CHAPTER 3: INFRASTRUCTURE AND UTILITIES

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ABSTRACT

This chapter presents a framework for both public and private sectors to support planning, designing and financing of infrastructure that is economically, financially, socially, environmentally and institutionally sustainable. The chapter intends to generate discussion amongst key stakeholders and serve as a basis for research and experimentation. It should be considered as a working document. Infrastructure covers various sectors which represent a large share of an economy and become a critical index of economic vitality. Both components of infrastructure, physical and social infrastructures, are required to provide the necessary services for public interest. Infrastructure is also important in environmental terms. Infrastructure choices determine whether there is clean power, compact cities and energy efficient buildings and whether infrastructure is resilient to a changing environment and climate. Getting these investments right is critical to whether or not the world locks into a high- or low carbon growth trajectory. Given that infrastructure lasts for decades, the choices made will affect carbon emissions for much of the century.

Keywords sustainability, sustainable infrastructure, inclusive growth, environmental, SDGs, National Development Strategy.

INTRODUCTION

Current infrastructure investment methodologies are outdated and unfit for an increasingly complex environment. Several systemic causes are fundamentally altering the value evaluation of infrastructure. First, because of the mounting threats posed by climate change, any new infrastructure must be compliant with the UN Sustainable Development Goals (SDGs). Because infrastructure assets have a long lifespan, long-term infrastructure must transition to zero-emission infrastructure immediately (Musungwini et al., 2016). However, a large portion of the existing profile consists of high-carbon, fossil-based and inefficient

projects. Not only does this increase the risk of stranded assets for investors, but it also jeopardises public property and livelihoods, endangering the habitability of some portions of the planet. On the plus side, new solutions are emerging because of both technological advancements and the low-carbon revolution (Rahman, 2018). Digital technology is also assisting citizens in becoming more active participants in the energy and other industries.

Demand-side management innovations and networked transportation, heat, digital and energy systems can assist in meet climate and sustainability goals. However, these solutions cut across both sectoral and national boundaries, necessitating the consideration of infrastructure systems, rather than individual infrastructure projects. Infrastructure policies and regulations are now too fragmented to effectively manage the interlocking risks posed by climate change, or to take advantage of crosssectoral technological solutions (Shannon et al., 2018). Fundamental institutional improvements are required, not just incremental policy modifications. Multilateral development banks (MDBs) play a critical role in tackling the sustainability challenge because the majority of new infrastructure is built in developing countries, both in assisting governments with creating an effective enabling environment for sustainable infrastructure and through providing various innovative financial instruments that increase participation of the private sector (Shahtaheri, Flint and Jesús, 2019).

The framework's goal is to increase clarity, reduce risks and capitalise on the opportunities that sustainable infrastructure provides for inclusive growth and productivity, improving the coverage and quality of services embodied in the SDGs, and speeding up the transition to low-carbon growth and climate resilient economies in Southern Africa (Baptista, 2019). The framework outlines four fundamental principles of sustainability, including economic and financial, environmental, social, and institutional elements, and suggests that each of these should be considered throughout the project cycle, including, most importantly, how upstream policy is implemented. Legislation, regulations, planning, and organisational capacities contribute to delivering sustainability (Biancone

and Radwan, 2018; Baptista, 2019). This chapter presents a list of more than 60 criteria for operationalising sustainability within this framework.

Infrastructure encompasses a wide range of industries that make up a significant portion of a country's economy and have become a key indicator of economic health. Both physical and social infrastructures are required to offer the necessary services for the general public's benefit. A productive economy requires reliable public utilities (electricity, telecommunications, water and gas supply, and other utilities), public works (roads, dams and canals, tunnels) and public transportation (urban transportation systems, trains, ports and waterways, and airports) (Gramlich, 1994). As a result, enough infrastructure must be built and maintained to achieve quick and long-term economic growth. The country's essential success elements in growing productivity, expanding trade and industry, coping with population expansion, reducing poverty, enhancing environmental sustainability and raising society's living standards, are all determined by the country's infrastructure (Chirisa et al., 2016).

