



Photo: Bangkok MRT Purple Line (Photo: JICA)¹

Sustainable Infrastructure: How can we promote “sustainability” in infrastructure projects in developing countries?

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Summary

- The development community has shown increasing interest in the concept of sustainable infrastructure over the past few years. There have been numerous initiatives, reports, and seminars on the concept of sustainable infrastructure. However, there is still little comprehensive research on how to realize sustainable infrastructure development in developing countries;
- This policy note discusses the findings of a series of research on sustainable infrastructure, focusing on finance and governance aspects, and presents practical suggestions on how to realize sustainable infrastructure projects for both policymakers in developing countries and practitioners of international cooperation in developed countries;
- This policy note first introduces the concept of sustainable infrastructure and its financial and governance success factors. It then discusses the findings of research on how PPPs (public private partnerships) and MDB/BDB (multilateral/bilateral development bank) finance—regarded as critical financial and governance success factors in theories on development—can work to realize sustainable infrastructure development;
- Based on these findings, this policy note provides several practical recommendations to realize sustainable infrastructure development, including: 1) Developing countries should consider using assistance from MDBs/BDBs in realizing PPP infrastructure projects by coordinating relevant stakeholders; 2) MDBs/BDBs should be involved in infrastructure projects from the planning phase to promote sustainability perspectives; and 3) MDBs/BDBs, together with the international development community, should maintain and promote the current global trend prioritizing “sustainability” and “quality” in infrastructure projects.

The views expressed in this paper are those of the author(s) and do not necessarily represent the official positions of either JICA or the JICA Ogata Sadako Research Institute for Peace and Development.

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1. What is sustainable infrastructure? What finance and governance success factors have so far been identified for realizing the concept?

The concept of sustainable infrastructure² has been widely embraced recently by the international development community, especially since the Sustainable Development Goals (SDGs) were adopted by the United Nations General Assembly in 2015. This is because the SDGs set “quality, reliable, sustainable and resilient infrastructure” as one of their targets (Target 9.1) (UN General Assembly 2017). Although there is no agreed definition of sustainable infrastructure, both development practitioners and academic scholars generally define the concept in line with the “three pillars” of sustainability—namely, economic, environmental, and social sustainability³ (de Jong et al. 2015; Endo et al. 2023⁴). In this sense, the most eloquent definition is deemed to be the Inter-American Development Bank (IDB) definition: “infrastructure projects that are planned, designed, constructed, operated, and decommissioned in a manner to ensure economic and financial, social, environmental (including climate resilience), and institutional sustainability over the entire life cycle of the project” (IDB 2018, 11).

Previous research has been conducted identifying the success factors for realizing sustainable infrastructure. According to Endo et al. (2023), in reviewing extant research on sustainable infrastructure⁵, PPPs (public-private partnerships) and MDB/BDB (multilateral/bilateral development bank) financing are essential from both finance and governance perspectives.

From a finance perspective, PPPs and MDB/BDB financing are most often referred to as available finance arrangements besides conventional public finance and play central roles in sustainable infrastructure development, frequently co-occurring with other arrangements such as conventional public finance and green finance, as seen in Table 1. These finance arrangements are important, especially for developing countries, in their efforts to address the enormous demand gap in their infrastructure by

mobilizing private and MDB/BDB funds. In addition, the benefits of the use of PPP and MDB/BDB finance for sustainable infrastructure are emphasized by recent research. The former can promote sustainable infrastructure by mobilizing relevant private sector knowledge, complementary resources, and management expertise, while the latter does the same by providing relevant knowledge and experience accumulated in developed countries through institutionalized banking institutions (Pinz et al. 2018; Bradlow 2015; Ray and Kamal 2019; Bak et al. 2017).

Moreover, from a governance perspective, PPP and MDB/BDB financing are crucial for realizing sustainable infrastructure. Indeed, according to previous literature (Endo et al. 2023), important governance characteristics for sustainable infrastructure that are frequently referred to by extant research could incorporate either PPP or MDB/BDB finance (see Table 2). As for governance for infrastructure projects under PPP and MDB/BDB finance, recent research suggests that a combination of vertical management (i.e., top-down project management) and horizontal management (i.e., process management based on collaborations and trust among stakeholders)⁶ is vital for realizing sustainable infrastructure (e.g., Pinz et al. 2018; Wang et al. 2022; Endo et al. 2023).

2. What factors are important for realizing sustainable infrastructure through PPPs?

There have been numerous discussions on the potential benefits of using PPPs for sustainability purposes. However, it is difficult to judge whether PPPs can really lead to realizing sustainable infrastructure since the actual effects are subject to ongoing debate among scholars (Pinz et al. 2018). On the other hand, based on the author’s previous and ongoing research, it is deemed that PPPs could work to realize sustainable infrastructure development if some specific conditions are fulfilled. Development assistance from MDBs/BDBs is considered to contribute to fulfilling these conditions.

