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Financing Infrastructure in Times of Net Zero: Trends, Challenges and Solutions

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Abstract and Policy Implications

The aim of the essay is to identify current trends in infrastructure financing in times of net zero, crucial challenges, and solutions to overcome these issues. To gain information, a fundamental literal research, and interviews with infrastructure financing specialists of development banks were conducted. The growing importance of climate aspects for financing decisions, the changing sources of infrastructure funding and the increased role of Multilateral Development Banks (MDBs) can be listed as the most important trends. The main challenges are the financing gap for infrastructure, the high investment risks and a lack of standards, and policies regarding climate neutrality. To overcome these challenges, innovative financing solutions and the merging of public and private funding have been identified as potential solutions.

1. Introduction

'Achieving the [Paris Agreement] goals creates at least US$12 trillion in opportunities' (Business and Sustainable Development Commission, 2017: p. 12). To benefit from these opportunities and to fulfill the Paris Agreement, infrastructure needs to be climate neutral. In addition to the urge towards environmentally responsible infrastructure, there is a significant demand for the expansion and development of infrastructure in order to reduce poverty and support development (Griffith-Jones & Leistner, 2018; Singapore Institute of International Affairs, 2020; Wright et al., 2018). The Global Infrastructure Hub (2020) identifies a funding gap of $15 trillion for infrastructure investment by 2040.

This essay examines infrastructure financing in times of net zero. The relevance of this topic is underlined by the above-mentioned infrastructure financing gap as well as by the substantial need for a more sustainable world. To analyse this research topic, trends and challenges in infrastructure financing are identified. The essay seeks to provide solutions to those challenges. To gain information, a primary literal review and interviews with experts in the field of infrastructure financing are conducted. The interview partners are employees of multilateral and unilateral development banks.

First, net zero and infrastructure are defined, and different financing methods of net zero infrastructure are pointed out. Second, the analytical framework for the interviews is described. The results of the interviews are presented afterwards. In the end, a summary and conclusion of the essay is made.

2. Basics: Definition of Net Zero and Infrastructure

To obtain a first impression of the topic, the terms of net zero, infrastructure, and financing are placed in context. Additionally, the relevance to this work is explained below.

2.1 Definition and the relevance of Net Zero

In recent years, many countries have signed agreements to move to a net zero emissions economy. Therefore, the question arises why this path was chosen and what exactly net zero means.

Initially, it is necessary to define net zero because there are many terms and definitions in the context of climate change. The UNFCCC defines climate change as 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere (…) over comparable time periods' (UNFCCC, 1992: p. 3). Carbon dioxide plays a fundamental role in this change. The greenhouse gas (GHG) is affecting the global radiative balance and is a responsible cause for the global warming. To counteract this, activities removing carbon dioxide from the atmosphere are required. 'Net zero emissions are achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period' (IPCC, 2018: p. 555).

In conclusion, the countries' main objective for reaching net zero is to counteract climate change. The emissions of the economy must be balanced by absorbing an equivalent amount from the atmosphere to ensure a sustainable and resilient future (Energy & Climate Intelligence Unit, 2021; Guterres, 2020). The issues related to climate change are rapidly increasing, leaving limited time to find and implement a suitable solution. Consequently, the im-

plementation of net zero actions involves the reduction of GHG production through appropriate targets of maximum carbon dioxide production and the development of projects that actively reduce the generated concentration of pollutants (Hoet, 2020).

The Paris Agreement is an important contract between many countries to work together to prevent further climate change and to achieve the goal of net zero. It was negotiated in 2015 and is now signed by 195 countries and ratified by 187 countries (Buchner et al., 2019; IPCC, 2018). The agreement specifies the limit of global warming to 1.5 degrees Celsius until 2050 (UNFCCC, n.d.; Guterres, 2020; Carney, 2020; IPCC, 2018). To keep the global mean temperature below 28 degrees Celsius, there needs to be a reduction of global emissions from 2.5% to 3 % per year on average until 2050 (Bowen, 2011). The Paris Agreement focuses on economic and social transformation and commits the participating countries to develop individual actions against climate change. The participating countries commit to a reduction of their GHGs as well as further actions against the impacts of rising temperature (UNFCCC, n.d.).

