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O Banco Nacional de Desenvolvimento Econômico e Social (BNDES) e a economia verde: desembolsos de recursos no contexto das mudanças climáticas

The National Bank for Economic and Social Development (BNDES) and the green economy: resource disbursements in the context of climate change

El Banco Nacional de Desarrollo Económico y Social (BNDES) y la economía verde: desembolsos de recursos en el contexto del cambio climático

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Resumo: O financiamento climático é um dos desafios colocados para as medidas de mitigação e adaptação às mudanças climáticas. A atuação dos bancos de desenvolvimento constitui um instrumento relevante para a promoção do financiamento de políticas com fins ambientais. O presente estudo propõe uma discussão sobre o papel do Estado e do Banco Nacional de Desenvolvimento Econômico e Social (BNDES) no financiamento da transição verde no Brasil. Este artigo tem como objetivo analisar os desembolsos desse banco entre 2016 e 2020, a fim de

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identificar como seus recursos foram distribuídos para financiar atividades e projetos relacionados à sustentabilidade. Verificou-se uma redução nos desembolsos de recursos para a economia verde, apesar do esforço de incorporação da sustentabilidade em seu comportamento estratégico.

Palavras-chave: Financiamento verde; bancos públicos; sistema financeiro brasileiro; mudanças climáticas; transição verde.

Abstract: Climate financing is one of the challenges posed for measures to mitigate and adapt to climate change. The action of the development banks, is a relevant tool for promoting the financing of policies for environmental purposes. The present study proposes a discussion on the role of the State and the National Bank for Economic and Social Development (BNDES) in financing the green transition in Brazil. This article aims to analyse the disbursements of this bank between 2016 and 2020 to identify how their resources were distributed to finance activities and projects related to sustainability. It was verified a reduction in the disbursements of resources for the green economy in the face of its effort to incorporate sustainability into its strategic behaviour.

Keywords: Green financing, public banks, Brazilian financial system, climate change, green transition.

Resumen: El financiamiento climático es uno de los desafíos que se plantean a las medidas de mitigación y adaptación al cambio climático. Las acciones de la banca de desarrollo son una herramienta relevante para promover el financiamiento de políticas ambientales. En este sentido, el presente estudio propone una discusión sobre el papel del Estado y del Banco Nacional de Desarrollo Económico y Social (BNDES) en el financiamiento de la transición verde en Brasil, entre 2016 y 2020, a través de sus desembolsos. Se identificaron cambios en el desempeño de estos recursos resultantes de nuevas estratégias de la propia institución. Durante el período propuesto, hubo una reducción en los desembolsos de recursos para la economía verde a pesar de los esfuerzos de la institución por incorporar la sostenibilidad a su comportamiento estratégico.

Palabras clave: Financiamiento verde, banca pública, sistema financeiro brasileño, cambio climático, transición verde.

1. Introduction

The World Meteorological Organization (WMO) predictions indicate that the average global temperature will be at least 1 ℃ above pre-industrial levels by 2024 (UN, 2020). Nevertheless, according to records, the period between 2011 and 2020 was considered the hottest in history. Projections of this scenario show that global warming and the corresponding effects are the main challenges for the 21st century (UN, 2021).

Global warming impacts the frequency and intensity of extreme weather events (hurricanes, tsunamis, storms, droughts), which, in turn, has consequences such as the destruction of cities and infrastructure, problems in the provision of public goods, food, and nutritional insecurity (OECD,2018). Given the complexity of these phenomena and their impacts, mitigation and adaptation policies have to be agreed upon with the objectives of a green transition, in which the investment needs are eminently long term, such as infrastructure, improvement in the global energy system, and incorporation of new technologies, among other investments to adapt to climate change (Stiglitz, 2020; Mazzucato, 2017).

In addition to reconciling the great challenge of global warming with the mitigation of its effects, ensuring citizens' basic needs is highlighted. According to a study published in the journal Nature (O'neill et al., 2018), in terms of resource use, no country meets the basic needs of its citizens on a globally sustainable level. The authors argue that for physical needs such as nutrition, sanitation, access to electricity, and the elimination of extreme poverty to be met universally and to ensure a standard of living that reconciles quality with less commitment of the planet's resources require the use of two to six times more resources.

Therefore, thinking about the mitigation and adaptation strategies of the planet against climate change should be understood as state policy involving various sectors (public, private, civil society) in the sense of providing the coordination of structural policies, new financing structures, new productive structures, and new forms of consumption (Crocco and Feil, 2020; Mazzucato et al., 2020). Dafermos (2023) deepens the analysis on the climate green finance by drawing attention to the 'global climate justice'. This term drew attention to different kinds of the supply, demand and magnitude of financing for the green transition, as well as the degree of exposure to the effects of climate change; distinct stages of development of the financial system and formal and informal institutions as a whole are very different between the Global South and North[4].

In this sense, climate change brings with it the challenge of planning strategies that allow medium- and long-term measures and solutions to be introduced to mitigate the consequences of global warming and to enable the transition to a low-greenhouse gas (GHG) economy (Leal; Viana, 2019; Chenet, 2019). The effort to construct practices and solutions to confront climate crisis has been transformed into goals and proposals for green recovery, like the *Green New*

[4] According to Dafermos (2023): "it is not only due to their differentiated responsibilities, but also due to the fact that countries in the global South are in a different developmental stage and have a more limited policy space due to their subordinate position in the global financial architecture".

