Key Points

- Due to rapid urbanization and chronic traffic congestion, the development of urban transport such as railways is key for urban development in Asian countries. International development institutions support urban transport development from the master plan stage.
- However, an enormous amount of funds are required for the construction and operation of urban transport. Effective finance measures for the priority projects proposed in the master plan are a challenge. Furthermore, these finance measures should be examined from the master plan stage.
- Finance with spillover effects is one option to boost the financial sustainability of urban transport in Asian developing countries.
- Although the master plan formulation by international development institutions in cooperation with recipient governments is generally carried out by consultants, the standard workflows in the master plan have not yet been clarified.
- This policy brief proposes seven concrete steps to examine the financial scheme with the spillover effects at the urban transport master plan to promote practical application of the financial method.

Seven Steps to Examine Urban Transport Finance with Spillover Effects from the Master Plan Stage

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Introduction

International development institutions, including the Asian Development Bank (ADB) and the Japan International Cooperation Agency (JICA), support the development of urban transport in large cities in Asian countries (JICA 2021). Asia and the Pacific’s urban population is projected to reach close to 3 billion by 2050 with an urbanization rate of 64% (ADB website). In response to population growth, the capacity of transportation infrastructure is becoming tighter, causing urban problems such as chronic road traffic congestion and air pollution associated with it. In this regard, urban railways have become an effective means, especially in metropolitan areas where transportation demand is high, from the viewpoint of mass transportation, high speed, and high energy efficiency.

To solve these issues, international development institutions not only implement individual projects, but also formulate urban transport master plans as a framework for the sustainable development of urban transport, and comprehensively from the upstream stage. In urban transport master plans the development policy of an entire city and the transportation project and land use plan based on this are shown in the master plans. In particular, the trunk lines of large cities have very high traffic demand, so urban railways have been proposed in response to this, and international development institutions such as ADB and JICA have supported their construction.
However, the amount of funds required for the construction and operation of urban transport (especially railways) is enormous, and securing funds is a major issue for project implementation. First, it is necessary that the central and local governments that bear the construction funds have a certain level of financial strength. According to JICA and ALMEC Corporation (2011), most cities begin operating metro services once they reach an urban gross domestic product (GDP) level defined by "urban population x GDP per capita" between $3 billion to $30 billion (Figure 1), suggesting that a lot of cities, especially in developing countries, will have difficulty constructing and operating metro services due to their urban GDP not reaching $3 billion. This is because it is difficult to improve urban transport until it reaches a certain stage of development, and it is necessary to have a financial source backed by a reasonable urban population and tax revenue to improve urban transport (Yoshino and Pontines 2015). In addition to the funds needed for constructing metro services, it is important to secure operating funds to be able to continue to operate services. For example, the MRT Line 3 in Manila in the Philippines had been operating relatively stably for 12 years after its opening in 2000, but due to budget shortages after that, appropriate maintenance and management has not been carried out, and accidents and train troubles are happening more frequently than before (Matsushita and Morichi 2019).

Figure 2 shows the main priority projects proposed in the Lahore Urban Transport Master Plan in Pakistan with the target year of 2030. Even if only the major railway projects are extracted, the cost is about $6.8 billion. Furthermore, the master plan rarely provides
effective recommendations or proposals regarding specific measures for financing measures for priority projects. With this background, this policy brief focuses on the spillover effects of urban transport infrastructure, which is regarded as a solution to fill the financing gap (Endo and Seetha Ram 2021). The spillover effects are an indirect economic effect on the surrounding areas due to the development of transportation infrastructure (Yoshino and Nakahigashi 2000). Examples include active private investment and increases in employment in areas along the railway lines. There are two ways to measure spillover effects. One is to use a macroeconomic approach by use of the trans-log production function. It measures the impact of infrastructure on private investment and employment (Nakahigashi and Yoshino 2016). The second way is to use project-oriented data such as highways, railways, and high-speed railways (Yoshino and Abidhadjaev 2017a, 2017b). Property taxes in areas along the railway lines are one of the measures to assess the impact of infrastructure investment (Yoshino et al. 2019a). Finance with the spillover effects involves a change in the use of taxes such as property tax, income tax, and corporate tax. In this regard, it is necessary to make administrative and/or political decisions regarding the change in tax use, such as approval by the tax authorities and/or parliament. Therefore, it is necessary to start discussions on financing methods that utilize the spillover effects from the urban transport master plan stage, which is the initial stage of the project.

