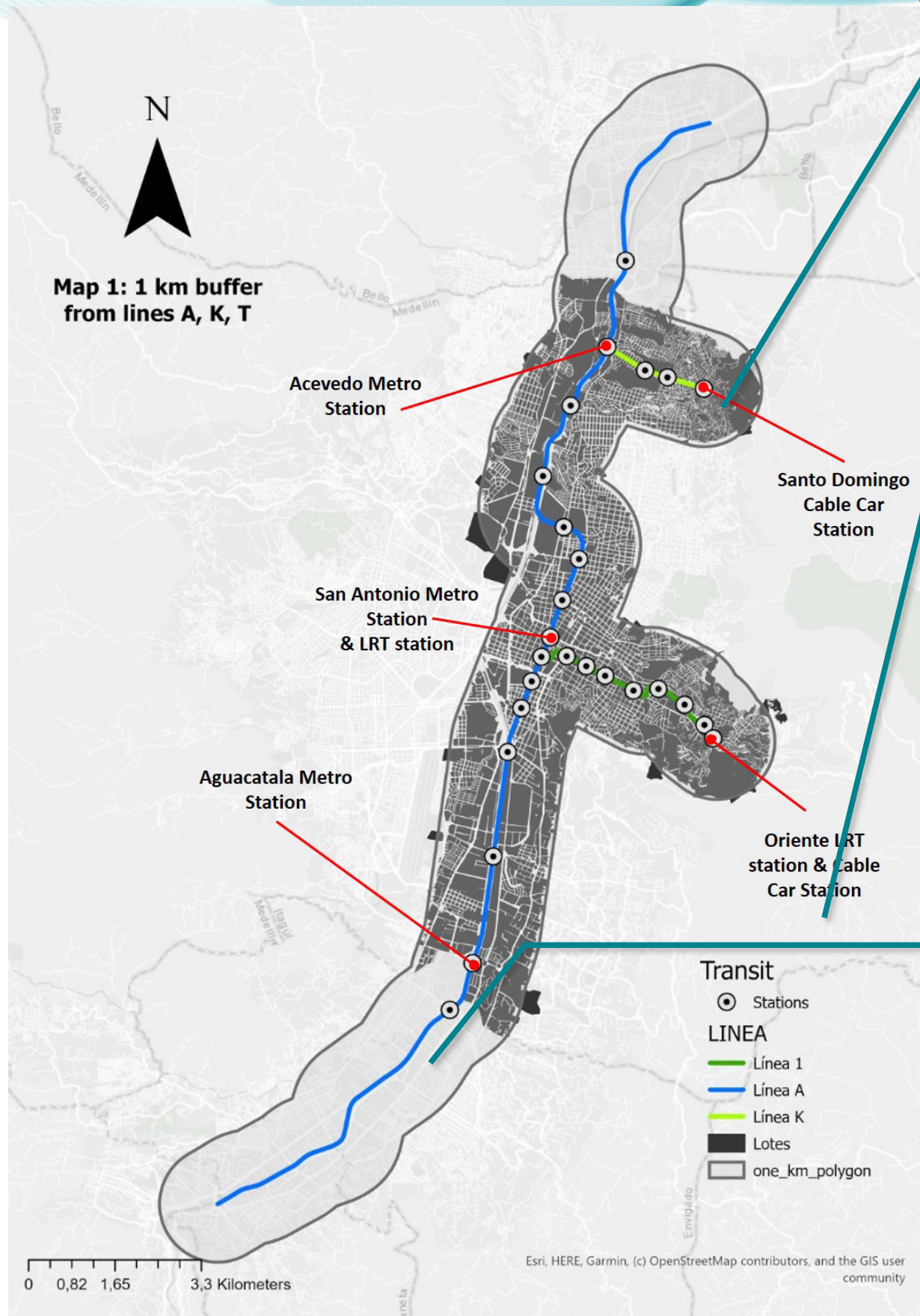
← Construction → ← Operation →

Table shows the case of the STAR Highway in Manila (Yoshino and Pontines, 2018). The periods t-1 and t indicate periods under construction. At the end of t, the highway had been completed and started operation. For Batangas City, tax revenues increased from nearly PHP 491 million (Philippine peso) without construction (t - 2) to over PHP 622 million and PHP 652 million after construction had started (t-1 and t).