First, in regard to the development phase of

PPP projects, infrastructure projects require certain conditions to be met for a PPP scheme to be realized. This is the case regardless of whether the purpose is the adoption of sustainability concepts or not. PPPs are a unique scheme involving various stakeholders, including the private sector. Therefore, the development phase generally requires a time-consuming process (i.e., from project planning to financial closure).⁷ For the smooth and timely financial closing of PPP projects, the appropriate government roles and responsibilities, the appropriate risk allocation between the public and private sectors, and sound financial arrangements are critical (Endo et al. 2021⁸)—details of these factors are summarized in Table 3. As for government roles and responsibilities, well-organized and coordinated government authorities and strong political/governmental commitment are especially critical for accelerating the relevant processes when bottlenecks occur (Endo et al. 2021).

Second, ongoing research by the author⁹ suggests specific success factors for the implementation phase, especially for sustainability purposes. PPP schemes should be applied from the operation phase if the projects have low profitability. In other words, capital costs for infrastructure should be covered by public funds and/or MDB/BDB finance to lessen the financial burden and risk uncertainty for private parties. This contributes to increasing the economic/financial and operational sustainability of the infrastructure system. The research also suggests the importance of vertical management in addition to horizontal management. Vertical management here includes strong government policies/regulations on sustainability issues (e.g., key performance indicators (KPIs) for infrastructure operations and regulations on protecting socially vulnerable people) and MDB/BDB policies/regulations on sustainability issues (e.g., strict guidelines on environmental and social considerations).

Moreover, the research emphasizes the importance of trust among stakeholders for close collaboration in a project (i.e., horizontal management). Increased trust promotes the exchange of knowledge and experience on creative activities and solutions for sustainable infrastructure

between public and private parties. In addition, competition between private and public operators, incentives for public and private parties to maintain their high-quality operations, as well as external pressure on the private parties (e.g., pressure to adopt environmental, social, and governance (ESG) investment by the international business community) could be considered success factors for realizing sustainable infrastructure through PPPs.

3. What factors are important for realizing sustainable infrastructure through MDB/BDB finance?

As for the use of MDB/BDB finance for sustainable infrastructure, there are also critical factors that should be prioritized for realizing sustainable infrastructure projects in both the planning and implementation phases.

First, the current global trend toward prioritizing sustainability perspectives in infrastructure projects plays an important role in the planning phase of sustainable infrastructure. MDBs/BDBs provide diverse forms of assistance for the development of sustainable infrastructure projects (e.g., see Table 4 for the case of Japan's ODA), but underlying drivers often guide MDBs/BDBs when applying specific forms of assistance. Ongoing research by the author¹⁰ suggests that developmental, commercial, and geopolitical/geoeconomic drivers can affect, to a lesser or greater degree, the types of assistance provided. The research found that not only development and commercial interests but also international development norms (e.g., prioritization of climate change and environmental issues) and geopolitical/geoeconomic interests (i.e., promoting and advertising “sustainability” in infrastructure projects for geopolitical/geoeconomic purposes) can promote proactive additional assistance for sustainable infrastructure. In this sense, the current global trend of prioritizing sustainability in infrastructure is deemed important for MDBs/BDBs to apply more sustainability-oriented assistance.

Another important factor during the planning phase is the possibility of a win-win

situation through the projects for both developing countries and MDBs/BDBs (Endo and Murashkin 2023). Sustainable infrastructure projects aligned with MDBs/BDBs' guidelines and recommendations generally require time-consuming processes for planning and appraisal, and the projects tend to become relatively costly. Therefore, incentives or “wins” to persuade developing countries to use MDB/BDB finance for sustainable infrastructure projects are deemed important.

Second, as for both the planning and implementation phases of sustainable infrastructure projects using MDB/BDB finance, ongoing research by the author¹¹ implies some success factors. The first factor is close communication between the recipient countries and MDBs/BDBs on how to adopt sustainability perspectives from the project planning stage. The research suggests early involvement of MDBs/BDBs makes it easier for the projects to adopt design, technology, and products aimed at sustainability. The second factor is the timely provision of financial and technical assistance by MDBs/BDBs for improving/raising the sustainability of the project. Infrastructure systems generally degrade over time and require huge investments in rehabilitation and upgrade. Therefore, readily available and user-friendly aid is critical for developing countries. The third factor is trust between policymakers in the recipient countries and practitioners of MDBs/BDBs. Without a close relationship underpinned by mutual trust, it is difficult for MDBs/BDBs to be involved in projects, especially from the planning stage, and similarly, it is difficult for developing countries to obtain timely assistance from MDBs/BDBs in this situation.

