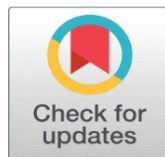


# INFRASTRUCTURE DEVELOPMENT AS A CATALYST FOR SUSTAINABLE ECONOMIC GROWTH

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## ABSTRACT

Infrastructure development is a key component of economic transformation. However, its role in sustainable development cannot be measured simply by counting roads, electricity grids, water supply systems, or digital capabilities. The value of development infrastructure rests on its ability to provide reliable, affordable, inclusive, and environmentally friendly services throughout its useful life. This paper examines the conditions under which infrastructure development can catalyze sustainable economic growth. It draws on selected academic research and institutional publications from a qualitative literature review up to 2024. The analysis links infrastructure investment to productivity, market access, social inclusion, investment efficiency, and climate resilience. The evidence suggests that infrastructure quantity and quality are linked to long-run economic growth, and institutional effectiveness to returns on public investment. Climate risks are also increasingly being taken into account in infrastructure planning and financing in recent policy literature. This paper develops a conceptual framework based on the notion of services and a service-evaluation framework that distinguishes among investment inputs, service performance, and service development outcomes. It makes clear that infrastructure alone does not guarantee sustainable growth: good project selection, good governance, infrastructure lifecycle management, and benefit sharing are key to infrastructure's contribution to sustainable growth. Finally, the paper argues that infrastructure investment policy should focus on creating lasting public value, not simply on the number of projects built.

**Keywords:** Infrastructure Development, Sustainable Economic Growth, Public Investment Efficiency, Inclusive Development, Climate Resilience, Infrastructure Governance

## 1. INTRODUCTION

Infrastructure is a key driver of economic development because it facilitates production, exchange, communication, and the delivery of essential services. Transport infrastructure links producers to consumers and connects workers to jobs. Energy infrastructure supports productive activity and household needs. Water and sanitation systems deliver services essential to a community's well-being. Digital networks allow information to be shared and can link users together from across geographic distances. They are therefore more than physical properties; they are networks in which economic and social activities are carried

out. Studies on infrastructure development have identified both the quantity and quality of infrastructure as factors influencing long-run growth [Calderón and Servén \(2010\)](#).

However, building infrastructure does not guarantee successful development. Access may not be guaranteed during bad weather conditions. A reliable supply may not exist, even with an electricity connection. The network can grow, and operations and maintenance may still be substandard. These differences show that physical delivery is a stepping stone toward the ultimate aim of development: delivery. [World Bank \(2020\)](#) identified poor infrastructure governance as poor planning, ineffective delivery, and poor infrastructure maintenance. [Asrum and Morkoyunlu \(2025\)](#)

Other factors come into play when sustainable economic growth is taken into account. This paper defines sustainable growth as economic development that ensures social inclusion, sustainable resource use, and resilience to disruptions. Infrastructure development is critical to this goal, providing more productive opportunities without unnecessary long-term vulnerabilities. This aligns with the SDGs for Resilient Infrastructure, Inclusive and Sustainable Industrialisation, Innovation, and Affordable and Equitable Access [United Nations. \(n.d.\)](#).

This is also reflected in research showing that infrastructure quality investments are efficient. According to the International Monetary Fund (IMF), public investment processes are about 30% less efficient at evaluating infrastructure coverage and efficiency than public capital inputs. It also finds significant differences in growth returns between less and more efficient public investors [International Monetary Fund \(2015\)](#). The results therefore show that simply increasing expenditure is not enough. Processes that translate expenditure into services that deliver benefits and value may also matter.

This is challenging because of climate change. As a result, assessing infrastructure's capacity to provide services in a future context is more pertinent than ever. The OECD highlights the importance of systematically incorporating infrastructure resilience into infrastructure planning and decision-making, and the potential for climate-related disasters to cause widespread infrastructure failure [Organisation for Economic Co-Operation and Development \(2024a\)](#).

In this paper, infrastructure is considered not as an assurance objective in its own right, but as a catalyst. The main takeaway is that, if infrastructure investment is reliable, available, environmentally friendly, and financially sustainable, the benefits can be sustained over time. The paper begins with a literature review, conceptual framework, social and economic developments, resilience and governance, and policy recommendations.

## **2. RESEARCH OBJECTIVES AND METHODOLOGY**

### **2.1. RESEARCH OBJECTIVES AND QUESTIONS**

The ultimate goal is to show the link between infrastructure development and sustainable economic growth, including its positive and negative impacts.

In particular, the paper aims to:

- 1) Review the role of infrastructure for productive investment, connectivity, and productivity.
- 2) Examine the impact that access and affordability have on infrastructure access and benefit distribution.