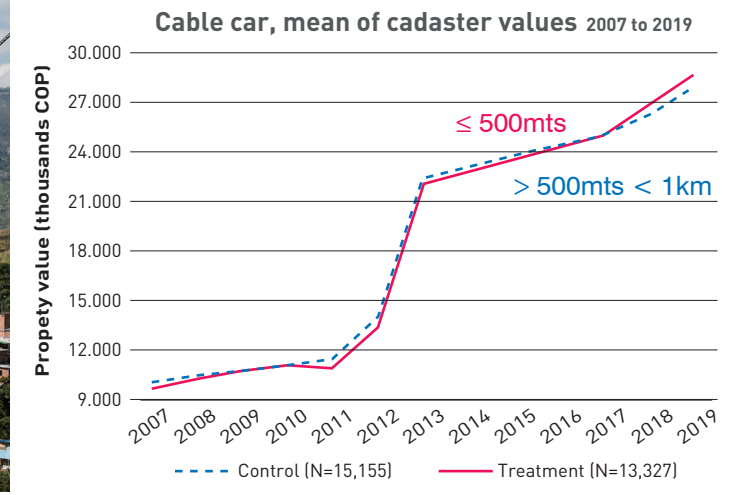
During the highway construction, construction workers and related construction projects came to the region, which increased regional GDP. At the end of t, the STAR Highway had been completed. Then, at t+2, tax revenues diminished compared with the construction period until after the fourth year when tax revenues increased drastically. At t+4, tax revenues reached PHP 1,208 million, about twice as much as before the construction. These are the spillover tax increases coming from infrastructure investment, in this case the STAR Highway.

These tax revenues are the increases, not the existing tax revenue. Due to the highway construction and increased economic activities, Batangas City had gained tax revenues of PHP 1,208 million by t+4 because of the highway construction and increased economic activities. If part of these incremental tax revenues (PHP 1,209 million- PHP 490 million) were to be returned to private investors, it is highly likely that they would be willing to invest in the construction of the highway.

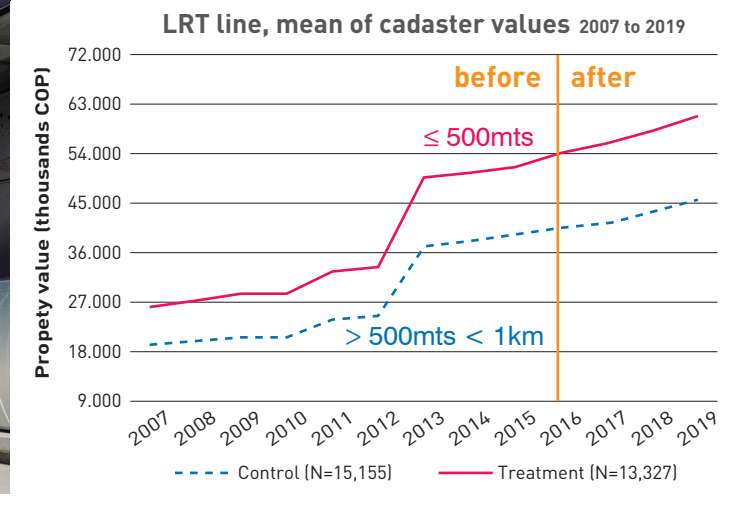
Example: The case of Medellin in Colombia



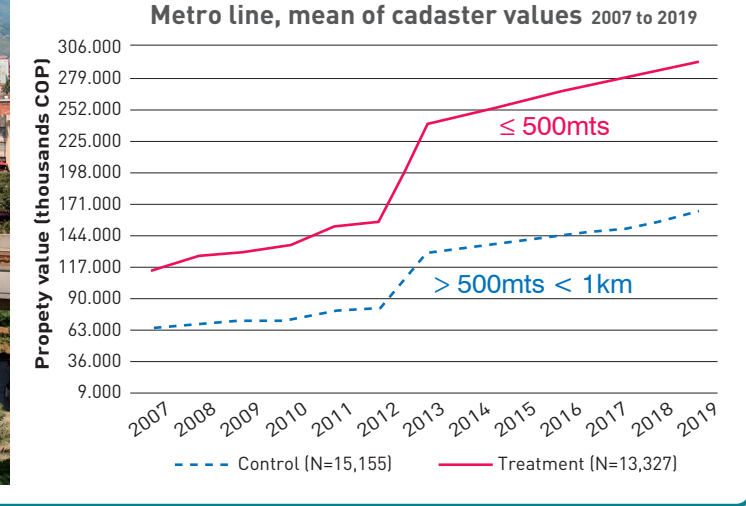
1.9% increase on land value (in 2019)



2.7% increase on land value (in 2019)



2.9% increase on land value (in 2016)



Data source: the Cadaster Department of Medellin (2020)
 Note 1: This analysis is based on C. Erik VERGEL-TOVAR, Ph.D & Paulo Martinez (2021): Spillover effects of mass transit investments on property values and urban development: the case of Medellín, Colombia, "Final Report".
 Note 2: COP is Colombian Peso.
 Note 3: Property value increase between 2012 and 2013 is due to the change of measurement rule of property value.