The UN Secretary-General points out, that in the current situation of the corona crisis, countries should not neglect the goals for achieving climate neutrality (Guterres, 2020). The goals are clearly communicated by the Sustainable Development Goals (SDGs). These are 17 global goals which are established by the United Nations to ensure well-being and equality for people from all over the world but also to implement measurements against climate change and to protect land and water (IPCC, 2018; IsDB, 2020). Despite the clear communication of these goals, there are still not sufficient ideas on how to finance sustainable infrastructure (Guterres, 2020). Regarding this, investors have a significant role to accelerate the change to a green and clean infrastructure (Horster, 2018; Ha et al., 2016; Kameyama et al., 2016).

2.2 Definition of Infrastructure and relevance to Net Zero

A study by the Global Infrastructure Hub (2020) highlights the growth of climate change as the greatest perceived risk across all industries, including infrastructure. In this context, there is a need to take a closer look at the term and meaning of infrastructure as well as the coherence between net zero and infrastructure. 'In the Organisation for Economic Co-operation and Development (OECD) reporting system, "infrastructure" refers to the sectors of water and sanitation, energy generation and support, transport, and communications' (Wright et al., 2018: p.8). Additionally, a sustainable infrastructure, which is of importance in times of net zero, (Williams et al, 2021; Griffith-Jones & Leistner, 2018) 'is socially, economically and environmentally sustainable' (Bhattacharya, 2016: p.2).

Sustainable infrastructure has a major impact on the achievement of the Paris Agreement and the Sustainable Development Goals (SDGs) from the United Nations. To fulfil the Paris Agreement and the SDGs, the main objective for investments in new infrastructure should be the achievement of net zero emission (Williams et al., 2021; Wright, 2018; Griffith-Jones & Leistner, 2018; OECD, 2017). It is of great importance for the infrastructure sector to reduce greenhouse gas emissions. New investments should shift from fossil infrastructure to a renewable one (KPMG, 2021; Volz, 2018). In 2017 the OECD published a study stating that 60% of the world's GHGs is caused by existing infrastructure. This demonstrates the major impact and need of net zero infrastructure to achieve the Paris Agreement (OECD, 2017). In the same study, the OECD (2017) identifies the most important changes in terms of net zero infrastructure investments in energy, mobility services and buildings.
A building which requires minimal energy can be defined as a nearly zero energy building. These kinds of buildings take a substantial part of their energy from renewable energy resources produced on-site or nearby the corresponding building (Alawode & Rajagopalan, 2019). Therefore, a net zero building has no external energy requirements and gets all its energy

from renewable energy sources. By focusing on net zero buildings, building infrastructure could result in a decrease in GHGs of up to 35%. These reductions are still considered possible even in light of population growth and consequential building growth (Alawode & Rajagopalan, 2019). The research of Williams et al. (2021) also underlines the fact that achieving net zero infrastructural emission targets is not expected to result in a loss of growth. Instead, it can be seen as a major opportunity to improve infrastructure while protecting the environment (OECD/ The World Bank/UN Environment, 2018).

The relevance of net zero infrastructure is also illustrated by the fact, that many developing countries are more exposed to climate risks. Especially Asian countries like Bangladesh, Vietnam, Thailand, and the Philippines have been extremely affected by climate change in recent years. Therefore, great investments in climate-neutral infrastructure across the vulnerable countries are needed. But since climate change is a worldwide challenge, especially the industrial countries are called to support those climate-vulnerable counties. Without their support, the goal of net zero infrastructure will be unattainable for developing countries due to a lack of resources (Betzold & Weiler, 2018; Ha et. al, 2015; Volz, 2018).

The investment in net zero infrastructure will support the fight against poverty as well as an increase in human well-being, sustainable economic growth, employment, and international trade (Wright, 2018; Griffith-Jones & Leistner, 2018; OECD, 2017; Bhattacharya, 2016). Moreover, promoting net zero infrastructure can lead to another beneficial side effect. It serves as a model for other sectors and can trigger a positive influence on sustainable development across industries (The Export-Import Bank of China, 2016).
To conclude, the importance of net zero infrastructure is therefore undeniable, but as of now, the investments made are insufficient (OECD, 2017; Global Infrastructure Hub, 2020; Thuard et al., 2019; AIIB, 2019).