Infrastructure development cannot be the duty of the government alone, because it necessitates huge expenditure. It is critical to encourage private sector participation in infrastructure development to maintain a long-term infrastructure development (Li et al., 2019). The public-private collaboration will enable a considerable rise in extra funding, improve the project's economic feasibility and improve the existing capital budget's performance. Meanwhile, better management in the private sector can lead to increased project efficiency, harness innovation capability and drive knowledge and technology transfer, all of which will result in better quality and lower cost services (IMF, 2014a).

LITERATURE REVIEW

Infrastructure, economic growth and inclusive and sustainable development are all intertwined. Infrastructure is a critical component of economic development. Infrastructure investment may play a particularly crucial role in the current context of growing concerns about global growth prospects, by raising global aggregate demand today and creating stronger foundations for future growth (Snider and McBean, 2021). It is also a critical component of the fight against climate change and promotion of

long-term prosperity and development. When done poorly, it contributes significantly to the problem as infrastructure accounts for over 60% of global greenhouse gas emissions (Laurance, 2018).

When done correctly, it is a critical component of both climate change mitigation and adaptation. Infrastructure adequacy, affordability, sustainability and resilience are critical for inclusive growth and poverty reduction. The world has a once-in-a-lifetime opportunity to make significant progress on this interrelated agenda. Important recent events have established a solid platform on which to build. Climate sustainability is integrated into the global development agenda through SDGs that were agreed on by the international community in September 2005. Infrastructure is intertwined with this goal. The globe has been underinvesting in energy systems, cities, transportation and water infrastructure. However, important international fora, such as the G-20, are now paying attention to the need to significantly increase infrastructure investment and address related policy agendas, resulting in considerable measures to strengthen the investment and financing framework.

Cities are reducing their carbon footprint by utilising new energy technology and increasing energy efficiency. Connectivity has enabled new "smart" solutions to reduce infrastructure costs through higher efficiency, thanks to a revolution in information and communications technologies (ICTs). This change has also thrown business models into disarray, prompting entrepreneurs and policy-makers to seek out new techniques that can help them leapfrog old technologies. Cities in emerging economies such as China, India, Brazil and South Africa, are collaborating with those in the Organisation for Economic Cooperation and Development (OECD) countries to generate new ideas. Businesses, colleges and civil society organisations are forging new sorts of multi-stakeholder collaborations with public policy-makers to find game-changing answers to local, national and global concerns. These methods must be pursued in ways that are specific to the situation.

In the industrialised world, urban infrastructure networks have already been planned out to a great extent. Planners can only make small modifications to city designs, but they can concentrate on techniques for rehabilitation and retrofitting, and the use of ICTs to increase efficiency and more aggressive demand management to reduce resource usage and emissions. Cities in developing and growing economies, particularly those in Africa and Asia, can make infrastructure decisions now that will employ emerging technology and procedures to build a more efficient and denser footprint. They can also benefit from more advanced technology when they are available and inexpensive. Given the magnitude of the problem, a revolutionary strategy is required. As a result, to promote the adoption of new infrastructure technologies and new ways of doing business, a supportive enabling environment and novel financing techniques are required.

Infrastructure services, such as the provision of drinking water and electricity, waste disposal and treatment, people and goods movement, and ICT, constitute the backbone of Latin America's economic development, competitiveness and inclusive growth (Calderón and Servén, 2014; Serebrisky, 2014; Serebrisky et al., 2015; Bhattacharya et al., 2016; The New Climate Economy, 2016). Even though the region's infrastructure investment needs are estimated to be 3-8% of GDP. investments are only 2 to 3% of GDP (Serebrisky, 2014: Fay et al., 2017). To accomplish the region's development goals, an increase of US\$120-150 billion per year is required (Serebrisky et al., 2015), with specific problems in the urban setting (Bonilla-Roth and Zapparoli, 2017). Closing the investment gap will necessitate the mobilisation of new long-term financing sources, particularly institutional investors (Bielenberg et al., 2016). Closing the infrastructure deficit will necessitate both increased expenditure on roads, power plants and water sewage systems, and a shift in how infrastructure is planned, produced and operated. The climate future is determined by infrastructure built now. Globally, 60% of carbon emissions are attributed to the building and operation of existing infrastructure, with infrastructure accounting for another 35-60% of the future carbon budget (Müller et al., 2013). Technological lock-in and the inertia of long-lived assets like infrastructure, highlight the importance of carefully considering the viability of additional fossil fuel power generation if the Paris Agreement objective of maintaining the global temperature increase well below 2°C is to be achieved (Hansen et al., 2013). Indeed,

according to Pfeiffer et al. (2016), the "2°C capital stock limit for fossil-fuel-based energy generation" had already been crossed in 2017.

