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Adoption Of Green Credit Policies By Financial Institutions. Critical Analysis Through Data Mining

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Abstract

One of the most effective tools for addressing environmental problems is green credit, which not only mobilizes more capital to support the environmental protection industry but also forces the transformation of highly polluting industries, ultimately achieving a reasonable allocation of resources. Through a literature review of scientific literature, patterns and trends related to the studied policies were identified. The results showed a growing interest in the adoption of these credits, particularly in relation to government regulations and incentives, as well as criteria and standards for their implementation. The importance of Green Credits for sustainable development and the transition to a low-carbon economy was emphasized.

Keywords: *Green credits, environment, sustainable development, fossil fuels*

Introduction

The use of fossil fuels as the main source of energy production plays an important role in greenhouse gas emissions and global warming. This pattern has caused the depletion of natural resources and a wide range of environmental problems. In contrast, the concept of Green Economy(Tavakoli and Motlagh 2012).

Based on the statement of partners on financial institutions and sustainable development developed at the World Economic Forum in Switzerland, the "Equator Principles" were proposed and adapted by 39 countries, leading to the adoption of objectives for the effective promotion of so-called green loans by the main commercial banks worldwide. This with the purpose of actively promoting the invocation and development of environmental projects in an orderly and constant manner (Shanglei Chaia, Ke Zhang, Wei Wei, Wenyuan Ma 2022). The green credit policy was carried out, commercial banks are increasingly supporting the project of energy saving measures (Li, Sui and Lu 2012).

A study conducted in China found that financing projects aimed at environmental protection or

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green credits has had a positive relationship in reducing pollution indicators, finding that in areas where the credit market is oriented to green credits, they presented a better level of environmental risk management. (Han, Xu and Tu 2019). Similarly, other research identified that there was a dynamic connectivity between green finance and the decrease in fossil fuel consumption when replaced by renewable energies such as; Wind energy, photovoltaic cells and use of biofuels (Eyup Dogan, Mara Madaleno, DilvinTaskin 2022).

Other studies mention that in 2012, in China, the Green Credit Guidelines were issued, for banking financial institutions to promote green credit from a strategic perspective, increasing support for the green, low-carbon economy. To this end, differentiated credit policies and other restrictions were generated that forced companies to implement energy conservation and environmental protection policies. (Deng 2021). The characteristics of the development of green finance can be understood from six dimensions: green bonds, green credits, green insurance, green values, green investments and carbon finance.(Le et al. 2019).

One of the most effective tools for solving environmental problems is the green credit, which can not only mobilize more capital to support the environmental protection industry, but also force the transformation of the high-pollution industry and ultimately achieve a reasonable allocation of resources.(Qu, Ma and Yan 2019).

Major policies have guaranteed long-term benefits for the private sector and tax credits for private participation. While incredible, these policies must be constantly compared and modified to keep green energy progress on track. (Izadian, Girrens and Khayyer 2013). In recent years, green finance has become one of the essential factors affecting the green transformation, industrial upgrading and sustainable development of countries and regions of the world. (HUANG, WANG and PANG [undated]).

However, the impulse of this type of green credits has presented several barriers, such as ignorance of this type of financial aid or the scope of these, even despite the increase in pollution in the world and the disclosure of the state of environmental criticality that has been felt in recent years, But there are no movements that disseminate at the social level the development of financing and leverage of environmental initiatives. (Mathuva and Kiweu 2016).

In relation to this article, it is identified that in the case of Savings and Credit Cooperatives of Ecuador, progress has been made in the management of green credits, however there is a low award rate due to the little intention on the part of the partners to develop this type of projects.

That is why the adoption of Green Credit policies by financial institutions is an issue of great relevance today, since it seeks to encourage investment in sustainable and environmentally friendly projects. In this sense, critical analysis by data mining is presented as a valuable tool to evaluate the efficiency and sufficiency of these policies. Through the collection and analysis of bibliometric data, patterns and trends can be identified to improve decision-making regarding the allocation of resources and the implementation of strategies to promote the adoption of Green Credits. This

scientific article addresses this issue from a critical perspective, evaluating the financial situation of financial institutions and their ability to implement Green Credit policies. It is expected that the results obtained through data mining will identify areas for improvement and contribute to promoting the adoption of more sustainable practices in the financial sector.

The objective of our research was to critically analyze the adoption of Green Credit policies by financial institutions.