Deal[5] (Grankow, 2020; Carvalho; Quinalha, 2020). Such commitment has also been translated into agreements and treaties between countries based on contributing to reducing damage to the environment, for example, the Paris Agreement.

Thus, instruments such as the *Nationally Determined Contributions* (NDC) propose that every five years, each signatory country of the Paris Agreement presents actions that will be performed to reduce GHG emissions. At the national level, they can be seen as tools for incorporating the issue of climate change in state policies. Thus, the structuring of treaties such as the Paris Agreement boosts the commitment of each member country in the fight against global warming and pays attention to the need to structure a financial and technical support and capacity building for countries (UNFCC, 2021).

From this scenario, a new financing structure for actions to mitigate and adapt to the effects of climate change becomes essential for the effective reduction of GHG emissions and the transition to a green economy (UNFCC, 2021). This is because the adoption and promotion of an agenda of commitments to combat climate change raises the need for innovation and medium- and long-term financing in the green transition process, where a low impact on the environment is substituted for a polluting technological standard (Stiglitz, 2020; Leal; Viana, 2019).

Works such as Araújo and Cintra (2011); Deos and Mendonça (2010); Hermann (2010) highlighted the role of public banks, especially the development banks, in order to provide long-term financing (which includes investments that involve more uncertainty), play an important role in the process of adapting to the green transition (Stiglitz, 2020; Mazzucato, 2017). The presence of financial institutions with adaptive and resilient development is a tool in coping with events related to climate issues.

Studies analyzing the green has expanded, but there are still relatively few of them which analyses the role of the BNDES in this process. Given the participation of Brazil in the Paris Agreement and the history and performance of public development banks in the Brazilian economy, this study is justified. This paper aims to verify how the National Bank for Economic and Social Development (BNDES) - the main financial agent in providing long-term resources in Brazil - has distributed the resources destined for the mitigation and adaptation of climatic effects. This questioning is based on the hypothesis that changes occurred in the last ten years,

[5] The Green New Deal, according to Grankow (2020), can be understood as a set of actions aimed at economic recovery based on sustainable growth models with a focus on protecting the planet's climate. For more information, see Grankow (2020) and Carvalho and Quinalha (2020).

especially in terms of the strategic positioning of the BNDES (IBASE, 2017; Slivnik and Feil, 2020; Torres Filho et al. 2021) may have influenced the bank's performance in financing activities and projects to combat climate change.

Crocco and Feil (2020, p. 06) emphasize that governments, central banks and financial systems need to adapt to these changes, and financial supervisors "*can and should actively guide market actors in a clear direction towards a managed green transition to ensure that a scenario that minimizes damage to the financial system and the economy in general in the future is the scenario that actually occurs*".

Compared to other emerging countries, especially China, Brazil has tentatively advanced in terms of proposing an agenda for the green transition. In the last five years, there has been growth in the issuance of green bonds, especially by the BNDES (De Deus et al., 2021); the Central Bank of Brazil launched the 'BC #Sustainability Agenda' in September 2020. Although important, the measures are far from a country's strategy for green financing; as there is no defined and aligned arrangement between economic policies, industrial and environmental protection has compromised ability to use a climate policy as an inducer of Brazilian economic development. Consequently, this lack of policy coordination can increase the investment gap for the green transition process in Brazil (Grankow, 2020; Leal; Viana, 2019).

From this context, the main objective of the present study is to identify how the BNDES has distributed the resources of its programs, lines of financing, and funds aimed at addressing climate change and the green transition of the economy in Brazil between 2016 and 2020. The choice of the period is associated with Brazil's adherence to the goals of the Paris Agreement.

Also, we aim to identify the programs, funds, and lines of financing developed by the BNDES that are related to the green economy and to analyse its disbursements based on the purpose of investments. The structure of this study was divided into four sections, in addition to this introduction. In the second section, we propose a reflection on the instability of the financial system in the face of climate change is given and the role of the state and public development banks in climate financing is explored. The third section presents an analysis of the performance of BNDES disbursements for climate change and the green economy; and finally, the final considerations.

2. The instability of the financial system in the face of climate change

The incorporation of climate issues in the debate of the financial system occurred late compared to that in other segments of society (Chenet, 2019). One of the explanations for this delay in managing the climate impact in their activities is based on the unpredictability of the dimension that the climate effects themselves will bring to the sector.

The advancement of sustainable finances collides with the structural barriers of the financial system, such as short-term and high-profit behaviour, which contrasts with the need for long-term investment and financing in actions to promote the green transition (Carney, 2015). The mismatch between the time horizon of sustainable investments and the need for quick results of policy-makers and investors is defined by Carney (2015) as the "tragedy of the horizon", which it is defined as the mismatch between the maturation period of a green project and the period in which the government or private investors require their profits or project externalities. It refers to the unpredictability of the occurrence and dimension that a climate event brings and is one of the elements that explain the slowness of the financial sector in incorporating climate issues in the management of investment risks.

Given the short time of action of political decision-makers, authorities and investors and the unpredictability of the occurrence of climatic events, the "tragedy of the horizon" is established in the debate on the instability of the financial system in the face of climate change and the green transition. Policies that can assist in the process of transition to a low GHG emission economy should have an extended time horizon, as the impacts of climatic events can be felt for decades and require the construction of proposals for continuous action (Bolton et al., 2020; Carney, 2015; 2018).