Given climate change, environmental issues and societal challenges, delivering infrastructure in Latin America and the Caribbean is becoming increasingly difficult. At the same time, new technologies will revolutionise the way infrastructure is designed, built and funded. Certain types of infrastructure may become obsolete because of innovative technology and business models, and demographic and demand shifts. The desire to attract new sources of private capital heightens the legal and regulatory hurdles that government agencies must overcome to enhance investment in long-term infrastructure. Climate change or physical climate risk are causing increasing concern, as they reduce the predictability of future infrastructure needs while also increasing asset vulnerability (Reyer et al., 2017). The region is one of the most sensitive to the effects of climate change. In 2017, it suffered significant losses because of natural disasters, including floods in Peru that cost \$3.1 billion and floods in Colombia that killed 329 people (Munichre, 2017).

According to Vergara et al. (2014), climate change will cost the region \$100 billion per year in damages by 2050. Social conflicts arise because of the loss of natural resources or ecosystem services, pollution, inadequate local benefits in terms of infrastructural services or job development, and reduced local access to resources. Conflict is causing infrastructure project delays, cost overruns and reputational harm for governments, financiers and the private sector, when combined with poor planning, consultation and transparency (Watkins et al., 2019). Meeting future infrastructure demand competes with the potential for severe environmental and social externalities from these projects that becoming a cause of increased contention between local communities and project sponsors. The growing strength of civil society and the rising use of technology to link people adds to the complexity of completing infrastructure projects (Valenzuela and Studer, 2016; Watkins et al., 2019).

As previously stated, the amount of investment and infrastructure quality in the region impede inclusive growth (International Monetary Fund,

2016). While there is rising support for sustainable infrastructure, present progress is disappointing (Mercer and Inter-American Development Bank, 2016,2017; Fey et al., 2019). Projects can generate both positive and negative externalities that are difficult to measure and control due to the extended time span and extensive spatial implications of infrastructure assets (Bak et al., 2017). The increasing complexity of infrastructure, especially for economic and sectoral decision-makers, along with the need to mobilise new sources of funding, necessitates the development of a framework that promotes common knowledge. As a result, the IDB Group defines sustainable infrastructure as infrastructure projects that are planned, designed, built, operated and decommissioned in such a way as to assure economic, financial, social and environmental sustainability (including climate resilience), and institutional sustainability over the entire life cycle of the project (Muguisha, 2007). The criteria that this definition is based on, are outlined in section 2 and are derived from existing sustainability tools and techniques.

Because infrastructure projects are so temporally and spatially complex, many diverse stakeholder groups must be involved in both defining and delivering sustainable infrastructure. Better project preparation, design, and decommissioning. building. operations must accompany improvements in upstream regulation and planning (Momin and Kolekar, 2017). This is determined by national and subnational governments' and sector agencies' capacities and their relationships with and ability to effectively engage the private sector, particularly project developers, construction and operations firms, sustainability standards setters, and private finance. MDBs are well positioned to assist in overcoming the challenges of delivering long-term infrastructure and mobilising large amounts of capital. They are already helping to advance the sustainable infrastructure agenda by supporting knowledge agendas, increasing national and subnational institutional capacities, assisting with project preparation and design, and facilitating access to and delivery of capital (IMF, 2015). Stronger collaboration with organisations like the IMF and the OECD is critical in assisting governments with the institutional adjustments required to regulate, plan, manage their economies and attract financing for pipelines of sustainable infrastructure projects (McKinsey Global Institute, 2013).

UNDERSTANDING THE PROVISIONS IN THE NDS1 DOCUMENT

The quality of infrastructure in an economy is a barometer of a country's residents' well-being. Furthermore, the size of a country's infrastructure has a significant impact on long-term economic growth. Economic challenges have plagued the previous two decades, making it impossible to ensure the continued rehabilitation and maintenance of infrastructure, including the growth of important sectors. Zimbabwe's infrastructure has deteriorated during the last two decades. As a result, Zimbabwe is ranked 127th out of 138 countries in the World Economic Forum's Global Infrastructure Index for 2017-2018.