Methodology

To carry out the research process, the qualitative methodology of bibliographic type was applied. The sources of information were scientific articles identified from a total of 85 articles from a search carried out in the scientific database Scopus, resulting from the search criterion "Green Credit" for the period from the years 2019 to 2023, all open access search criteria. After the selection process, 19 articles presented in **Table 1** below were identified:

Table 1 Group of articles used as a source of information for the study

Code	Title	Appointment
ART 1	Green credit, carbon emission and high quality development of green economy in China	(Zheng, Zhang y Hu 2022)
ART 2	The impact of the Equator Principles on carbon financial markets: A case study based on China's green credit data	(Chen, Wang y Liu 2022)
ART 3	Impact of the green credit policy on external financing, economic growth and energy consumption of the manufacturing industry	(Wu, Wu and Zhao 2022)
ART 4	Does green credit improve the core competence of commercial banks? Based on quasi-natural experiments in China	(Luo, Yu and Zhou 2021)
ART 5	Corporate social responsibility and bank financial performance in China: The moderating role of green credit	(Zhou et al. 2021)
ART 6	Operational decisions of green supply chain under financial incentives with emission constraints	(Yes, Wu and Yan 2023)
ART 7	Green financial policies and capital flows	(Yang et al. 2019)
ART 9	The impact of fintech innovation on green growth in China: Mediating effect of green finance	(Zhou, Zhu and Luo 2022)
ART 8	Green finance, fintech and environmental protection: Evidence from China	(Muganyi, Yan y Sun 2021)
ART 10	Does green governance affect financing constraints? Evidence from China's heavily polluting enterprises	(Liu, Song Yixin 2022)
ART 11	Dataset for the climate-related financial policy index (CRFPI)	(D'Orazio 2023)
ART 12	Central bank mandates, sustainability objectives and the	(Dikau y Volz 2021)

	promotion of green finance	
ART 13	Climate-related financial policy index: A composite index to compare the engagement in green financial policymaking at the global level	(D'Orazio y Thole 2022)
ART 14	The interaction of finance and innovation for low carbon economy: Evidence from Saudi Arabia	(Samargandi y Sohag 2022)
ART 16	Unlocking green financing for building energy retrofit: A survey in the western China	(Zhang et al. 2020)
ART 15	How does green finance asymmetrically affect greenhouse gas emissions? Evidence from the top-ten green bond issuer countries	(Li, Faridi y Nazar 2023)
ART 17	The role of green finance in reducing CO2 emissions: An empirical analysis	(Saeed Meo and Karim 2022)
ART 18	Sustainable financial systems toward sustainability in finance. Institutional and managerial approach	(Zioło et al. 2021)

Own source., from the initial documentary search.

Once the documentary base was obtained, the categories and codes presented in **Table 2** were defined to proceed with the analysis by data mining using the QDAMiner version 6 software.

Table 2 Description of the categories of analysis and codes for the study of data mining

Category	**Subcategory**	**Code**
Definition and characteristics of Green Credits	Concept and objectives:	CYO
	Criteria and standards	CYE
Importance of Green Credits	Environmental and social benefits	BAYS
	Sustainable development and transition to a low-carbon economy	DSYEB
Policies for the adoption of Green Credits by financial institutions	Government regulations and incentives:	RIG
	Strategies and commitments of financial institutions	EYCIF