2.3 Financing methods of Net Zero Infrastructure

The transition to a net zero infrastructure to reach the Paris Agreement requires green financing. Therefore, various financing methods and the redirection of investment flows are required (Carney, 2020). The estimation of the financing gap for infrastructure worldwide is $15 trillion by 2040. The infrastructure financing gap describes the gap between planned investments and the requirements to provide a proper infrastructure (Global Infrastructure Hub, 2020). According to the World Bank (2015) the estimated infrastructure financing gap in Asian developing countries is up to $1.5 trillion per year. But the benefit of low-carbon infrastructure worldwide is estimated at $26 trillion in total by the end of the decade compared to the current high-carbon infrastructure (Carney, 2020).

Since the lifespan of infrastructure is often several decades, all investments in infrastructure made today have a major influence on the future and the achievement of climate protection goals like the Paris Agreement. To reach this agreement and handle the climate crisis, only net zero infrastructure should be supported (Di Leva, 2015). Therefore, green finance plays an important role to support such net zero infrastructure projects. Environmental aspects like pollution or greenhouse gas emission as well as climate change-related aspects including energy efficiency and renewable energies are addressed by green finance (European Banking Federation, 2017).
This leads to the assumption that it is necessary to focus on the financing factor of infrastructure in times of net zero. The finance source can come from a public as well as a private origin (Brunner & Enting, 2014). The different funding options for infrastructure finance are illustrated in the following diagram.

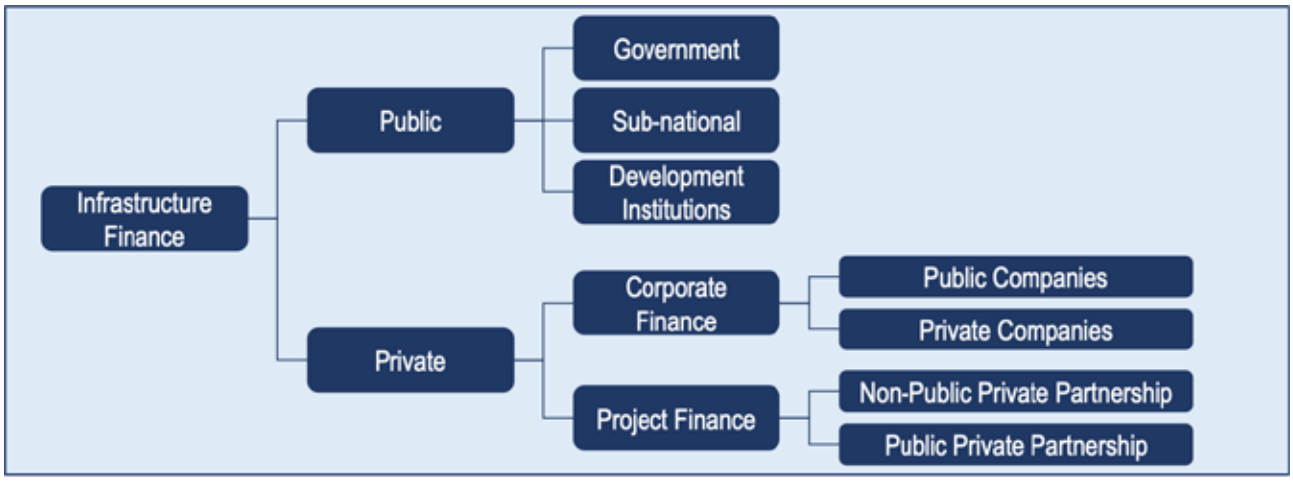

Figure 1: Sources of Infrastructure Finance (Author's illustration based on Volz, 2018; Kameyama et al., 2015)

The figure shows the main categories of infrastructure finance and the differentiation between public and private sources of finance. With these instruments a substantial investment has to be made to close the gap and to fulfil infrastructure requirements in times of net zero. As mentioned above, developing countries account for a large share of the total financing volume. Sources of infrastructure finance especially in these economies are satisfied by government budgets, private finance and also multilateral or national development banks (Volz, 2018; Ha et al., 2016; Kameyama et al., 2015). In addition to the financing function, MDBs play an important role in bringing together financiers, offering technical assistance or knowledge, ensuring the social economy orientation of projects, and providing protection against political risks. Because of that, MDBs will rise in importance because of the COVID-19 pandemic (AIIB, 2020; IsDB, 2020; European Banking Federation, 2017). Due to these aspects, conducting interviews with development banks can lead to valuable insights related to infrastructure financing. The following research will focus on new trends, challenges, and solutions regarding financing net zero infrastructure.