Several reasons contributed to the reduction in infrastructure, including the following:

- Inadequate public spending on normal and periodic maintenance, including infrastructure network maintenance and repair;
- Lack of an integrated approach to infrastructure investment planning, exacerbated by significant talent loss;
- Lack of development in developing institutional capacities for basic service management and regulation;
- Both public and private sectors are investing in infrastructure at a low level; Inadequate capital and operating expenditure funding,
- Low levels of support from development partners because of arrears and other issues;
- Capacity constraints in managing the entire project cycle, particularly limited implementation capacity; and
- Unviable utility prices that make it impossible for institutions to reinvest in infrastructure, and inadequate monitoring and assessment methods.

The deterioration of the country's fundamental infrastructure has had a major impact on the productive sectors of the economy and the level and quality of services provided to the general public. During the NDS1 period, effective infrastructure delivery is critical to achieving national priorities and overall socioeconomic development. This will entail the restoration of essential infrastructure services like roads and expansion in critical areas such as electricity, transportation, water and sanitation, information and communication technology, and housing. The strategy's targeted

infrastructure sector outcomes are supported by well-defined and realistic sector strategies and interventions, and performance indicators aimed at ensuring the restoration of basic infrastructure services that contribute meaningfully to economic growth and development. Capacity-building programmes for public investment management will also be implemented for implementing agencies involved in infrastructure delivery to improve efficiency and effectiveness in the execution and achievement of sector outcomes.

Energy, water and sanitation, and transportation are the priority sectors for infrastructure and utilities. The following initiatives is implemented to improve infrastructure and access to services:

- Maintaining and repairing existing infrastructure and equipment;
- completing ongoing and stalled projects;
- attracting FDI in infrastructure;
- increasing private sector investment in public infrastructure provision;
- promoting facilities for people with disabilities;
- promoting infrastructure research and development; and
- designing and implementing climate-proofing and resilient infrastructure

APPRAISAL OF PLANNING

There is a requirement to increase and monitor performance improvement to meet benchmarks. This is consistent with the adage, "If you can't watch it, forget it!" A credible monitoring and assessment method puts the operating utility under pressure to enhance performance. The utility must be aware that its performance is being monitored and that something is done to improve it. An evaluation process that does not fully understand the regulator-regulated interaction is useless. The utility must understand that a "bite" will occur in the event of noncompliance and a "carrot" will appear in the event of objective attainment. The evaluation criteria must be published in advance, and no "after-the-facts adjustments" to the evaluation policy are permitted. The Uganda's National Water and Sewerage Corporation (UNWSC) monitoring and incentive framework adheres closely to the 10 parameters proposed by Sappington (1994) for establishing incentive regulation programmes.

- Use incentive regulation to better employ the firm's superior information:
- Prioritise regulatory goals and design incentive regulation to achieve stated goals;
- Link the firm's compensation to sensitive measures of its unobserved activities;
- Avoid basing the firm's compensation on performance measures with excessive variability;
- Limit the firm's financial responsibility for factors beyond its control;
- Adopt broad-based performance measures where possible, unless their variability is excessive;
- Choose exogenous performance benchmarks;
- Allow the firm to choose among regulatory options, while recognising the interdependencies among the regulatory options offered to the firm:
- Promise only what can be delivered and deliver whatever is promised;
 and
- Plan for the rare, unforeseen event, but minimise after-the-fact adjustments to the announced regulatory policy.

IMPLEMENTATION, MONITORING AND EVALUATION

The Government of Zimbabwe is committed to ensuring a strong culture of monitoring and evaluation of all its programmes to achieve the visions of achieving middle-income status by 2030 and also "Towards an Empowered Society and a Growing Economy" espoused by the national socio-economic blueprint, the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim-Asset) 2013-2018. The MDR approach, which adheres to the principles of the IRBM system, would underpin this. This system ensures that the government manages public resources properly and that accountability, openness and high-quality service delivery are all guaranteed.