Importance of Considering the Spillover Effect at the Stage of Designing the Urban Transport Master Plan

1. JICA has supported formulating various Urban Transport Master Plans worldwide as follows.

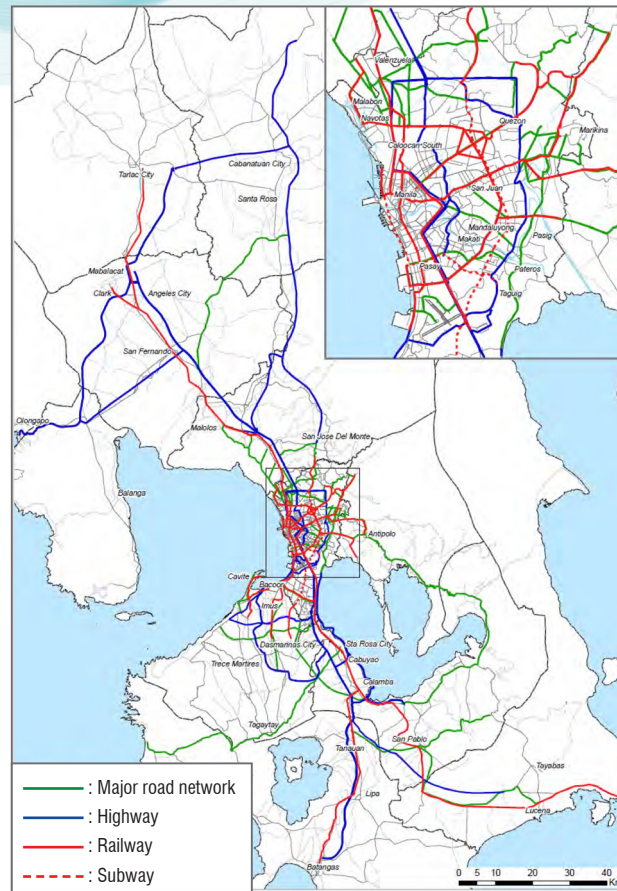
e.g.

- Roadmap for transport infrastructure development for Metro Manila and ITS surrounding areas (region III & region IV-A) in the Philippines. (2014)
- Comprehensive transport master plan for JABODETABEK in Jakarta, Indonesia (2019)
- Project for Formulation of National Transport Master Plan in Cuba (2020)
- Urban Transport Improvement Master Plan Project for Santa Cruz de la Sierra Metropolitan Area (2014)
- Project for Urban Transport Master Plan in Kinshasa City. (2018)
- Project on Integrated Urban Development Master Plan for the City of Nairobi (2014)
- Project for Revision of Dar es Salaam Urban Transport Masterplan (2018)

2. In each project, the following items are generally researched; namely (1) major issues in the urban transport sector, including in the legal system, (2) traffic survey and transport demand forecast, (3) the desirable transport network plan based upon the future demand, (4) the drafted plan of major transport projects and rough estimation cost, and (5) social and economic impacts.

3. Further to above-mentioned items, the data for identifying the Spillover Effect, such as the data availability of the property tax, and the land use system relating to land price, are recommended to be also researched at the stage of designing the Urban Transport Master Plan. This could lead to the establishment of the bankable financial scheme for sustainable urban Transport projects.

See P. 8 for the example of Terms of Reference.



↑ Urban Transport Network proposed in the Project of the Roadmap for transport infrastructure development for metro Manila and ITS surrounding areas
Based upon the roadmap, JICA supports the construction of the Metro Manila Subway and North-South Commuter Railway.



Steps to Elaborate the Financial Schemes of Urban Transport Projects Incorporating their Spillover Effects

1. Confirm the data availability

- ✓ Property tax, Property/Land value, and etc
- ✓ Data coverage area, grid, year
- ✓ Precise definition of data

2. Investigate the related policies on property tax and land value

Policy and systems on

- ✓ Property tax
- ✓ Property appraisal
- ✓ Land transaction

3. Set the indicator representing spillover effects in the context of the project

For example...