Own source

Results and Discussion

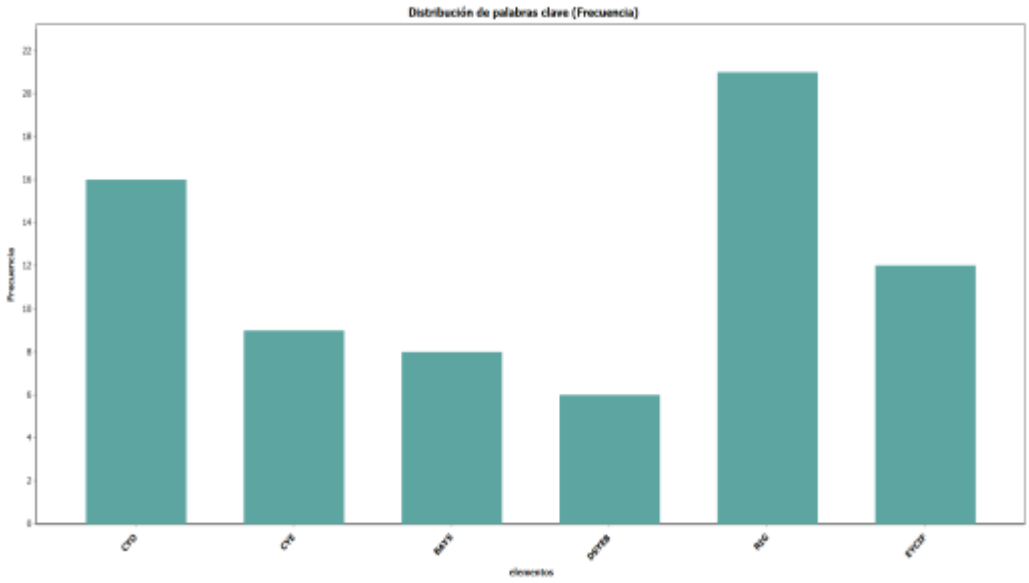

Figure 1 Distribution of keywords according to the frequency of citation in the articles analyzed with QDA Miner

Own source Generated with QDAMiner after the review process

As can be seen in **Figure 1** in relation to the distribution of words, in the articles reviewed there is a greater presence of topics related to government regulations and incentives associated with green credits, as well as the criteria and standards for their implementation. This behavior suggests that there is a growing interest in the approach and promotion of green credits by the scientific community.

After the analysis of the information, the following analyses were generated:

Definition and characteristics of Green Credits

Concept and objectives

Green loans are a form of financing that aims to support projects and activities that are sustainable and environmentally friendly. (Zheng, Zhang and Hu 2022) They mention that these credits involve the allocation of green resources and the control of carbon emissions to promote high-quality economic development. According to (D'Orazio and Thole 2022), central banks can implement credit measures to incentivize green and environmentally friendly investments, such as green loan installments and concessional loans to priority sectors.

According to (Samargandi and Sohag 2022), green credit is a new financial technique adopted by the financial sector to promote growth and protect the environment. Green investments and energy-efficient technologies are used to reduce environmental pressure, and low-interest loans are

provided to industries for the adoption of clean technologies.

Green finance has been recognized as a vital part of complying with the Paris Agreement, with several countries enacting regulations on financial instruments to achieve environmental sustainability. (Samargandi and Sohag 2022). For its part (Li, Faridi and Nazar 2023) They add that green bonds, used to finance green operations, are an important financial instrument in this area.

(Saeed Meo and Karim 2022), expand the discussion by noting that green financial instruments, such as green bonds, green home mortgages, green loans for commercial buildings, among others, have been designed to foster a green environment. In addition, they also indicate that green finance represents an intersection between environmentally friendly behavior and the financial and business world.

(Chen, Wang and Liu 2022), mention that green credit can improve the capital adequacy ratio through asset securitization and encourage commercial banks to solve environmental pollution. Thus, green credit not only achieves the objective of environmental protection, but also improves the risk-resilience of commercial banks.

Green credit policy, according to (Wu, Wu and Zhao 2022), is essentially a macro control policy that promotes environmental protection through credit control. An important feature of this policy is that banking and financial institutions are obliged to restrict the credit exposure of highly polluting and energy-intensive industries.

(Luo, Yu and Zhou 2021), define green credit as those activities in which financial institutions must grant preferential credit to projects with sustainable development that meet environmental protection requirements. (Bai, Wu and Yan 2023) They agree with this definition, stating that green credit fundamentally involves the allocation of capital in the context of environmental constraints.

At last (Yang et al. 2019) suggest that green credit policy can include measures such as low-interest or soft loans to reduce firms' cost of production, while (Muganyi, Yan and Sun 2021) They argue that green finance is not only a global trend, but has become an important channel for industrialized nations to achieve sustainable growth.

Criteria and standards

According to (Zheng, Zhang and Hu 2022) Green credit, in relation to the "Green Industry Guidance Catalogue (2019)" issued in China, refers to financing that targets enterprises whose core business consists of green and sustainable activities. These can include the manufacture of energy-saving equipment, environmental protection, resource recycling, production of new energy vehicles, green landscaping, green services, and more.

(Dikau and Volz 2021), provide a detailed description of climate-related risks that could affect the economy and financial stability. Physical hazard describes the danger of natural events, such as floods and storms, that can cause direct and indirect damage. Meanwhile, liability risk refers to

potential financial losses and compensation claims due to damage caused by natural hazards related to climate change. These climate risks have clear implications for central banks and financial institutions.