Furthermore, Bolton et al. (2020) emphasize the need to align financial flows for green assets. However, a better understanding of climate-related risks is key to "making funding flows consistent with a path for low greenhouse gas emissions and climate-resilient development" (Bolton et al. 2020, p. 21) of this general problem, and assessing the effects of climate change and green transition on capital risk management is a very difficult task. Traditional models of risk assessment and management are performed through a probabilistic approach, which extrapolates past results. These models are inadequate for addressing the uncertainty that the

risks of climate change carry (Bolton et al., 2020). In view of these authors, the risks of climate issues may affect financial stability assumes the form of green swan risks[6].

For Carney (2015, 2018), climate change can affect financial stability through three transmission channels: physical risks, responsibility risks, and transition risks. Understanding how these risks are structured is crucial to obtaining positive results in addressing climate effects. Physical risks are characterized as risks arising from the effects of climatic events that damage private property and cause production interruptions, such as floods, droughts, storms, and sea level rise. (Carney, 2015). The risks of liability originate from the compensation of those who were affected by losses and/or damage caused by climatic events by those responsible for such consequences, as in the case of insurance companies. In turn, transition risks are related to the impacts that a sudden adjustment to a low GHG emission economy can bring due to changes in policy and technology that may result in the reassessment of asset value (Carney, 2015; 2018).

From Carney (2015), the structure of central banks and the instruments available to policy-makers should be used to build frameworks that help the market itself adjust based on the improvement in information available to investors and with the adoption of standards and metrics for the disclosure of information and data on climate issues. Thus, the response to climate issues must be coordinated by governments, requiring coordinated action between the public spheres.

Central banks have limitations that can lead to adverse situations. The adoption of a strategic stance based on "wait and see" may lead an institution to act as a regulator of last resort for the green transition, bearing the losses of the financial system in the purchase of assets devalued as a result of a climatic event. In this sense, central banks should assume activism in the coordination of broad and associated changes so that the mandates of financial and price stability are based on three paradigms to combat the climate issue: risk, time horizon, and systemic resilience (Bolton et al., 2020). This study indicate that central banks can promote a long-term vision by integrating sustainability criteria in their portfolio, thus minimizing the tragedy of the horizon, in addition to performing the integration of climate risks in prudential regulation, including new modelling approaches and analytical tools to explain the uncertainty and complexity of investments in the climate issue.

[6] Green swan risks are similar to black swans, as they can have several formats and there is no possibility of predicting their occurrence, and must be understood as potentially and extremely disturbing events from a financial point of view, to the point of being able to cause the next systemic financial crisis (BOLTON et.al, 2020).

The time horizon of climatic events is greater than the time of action of policy-makers imposes itself as a driver of instability in the financial system (Carney, 2018). From this, Carney (2018) classifies the sudden movement of transition to an economy with low GHG emissions, which generates destabilization in the financial system due to changes in the assets and liabilities of financial institutions. That is, success in the green transition can generate a paradox where success is a failure (Feil and Feijó, 2022). That is, a rapid movement towards a low-carbon economy increases the risk of transition and the amount of stranded assets, impairing financial stability. A general reassessment of the perspectives as the climate-related risks are reevaluated could destabilize the markets, triggering a cycle of losses and leading to a persistent tightening of financial conditions, which the author called the Minsky climate moment (Carney, 2018).

According to Chenet (2019), the difficulty found in the financial sector in the development of climate risk pricing methodologies in investments is linked to the unpredictability in terms of the scale and speed of phenomena that can be triggered by climate change due to the lack of precedents and data that allow estimating the reaction of economies and the financial system itself. From this perspective, the complexity that involves the management and calculation of financial risks, together with the multiplicity of factors on the climate issue, tends to increase uncertainty, reinforcing the unpredictable nature of climate financing.

Chenet (2019) highlights that the greater probability that the risks related to climate change are of an extreme nature compared to other events such as financial crises and the limited rationality of risk analysis models of the financial sector, which cannot address the complexity that involves such risks, can also be identified as obstacles to the pricing of the climate issue by the sector. In this sense, the author exemplifies that the efficient market hypothesis - used since the 1970s as a basis for financial risk management - can reinforce the incorrect pricing of climate risks, generating two problems: the weakening of market orientation capacity by financial institutions and their exposure in their operational processes.

The creation of conditions for the mitigation of climatic effects and the green transition to occur requires a break with the metrics, methods, and ideologies practised that are not able to align with the climate issue and the economic issue at the microeconomic level, in addition to revealing the need for a macroeconomic policy in line with a climate policy led by the state (Mazzucatto et al., 2020; Mazzucato, 2017). According to Chenet, Hilke, and Duan (2017), the climate issue impresses the character of reconversion in the scope of actions that the financial

sector develops. It is about creating and sustaining the flow of investments in sustainable activities to mitigate the effects of climate change and to interrupt financing and investments in brown economic activities that correspond to the worsening of global warming.

Thus, what is proposed is the sharp decrease in financing and implicitly the of the economic sectors that have as basis for action and support the use of highly polluting techniques and practices that influence the acceleration of global warming, for example, the fossil fuel sector. That is, what is presented to the financial sector is not only linked to the expansion of its investment capacity in combating climate effects, which, as Chenet, Hilke, and Duan (2017) explain, needs to be much larger and more diverse than what is found in its current state. The climate issue exposes the very fragility of the financial sector in creating skills that are able to guarantee its stability through events that have no history of comparison, thus focusing on its ability to react and consequently adapt.