- ✓ Property tax increase or land value increase between treatment area and control area
- ✓ Capture XX % of the above increase as a potential financial source

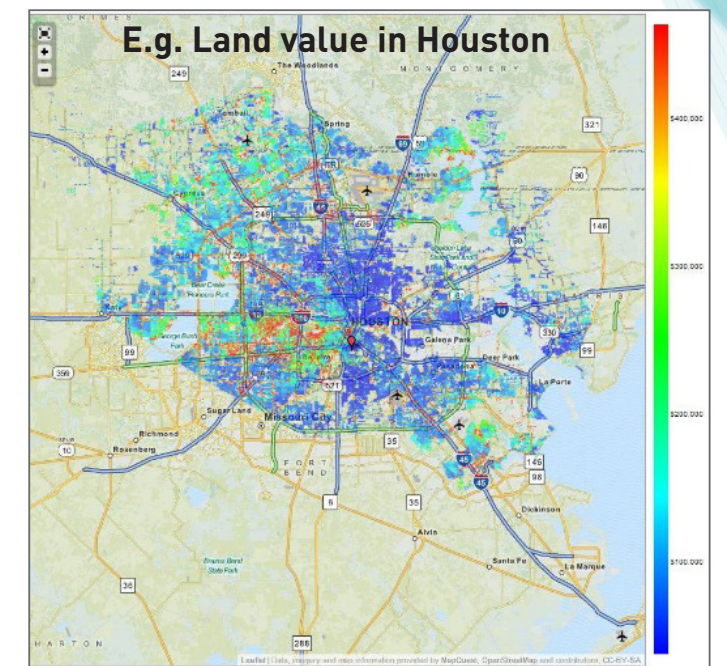
4. Estimate the rough amount of potential financial source generated by spillover effects

5. Propose the coordinating body and mechanism to manage the potential financial source

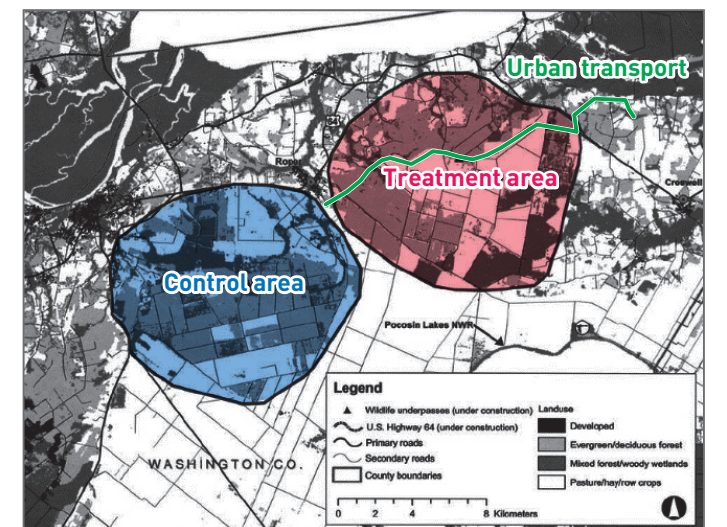
- ✓ Coordination mechanism among multiple stakeholders
- ✓ Management body of the potential financial source

6. Conduct the economic and financial evaluation of the projects considering the spillover effects

- ✓ FIRR with/without the potential financial source induced by the spillover effects



Source: Reddit Inc (2021), Land value in houston [map], https://www.reddit.com/r/houston/comments/2ajybh/land_value_in_houston_map/



Source: Laura et al. (2009), Geostatistical analysis of allele presence patterns among American black bears in eastern North Carolina

Summary

The case studies show the potential of spillover effect generated from the actual transport projects.

For the Spillover effect, the following viewpoints are important in the urban transport master plans and urban transport projects.

1. Maximize the spillover effect (utilization in master plans)
 2. Utilization of the spillover effect as a financial source
1. To maximize the spillover effect, below surveys and studies are necessary from the master plan stage.
 - Data collection of land price and tax revenues, etc. and estimation of future increase of these value.
 - Evaluation of spillover effect based on the above estimation.
 - Discussion on policies and measures to maximize the spillover effect and implementation of the policies and measures.
 2. To utilize the spillover effect as a financial source, there are still challenges to utilize it.
 - Quantitative analysis based on the past data are quite important.
 - The result of this analysis may indicate hints about the quantity of spillover effect and based on which more concrete measures or rules to utilize the spillover effect can be discussed. We will continue to investigate the spillover effect with master plans etc.