- 3) Discuss the importance of investment efficiency, maintenance, and governance.
- 4) Review the contribution of environmental sustainability and climate resilience.
- 5) Create a system for measuring infrastructure performance and development outcomes.

The main question is:

In what conditions does the development of infrastructure result in sustainable economic growth and not in construction job activity or substandard performance of infrastructure?

There are two subsidiary questions to guide the analysis. First of all, what is the difference between the “effective” use of infrastructure and spending on infrastructure? Second, how is it possible to integrate the Economic, Social, Environmental and Institutional aspects into a coherent evaluation framework?

## 2.2. RESEARCH DESIGN

The paper uses a qualitative secondary research design. It collates key scholarly research and institutional documents that have been published up to 2024. The evidence base covers research on public infrastructure and productivity, cross-country analysis of infrastructure and inequality, reports about public investment efficiency, infrastructure governance, private investment, and climate resilience.

The analysis is thematic and not statistical. These five themes, central to productive capacity, connectivity, social inclusion, resilience, and institutional effectiveness, are interrelated throughout the paper. This process will be connected with real-world issues of project selection and funding, and service provision.

## 2.3. INTERPRETATION OF EVIDENCE

In this paper, three things are differentiated. One, there is a difference between publication years and observation years. For instance, the World Bank released a report on private infrastructure investment commitments in 2024, based on 2023 data. Second, the report separates investments into investment expenditure and completed investments. Third, efficiency estimates across countries do not guarantee that specific projects will realize those benefits, and the models' resilience findings do not guarantee that specific projects will be resilient [World Bank. \(2020\)](#), [International Monetary Fund \(2015\)](#).

The paper is NOT a systematic review. It has no comprehensive source search protocol, original fieldwork, or independent causal evaluation. It is an analytical synthesis; it explains how infrastructure can support sustainable development and what institutional and service conditions are needed.

## 3. LITERATURE REVIEW

### 3.1. PUBLIC INFRASTRUCTURE AND PRODUCTIVITY

Aschauer's paper, “Is Public Expenditure Productive?”, was a key development in productivity analysis of public infrastructure. It looked at the relationship between aggregate productivity and government spending and showed that core infrastructure capital [Aschauer \(1989\)](#) was important. The study matters because it recognizes that producing goods and services is a private enterprise, but if it is a partial system, it must be public.

This is most appropriately viewed as complementary. Labour, machines and a firm's organisational skill are part of a wider context of transport, energy and other infrastructure services. Thus, public capital can affect the efficient use of private capital. However, productivity gains from infrastructure investment do not necessarily increase with every additional unit of government spending.

Spending and real capital have to be differentiated. Expenditure is an input, the functioning asset is an intermediate output, and reliable service may make productive activity more productive. In this paper, I build on the public capital literature and explicitly link service delivery, investment, and economic outcomes.

### **3.2. INFRASTRUCTURE QUANTITY, QUALITY, AND INEQUALITY**

Calderón and Servén discuss infrastructure development from 1960 to 2005 in over 100 countries. They find that infrastructure has a positive effect on the long-run growth rate, which increases in absolute terms when infrastructure is large and of high quality, and that lower income inequality is associated with infrastructure [Calderón and Servén \(2010\)](#).

The focus is particularly on quality. However, despite poor performance, infrastructure stocks can still increase. In contrast, improving the network's reliability or usability may yield better development results without the need for a new network. Similarly, when planning rehabilitation and expansion, planners should account for this separation, as they will need to consider rehabilitation, maintenance, and operational improvements.

The inequality discussion also extends the infrastructure discussion. Infrastructure can shape the composition of economic activity and the level of economic output. However, this correlation depends on conditions. The presence of an asset does not mean that it is being accessed and/or used by disadvantaged people. So, accessibility should be thought of explicitly, not as a subset of total investment.

### **3.3. PUBLIC INVESTMENT EFFICIENCY**

The IMF report *Making Public Investment More Efficient* is based on coverage measures and infrastructure quality. The IMF estimates the average inefficiency at 30% (2015), and the best and worst investors have twice the impact on growth as the least efficient.

The study findings remind investors of the importance of investment-process quality. The greater the funds, the less "proportional" the services. Planning, appraisal, procurement, implementation, and management affect how effectively resources are used and how assets perform.

Take the 30% figure with a pinch of salt. The figure for 'wasted or misspent' money is 30% of any project, but it is not substantiated. It measures countries' efficiency in infrastructure inputs and outcomes. The policy conclusion is that better management will lead to higher development returns, with lower expenditures.