Lastly, combining MDB/BDB financing with PPPs in infrastructure projects—usually referred to as “blended finance”¹² by the international development community—is vital in promoting the use of MDB/BDB finance and technical assistance for sustainable infrastructure. The combination of MDB/BDB finance and PPPs does not automatically lead to sustainable infrastructure; rather, excessive dependency on MDB/BDB funds can generate the unsustainable use of PPP schemes (Endo et al. 2021). However, with appropriate leadership by

governments in developing countries and/or MDBs/BDBs, blended finance schemes can work to realize sustainable infrastructure. They can implement this approach by leveraging benefits from both MDB/BDB finance and PPPs (i.e., mobilization of both the private sector's and the MDB/BDB's knowledge, resources, and management expertise). To apply a blended finance scheme, where many stakeholders are involved, to sustainable infrastructure projects, trust among the stakeholders is even more critical (Endo and Ram 2021).

4. Policy recommendations

Based on the above discussion, this policy note provides the following recommendations for realizing sustainable infrastructure for both policymakers in developing countries and practitioners of international development organizations:

For policymakers in developing countries:

- Develop sound environments for PPP projects (i.e., development of legal and regulatory frameworks, risk allocation mechanisms between public and private sectors, financial arrangement mechanisms, and incentive mechanisms for private parties)—all of which will create trust in PPPs from private stakeholders;
- Develop coordination mechanisms among the relevant stakeholders with strong leadership for a smoother process toward the financial closure of PPP projects;
- Use MDB/BDB assistance (e.g., technical assistance for coordination among the stakeholders and their transaction advisory service¹³) to develop a sound PPP environment and coordinate the stakeholders under both PPP and MDB/BDB-financed projects;
- Prioritize long-term sustainability perspectives rather than easy and near-term benefits for infrastructure projects under both PPP and MDB/BDB finance;
- Involve MDBs/BDBs in infrastructure projects under both PPP and MDB/BDB finance from the

planning stage (i.e., development of master plans and feasibility studies) to adopt sustainability perspectives in those projects.

For practitioners of international development organizations:

- Maintain and promote the current global trend by prioritizing “sustainability” and “quality” in infrastructure projects with the international development community and monitor MDB/BDB assistance;
- Set specific conditions on sustainability for developing countries to obtain MDB/BDB finance and assistance (e.g., KPIs for infrastructure operations and strict guidelines on environmental and social considerations);
- Create incentives (win-win situations) for developing countries to use the generally time-consuming and conditional MDB/BDB finance and assistance packages for sustainable infrastructure projects from the planning stage. The possible incentives include concessional loans or grants for the projects, which would provide visible financial benefits; special treatments for accelerating the procurement process; responsible and continuous support from the development phase (e.g., assistance for the establishment of coordination mechanisms among the stakeholders) to the implementation phase (e.g., a transaction advisory service for PPPs projects); and continuous technical assistance even after the implementation phase (e.g., periodical training for infrastructure operation), which would make the participant countries more confident about realizing projects throughout long project life-cycles;
- Develop trust from developing countries for MDB/BDB assistance for sustainable infrastructure by showcasing successful MDB/BDB finance projects (including blended finance projects) and by establishing readily available and user-friendly assistance;
- Develop and promote new development finance schemes for sustainable infrastructure such as ESG investment and green finance, which have recently become widespread across the private sector in developed countries.

Table 1: Finance arrangements for sustainable infrastructure

No.	Finance arrangement	Number of mentioned articles	Most focused sustainability pillar by articles	Frequently co-occurring finance arrangements
1	PPPs	41	General	2, 3
2	Conventional public finance	16	General	1
3	MDB finance	13	Environment	1, 4, 6
4	Green finance	10	Environment	3, 6
5	Reducing cost by technologies	9	General	-
6	Specific funds	9	General and Environment	3, 4

Note: specific funds are dedicated funds related to the development of sustainable infrastructure, including project preparation, finance, and guarantees.

Source: prepared using Endo et al. (2023).

Table 2: Governance characteristics for sustainable infrastructure

No.	Governance characteristics	Number of mentioned articles	Nature of governance	Most focused sustainability pillar by articles	Relevant finance arrangement
Polity (system of government administration)					
1	Collaboration among stakeholders	50	Horizontal	General	PPPs
2	Public party's leadership	20	Vertical	General	PPPs
3	Trust among stakeholders	12	Horizontal	General	PPPs
4	Collaboration among MDBs and countries	11	Horizontal	Environment	MDB finance
5	MDB leadership	9	Vertical	Environment	MDB finance
Policy/regulation					
6	Provision of planning tools for sustainable infrastructure	26	In-between	General	PPPs
7	Provision of education related to sustainable infrastructure	22	In-between	General	PPPs
8	Provision of platforms for communication among stakeholders	20	In-between	General	PPPs / MDB finance
9	Policies on sustainable infrastructure	20	Vertical	General	PPPs / MDB finance
10	Adding condition of sustainable infrastructure to bid documents	10	Vertical	General	PPPs

Source: prepared using Endo et al. (2023).