3. Analytical Framework

To create an analytical framework, semi-structured interviews with experts were carried out for this paper. Interviews in general are a type of qualitative research (Jamshed, 2014; Queirós et al., 2017; Kallio et al., 2016). Qualitative research involves the collection and analysis of non-standardised data. The goal is the generation of hypotheses and ideas, rather than analyses or exact measurements (Kuß et al., 2014). There are two major types of interviewing, which are structured interviews as well as unstructured interviews. While structured interviews use questionnaires that are standardized and predetermined, unstructured interviews only use keywords and topics, but no questions (Bell, Bryman & Harley, 2019). Semi-structured interview strategy can be defined as a special format of unstructured interviews. The main purpose of this concept is to gather information on the same topics in an informal environment (McIntosh & Morse, 2015; Holloway & Wheeler, 2010; Queirós, et al., 2017).

When comparing semi-structured interviews with other survey formats, there are several advantages and disadvantages. Initially, compared with structured interviews, semi-structuring requires a lot of time regarding the interview preparation and the duration itself, but also for the longer verification process to extract the comparative information. Due to this time aspect, the relative costs are also higher compared to a structured interview (Queirós, et al., 2017). However, by using the semi-structured research method based on participant responses, follow-up and in-depth questions are possible. Through this opportunity, more detailed and insightful information is obtained from each participant. (Queirós, et al., 2017; Galletta, 2012; Polit & Beck, 2010). In general, it should be mentioned that in comparison, fewer participants are needed to receive relevant insights and deeper information about the questions asked. Nevertheless, due to the limited number of participants, the selection of them should be done carefully to avoid bias (Queirós, et al., 2017).

As already mentioned, development banks have a significant role in financing net zero infrastructure. Therefore, various national as well as multilateral development banks worldwide were contacted. With specialists consulted from these institutions, a thirty-minute interview including seven questions was conducted via an online video.

4. Financing Infrastructure

The following chapter is based on findings of several interviews with multilateral and unilateral development banks and the literature. In order to ensure the confidentiality of the interviews, no source information can be provided. The findings of the trends, challenges and solutions are shown in a figure at the beginning of each subchapter and the most relevant points are explained afterwards.

4.1. Current trends in times of Net Zero

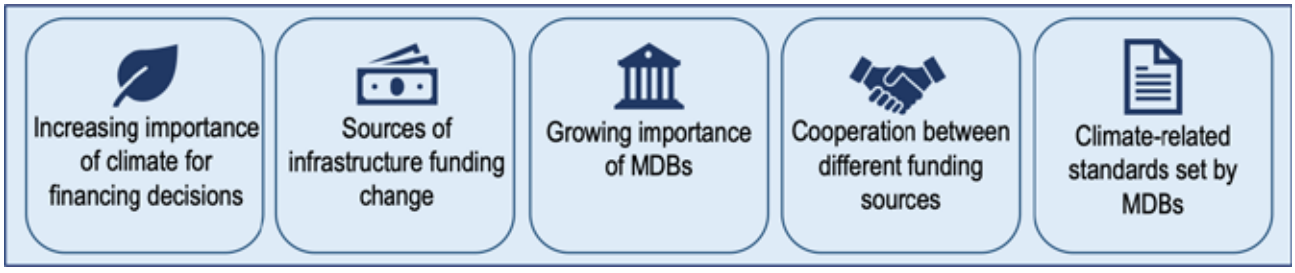

Figure 2: Collection of current trends in Infrastructure Financing (Author's illustration based on KPMG, 2020a, 2020b; Griffith-Jones & Leistner, 2018; AIIB, 2021; Milken Institute, 2017, and conducted interviews)

As a first trend in infrastructure financing all interview partners mentioned the increasing importance of climate neutrality for investment decisions. Investments in sustainable projects are rising significantly worldwide (KPMG, 2020a). One of the reasons mentioned was the massive pressure from politics and other stakeholders, resulting, among other factors, from the upcoming COP26 summit in November 2021. As a consequence, many development banks no longer finance projects based on fossil energy or producing it, for example coal or gas power plants. Development banks are pioneers in this aspect and serve as a role model for commercial banks and further investors.