### **3.4. RESILIENCE, BENEFIT SUSTAINABILITY**

The World Bank's *Lifelines* report is not just about infrastructure in use. The estimated net benefits of more resilient new infrastructure are approximately

US\$4.2 trillion across the infrastructure's life in developing countries, or US\$4 for every \$1 invested in resiliency [Hallegatte et al. \(2019\)](#).

Estimates should not be automatically used to estimate the cost of specific projects without the use of models. They can still show considerable economic benefits by avoiding infrastructure damage and service loss. Resilience is not just about physical assets; it also depends on the activities that rely on them.

This view can be found in the OECD literature in 2024. This requires climate-resilient infrastructure and poses particular challenges for developing countries in building climate-resilient infrastructure systems [Organisation for Economic Co-Operation and Development \(2024a\)](#). The companion financial report on financing and investing in climate-resilient infrastructure [Organisation for Economic Co-Operation and Development \(2024b\)](#) looks at strategies for financing and investing in climate-resilient infrastructure.

**Table 1**

| Table 1 Selected Literature and Its Analytical Contribution                                                                                                          |                                  |                                                                                       |                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Source                                                                                                                                                               | Main focus                       | Contribution to the infrastructure debate                                             | Implication for this paper                                         |
| <a href="#">Aschauer (1989)</a>                                                                                                                                      | Public capital and productivity  | Highlights the productive significance of core infrastructure.                        | Infrastructure can complement private productive resources.        |
| <a href="#">Calderón and Servén (2010)</a> .                                                                                                                         | Growth and inequality            | Connects infrastructure quantity and quality with growth and distributional outcomes. | Expansion, performance, and inclusion should be analysed together. |
| <a href="#">International Monetary Fund. (2015)</a>                                                                                                                  | Public investment efficiency     | Identifies substantial efficiency gaps and differences in growth returns.             | Better management matters alongside higher spending.               |
| <a href="#">Hallegatte et al. (2019)</a> .                                                                                                                           | Infrastructure resilience        | Examines the benefits of reducing damage and service disruption.                      | Resilience helps preserve development gains.                       |
| <a href="#">World Bank (2020)</a>                                                                                                                                    | Infrastructure governance        | Addresses preparation, procurement, contract management, and asset management.        | Institutional capacity shapes lifecycle performance.               |
| <a href="#">Organisation for Economic Co-Operation and Development. (2024a)</a> ,<br><a href="#">Organisation for Economic Co-Operation and Development. (2024b)</a> | Climate resilience and financing | Emphasises integration of climate risk into infrastructure decisions and financing.   | Sustainability must be incorporated before and after construction. |

**Source:** Author's synthesis of the reviewed literature.

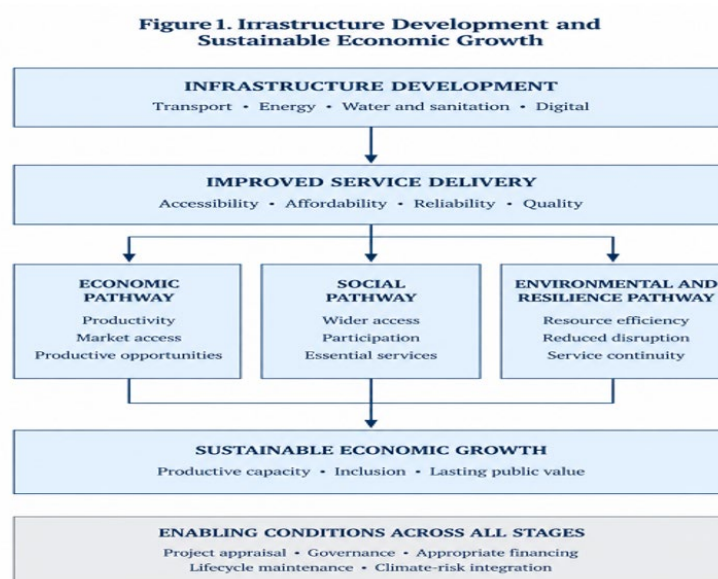
As shown in [Table 1](#), infrastructure studies have shifted from productive capital to broader development performance. The main priority is economic contribution, but it must be sustainable, quality-based, distributed, resilient, and institutionally effective.

## 4. CONCEPTUAL FRAMEWORK: INVESTMENT TO PUBLIC VALUE

This paper proposes a three-stage approach to service development: infrastructure investment, service performance, and development outcomes. Funding for financing investments. These inputs build, enhance, or maintain assets. Usable, accessible assets are reliable and support service delivery and development.