For the successful implementation of national development plans, programmes and projects, and for efficient and effective service delivery, the government needs a strong monitoring and evaluation system. The formulation of a national monitoring and evaluation policy for Zimbabwe is

thus crucial in providing the necessary framework for institutionalising M&E in the public sector. Through a consultative approach, the National Monitoring and Evaluation Policy intends to provide a systematic, coordinated, streamlined, results-oriented, dependable and effective framework. As a result, substantial research and learning from the experiences of other countries went into the formation of Zimbabwe's policy. The Office of the President and Cabinet also led and coordinated stakeholder discussions.

Many water utilities in low-income nations begin by investing heavily in infrastructure to improve their performance. Focusing solely on this engineering technique has been ineffective in achieving the desired efficiency increases (Folkman, 2018). Depending on where managerial deficiencies are most prominent in the utility, a variety of orientations is required. Benchmarking and performance monitoring are two major aspects of water infrastructure management that require significant attention. Benchmarking is becoming a powerful performance motivator, particularly in utilities where significant tariff incentive applications are difficult to come by. It is a nice way to keep the regulator-controlled interface active in a meaningful way (Chogugudza-Sithole, 2014). It puts pressure on the operating utility to achieve what was promised if i adequately constituted. At the same time, it provides the regulator with a proactive framework for implementing its mandate to improve the water industry's performance. In this chapter, the case of Uganda's NWSC, is described, including a summary of performance improvement approaches, accomplishments and lessons learned (Asquer, 2018). Specific empirical evidence demonstrating how balancing engineering and commercial/customer orientations improves infrastructure care performance dramatically is presented.

DISCUSSION

The definition and principles of infrastructure sustainability should be converted into practical and measurable criteria to operationalise infrastructure sustainability. The criterion for delivering sustainability in infrastructure projects must be consistent across all four sustainability aspects and throughout the project cycle. Notably, addressing some aspects of sustainability upstream could be far less expensive than

attempting to address sustainability after projects have been designed or put into operation (Georgoulias and Arrasate, 2016). There are numerous publications that offer insights into how to build sustainable infrastructure, easily the most analysed are approaches to sustainability assessment and guaranteeing environmental and social sustainability during project planning and design. As a result, this chapter begins by looking at how to deliver sustainability during project preparation, and then highlighting measures that may be implemented earlier in the project cycle and during finance to help deliver sustainability.

Governments should foster institutional awareness and keep a close eye on societal demands and trends. They must guarantee that decisions are made using up-to-date and trustworthy demographic and demand data, and formal and functional frameworks for successful stakeholder involvement and community participation. Governments should put in place an institutional framework to ensure equitable benefit sharing and compensation for project-affected communities. They should develop norms and methods for equitable relocation and displacement of impacted persons, and regional and local policies and plans for public amenities, community mobility and connection. Governments should guarantee that universal accessibility standards and norms are adopted to ensure that people with disabilities are not discriminated against (Chirisa et al., 2016). They should also set norms and capacities to safeguard the health, safety and security of the community. Governments should also show commitment and capacity to ensure adherence to occupational health, safety and labour standards, and standards and capacities for vulnerable group protection. They should provide institutional commitment and capacity to ensure gender equality, proper community access to resources, effective cultural resource and heritage management, and indigenous and traditional peoples' participation.

A productive economy requires reliable public utilities such as power, telecommunications, water and gas supply and other utilities, and public works such as roads, dams and canals, tunnels and public transportation (urban transportation systems, railways, ports and waterways, and airports). As a result, enough infrastructure must be built and maintained to achieve quick and long-term economic growth. The country's essential

success elements in growing productivity, expanding trade and industry, coping with population expansion, reducing poverty, enhancing environmental sustainability and raising society's living standards, are all determined by the country's infrastructure. Infrastructure development cannot be the duty solely for the government because it necessitates huge expenditure (Rahman, 2018). It is critical to encourage private sector participation in infrastructure development to maintain a long-term infrastructure development. The public-private collaboration will enable a considerable rise in extra funding, improve the project's economic feasibility and improve the existing capital budget's performance. Meanwhile, better management in the private sector can increase project efficiency, leverage innovation capacity and stimulate knowledge and technology transfer, all of which will result in better quality and lower cost services (Wallis, Ambrose, and Chan, 2009).