Although the master plan formulation by international development institutions in cooperation with recipient governments is generally carried out by consultants, the standard workflows in the master plans have not yet been clarified. Thus, this policy brief aims to propose a standard workflow (TOR) for the master plans when applying a financial method with spillover effects to promote a practical application of the financial method.

**Urban Transport Finance with Spillover Effects as One Option**

This section explains the theoretical framework for the spillover effects of infrastructure based on Hayashi, Seetha Ram, and Bharule (2020) and Yoshino and Abidhadjaev (2016, 2017a, 2017b); and Yoshino, Taghizadeh–Hesary, and Nakahigashi (2019). The spillover effects of infrastructure are the indirect effects. Figure 3 shows an image of the spillover effects. It is expected that the investment in transportation infrastructure will create new businesses in the surrounding area, create new jobs, and create new small and medium-sized enterprises. Due to the spillover effects, property taxes in the surrounding area will increase. On the other hand, there is no increase in tax revenue in areas not affected by transportation infrastructure.

In developing countries, it might be difficult for transport companies to obtain enough revenue to cover costs in urban transportation infrastructure development and operation. However, urban transport may lead to the development of local economies such as new high-rise housing, new commercial facilities, and new hotels and/or restaurants, the promotion of

Figure 2: Main Proposed Urban Railway Projects in Lahore Urban Transport Master Plan

LUMTP = Lahore Urban Transport Master Plan, TD = Transport Department (responsible agency).
employment, and the reduction of poverty. Due to these external economic effects, tax revenues such as income tax, corporate tax, sales tax, and property tax, will increase. All of these tax increases have been absorbed by the central and local governments, and many urban transport developers have been operating solely on usage fees. Such a financial structure that relies solely on usage fees may be one of the factors for the financial deficit in urban transport in developing countries. Thus, financing that utilizes the spillover effects diversifies the revenue sources of transport companies, which is also expected to lead to strengthening financial sustainability. It will provide incentives for the urban transport sector to help to develop surrounding regions in order to increase revenues from spillover taxes. New businesses along urban transport corridors will increase new job opportunities at restaurants, shopping malls, offices, etc.

The spillover effects are measured by the difference-in-difference (DID) method. Figure 4 shows the concept of the spillover effect and DID. The DID method measures the difference in outcome variable differences between different groups, which can be applied to various cases: the effects of policies, the effects of a drug or medical treatment, etc. Here, we are using it to analyze the effects of infrastructure projects. The assumption is that the change in outcomes between different groups is the same over time and that the project is the only intervention that makes a difference. To measure the spillover effects, measure the outcomes of the treatment group (the beneficiaries or affected group by the transport project) and the control group (the non-beneficiaries or non-affected group by the transport project) before and after infrastructure investment. Specifically, first, one will obtain outcome indicators for both groups before and after infrastructure investment. Secondly, the difference between the treatment group and the control group, which is obtained by removing various elements with the passage of time, is defined as the spillover effect. This spillover effect is usually collected by the government as property tax, etc., but is generally not returned to infrastructure developers/operators. For example, Figure 3 shows that 50% of this will be returned to infrastructure investors as subsidies.

This policy brief proposes to return a certain part of the various tax revenues brought about by the spillover effects to the operator of urban transport and the investor of private funds for urban transport. This policy brief also aims to help solve the problems of urban transportation infrastructure finance in Asian developing countries by utilizing the increase in tax revenue due to the spillover effects of urban transport.
Proposal of a Standard Workflow (TOR) for Examining Finance Incorporating the Spillover Effects in the Urban Transport Master Plan

A standard workflow (TOR) for examining finance that incorporates the spillover effects at the urban transport master plan stage has been proposed. Since it is necessary to reorganize the system of the partner country’s government and make decisions in order to institutionalize the finance utilizing the spillover effects, policy discussions are also required as necessary. In the process, it will be helpful to cultivate an understanding of the effectiveness of the method by introducing successful cases in developed countries and other developing countries, and to promote the understanding and decision making of the government of the partner country. The outline of the TOR is as follows.

(1) Confirm the details of property-related data such as property prices and property taxes (years, update frequency, data resolution, etc.), their availability, and the accuracy of data (e.g., the degree of reflection of the market trends into the official land price).

(2) Confirm the property price and property tax system (taxable entity, official land price announcement system, real estate appraisal system, etc.) including the maturity of the system as well as restrictions on the publication of data.