The framework does not presume that spending and growth are necessarily linked. Rather, it argues that the middle ground relates to service quality. A reliable, cheap, well-connected, and well-maintained network is necessary to get the benefits, but not sufficient.

**Figure 1**



Source: Author-developed conceptual framework. Arrows represent proposed pathways, not estimated causal effects.

**Figure 1 Conceptual Pathways Linking Infrastructure and Sustainable Growth**

The diagram illustrates the catalytic role of infrastructure. Infrastructure is an important facilitator of economic and social activity, but complementary factors are needed. A good appraisal will assist you in making a suitable investment selection. Governance supports delivery. The quality of service is ensured. Affordability enables participation. Preparing for climate hazards reduces the risk of failure.

The framework also offers a means of assessment. Consider any inputs that can create a useful and inclusive function; consider services that can create a useful and inclusive function. This sets a higher bar than simply measuring a construction project's completion date.

## 5. ECONOMIC PATHWAYS OF INFRASTRUCTURE-LED GROWTH

### 5.1. COMPLEMENTARITY WITH PRIVATE PRODUCTIVE ACTIVITY

Infrastructure enables the economy by providing common systems that the economy's individual users rely on. What is known in the public capital literature is

that infrastructure may impact the performance of private labour and capital, but not independently of them [Aschauer \(1989\)](#).

For example, a manufacturing business might have up-to-date equipment and trained employees but be limited by a lack of supporting services. In this case, development is less about access to more private money. It depends on whether existing resources can be used effectively given the surrounding infrastructure.

This example is not representative of an individual enterprise but is a concept. It illustrates the need to identify the constraint being addressed through investment appraisal. The need for infrastructure which eliminates a major constraint may be more important than the need for a larger project to provide capacity where services are already satisfactory.

## 5.2. CONNECTIVITY AND MARKET PARTICIPATION

Transportation and communication systems link economic activities. They depend not only on proximity but also on accessibility. Other sectors that affect sustainable development are foundational to sustainable transport, energy, irrigation, and information and communication technology (ICT), according to the [United Nations. \(n.d.\)](#).

The network perspective is crucial because standalone assets may have only minimal value. When planning a new road, consider locations, connections, maintenance, and service conditions. Likewise, evaluate digital infrastructure based on whether users can maintain a functional connection.

This paper therefore contends that appraisal should focus on network outcomes. An individual project is relevant but must not be in place instead of evidence of connectivity being enhanced. The difference between asset delivery and user benefit is critical to infrastructure-led growth.

## 5.3. QUALITY IMPROVEMENTS AND EXISTING ASSETS

Expansion of infrastructure is not the only way to improve performance. Calderon and Servén's focus on quality suggests that the quality of services currently provided matters as much as quantity [Calderón and Servén \(2010\)](#).

This indicates a need to consider rehabilitation and operational improvement. When choosing a new project, planners should also consider whether available capacity could be better used for maintenance, redesign, or management. It goes beyond a preference for expansion and depends on the problem being solved.

A service-centred approach will also affect how we report success. The number of assets completed may be less revealing than whether interruptions decrease or access increases. These measures are more directly linked to infrastructure performance and the conditions businesses and households face.

## 5.4. CONSTRUCTION ACTIVITY VERSUS LASTING GROWTH

This paper should differentiate between the value of infrastructure and the value of infrastructure use in infrastructure activities, as well as the long-term value of these activities. The construction part of the investment process is not development itself – there is a need for sustainable service provision.

This is relevant when doing appraisal. While a project is being implemented, it may show activity but have little impact after it ends. However, a "fresh" system may go unnoticed and still provide useful services. This paper does not dismiss

construction as unimportant; rather, it argues that construction should be seen as a means, not an end.

The solution to infrastructure policy depends on assets and whether they can support sustained productive activities. This means being mindful of service needs, service responsibility, and ongoing performance after construction.

## **6. INFRASTRUCTURE AND INCLUSIVE DEVELOPMENT**

### **6.1. DISTRIBUTION OF ECONOMIC OPPORTUNITIES**

Infrastructure development may affect economic participation by making access to services and connections easier or more difficult. Beyond the aggregate impact of infrastructure, Calderón and Servén's results also confirm its distributional effects, as they conclude that infrastructure matters for inequality reduction [Calderón and Servén \(2010\)](#).

However, not all investments necessarily reduce inequality. The placement of infrastructure, users, and how they use it are critical. A programme can improve overall capacity but may not meet the needs of specific communities.