In the objective to promote sustainable development and manage climate change through better infrastructure, public policy plays a critical role. This is due, in part, to the fact that the government is a significant infrastructure investor, and its investment decisions and institutional capacity have a direct impact on the quantity and quality of infrastructure provided and how it supports growth, inclusion and sustainability (Studart and Gallagher, 2018). However, public policy is more significant because it sends signals and establishes the regulatory and institutional frameworks that impact the activities of all parties, including private investors and consumers. Given the scale of the infrastructure challenge, private investment and financing is required to play a far larger role than the previous. The incentives and enabling environment offered by public policy at national and international levels is critical in mobilising private investment at scale and channelling it to sustainable infrastructure. Infrastructure adequacy, efficiency, affordability and sustainability, are all harmed by a variety of governmental, institutional and market shortcomings (Bogetic and Fedderke, 2006). These failures produce a wedge between social and private costs and returns by raising costs and lowering returns, increasing risks, limiting institutional capabilities and driving a gap between social and private costs and returns. The role of government policy is to correct these flaws. Given the long-term nature of infrastructure expenditures, the public good character of most of it,

significant associated externalities and the inescapable and intimate links to government policies, soundness, clarity and credibility of public policy are especially critical. Infrastructure financing is particularly difficult due to high upfront expenses with long-term rewards and long-term financing constraints.

CONCLUSION AND OPTIONS

Finally, in the face of significant global environmental concerns, great cities are grabbing possibilities to address expanding infrastructure demands while using innovative technology and approaches to resource conservation. Local policies that promote efficiency, and international and national policy frameworks that provide incentives, such as the price of natural resources like fossil fuels and water to reflect externalities, are required. Some alternative technologies' capital costs are still significant, and a variety of restrictions and dangers must be solved. In the absence of suitable price signals, financial support from market mechanisms or national or international subsidies is also required to fill this gap. However, because public finances are limited, policy-makers are turning to new financing strategies to leverage private investments (Guyatri et al., 2021). Cities are also forming new relationships with the public sector, civil society, business, academia and academics to enable them to speed up the implementation of sustainability plans by sharing their experiences and establishing a conducive atmosphere for sustainable solutions creation. Green growth strategies to support long-term infrastructure development can be found in industrialised, emerging and developing economies.

As indicated by the rapid growth of the green bond market, investor interest in "green financing" targeted investments for climate mitigation, climate resilience/adaptation and environmental sustainability, is expanding. Standardising green finance processes, improving risk transparency and disclosure standards, expanding green investment markets and supporting developing-country sustainable finance roadmaps are all essential for further growth (Berensmann et al., 2017). The country's ability to provide continuous and sustained rehabilitation and maintenance of transportation infrastructure has been harmed by the country's economic woes over the last two decades. Furthermore, an over-

reliance on vehicle traffic places strain on already deteriorated road networks, necessitating considerable rehabilitation (Studart and Gallagher, 2018). Improved road transportation services are crucial for increasing accessibility and promoting domestic, regional and international trade by allowing products and people to travel more freely.

A substantial portion of the road network is in bad shape, which has had direct and indirect effects on road safety. During the NDS1 period, the goal is to establish high-quality, efficient public transportation services in both rural and urban areas. The goal is to minimise traffic accidents and mortality by a quarter each year. The Zimbabwean government has been responsible for the majority of the country's economic infrastructure, with the private sector having a limited part. As a result, policy-makers may choose to focus public spending on infrastructure projects as a means of boosting short-term economic growth (Marcelo et al., 2015). Through both direct and indirect transmission mechanisms, public investment in infrastructure projects can have a favourable impact on economic growth. Economic growth can be boosted by providing basic infrastructure services that meet the demands of businesses and households. As a result, policymakers must concentrate, not only on increasing the number of infrastructure stocks, but also on enhancing the quality of infrastructure service delivery. As a result, regulatory organisations must increase their efficiency to assure the delivery of services in the various infrastructure sectors.

The favourable influence of infrastructure development on economic growth, as evidenced by infrastructure indicators, could imply an increase in aggregate demand in the economy through large-scale public works spending. Because of greater job possibilities created by public works, public spending on infrastructure can help stimulate aggregate demand. When issuing tenders for infrastructure projects, it is critical for officials in the Ministry of Transport and Communication, Ministry of Energy and Power Development, State Procurement Board, and other related organisations, to consider local contractors. Tenders awarded to local enterprises rather than foreign contractors would benefit the economy more, as it would lower the risk of capital flight.