Effectively Utilizing Infrastructure to Achieve Economic and Societal Growth in Developing Countries

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Abstract. Developing countries can benefit economically and socially from the construction of infrastructure. However, poor policy decisions regarding investment in public goods and services often impede infrastructure's effectiveness in achieving such benefits. This paper seeks to provide a coherent framework for developing countries to consider when planning and implementing infrastructure projects. Gathering insights and policy suggestions from various relevant studies, it proposes three factors necessary for developing countries to consider. These three factors emphasize individual quality of life and long-term development instead of simple short-term economic growth described by basic economic indicators. They also account for the social and environmental concerns or implications of infrastructure construction, often overlooked in many policy agendas. The first factor is the efficiency of expenditure and accessibility of infrastructure, achieved through the consideration of diminishing returns to scale for capital investment and an emphasis on the delivery, not just the provision, of public services; the second is resilience and sustainability in the context of local environmental attributes and regional independence during the decision-making process; the third is the maximization of indirect benefits, most notably the increases in human capital and productivity caused by infrastructure construction.

Keywords: Infrastructure; developing countries; development.

1. Introduction

The building of infrastructure allows governments to provide public services to citizens and businesses. It helps create better transportation services, more convenient energy access, higher-quality education, etc., while also increasing the quality of life for its citizens [1]. Hence, infrastructure is essential to economic growth and social development [1]. According to data from the World Bank, however, the percentage of Gross Domestic Product (GDP) a country spends on the delivery of public goods and services has little correlation with the estimated quality and effectiveness of governance. Economic and societal development through infrastructure, therefore, must be planned strategically and thoroughly, as its benefits cannot be accessed simply through the increase in expenditure on infrastructure creation.

Unreliable policy agendas and inefficient government spending are often blamed to be the sources of such phenomena, especially in developing countries. Incorrect policy decisions are likely to impede infrastructure's ability to contribute to economic and social development. A study about Nigeria in 2018 found that government spending on infrastructure regarding agriculture and natural resources was actually negatively impacting the country's economic growth [1]. Unintended societal and environmental impacts are also occasionally caused by the construction of poorly planned and implemented infrastructure projects [2]. Furthermore, a significant opportunity cost is also associated with any wasted or even counterproductive infrastructure investments, making wrong policy decisions even more devastating.

The key to taking advantage of infrastructure to advance a country's economy, therefore, lies not merely in the magnitude of government spending, but rather in smart and well-informed policy decisions ensuring the effective use of government expenditure. Furthermore, developed and developing countries already differ significantly in the quality and quantity of their infrastructure [3]. Since developing countries can benefit economically from better infrastructure systems, related policies and investments are key to their economic progress and decreasing the global wealth gap [3]. Additionally, infrastructure is essential to ensuring healthy and long-term societal growth, being

related to all 17 of the Sustainable Development Goals proposed by the United Nations [2]. Thus, how policies on infrastructure should be made to ensure government expenditures are most effectively utilized to achieve positive long-term economic and societal growth in developing countries must be considered.

This paper proposes three essential factors developing countries should consider when making policy decisions regarding infrastructure construction and investment: efficiency and general accessibility, long-term resilience, and human capital. The necessity of each factor is explained, along with suggestions for the specific implementation of the aforementioned principles.

2. Investment Efficiency and Accessibility of Services

2.1. Maximizing Efficiency

Even within a country, disparities in the level of development between different regions are common. Existing infrastructure is likely to be unevenly distributed across the nation, with parts of the population able to access public goods and services more easily than others. However, such a model of infrastructure distribution is often to the detriment of the efficient use of government funds. Neo-classical theories for economic development often state that due to the diminishing returns of capital, higher-income regions are less suitable for fast-paced economic growth compared to lower-income regions [4]. A governmental focus on only a few already well-established regions for infrastructure investment, commonly seen in developing countries, therefore, causes funds to not be utilized the most efficiently.

Alternatively, governments wishing to improve the well-being of all their citizens should not overlook the lesser-developed regions within their borders. Despite their seemingly undesirableness for economic development, these regions, when shocked with previously lacking exogenous factors of development, have proven to be capable of progressing economically and socially at rapid rates [4]. In contrast to relatively developed regions within the nation, infrastructure expenditure and investment in these regions are marginally more worth the cost, meaning that governments should consider reorientating their focus towards these regions to achieve the most amount of gain for the least cost.

This is not to say, however, that unequal wealth and infrastructure distribution among different regions is necessarily incorrect, or that continually investing in already well-developed regions is inherently inefficient. Many other factors, most notably population, climate, and natural resources determine the suitability of investment in a region as well. However, when it comes to maximizing the efficiency of expenditure on infrastructure specifically and focusing not just on plain economic productivity but also improvements in the quality of life of ordinary citizens, governments and agencies should take advantage of the higher marginal returns to scale of infrastructure investment in lesser-developed regions of the country.