(3) Set an indicator of the spillover effects in the target project (for example, XX% of the difference in property tax revenue after the opening of transport in the treatment area and control area, or XX% of land price increase due to transportation infrastructure).

(4) Predict the amount of potential financial resources generated by the spillover effects.

(5) Examine the scheme of securing potential financial resources into the transport projects due to the spillover effects (the management entity of the financial resources, the coordination framework in the case of multiple parties, etc.).

(6) Calculate the financial internal rate of return (FIRR) of the project that incorporates the spillover effects (comparison of FIRR with and without the spillover effects).

(7) Propose measures and system improvements to maximize the spillover effects.

The details of each step are explained below.

**Step 1: Availability of data**

In order to measure the spillover effects, the property tax and/or the land price in the areas that will benefit and will not benefit from urban transport should be obtained. Table 1 shows the items to be surveyed. Although tax...
revenue data such as property tax are desirable as the data source for spillover effect measurement from the viewpoint of monetization, there would be cases where the recipient government may raise concerns about the disclosure of the property tax data. Because of this, land price data are also a candidate for the data source. If appropriate data do not exist, one option is to consider collecting land price data with a private real estate appraisal company that is familiar with real estate appraisals in the country. Table 2 also shows an example of the criteria for determining data validity of existing data. In the case of the official land price, even if the data exist, in some countries, it deviates hugely from the market price trends. To judge the validity of the official land price, the relationship between the official land prices and market prices trends should be carefully examined.

**Step 2: Property tax and land price system**

The country’s system regarding property tax and land prices is investigated. The specific survey items are shown in Table 3. It is also confirmed whether there is an institutional basis that can allocate the increase in tax revenue and the increase in land price for transportation projects. In addition, the overall maturity of the property tax system, including the official land price system, the transparency of the appraisal price, and the degree of deviation from the market price trends, will be analyzed. Furthermore, since land prices and property taxes may have restrictions on the publication from the socioeconomic point of view of the country concerned, we will also confirm the restrictions on data disclosure.

**Step 3: Setting of the spillover effect measurement indicator in the context of proposed projects in the master plan**

The indicators of the spillover effects are examined and set depending on the context of the proposed projects in the master plan, the availability of data, and the systems concerned.

Table 4 shows major points to be examined when to set indicators of the spillover effects.
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Step 4: Forecast of potential financial resources generated by the spillover effects

The amount of potential financial resources generated by the spillover effects is predicted. This prediction analysis includes how much of the potential financial resources created by the spillover effects will be allocated to financial resources related to priority projects. This prediction analysis also includes sensitivity analysis for predictions with regards to the policy change risk such as changes in property tax rates, and changes in plans for urban transportation projects (significant changes in opening times and routes).

Step 5: Proposal for the return scheme of potential financial resources by the spillover effects to projects and its institutionalization

A sustainable financial scheme to return the captured spillover effects to the project is examined. When multiple stakeholders are involved, the financial scheme has to be feasible considering the items as shown in Table 5. Based on the current system on the property tax and land price systems investigated in Step 2, the proposed scheme allows tax revenue increments and land price increases to be used for transportation businesses and railway development projects with providing incentives for improving non-fare revenue of transport operators. It is also noted that the purpose here is not to finalize the scheme, but to provide materials for advancing the institutional restructuring of the recipient government to operationalize the financing method utilizing the spillover effects.

Step 6: Economic and financial analysis of priority projects incorporating spillover effects

To examine the impact of spillover effects on the financial sustainability of the priority projects, the comparison between the FIRR of a project with and without spillover effects is conducted.

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Table 3: Survey Items Related to Property Tax and Land Prices

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property tax system of the country</td>
<td>Especially whether there is an institutional basis that can use the increase in tax revenue and the increase in land price due to the spillover effects for transportation projects.</td>
</tr>
<tr>
<td>The taxable entity of property tax</td>
<td>The entity that determines the tax rate.</td>
</tr>
<tr>
<td>Legal restrictions on the use of tax revenue</td>
<td>Legal restrictions.</td>
</tr>
<tr>
<td>Accountability system for tax use</td>
<td>Systems and procedures for decision-making to change tax use.</td>
</tr>
<tr>
<td>Land ownership and transaction system</td>
<td>For example, in some countries such as the People's Republic of China, private ownership of land is prohibited and only the right to use is the target of transactions, so we will investigate the outline of the land system.</td>
</tr>
<tr>
<td>Official land price notification system (including appraisal method)</td>
<td>Transparency of appraisal price, degree of deviation from market price trends.</td>
</tr>
<tr>
<td>Real estate appraisal system</td>
<td>(real estate appraisal standards and their details).</td>
</tr>
<tr>
<td>Urban development system of land systems such as land adjustment or</td>
<td>Land pooling system.</td>
</tr>
</tbody>
</table>

Source: Authors.