This paper thus suggests that project appraisal should include a distributional assessment. Relevant questions include: Who is served, who is not served, and what do they serve that is better? The following questions are intended as additions to the economic evaluation, not a substitute.

### **6.2. EFFECTIVE ACCESS AND AFFORDABILITY**

Affordable, equitable access to infrastructure is a key element of Sustainable Development Goal 9 [United Nations. \(n.d.\)](#).

This differs from physical availability; it is effective access. A facility may have a technical connection but not be affordable. A facility could be nearby but not offer sufficient services. This should be taken into account in the evaluation of affordability, reliability, and coverage.

This paper is not prescriptive in terms of pricing models. However, it recommends evaluating financing and access together. Arrangements should allow service providers to operate continuously, not terms that prevent or undermine the investment's inclusion goals for its users. The two aspects of this relationship need to be understood for appropriate design.

### **6.3. PARTICIPATION AND LOCAL PRIORITIES**

This affects planning also as part of the inclusion objective. The research presented here suggests defining user needs first before making final design decisions. Construction specifications may not clearly define access barriers, and communities and service users can help clarify them.

Do not treat participation as an alternative to technical appraisal. Instead, use it alongside appraisal to determine whether proposed services meet actual needs. The goal is to ensure greater project relevance and more equitable distribution of benefits.

Because inclusion is defined as a goal considered at three infrastructure levels, selection, design, and monitoring, it is important to incorporate it into a sustainable infrastructure strategy. Selection focuses on location, design focuses on user benefits, and monitoring focuses on whether access improvements are achieved.

## **7. ENVIRONMENTAL SUSTAINABILITY AND CLIMATE RESILIENCE**

### **7.1. ENVIRONMENTAL PERFORMANCE ACROSS THE LIFECYCLE**

Infrastructure needs to be evaluated and measured beyond construction for environmental sustainability. Increased use of clean, environmentally sound technologies [United Nations. \(n.d.\)](#) is one of the goals of Sustainable Development Goal 9, which focuses on improving resource efficiency.

This paper addresses this requirement through life-cycle assessment. It should consider and plan construction, operation, maintenance, and eventual replacement together. A design with a low up-front cost but high operating requirements, or one that must be replaced quickly, may not be the best option.

Lifecycle evaluation is not to presume that one technology is always better. It compares options based on the type of service needed and potential longer-term impacts. It is more useful to consider environmental factors in design decisions than after major decisions have been made.

### **7.2. CLIMATE RISKS AND ECONOMIC VULNERABILITY**

Infrastructure damage and failure are among the most common effects of climate-related disasters, and are often more pronounced in developing countries than in developed ones, according to the [Organisation for Economic Co-Operation and Development \(2024a\)](#).

This implies that the service performance that is expected is to be judged under more than normal conditions. Infrastructure can facilitate economic activity in normal times but become a vulnerability when disrupted during a crisis.

The implications for development extend beyond the damaged asset. Other activities rely on infrastructure systems; if those are disrupted, the disruptions can spread across systems and users. The OECD's focus on systematic resilience planning also aligns with treating infrastructure as a 'system' of facilities, rather than as independent assets.

### **7.3. THE ECONOMIC CASE FOR RESILIENCE**

These potential benefits include estimated net benefits over the life of new infrastructure of about US\$4.2 trillion in developing countries, for example [Hallegatte et al. \(2019\)](#).

This estimate is analytical, as resilience can protect the services that deliver development benefits. It is not a guaranteed return that would apply to all locations and assets. The type of intervention depends on factors such as local exposure, design considerations and service objectives.

This paper therefore treats resilience as part of economic appraisal. The costs of protective measures and the losses/disruption that such measures can help reduce are the elements of the relevant comparison. Resilience is not an extra that is necessarily connected to growth; it supports the conditions for growth.

## 7.4. REGIONAL AND LOCAL IMPLEMENTATION

Regional and local governments are central to climate action and on the frontline of building climate resilience, according to the [Organisation for Economic Co-Operation and Development \(2024a\)](#).

This underscores the need to ensure policy accountability and capacity for implementation. National goals must link to decisions about local resources, upkeep, and service continuity. A resilience strategy that does not hold the people responsible for implementing and sustaining the necessary actions accountable is incomplete.

The paper therefore suggests a system of coordination across government levels. Decision-making, financial, and operational responsibilities need to be clearly distributed, and an emergency preparedness plan should be in place. The goal is to get resilience into action, not just words.