From the perspectives presented, it becomes noticeable that the discussion about climate risks and the instability of the financial sector exposes the resilience capacity of the financial system itself. Regarding the search for a path that materializes the green transition, the financial system is one of the main actors necessary for this process to actually happen; however, the slow development of methodologies that assist in the pricing of climate risks in financial investments ends up exposing the system itself to the unpredictability of these risks.

2.2. The role of the state and development banks in climate funding

The funding capacity available to an economy is one of the main tools for economic growth and development. In this sense, the presence of solid financial institutions with strategic alignment to help economic agents with their financial needs is important to ensure the sustainable dynamics of the growth process.

Public financial institutions have a history that goes back to the actions within the scope of the Bretton Woods consensus and the Marshall Plan due to the action of such institutions in the promotion of economic growth and development in the period after the Second World War. In this sense, since the 1950s, public banks have been relevant in the economies of developed and developing countries (Mazzucato; Penna, 2015).

The role of public banks in the economic scenario is mainly justified in the economic literature through market failure theory (MFT) (Mazzucato; Penna, 2015). As stated by these authors, when there is information asymmetry and/or agents do not behave competitively, the

conditions that support the "first fundamental theorem" of welfare economics are violated, and thus, the market does not allocate resources efficiently. From this scenario, market failure emerges, which is a condition necessitating state intervention, while the sufficiency for state action is the result of the evaluation in which it is found that the gains from the intervention are higher than the costs related to government failures (Mazzucato; Penna, 2015).

This article highlights another essential role of the public banks, in a more structural view of their performance: they are essential instruments of public policy and fundamental for financing the catching up and green transition. Tackling the climate crisis, the economy's biggest challenge for this century, needs long-term investment in innovative new sectors and nascent industries. A structural approach gives a more significant role to public banks, advocating their function beyond market failures. They are essential because long-term decisions are driven by non-probabilistic uncertainties. Their performance is not limited to complementing private institutions or acting countercyclically (Andrade; Deos, 2009).

The interpretation of structural change addresses alternative ideas that are complementary to the theory of market failures and are not aggregated around a single theoretical framework. Public banks assume different formats and functions, depending on the level of development of the country and the institutional, structural, legal, macroeconomic and political framework (Feil; Feijó, 2022).

As Carney (2015) and Bolton et al. (2020) point out, the issue of the "tragedy of the horizon" is one of the greatest challenges for mitigating and adapting to climate change because the need for financing such that for infrastructure involves long-term investments with uncertainty. This challenge is imposed by several aspects of the performance of public banks, which go beyond the perspective that such institutions act only as resolvers of market failures and are based on the historical-economic process of countries (Mazzucato; Penna, 2015).

When analysing the process of creating the main public banks around the world and taking as an inflection point their role during the occurrence of the financial crisis that began in the 2007/2008 biennium, Mazzucato and Penna (2015) identify four categories of action of these banks: countercyclical action, financing of long-term projects for the industrialization and development process, innovation, and promotion of investments in solutions to complex problems of the economy, such as climate change. In line with this identification, when considering the paradox between the need for long-term funding on climate issues and the short-termism of private financial institutions.

The *United Nations Conference on Trade and Development*-UNCTAD (2020) points to four observations that should be weighed by development banks and/or public banks formulating action strategies, which are as follows: i) the catalytic and long-term capacity of public investments compared to those of private origin; ii) the insufficiency of funding that public banks may suffer to maintain their operations; iii) the need for strategies oriented to meeting social changes, with a distance from speculative actions; iv) the need to join public banks with other financial institutions in a general system that supports inclusive and sustainable development.

Thus, the issue of funding the fight against climate change requires the planning action of the state, with the strategic use of public institutions, such as central banks and public banks, focusing on the adaptation of the financial system to physical and transition risks to an economy with low GHG emissions (Bolton et al., 2020; Carney, 2015; Mazzucato, 2017; Mazzucato; Penna, 2015; UNCTAD, 2020). One of the roles highlighted by Mazzucato and Penna (2015) that can be strengthened so that public banks invest in projects and actions focused on sustainability is that of leadership through challenges, as climate change imposes itself on society as a need for changes in technological paradigms.

Bhandary, Gallagher, and Zhang (2021) highlight development banks as a policy instrument that has an ability to mobilize finances and environmental integrity that can benefit small and medium-sized enterprises or neglected sectors; however, it presents vulnerability to political influence. The emphasis made by the authors in relation to the weaknesses and strengths of development banks corroborates the need for the state to plan the conduct of environmental policy.

From this perspective, Bhandary, Gallagher, and Zhang (2021), when comparing climate finance policies in practice, list the main characteristics of development banks: i) stability: stable, but its priorities are subject to the goals and objectives of the government; ii) simplicity: the registration process is simple; iii) transparency: information is usually ready and available on websites; iv) consistency and coordination: very consistent, highly coordinated with other policies; v) adaptability: can adjust their investment in portfolios according to government priorities.

The experience that development banks have in funding projects and economic activities that have an innovative process as a production base, for example, could expand their leadership capacity in challenges in the allocation of resources to projects, activities, and economic sectors that are oriented towards the construction of innovative solutions capable of mitigating and

combating the risks that climate change will bring. This type of orientation with challenges by public banks and/or development banks has the potential to induce the construction of a new vision by the different agents (public and private) and thus would reinforce the sustainability of the financing strategy (UNCTAD, 2020).