In this way this paper concludes that there is the potential of spillover effect from the transport infrastructures from the past cases and it is necessary to start the discussion on spillover effect from master plan stage to utilize the spillover effect as a financial source.

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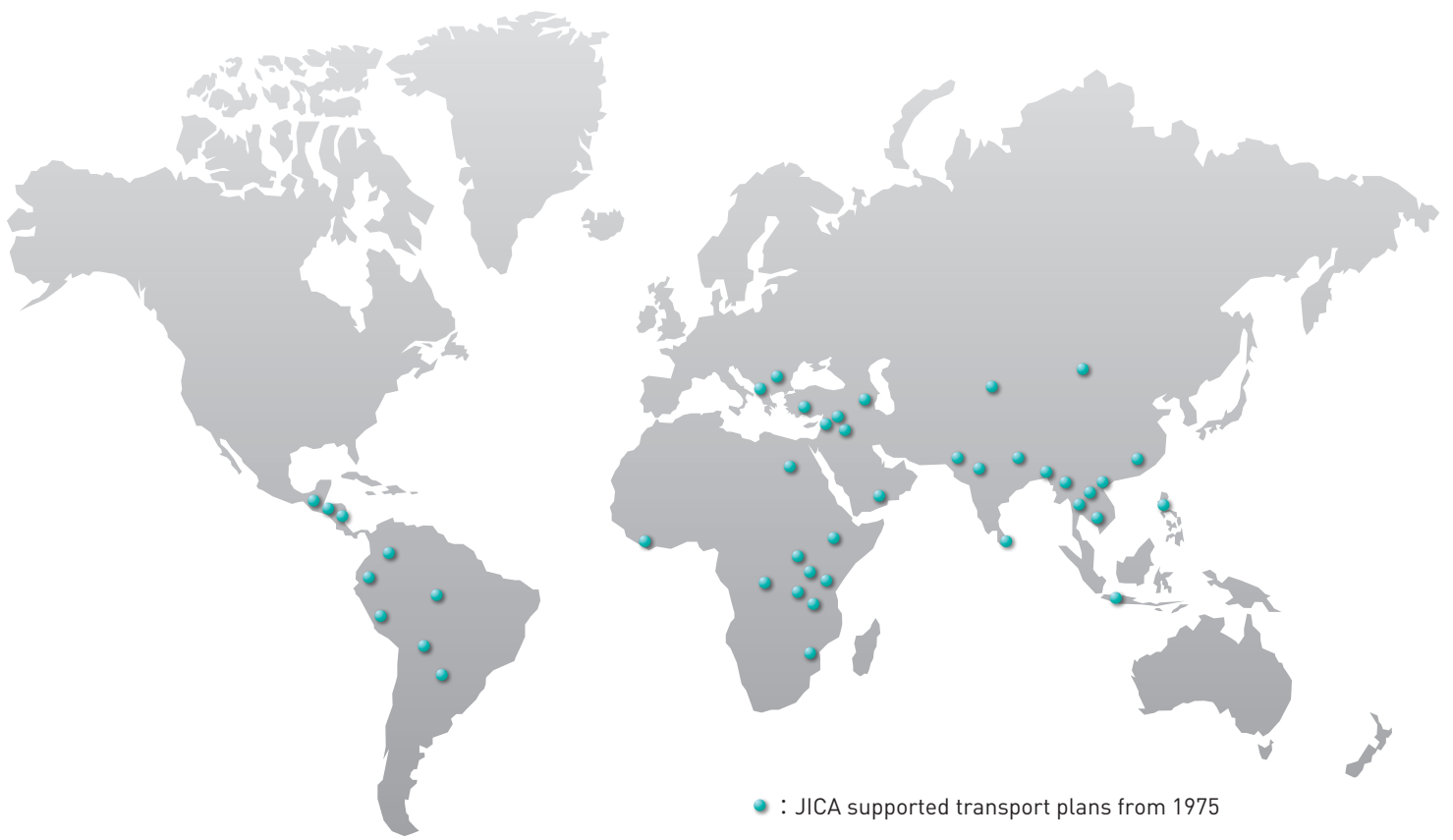
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