## 8. FINANCING INFRASTRUCTURE

### 8.1. THE ROLE OF PUBLIC INVESTMENT

Public investment provides critical services and links households and firms to opportunities. The IMF's analysis clearly shows that the quality of public investment processes also affects the economic and social results of public investment [International Monetary Fund \(2015\)](#).

This should not be just about the money raised; the financing question should include more. It should also include details on the process for selecting investments, whether or not the investments involve recurring costs, and whether the public authority has the capacity to manage the delivery.

This paper distinguishes financing availability from making a case for a project. A project might receive funding but not be well suited to service needs. Conversely, a well-founded investment may face financing constraints. Sound policy must address both issues; one should not justify ignoring the other.

### 8.2. PRIVATE PARTICIPATION AND RECENT EVIDENCE

The World Bank reported that US\$86 billion in private infrastructure investment commitments in low- and middle-income countries were announced in a release dated 14 May 2024. This is about 5 per cent lower than 2022, but generally is similar to the previous five-year average [World Bank \(2020\)](#).

The same release notes a broader geographical and project distribution: 68 countries received investment in 2023, with 260 projects; in 2022, the same number of countries received investment, with 202 projects. So, there was a balance of fewer commitments and more participation. This suggests that investment alone cannot provide any information about investment trends.

These are participations in infrastructure financing, not overall participation. They do not reflect finished assets or the economic benefits users receive. Their role is to "mark" what they are aware of as proper behaviour in the database.

**Table 2**

**Table 2 Selected Infrastructure Evidence and Correct Interpretation**

| Source | Reported evidence | Analytical significance | Interpretation limit |
|--------|-------------------|-------------------------|----------------------|
|--------|-------------------|-------------------------|----------------------|

|                                                     |                                                                                                                                          |                                                                  |                                                              |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------|
| <a href="#">International Monetary Fund. (2015)</a> | Average public investment inefficiencies of around 30%                                                                                   | Highlights the gap between inputs and coverage or quality.       | Not a project-specific measure of waste.                     |
| <a href="#">International Monetary Fund. (2015)</a> | Approximately twice the growth impact per unit of investment among the most efficient compared with the least efficient public investors | Shows the importance of investment effectiveness.                | Not a universal growth multiplier.                           |
| <a href="#">Hallegatte et al. (2019).</a>           | Approximately US\$4.2 trillion in potential net resilience benefits                                                                      | Demonstrates the value of reducing damage and disruption.        | Model-based estimate over new infrastructure's lifetime.     |
| <a href="#">World Bank. (2020)</a>                  | US\$86 billion in private commitments in 2023, approximately 5% below 2022                                                               | Indicates variation in private financing activity.               | Not total infrastructure investment.                         |
| <a href="#">World Bank. (2020)</a>                  | 68 countries and 322 projects in 2023, compared with 54 countries and 260 projects in 2022                                               | Shows broader participation despite lower aggregate commitments. | Counts do not measure service quality or completed delivery. |

Source: [International Monetary Fund \(2015\)](#), [Hallegatte et al. \(2019\)](#), and [World Bank \(2020\)](#).

The figures in [Table 2](#) describe different phenomena and should not be combined into a single statistical series. Efficiency estimates, projected benefits, and investment commitments have different measurement bases.

### 8.3. FINANCING THE SUSTAINABILITY TRANSITION

For electricity generation projects, the 2024 World Bank report indicates that 97% of projects in the sample were in the renewable category, compared with 93% in the previous five-year period [World Bank \(2020\)](#).

This is a project count statistic in a given data set. It does not imply 97% of total electricity generation or electricity installed on the grid was from renewables. This difference is crucial, as the number of projects does not reflect a project's relative size or output.

However, this finding underscores the importance of considering sustainability in private infrastructure activities. The 2024 OECD financing report also covers climate action investments in resilient infrastructure [Organisation for Economic Co-Operation and Development \(2024b\)](#).

### 8.4. LONG-TERM OBLIGATIONS

In this paper, the authors argue that financing design should consider operating and maintenance responsibilities from the outset. Capital investment without a viable service program can result in assets that are hard to maintain.

Private involvement should be judged not by development success, but by service outcomes and contractual commitments. The right setup depends on the ability to distribute and control risk and maintain accountability.

The central funding principle is therefore aligned: the funding model should be in line with the objective of the service over the life of the assets. Evaluate design, construction, and long-term functionality together.

## **9. GOVERNANCE, MAINTENANCE, AND INSTITUTIONAL CAPACITY**

### **9.1. PROJECT SELECTION AND APPRAISAL**

The World Bank's Benchmarking Infrastructure Development 2020 Report highlights the importance of appropriate regulatory frameworks and explores preparation, procurement, contract management, and asset management [World Bank. \(2020\)](#).