Strengthening development banks to provide investments towards the climate policy has the potential to increase the added value in terms of financing, mobilization and policy reform and creation of new markets (OECD, WB, UN ENVIRONMENT, 2018). Due to its characteristics and scale of performance, the DBs can provide financing for resilient and low-emission infrastructure projects in developing countries. In this way, BD's are important institutions to financing of innovative projects that deal with high uncertainty, which require large scale of resources and longer terms of investment and amortization. These kinds of financing can serve as proof-of-concept for specific technologies and investments, and business models in new markets (OECD, WB, UN ENVIRONMENT, 2018).

By mobilizing resources for sustainable projects, DBs have the potential to stimulate private and public investment to sustainable projects, as well as improve the risk-adjusted returns of renewable energy and sustainable transport projects through risk mitigation tools (OECD, WB, UN ENVIRONMENT, 2018). The action through policy reform and creation of new markets by the DBs in the fight against climate change is intended to eliminate specific barriers that can affect the investment of local governments, which can stimulate the creation of new markets that expand action to combat climate change (OECD, WB, UN ENVIRONMENT, 2018).

Therefore, as stated by Mazzucato and Penna (2015) the developmentalist role and the provision of social capital are likely to be complemented by the orientation of challenges in the sustainable financing of development banks, which are under the capital of a planning state with a focus on the coordination of the cognitive efforts of economic and social agents in directing their actions beyond the existing technological paradigms.

2.3. Results and discussions: BNDES disbursements to the green economy between 2016 and 2020

The Brazilian financial market can be considered as a 'bank-based' model, if we consider the weight of the banking system in the Brazilian financing structure. The segmentation of the Brazilian banking market is marked by two peculiarities: the presence of

large (and public) commercial banks (such as Banco do Brasil and Caixa Econômica Federal), and the development banks. In the latter case, the main one is the BNDES.

The BNDES is a federal autarchy created in 1952 with the objective of being the formulator and executor of the national economic development policy in Brazil. BNDES disbursements in the Brazilian economy are made through financing lines, programs, and funds, and it may combine more than one type of financial instrument, depending on the purpose of the financing operation. Since 2000, the Brazilian economy begins a growth cycle driven by monetary stabilization, the commodity boom and growth in Asian countries, especially China (Fontana and Gontijo, 2024). In line with this context and the Paris Agreement, sustainability has been part of the BNDES mission to promote the competitiveness of the Brazilian economy (BNDES, 2021).

In 2005, the socio environmental policy of the BNDES was approved, and in 2008, the bank defined its indicators of support for the green economy and thus was able to measure and improve its socio environmental performance. In 2009, the Environmental Area (AMA, for the acronym in Portuguese) was created, including the already existing Social Inclusion Area, and the Amazon Fund was launched. Subsequently, in 2010, the bank approved its Social and Environmental Responsibility Policy (PRSA, for the acronym in Portuguese), which establishes guidelines for the institution and is monitored by the Social and Environmental Sustainability Committee (CSS, for the acronym in Portuguese) created in 2014 (BNDES, 2017). Table 1 shows the classification of investments in the BNDES Green Economy indicator.

Table 1 - Classification of investments with the Green Economy indicator

Activities	Purposes
Renewable energies and energy efficiency	Stimulus for the generation of renewable energy (except hydroelectric plants above 30 MW), the use of fuels with lower carbon content, and the improvement in efficiency in the supply, distribution, and consumption of energy.
Hydroelectric plants above 30 MW	Support for hydroelectric power generation (power above 30 MW).
Public passenger transport	Support for urban mobility, the substitution of private transportation for public transportation, fleet modernization, and other initiatives to reduce the emission of greenhouse gases and local pollutants in collective passenger transportation.
Freight transport	Support for rail and maritime cargo transportation.
Water and sewage management	Expansion of access to basic sanitation services - water resources management and sanitation.
Solid waste management	Support for investments in the expansion and improvement in the collection, treatment, and disposal of solid waste, in addition to encouraging the recovery of materials.
Forests	Stimulation of reforestation, afforestation, and sustainable forest management, in addition to activities for the prevention, monitoring, and combat of deforestation.

Agricultural improvements	Support for investments that promote an increase in sustainable agricultural production and the recovery of degraded areas.
Adaptation to climate change and disaster risk management	Combating desertification and supporting regions affected by natural disasters or climate issues.
Other	Activities not included in the previous items.

Source: BNDES (2021).

Between 2008 and 2017, more than R $180 billion (US$ 32.48 billion)[7] was disbursed for investments in the green economy indicator. In this period, specifically starting in 2014, there was a reduction in disbursements made by the bank, as shown in Figure 1. In addition to the cyclical factor of the Brazilian economy, according to Teixeira, Maciel, and Besso (2020), the decrease in total disbursements coincides with changes in BNDES funding conditions, such as the beginning of the long-term rate (LTR) rule in 2018, which brought the rates offered by the BNDES closer to market rates.

It is worth noting that starting in 2016, the BNDES became the focus of an attempt at reform that aimed to decrease its participation in the supply of long-term credit, stimulating the role of the private sector. This renewed a neoliberal agenda that understood the bank as an obstacle to the development of long-term credit in the country (Fontana and Gontijo, 2024). Thus, the strong previous expansion of the bank's credit supply, which allowed the rapid adoption of a countercyclical policy in 2008-2009, was made possible in large part by contributions from the National Treasury. The BNDES received a total of R $416.1 billion (US$ 74.51 billion) in current values through Treasury loans made through the issuance of government bonds (Slivnik; Feil, 2017). Considering interest and corrections, the amount owed by the BNDES to the National Treasury reached its peak of R $526.8 billion (US$ 5.81 billion) in November 2016. Of the total borrowed, the BNDES has already returned the amount of R $409 billion (US$ 73.24 billion) to the National Treasury and still owes R $225 billion (US$ 40.30 billion), an amount to be returned over the next five years (Brazil, National Treasury Secretariat, 2019). This policy of early return of loans from the National Treasury drastically affects the ability of this agent to provide liquidity to the market.