2.2. Consideration of Local Attributes

Different regions are suitable for different kinds of infrastructure investment. Older literature regarding infrastructure investment commonly classifies regions into three categories based on their level of development: intermediate, congested, and lagging [5]. Within this theoretical framework of infrastructure policy, intermediate regions are the most suitable for investment, because they do not experience as diminished marginal returns to scale as congested regions do, yet still benefit from a strong enough foundation for potential development, unlike lagging regions [5].

Such a way of thinking about public investment in infrastructure, nevertheless, is based on the assumption that infrastructure must always primarily serve as a means to economic development, not a general tool for societal progress and improvements in quality of life. While less developed regions may experience challenges during the implementation and construction of physical facilities, they can also benefit from infrastructure focused on providing helpful and accessible services to citizens [5]. For instance, roads and factories may be beneficial to intermediate regions, but healthcare and

education, which count as infrastructure as well, are more suitable for lagging regions. They do not guarantee immediate economic growth but do ensure that long-term potential for development is created and the basic well-being of citizens is guaranteed. Instead of making decisions based on the pure monetary returns of infrastructure investments, countries will be much better off reorientating their focus towards creating long-term potential for economic and societal growth [6].

To achieve such an effect, infrastructure policy must not only answer the question of how much and where to invest but also the question of what to invest specifically. Healthy policy decisions for the construction of infrastructure should be made based on careful observations from the field, taking into account local perspectives, instead of relying on over-generalizations derived from aggregated data often detached from reality [7]. Furthermore, national consistency of infrastructure policy and standards should be balanced with the individual needs of different local regions. While certain restrictions on funding and environmental concerns are necessary to follow, governments should allow legislators enough flexibility during the policy-making process so that the specific demands and requirements of all regions can be met [5].

2.3. Delivery of Public Services

As previously mentioned, despite often being viewed as a tool solely for economic development, infrastructure is also essential for the improvement of the general well-being of individuals. Hence, the effectiveness of infrastructure should be measured not just with economic indicators, but with its societal impact as well. The extent to which government-provided goods and services are assessable and delivered to the average citizens, therefore, should be emphasized as a major determinant of the effectiveness of infrastructure investment.

Instead of focusing on the construction of physical infrastructure facilities such as railroads or energy plants, governments should focus on the delivery and maintenance of already existing services and facilities [5]. For instance, instead of building a completely new water treatment facility, governments should consider improving preexisting facilities and delivering clear water to a broader population. Such an emphasis on the delivery of services decreases government spending whilst ensuring that the benefits of infrastructure truly reach and benefit ordinary citizens [5]. Quantitative indicators of development, such as electricity provision or GDP per capita, must not be confused with development itself, which is much more dependent and reflective of the general accessibility to, not just the mere existence of government services.

3. Resilience and Sustainability

3.1. Climate Change Resilience

Developing countries are especially vulnerable to the destructive impacts of climate change on infrastructure [7]. For instance, more extreme volumes of precipitation associated with climate change are likely to render drainage systems insufficient for further usage in urban areas [8]. Based on the fair assumption that climate change will become an increasingly significant issue in global development, combating the impacts of increasing global temperatures, rising sea levels, regional climate disruptions, etc. is essential for the long-term beneficial impact of infrastructure. Thus, without an emphasis on climate-resilient infrastructure, there is no guarantee that short-term economic growth can be translated to continued long-term development.

Most theories regarding development and environment propose that there is a general trade-off between the two. Admittedly, an emphasis on sustainability and environmental protection is often to the detriment of short-term economic growth, thus leading to the prioritization of unsustainable resource extraction and infrastructure construction in many developing countries [6]. However, within a longer time frame, all countries, and the infrastructure projects within, will be negatively impacted by environmental changes. Infrastructure will thus become less effective for development absent careful considerations of long-term environmental changes. Furthermore, maintenance and rebuilding costs of unsustainable infrastructure may in fact surpass the cost of building infrastructure

correctly the first time. Thus, sustainably and climate change resilience must always be a priority for governments wishing to effectively utilize infrastructure to achieve healthy and long-term growth.

At the center of infrastructure resilience is the anticipation of future changes in climate and long-term planning based on those predictions [7]. Future impacts of climate change must be identified and prepared for. Thus, policy planning of climate-resilient infrastructure generally consists of two main components: vulnerability assessment and the creation of an adaptation strategy [8]. Both components are essential to the long-term benefits of infrastructure and must be carefully considered during the policy decision-making process.