The initial point at which investment quality can be enhanced is project selection. Appraisal should identify the service problem, consider alternatives, and determine whether the proposed project solves the problem within the constraints. This Paper argues that improving existing assets should be done alongside new construction.

There are also explicit assumptions which are required for sound appraisal. Future performance should be documented against the original justification, taking into account the expected demand, operating requirements, and responsibilities.

### **9.2. PROCUREMENT AND IMPLEMENTATION**

Procurement and contract management can significantly affect the successful implementation of the desired project design and development, which then becomes an actual asset. The World Bank's governance framework acknowledges this role [World Bank. \(2020\)](#).

Beyond contract award and expenditure progress, this paper suggests supplementing delivery evaluation with other elements. The relevant objective is an asset that can deliver the desired service. Therefore, it should be clear who is responsible for quality verification, commissioning, and transitioning to operations.

The difference between short-term completion and lifecycle value also shows up in implementation. Evaluate any cost-saving choices that affect long-term durability and performance.

### **9.3. MAINTENANCE AS INVESTMENT PROTECTION**

Poor maintenance is a key factor behind poor infrastructure services [World Bank. \(2020\)](#).

Maintenance must therefore be considered protection of previous investments. Expected development gains may not continue if service quality declines after the works are completed. An asset expansion construction programme that does not ensure continuity of existing systems may increase operational burdens.

The paper suggests incorporating maintenance agreements into project approval. This includes identifying institutional responsibilities, expected requirements, and funding provisions. It is not meant to ensure flawless performance, but to clarify long-term obligations before commitment.

### **9.4. ACCOUNTABILITY FOR OUTCOMES**

Accountability should link public expenditure to service outcomes. This paper suggests monitoring user-felt indicators, such as reliability, accessibility, and recovery after disruption.

The construction targets are still valid but need to be supported with outcome targets. A project can be successful from an administrative perspective but fail in service delivery. Distinguishing these outcomes is a first step toward better measurement of infrastructure policy.

Institutional effectiveness is an internal condition to consider before investment. It is one way infrastructure becomes productive and sustainable.

## 10. EVALUATION FRAMEWORK AND POLICY RECOMMENDATIONS

### 10.1. A MULTIDIMENSIONAL EVALUATION APPROACH

The foregoing analysis suggests using economic, social, environmental, resilience, and institutional metrics to assess infrastructure performance. No one indicator encompasses them all.

**Table 3**

| Table 3 Proposed Evaluation Framework for Sustainable Infrastructure |                                                      |                                                                 |                                                  |
|----------------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------|
| Dimension                                                            | Central question                                     | Illustrative indicators                                         | Appraisal implication                            |
| Economic performance                                                 | Does the investment address a meaningful constraint? | User benefits, travel time, service reliability, market access  | Compare alternatives according to service value. |
| Social inclusion                                                     | Can intended users benefit?                          | Coverage, affordability, underserved-area access                | Assess the distribution of benefits.             |
| Environmental performance                                            | Does the design support responsible resource use?    | Energy requirements, water efficiency, cleaner technology       | Consider lifecycle consequences.                 |
| Resilience                                                           | Can essential functions continue or recover?         | Downtime, recovery time, alternative connections                | Integrate relevant risks into design.            |
| Governance                                                           | Are responsibilities and processes effective?        | Appraisal quality, procurement arrangements, contract oversight | Evaluate implementation capacity.                |
| Lifecycle sustainability                                             | Can the asset remain functional?                     | Maintenance requirements, operating costs, asset condition      | Recognise recurring obligations before approval. |

**Source:** Author's proposed framework informed by the reviewed literature. Indicators are illustrative, not reported observations or a validated index.

Table 3 operationalises the service-centred framework. It does not prescribe identical priorities for every project. Instead, it provides questions to adapt to the sector, service need, and institutional setting.

### 10.2. PRIORITISE SERVICE CONSTRAINTS

The first step for government is to identify the service problem, not choose a preferred construction solution. This helps prioritize what needs to be expanded to improve current systems.

The goal of a policy is to eliminate an important constraint. The scale, visibility, and availability of funding for a project should not be a substitute for evidence of relevance of the intervention.

### **10.3. IMPROVE EFFICIENCY ALONGSIDE INVESTMENT VOLUME**

The IMF has found evidence that investment effectiveness significantly affects growth returns [International Monetary Fund \(2015\)](#).

Governments should thus invest in strengthening preparation, selection, procurement, and management, and mobilize resources. This avoids the illusion that infrastructure policy is about spending more or managing better. Both may be required, but they serve different aspects of the development process.