It was mentioned that the sources of infrastructure funding are changing, as public funding is often insufficient. Therefore, private funding needs to be leveraged. This includes green bonds, pension funds, private partnerships, and investments from donor-funded organisations and insurance companies (Milken Institute, 2017; KPMG 2020b). In addition, infrastructure is privatised in many developing und emerging countries to stimulate investment (KPMG, 2020b).

Furthermore, the growing importance of MDBs was addressed, as most of the new infrastructure is established in developing and emerging countries. MDBs ensure that enough private investment is provided for sustainable infrastructure in the respective countries (Griffith-Jones & Leistner, 2018). In countries where investment risks are particularly high, for example due to political instability and currency risks, MDBs can strengthen projects to help improve their positioning for private investors at later phases of the projects (Milken Institute, 2017). Also, MDBs bring together different financiers, ensure the social alignment of projects as well as hedge against political risks. As an example, the steadily increasing budget of these banks, which are mostly funded by governments, was brought up in the interviews. Collaboration between different funding sources was identified as another trend in infrastructure financing. For example, several national development banks from Europe collaborate. MDBs also work together with national development banks or NGOs. By working together, larger projects can be implemented that otherwise would be infeasible. As an example of cooperation, the establishment of mangrove forests on coasts as a natural protection against tsunamis was stated.

4.2. Crucial challenges in times of Net Zero

Figure 3: Collection of current challenges in Infrastructure Financing in times of Net Zero (Author's illustration based on KPMG, 2021; KPMG, 2020a; Wright et al., 2018; Volz, 2018; Milken Institute, 2017, and conducted interviews)

In general, there must be a differentiation between project specific problems and systematic problems. Regarding systematic problems, almost every interviewed specialist identifies the lack of international standard structures and policies as a main challenge. Due to different standards worldwide, MDBs struggle to define net zero investments and to act accordingly (KPMG 2020a).

The lack of investor capabilities and the resulting funding gap leads to further difficulties for MDBs. As of

now, most net zero infrastructure investments are financed by public funds. MDBs note that private investors should finance in larger volumes than currently done in order to close the funding gap (Volz, 2018). One interviewee states that the funding gap is not the main problem. Private infrastructure projects fail more often due to a lack of structure, inefficiency, and corruption in the respective countries - especially in developing countries. On top of that, more challenges arise due to new occurring risks in times of net zero. Especially the private sector is exposed to more risks because of less risk-bearing capacities than bigger public institutions. But also, MDBs struggle to cope with emerging risks like currency risks, technological risks, political violence, or contract disputes (KPMG, 2021, Milken Institute,2017). Current policies are insufficient to deal with the risks associated with climate change and investment (Wright et al., 2018).

Along with the mentioned challenges, it is important to note that different countries struggle with different individual situations. Therefore, the relative magnitude of the difficulties varies across countries and regions.