Table 3: Critical success factors for PPPs

No.	Critical success factors for PPPs
1	Government roles and responsibilities
1-1	Legal and regulatory framework
1-2	Well-organized/coordinated government authorities
1-3	Providing a good PPP candidate project
1-4	Strong political/governmental commitment
2	Risk allocation between public and private sectors
2-1	Clear mechanism to decide risk allocation
2-2	Government/governmental agency's guarantee
3	Financial arrangement
3-1	Mature and available financial market
3-2	Government financial support

Source: prepared using Endo et al. (2021).

Table 4: Types of assistance for sustainable infrastructure (Case of Japan's ODA)

No.	Type of assistance
1	Provision of a near-zero interest loan
2	Improvement of sustainability by adopting high-quality, advanced Japanese products /technologies
3	Planning of a project considering sustainability aspects by relevant grant studies (e.g., feasibility study and detailed design)
4	Confirmation and provision of recommendations on the sustainability of a project in the project appraisal
5	Support for sustainability from supervisory consultants hired by a recipient country using an ODA loan
6	Additional assistance for sustainability from donors (e.g., JICA and MDBs)
7	Establishment of new institutions for operation/maintenance and/or Japanese firms' involvement in operation/maintenance

Source: prepared using ongoing research by the author.¹⁴

¹ The train cars of Bangkok MRT Purple line are “Japan-made stainless steel cars that are lightweight, energy-saving, and reduce maintenance costs,” and “a Japanese railway operator engaged in this project as a maintenance service provider has provided integrated knowledge and expertise related to Japanese maintenance methods” (MLIT 2021, 16).

² “Quality infrastructure,” a term similar to sustainable infrastructure, has become widely used by the development community recently (e.g., the G20 principles for quality infrastructure investment were set in 2019). There is no clear difference between the two terms—rather, they are regarded as two sides of the same coin (Taras 2019). However, “quality infrastructure” tends to be used by development practitioners, while “sustainable infrastructure” is used by both development practitioners and academic scholars.

³ According to a systematic review of recent research on sustainable infrastructure (Endo et al. 2023), there are various definitions and areas of focus for the concept. Of the articles surveyed, 51.0% regard sustainable infrastructure as a comprehensive concept covering all three pillars of sustainability. Other articles focus on one or some of the sustainability pillars and define sustainable infrastructure in line with their own usage. The environmental sustainability pillar receives more attention in the articles (21.6%) than the economic and social sustainability pillars (both are discussed in 9.8% of the articles) and project institutional /managerial sustainability (mentioned in 7.8% of the articles).

⁴ First published online on November 15, 2022.

⁵ This study selected 85 research articles that were published between 2005 and 2021.

⁶ For instance, horizontal management includes collaboration among the public sector, private sector, and MDBs/BDBs based on trust among stakeholders, while vertical management includes policies/regulations on sustainability issues by the public sector and MDBs/BDBs. There are also in-between (both horizontal and vertical) types of management, such as the provision of planning tools for sustainable infrastructure.

⁷ In the context of infrastructure development in developing countries, the number of realized PPP projects or PPP projects reaching financial closure tends to be regarded as an indicator for judging the maturity of the application of PPP schemes in those countries (e.g., ADB 2017; Endo and Ram 2021).

⁸ First published online April 27, 2020.

⁹ Comparative case analysis research on urban railway projects in Manila. The research was conducted in 2022–2023 and the article is currently under peer-review by an academic journal.

¹⁰ Comparative case analysis research on infrastructure projects under Japan’s ODA. The research was conducted in 2023 and an article based on it is currently under peer-review by an academic journal.

¹¹ Comparative case analysis research on urban railway projects in Manila. The research was conducted in 2022–2023 and the article is currently under peer-review by an academic journal.

¹² Blended finance is defined as “the strategic use of development finance for the mobilization of additional finance towards sustainable development in developing countries” (OECD 2017, 4).

¹³ The transaction advisory service comprises technical advice and assistance for structuring and procuring viable PPP projects. The service is provided by MDBs/BDBs (e.g., International Finance Corporation (IFC) of the World Bank Group, the Asian Development Bank, and JICA).

¹⁴ Comparative case analysis research on infrastructure projects under Japan’s ODA. The research was conducted in 2023 and an article based on it is currently under peer-review by an academic journal.

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