According to Albuquerque et al. (2018), one of the main reasons for the significant increase in loans from the National Treasury to the BNDES between 2009 and 2014 is the Investment Sustainability Program (PSI). The federal government designed the PSI as an anti-

[7] According to the Brazilian Central Bank (BCB): 1 USD = 5.5841 Real/BRL on 22nd November 2021. In this article, all values are converted from Reais to Dollars using this exchange rate.

cyclical measure in the face of the effects of the 2007-08 crisis, aiming to resume investments in the face of the scenario of falling Gross Fixed Capital Formation (GFCF). In this sense, the authors emphasise that the BNDES demonstrated that its central performance is not autonomous but guided by the economic policy developed. In line with the author, to enable the stimulus to investment expansion, the federal government chose to lend funds to BNDES because the bank's traditional source of funds, the FAT (Workers' Assistance Fund), would not be enough to accomplish what had been delimited by the program. The authors believe the criticism involving the loans is related to PSI's extension, which initially would be valid during 2009 but was expanded until 2015.

Another issue addressed by the changes in recent years involves collecting long-term loans offered by the BNDES. The bank used the long-term interest rate (TJLP, for the acronym in Portuguese), which is a fixed rate that is historically lower than that charged by the market. In January 2018, the TJLP was replaced by the long-term rate (TLP, for the acronym in Portuguese). While the former was defined by the National Monetary Council based on the inflation target and a risk premium, the TLP is defined by the Broad Consumer Price Index (IPCA, for the acronym in Portuguese), plus the real interest rate of the five-year NTN-B (quarterly mean). The new rate is released by the Central Bank on a monthly basis.

Through this change, the rate charged by the BNDES is equivalent to the rates paid by the National Treasury in borrowing from the market. This change causes the basic interest rate charged by the BNDES to be higher than the TJLP and the Selic - the basic interest rate of the economy. This means that the rate is above the cost of funding commercial banks. Additionally, given that the rate is fixed in the market and no longer by the CMN, it oscillates according to the market in a pro-cyclical manner, hindering the countercyclical action of the BNDES (Torres Filho, 2018).

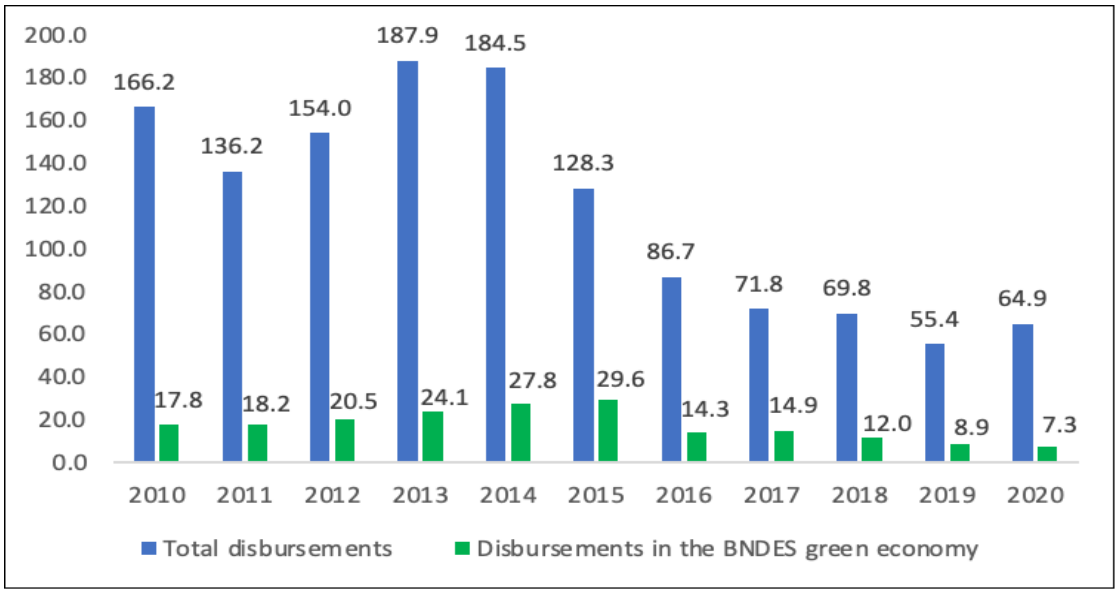
In addition to the replacement of the TJLP rate for the TLP, from April 2018, the presidency of the BNDES was changed highlighting that the role of the BNDES would act as a promoter of the financial and long-term capital markets, letting the market manage and support the demand for resources[8]. In the second hald semester of 2018, BNDES launched BNDES Guarantees, BNDES Credit Funds in Infrastructure, BNDES Corporate Credit Funds - products that have the objective of strengthening the capital market. In addition to these actions, for the first time, the bank issued Treasury Bills amounting to R$ 1.7 billion (US$ 0.30 billion) in May

[8]Speech given by Dyogo Henrique de Oliveira, at the ceremony for transferring the position of president of BNDES on 9th April, 2018. Available at: https://www.bndes.gov.br/wps/portal/site/home/imprensa/noticias/conteudo/discurso-dyogo-henrique-transmissao-de-cargo-de-presidente-do-bndes. Access: 29/09/2021.