3.2. Suitability and Independence

Countries typically lack the ability to adapt infrastructure policies to fit the requirements of their specific environmental conditions [9]. General principles and guidelines of infrastructure development are often mistakenly regarded as absolutely necessary to follow, leading to poorly made policy decisions and subsequent economic and social inefficiencies. Governments must understand that policy decisions must be made based on well-observed phenomena and situations within their own borders, and local suitability should always be prioritized over convention.

Additionally, in a globalizing world with climate issues becoming increasingly dominant in international discourse, it is important for developing countries to maintain individuality when it comes to decisions about their own infrastructure and environmental issues. For many middle-to-low-income countries, the portrayal and public understanding of climate concerns are often dependent upon powerful countries and large international organizations, but not based on specific local concerns [10]. Instead of relying on international communities to dominate how infrastructure policies regarding the environment should be made, governments should recognize the necessity of crafting policies suitable for their own individualized developmental needs.

3.3. Planning and Implementation of Green Infrastructure

Another environment-related kind of infrastructure policy is the creation of green and blue spaces, often acting as mini yet diverse ecosystems usually within urban settings. Green infrastructure, as these government projects are commonly referred to, is capable of achieving economic and societal benefits [11]. Governments wishing to take full advantage of these potential benefits, therefore, must plan accordingly and effectively implement well-informed policies.

While green infrastructure planning has been researched intensively, very little of the research has been conducted specifically within the context of developing countries. Out of the many proposed principles of green infrastructure development, two of the most essential ones for developing countries are multifunctionality and applicability. Multifunctionality associates the direct environmental benefits of green infrastructure with the provision of other related services [11]. Conservatory parks, for example, can primarily serve as habitats for plants and animals; yet, they can also offer a location for outdoor recreation and increase the economic value of nearby real estate. Thus, such positive externalities of multifunctional green infrastructure benefit developing countries, often seeking cost-effective approaches to infrastructure. Applicability, a measurement of the practicality and local adaptability of green infrastructure projects is also essential for developing countries [11]. This is partially because such countries typically suffer from poor planning and inefficient execution of policies [7]. An emphasis on applicability would therefore reduce the likelihood and impacts of these challenges.

The second step to effectively using green infrastructure to achieve widespread societal and economic benefits is efficient implementation of the planned policies. While the specific method of implementation is different for every single infrastructure project, all of them must rely on strong support from political leaders, local communities, and manufacturers [7]. Ensuring that green infrastructure provides substantial and tangible impacts for local communities and providing incentives for all groups in the implementation process is thus essential to the effectiveness of green infrastructure policies.

4. Maximization of Indirect Benefits

4.1. Education and Human Capital

At the center of utilizing infrastructure to achieve long-term growth is the idea of maximizing the indirect benefits of infrastructure, or more specifically within context, the economic and societal benefits infrastructure projects can provide that are outside the scope of their pure monetary returns of investment. Generally, the more indirect benefits are generated by infrastructure projects, the more worthwhile they are to prioritize. Often, these indirect benefits are capable of further leading to the development of even more infrastructure, propelling the economy and society forward.

The most notable example of an indirect benefit infrastructure provides is an increase in human capital. Quantitative studies have proven that better-developed infrastructure leads to an increase in worker productivity and human capital [12]. Thus, in addition to its monetary value, infrastructure provides the indirect benefit of increasing local worker competency, which in turn promotes further economic growth. As previously mentioned, without qualified workers and planners, developing countries are unable to create and carry out effective infrastructure projects, and little growth can be achieved; conversely, the more qualified workers and planners are, the more likely public goods and services will be efficiently provided for the general population. The subsequent better accessibility to education and more optimal learning environments created by this increase in public goods and services is likely to create a second order increase in human capital. Thus, a positive feedback loop between the two is formed, where infrastructure increases human capital and increased human capital creates more and better infrastructure.

The key to maximizing the propelling force of this positive feedback loop is to ensure that infrastructure and the increase of human capital are indeed closely linked together. First, more infrastructure must lead to more human capital, and to do so, infrastructure regarding education must be carefully planned to maximize effectiveness and efficiency. More specifically, national and local governments should prioritize increasing the quality of education, not just the mere quantity of it, even if that increased quality may only affect a small portion of the population [13]. Next, increased human capital must link back to more and better-built infrastructure. Governments should thus ensure that high-skilled workers and planners of infrastructure projects are treated well and provide them with as much work experience as possible.

4.2. Future Productivity

In addition to increasing human capital, infrastructure can also lead to reduced input costs for businesses, increasing economic and social productivity [12]. This is generally a major motivator for the implementation of infrastructure projects and therefore can be considered a direct benefit already accounted for and actively aimed towards during the planning process. However, this increased productivity, especially when adjacent to the public sector, can lead to the more efficient construction of further infrastructure projects. Since this is typically outside the scope of the initial planning stage of infrastructure projects, it can be thought of as another indirect benefit. Similar to infrastructure and human capital, infrastructure and the subsequent increase in potential for future infrastructure projects also create a positive feedback loop, propelling long-term sustained economic and societal growth.