### **10.4. INTEGRATE INCLUSION AND RESILIENCE EARLY**

Select and design for affordability and equitable access, guided by Sustainable Development Goal 9 [United Nations. \(n.d.\)](#).

As the OECD also highlighted, systematic climate-risk planning [Organisation for Economic Co-Operation and Development \(2024a\)](#) should occur before key design and financing decisions are made and implemented, before they become locked in.

These objectives should be integrated at the outset of the project as a fundamental component of the project logic, rather than as additional elements that may be difficult to embed later.

### **10.5. PROTECT LIFECYCLE FUNCTIONALITY**

Before construction, it is important to define operating and maintenance responsibilities, which should be decided by the owner of the facilities. The projects should be evaluated on the premise that they can offer the services under realistic institutional and financial circumstances.

The difference between assets and outcomes discussed in this paper is the one relevant to the recommendation. A physical product adds value to the public, and its continued function keeps it alive.

### **10.6. MONITOR AND LEARN FROM OUTCOMES**

The actual performance should be assessed at the end of the project to see how well the project has performed and to compare with the assumptions in the appraisal. It is not just about accountability; it is about learning!

Plan for future project design when access, reliability, or maintenance expectations are not met. The evaluation process is more useful for infrastructure policy when it is followed by policy action (such as an Infrastructure completion certificate) rather than just certificate issuance.

## **11. DISCUSSION: INFRASTRUCTURE AS A CONDITIONAL CATALYST**

This paper explains why infrastructure can be considered a conditional catalyst. It offers enabling systems; development outcomes depend on the quality of the services and institutions that provide them.

Three key relationships are of particular significance. First, planning and delivery relate to investment and function. Second, participation is linked to

functionality, including access and affordability. Third, present and future benefits are linked through maintenance, resource efficiency, and resilience.

These relationships are based on recent spending; thus, results differ for comparable spending. The IMF's efficiency results couple quantity and quality, as in the infrastructure literature [International Monetary Fund \(2015\)](#), [Calderón and Servén \(2010\)](#), to emphasize processes and spending outcomes.

Another perspective on success comes from a sustainability standpoint. No project is to be evaluated only based on its potential to be successful in good conditions. Its utility and its ease of service and management over time should be assessed. Such a longer-term view is facilitated by OECD's climate-resilience framework [Organisation for Economic Co-Operation and Development \(2024a\)](#) and the Lifelines analysis [Hallegatte et al. \(2019\)](#).

Last but not least, sustainable infrastructure policy must be balanced; it is not just about the same goals. Explicit choices must be made to make services financially viable, affordable, and resilient. As long as the appraisal is clear, those decisions will be apparent, and the value of various choices can be better determined.

## 12. LIMITATIONS AND FUTURE RESEARCH

This paper has three limitations: First, it is based on selected sources, as opposed to a systematic and thorough review. Second, it is not conclusive about cause and effect, nor does it provide project-level economic results. Third, it merges data from different methods and collection time points, making comparisons difficult.

Future studies would further explore and substantiate the service-centred approach using sectoral-level data. Studies could be conducted to gauge whether reliability, affordability, and maintenance performance would be better predictors of development outcomes than would expenditures.

Comparative studies on how institutional arrangements affect climate risk integration and service continuity could also be explored as an institutional factor. The results of this study may help decide whether to expand existing facilities and build new ones to benefit the public.

The conceptual framework should therefore be seen as an initial framework for empirical investigations – not as an already established statistical model.

## 13. CONCLUSION

Infrastructure development can foster sustainable economic growth, enable productive activity, improve connectivity, and expand participation. However, these results do not strictly result from physical expansion. The literature reviewed emphasizes infrastructure quality, investment efficiency, institutional effectiveness, and infrastructure resistance and resilience [Calderón and Servén \(2010\)](#), [International Monetary Fund \(2015\)](#), [Organisation for Economic Co-Operation and Development \(2024a\)](#).

First, infrastructure is a service-producing system. Investment creates assets and services that are accessible and will facilitate development. Good maintenance and resilience sustain and strengthen these benefits, and inclusion determines how widely they are shared.

However, this approach to sustainable infrastructure must focus on creating long-term public value, preparing the built work, and conducting thorough financial

analysis to fund it. It should not only provide additional infrastructure; it must also be useful, affordable, and reliable.

In this scenario, infrastructure is an economically and socially inclusive catalyst for growth and is more sustainable in the face of future challenges.

## CONFLICT OF INTERESTS

None.

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