2018, as part of the strategy for developing new market funding instruments in the bank's portfolio (BNDES, 2018).

As stated by Fontana and Gontijo (2024), the 'Brazilian model of development' cannot contain the process of deindustrialization and financialization based on the neoliberal agenda. Between June 2016 and December 2018, there was a period of restructuring of the policies practiced at the BNDES, with a focus on reducing the bank's role as a long-term financial intermediary in the Brazilian economy. This trend has been maintained by the Bolsonaro administration. For example, by the creation of the Government and Institutional Relationship Area (AGOV). This Agency has been used for the development of interlocution between the Federative Units with a focus on the concessions and public-private partnerships (PPPs). Another example is the Business Structuring and Divestment Area (AED). It was also created, focused on privatization, and the Investment Partnership Structuring Area (AEP) focused on concession and PPPs (BNDES, 2019).

Graph 1 - Total disbursements and disbursements in the BNDES green economy between 2010 and 2020, in billions of reais (R$), in real values (Base 100 = IPCA 2020).



Source: BNDES (2021).

In 2016, the Environment Area was transformed into the Public and Socioenvironmental Management Area, incorporating the social theme and assignments from other areas, with emphasis on the management of socio environmental activities, territorial development, public management, and productive inclusion (BNDES, 2017), which it is shown in Table 2.

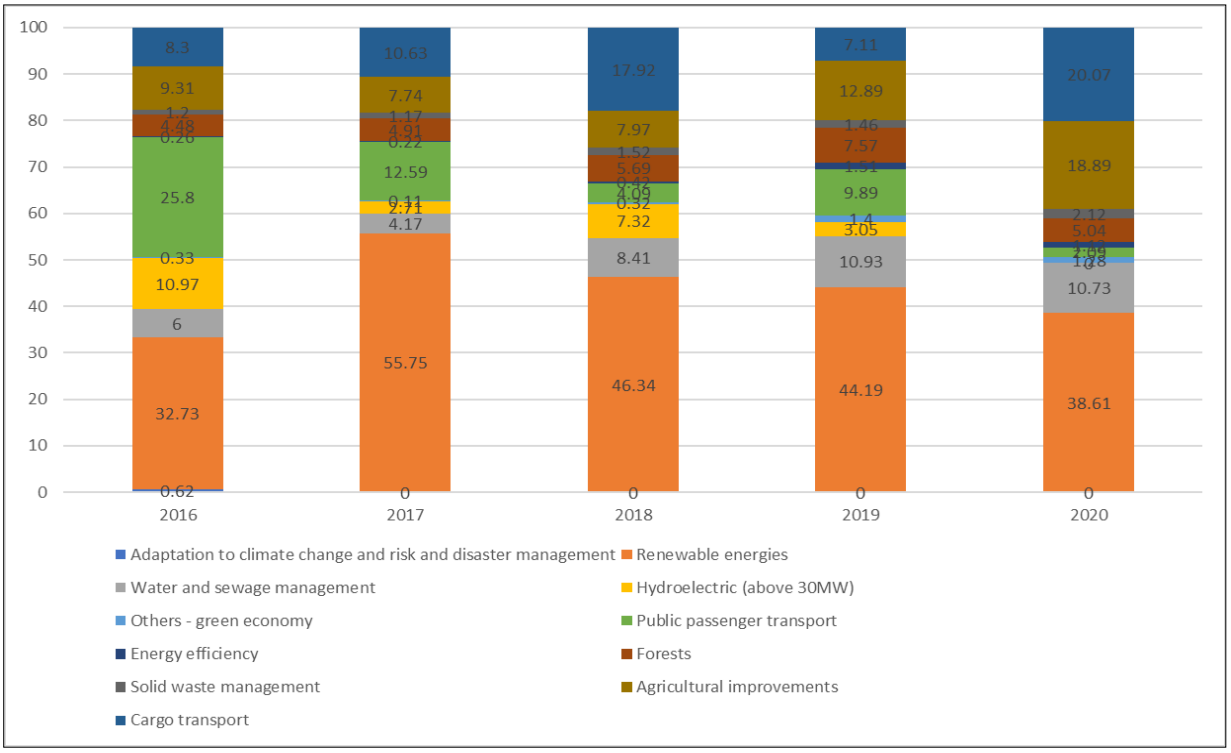
Table 2 - BNDES financial instruments linked to environmental credit

Financial instrument	Category of financial instrument	Comprehensive subcategories
Climate Fund	Fund	Renewable Energy Subprogram
		Charcoal Subprogram
		Native Forests Subprogram
		Solid waste subprogram
		Innovative Projects Subprogram
		Subprogram Sustainable Cities and Climate Change
		Urban Mobility Subprogram
		Efficient Machines and Equipment Subprogram
		Carbon Management and Services Subprogram
BNDES Finem - Environment	Financing line	Reduction in the use of natural resources
		Recovery and conservation of ecosystems and biodiversity
		Planning and management
		Recovery of environmental liabilities
		energy efficiency
		Sustainable products and processes
		Buses and trucks with low-carbon traction technologies and more energy-efficient and/or carbon-reducing equipment
BNDES Finem – Power generation	Financing line	-
ABC Program (Low Carbon Agriculture)	Program	ABC permanent crops
		ABC Organic
		ABC Recovery
		ABC no-tillage
		ABC Integration
		ABC Forests
		ABC Waste treatment
		ABC Palm
		ABC Fixation
Amazon Fund – Support for the Environment	Fund	-
BNDES Finame – Low Carbon	Financing line	-

Source: BNDES (2021).