4.3. Solutions to overcome the challenges

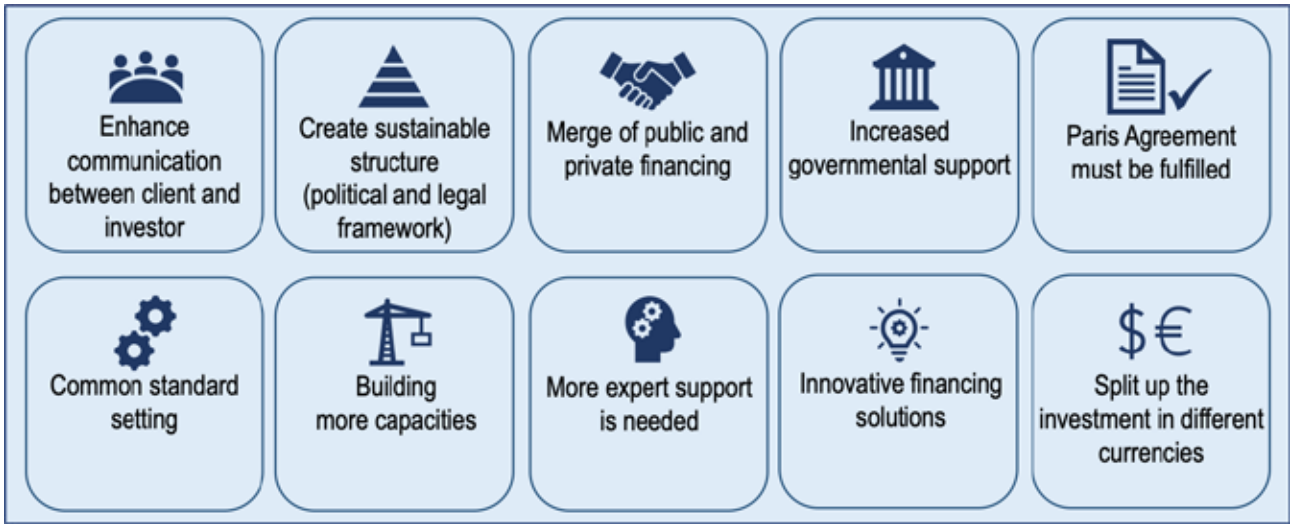

Figure 4: Collection of solutions in Infrastructure Financing (Author's illustration based on Volz, 2018; Griffith-Jones & Leistner, 2018; Milken Institute, 2017; Wright et al., 2018; Buchner et al., 2019; KPMG, 2020a; Singapore Institute of International Affairs, 2020, and conducted interviews)

As a solution approach, improved communication between customer and investor was mentioned. Since there is a lack of standards, a consistent agreement between the customer and the financing department is necessary. Furthermore, a common language should be developed. A shared understanding among stakeholders about sustainable infrastructure can lead to more funding equity, which is essential to close the critical gap in infrastructure financing. It can be concluded that communication contributes to the simplification of the agreement between the contracting parties (Singapore Institute of International Affairs, 2020; Volz, 2018; Wright et al., 2018).

Cooperation between public and private funding represents an additional solution for overcoming the challenges, which was identified by almost all interviewees. Currently, a major part of infrastructure financing is provided by public funds. Also, the public sector can take risks more easily than the private sector. Therefore, development banks should take

a certain risk, especially in terms of new technologies (Buchner et al., 2019). To close the financing gap and ensure sufficient private investment in sustainable infrastructure, effective incentives and clear mandates for development banks are needed as well (Griffith-Jones & Leistner, 2018).

Moreover, innovative financing solutions should be considered, and the impact of currency risks should not be underestimated. The respondents from development banks also mentioned that the financing portfolio should be extended to loans, grants, technical assistance, green bonds, and blended finance. To minimize the currency risk, different currencies should be used for projects (Wright et al., 2018). A diversified portfolio and structural reforms are key to attract private and institutional investors as well (Milken Institute, 2017).

A further important solution which was mentioned is the creation of common standards regarding sustainability. Political and legal frameworks are needed to facilitate the implementation of projects. A positive investment climate encourages the entry of further investors to finance infrastructure. In the context of structure, transparency for all participants is essential (Griffith-Jones & Leistner, 2018; Wright, 2018)

5. Summary and Conclusion

When it comes to financing infrastructure in times of net zero, different countries face various individual circumstances. Nevertheless, there are common trends and challenges which can be identified. To overcome these difficulties, suitable solutions are required. By conducting five qualitative interviews with different development banks, these trends, correlating challenges, as well as suitable solution were discussed. The main results of the essay include the following issues.

Figure 5: Main findings of trends, challenges and solutions in infrastructure financing (Author's illustration based on figure 2-4)

For future development, the COVID-19 pandemic will affect infrastructure finance. The impacts and disruption for different regions worldwide differ in magnitude and are delayed in time. To counteract this, developing banks offer financial and vaccination aid, that significantly shifts the banks' previous portfolios. One interviewee appeals for lessons to be learned from international cooperation during the pandemic to stop climate change. According to this, banks need to adapt to the renewed situation and create new opportunities to overcome this crisis and provide the right financing opportunities. Future research should focus on impacts of COVID-19.
In conclusion, financing infrastructure in times of net zero is a complex and volatile field. Therefore, it is important for development banks to keep up with current trends and realize solutions to overcome challenges.

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