Governments, therefore, should not plan each infrastructure project individually, but instead focus on the progression of multiple infrastructure projects over a wider timeframe. Each project requires a strong foundation and support from previous projects and can then themselves become the foundation and support for future projects. For example, the construction of a highway is possible only with a sufficient quantity and quality of construction equipment, but it also ensures that any demands for transportation during future projects are likely to be met. Intuitively, developing countries, often lacking strong infrastructural foundations for many projects, must initiate such a chain reaction of indirect benefits depending on their current stage of development. Along with the direct benefits derived from the monetary returns of infrastructure investment, indirect benefits must be accounted for and maximized as well in the planning process.

5. Conclusion

This paper challenges the common misconception that the effectiveness of public goods and services is reliant primarily on the amount of government expenditure towards infrastructure projects. It proposes three factors that developing countries should consider while making related policies to ensure that infrastructure investment achieves the most amount of economic and societal growth at the least cost. While many similar policies have been proposed in previous research regarding infrastructure, little have aimed towards the establishment of a coherent framework of infrastructure construction in developing countries. These three factors are proposed by gathering insight from various previously suggested policies and combine them to form a reliable strategy that these countries can then use to achieve economic and societal development. First, governments should consider diminishing marginal returns and local attributes while making policy decisions and focus on the delivery, not just the provision, of services. Second, region-specific climate and environmental conditions must be factored in and met during the design and implementation of infrastructure projects. Third, indirect benefits, often harder to quantify, should be accounted for during the planning process, and decisions should be made with previous and future infrastructure projects in mind.

The coherent framework of infrastructure construction this paper seeks to provide should be generally considered for all developing nations. However, any decision regarding its specific application for individual countries must be made on a case-by-case basis, as emphasized by multiple points throughout the paper. Additionally, since a large part of this research was performed to challenge the heavily quantified approach of considering infrastructure investment, often detrimental to the long-term growth of many developing countries, it has primarily taken a qualitative approach instead. Future research capable of indicating and quantifying the benefits of implementing these policies for developing countries is therefore required.

References

[1] Babatunde, S. A. Government spending on infrastructure and economic growth in Nigeria. Economic research-Ekonomska istraživanja, 2018, 31(1): 997-1014.

[2] Thacker, Scott, Daniel Adshead, Marianne Fay, Stéphane Hallegatte, Mark Harvey, Hendrik Meller, Nicholas O'Regan, Julie Rozenberg, Graham Watkins, Jim W. Hall. Infrastructure for sustainable development. Nature Sustainability, 2019, 2(4): 324-331.

[3] Irshad, R., Ghafoor, N. Infrastructure and economic growth: evidence from lower middle-income countries. Journal of the Knowledge Economy, 2022, 14(1): 161-179.

[4] Kodongo, O., Ojah, K. Does infrastructure really explain economic growth in Sub-Saharan Africa?. Review of Development Finance, 2016, 6(2): 105-125.

[5] Fox, W. F., Smith, T. R. Public infrastructure policy and economic development. Economic Review, 1990, 75(Mar): 49-59.

[6] Zuluaga, S., Karney, B. W., Saxe, S. The concept of value in sustainable infrastructure systems: a literature review. Environmental Research: Infrastructure and Sustainability, 2021, 1(2): 022001.

[7] Chirisa, I., Nel, V. Resilience and climate change in rural areas: a review of infrastructure policies across global regions. Sustainable and Resilient Infrastructure, 2022, 7(5): 380-390.

[8] Kirshen, P., Caputo, L., Vogel, R. M., Mathisen, P., Rosner, A., Renaud, T. Adapting urban infrastructure to climate change: A drainage case study. Journal of Water Resources Planning and Management, 2015, 141(4): 04014064.

[9] Bak, Céline, Amar Bhattacharya, Ottmar Edenhofer, Brigitte Knopf. Towards a comprehensive approach to climate policy, sustainable infrastructure, and finance. Economics, 2017, 11(1): 20170033.

[10] Horta, A., Carvalho, A., Schmidt, L. The hegemony of global politics: News coverage of climate change in a small country. Society & natural resources, 2017, 30(10): 1246-1260.

[11] Monteiro, R., Ferreira, J. C., Antunes, P. Green infrastructure planning principles: An integrated literature review. Land, 2020, 9(12): 525.

[12] Palei, T. Assessing the impact of infrastructure on economic growth and global competitiveness. Procedia Economics and Finance, 2015, 23: 168-175.

[13] Agénor, P. R. Infrastructure, public education and growth with congestion costs. Bulletin of Economic Research, 2012, 64(4): 449-469.