Table 4: Items to be Examined Regarding Index Setting of Spillover Effects

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Whether to target the property tax increase</td>
<td>Whether to target the property tax increase due to the project or the land price increase due to the project.</td>
</tr>
<tr>
<td>Setting intervention area</td>
<td>Setting intervention area (i.e., treatment area (area that receives positive economic effect by urban transport) and control area (area that is separated from urban transport and the influence of economic effect by urban transportation is limited)).</td>
</tr>
<tr>
<td>Example</td>
<td>An example is within or outside the XXm area along the railway line.</td>
</tr>
<tr>
<td>Potential source of spillover</td>
<td>What is the potential source of spillover (e.g., XX% of the difference in property tax revenue after the opening of traffic in the treatment area and control area, XX% of the increase in land prices due to transportation infrastructure, etc).</td>
</tr>
<tr>
<td>Measure past spillover effects and obtain the rough amount of</td>
<td>Measure the past spillover effects and obtain the rough amount of the spillover effects in the city (when there is existing urban traffic in the target city).</td>
</tr>
<tr>
<td>Examination of measurement method</td>
<td>Examination of measurement method (example: difference-in-difference method, hedonic method).</td>
</tr>
</tbody>
</table>

Source: Authors.
Step 7: Proposals for policy measures to maximize the spillover effects

Policy measures to maximize the increase in land prices and property taxes, as a result of the spillover effects are proposed. Examples include the formulation and implementation of transit-oriented development plans for stations, the construction of intermodal infrastructure with other transportation modes, and infrastructure of safe movement around the stations even at night, especially for female railway users. Last-mile measures such as improving streetlights and streets and expanding feeder traffic to destinations are also considered.

Conclusion and Practical Suggestions

In this brief we focused on the spillover effects of urban transportation infrastructure on the surrounding areas, in response to the issue that some priority projects proposed in the urban transport master plan may not be realized due to the enormous cost for construction and operation. We proposed a standard workflow (TOR) for infrastructure finance that incorporates the spillover effects at the master plan stage as follows.

1. Confirm the details of property-related data such as property prices and property taxes, their availability, and accuracy.
2. Confirm the property price and property tax system including the maturity of the system as well as restrictions on the publication of data.
3. Set an indicator of the spillover effects in the target project.
4. Predict the amount of potential financial resources generated by the spillover effects.
5. Examine the scheme of using potential financial resources into the transport projects due to the spillover effects.
6. Calculate the FIRR of the project that incorporates the spillover effects.
7. Propose measures and system improvements to maximize the spillover effects.

We would like to mention two important points of view in promoting practical application of this method in the future. The first point is to set policies that utilize the spillover effects as one of the necessary measures to be implemented in the urban transport master plan. This could increase the feasibility of the proposed finance method with the spillover effects. In order to utilize the spillover effects as revenue for transport operators, it is necessary to institutionalize it, and it is likely to take time to develop the system. In support of the formulation of the urban transport master plan, international development institutions are working to obtain government approval for the urban transport master plan. For this reason, it is expected that positioning a system that utilizes the spillover effects as one measure of the urban transport master plan will contribute to the promotion of institutionalization for finance with the spillover effect. The second point is to set the spillover effects as the evaluation axis of the infrastructure development project proposed in the urban transport master plan. This leads projects to create larger spillover effects. Future research is needed on how to promote the institutionalization regarding the utilization of the spillover effects. It is required to carry out trial infrastructure finance incorporating the spillover effects to accumulate further knowledge through practice. Through these efforts, it is expected that the resolution of financing issues for urban transportation infrastructure in developing countries will be promoted.

Table 5: Items to be Examined for the Return Scheme of Potential Financial Resources Due to the Spillover Effects

| Targets of use of the financial resources such as new urban transportation development, operation and maintenance, real estate development around stations and along railway lines by transport operators |
| The management entity of the financial resources |
| Business scheme, e.g., tax-based land value capture, joint-development method |
| The coordination framework in the case of multiple parties (when multiple local governments are involved, the local government unit is an example) |
| An institutional basis (if not currently available) that allows the increase in tax revenue and land price to be used for transportation development projects |

Source: Authors.
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References