Through graph 2, the distribution of resources allocated to investments of the green economy indicator is observed shows that between 2016 and 2020, the area linked to renewable energy was the area in which the BNDES acted the most. Investments related to cargo transport and public passenger transport also stood out in terms of receiving funds from the BNDES.

Graph 2 – Disbursements (R$) in investments of the BNDES Green Economy indicator between 2016 and 2020



Source: BNDES (2021).

The area of agricultural improvements also increased its percentage of receipt of funds from the bank between 2018 and 2020. From the distribution of investment resources from the BNDES green economy indicator, it is clear that the bank has sought to operate in the areas of transport and agriculture, especially in the area of energy in regard to green financing. The areas that received fewer investment resources during the period from 2016 to 2020 were energy efficiency and solid waste management. In particular, the area of adaptation to climate change and risk and disaster management did not receive funds from the BNDES for investments during the period of 2017 and 2019.

In 2017, the BNDES raised US $1 billion in green bonds maturing in 2024 and thus became the first Brazilian bank to issue green bonds in the international market (BNDES, 2018). The demand reached US $5 billion in orders, with the participation of more than 370 investors in the price formation process of securities. In October 2020, the bank issued R$ 1 billion in Green Finance Bills (LFV, for the acronym in Portuguese), with a two-year maturity and a CDI rate of + 0.45% per year. The issue was made in the domestic market, with a private offering to the main business partners of the BNDES, especially Brazilian financial institutions and institutional investors, with demand exceeding R $7 billion (BNDES, 2020).

In April 2021, the bank launched its Sustainability Bond Framework (SBF) to facilitate the issuance of green, social, and sustainable bonds in Brazil and abroad. The document received a favourable opinion (Second Party Opinion - SPO) from Sustainalytics and was developed based on technical cooperation between the BNDES and the Inter-American Development Bank (IDB) (BNDES, 2021).

Despite showing reductions in disbursements aimed at the green economy between 2016 and 2020, the BNDES has incorporated the issue of sustainability into its strategic positioning. Currently, the bank has eight missions in its long-term agenda, and among them, the mission of sustainability is to promote the transition to a resilient and low-carbon economy with support for the protection and recovery of forests (BNDES, 2021).

In addition to having a specific mission aimed at promoting Brazilian development based on sustainability, the infrastructure and production structure missions of the bank present actions related to sustainable processes and decarbonization. Thus, it can be inferred that the bank has presented actions to incorporate sustainability issues into its strategic positioning and thus to contribute to the sustainable and resilient development of the Brazilian economy in the face of the challenges that climate change brings. However, there is a latent need for such efforts to materialize and to enhance initiatives and projects aimed at combating climate change and the green transition in the country.

3. Conclusion

The transition to a low GHG emission economy, as well as the goals for mitigating the effects of climate change, require the coordination of the public and private sectors to ensure funding sources. The action of the state through development banks and regulatory agencies is a way to awaken private investment in green activities and in particular to stimulate disinvestment in activities related to brown sectors. In particular, the expertise of development banks in long-term and high-uncertainty financing can be an important instrument in the capillarity of financing for activities and projects that use technologies and innovations with low GHG emissions.

Thus, the incorporation of the sustainability variable in the investment risk management of public financial institutions becomes relevant because it gives the state greater capacity to plan and implement environmental policies. In this sense, when observing the performance of

the BNDES, we note that this institution has performed actions for the green transition in the Brazilian economy, albeit in an incipient manner.

This work sought to fill a gap in the analysis of how green financing has advanced in Brazil, especially regarding the role of BNDES in this process. When observing the performance of the BNDES, we note that this institution has performed actions for the green transition in the Brazilian economy, albeit in an incipient manner. Although the BNDES green performance can be considered incipient in the face of the broader and more coordinated efforts necessary for Brazil to advance in the green transition, this study revealed that the BNDES' performance has been important, especially in order to stimulating the financing of mature sectors (energy, transport), and encouraging the participation of the private sector. For example, through new contractual arrangements (PPP's) and private financing instruments, (such as the green bonds)

Through the resources disbursed in investments linked to the green economy, it is observed that the bank has devoted a large part of its climate financing to the areas of energy, agriculture, and transportation. In particular, the area of adaptation to climate change and risk and disaster management has not been explored by the BNDES. This fact is evidenced by the lack of resources allocated to these activities between 2017 and 2019 and reflects the evidence of the lack of planning and coordination of the Brazilian state in promoting actions that are able to adapt the Brazilian economy to possible climatic events.

The need for a financing structure aimed at sustaining the implementation of actions and goals in the fight against climate change presents a problem related to the instability to which the financial system is exposed. In this sense, coordination between the state and the private sector is one of the solutions for creating an environment where investments and financing related to environmental issues can effectively occur.

The importance of development banks in defining and inducing their policies and strategies to boost economic development is known, especially in emerging countries. Despite the strategic changes that the BNDES has undergone, especially in the last five years, it emerges as the first Brazilian bank to raise exclusive resources for sustainable activities and projects through green bonds in the international market and, thus, in addition to diversifying its sources of resources, ends up stimulating the internal market to start investing in assets of this modality. In this sense, it can be inferred that the BNDES has played an important role in stimulating the Brazilian domestic market, making advances with regard to funding the green transition in Brazil.

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