(Li, Faridi and Nazar 2023), highlight that access to green finance is a challenge for SMEs around the world, as green activities tend to focus on improving efficiency, which is not the core business of conventional commercial banks. However, they note that barriers to accessing green finance at the operational level can be overcome by working with financial sector stakeholders.

(Ziolo et al. 2021) argue that sustainable financial systems must take into account the impact of ESG (environmental, social and governance) factors on finance and financial decisions. These risks are mitigated by incorporating them into risk management and decision-making systems.

(Wu, Wu and Zhao 2022), mention that green credit policy involves banking and financial institutions restricting the credit exposure of highly polluting and energy-intensive industries. This approach also includes an evaluation mechanism for industries.

(Luo, Yu and Zhou 2021) They define green credit as an important policy of environmental regulation, which pays attention to the impact of environmental issues on finance and requires financial institutions to consider environmental factors when deciding whether to lend to a project.

At last (Bai, Wu and Yan 2023) They explain that under the green credit subsidy policy, the government provides incentives to encourage the bank to finance capital-constrained manufacturers. This approach may include commitments by the manufacturer to use the loan to reduce emissions and meet policy requirements.

Importance of Green Credits

Environmental and social benefits

Green loans are financial instruments that are becoming increasingly important in the drive towards a more sustainable and environmentally friendly economy. According to (Zheng, Zhang and Hu 2022), green credits play an important role in the high-quality development of the green economy. These make it possible to finance projects and initiatives that reduce environmental pollution and promote energy conservation.

In relation to monetary and financial policy, (Dikau and Volz 2021) They argue that most central banks will need to incorporate climate and mitigation risks into their basic policy implementation frameworks to maintain financial and price stability. This inclusion of sustainability factors in central banking practice can help further boost green lending and other environmentally friendly financial instruments.

Green credits are also connected to other green financial instruments, such as green bonds, which are used to finance environmentally friendly projects, according to (Saeed Meo and Karim 2022). These projects can range from solar energy to clean transport, thus contributing to reducing

pollution and promoting sustainability.

In addition, several studies cited by (Ziolo et al. 2021) confirm that initiatives financed by green credits improve environmental quality and reduce environmental degradation. These green finances have resulted in significant reductions in CO2 emissions and driven green innovation.

With regard to incentives, (Li, Faridi and Nazar 2023) They suggest that the government can boost green finance by expanding channels for businesses by increasing subsidies for green projects. This could ensure adequate financing for green technological innovation and meet the growing demand for green investment.

In the context of China, (Chen, Wang and Liu 2022; Zhou, Zhu and Luo 2022) They highlight the development of green credit policies and their significant impact on promoting energy conservation, reducing emissions and optimizing industrial structures. Zhou et al. also point out that green credit policies can stimulate green innovation in polluting enterprises, thus achieving the green transformation of emerging economies.

In conclusion, green credits represent a crucial financial instrument for the transition towards a green and sustainable economy. They finance projects that reduce pollution, promote energy conservation and encourage green innovation. In addition, they are a valuable tool for central banks and governments in their efforts to integrate sustainability into their financial policies and strategies.

Sustainable development and transition to a low-carbon economy

Green credits are a crucial tool to support sustainable development and facilitate the transition to a low-carbon economy. This importance stems from its ability to reallocate financial resources in ways that reduce carbon emissions and promote environmental sustainability.

(Zheng, Zhang and Hu 2022), highlight that the allocation of credit resources is closely related to carbon emissions. According to their analysis, green credit is a key factor affecting the high-quality development of the green economy. They further note a positive correlation between green credit and this type of development, and a negative correlation between environmental pollution and the high-quality development of the green economy. That is, the more severe the environmental pollution, the lower the level of development of the green economy.

The importance of green credit is also underlined in the role central banks play in managing climate risks. (D'Orazio and Thole 2022) They suggest that central banks should increase their attention to climate change because of the likelihood that it will affect their ability to deliver on their mandates and the stability of the financial sector.

Green credits are also a crucial tool for managing energy-intensive, high-pollution industries. (Wu, Wu and Zhao 2022) They describe green credit policy as a combination of credit tightening for these industries and credit support for green industries.

In addition (Liu, Song and Xin 2022) They show that green credit policies can have significant

effects on production, the environment, health and welfare of public services, improving the industrial structure and achieving a balance between production and the environment. From the perspective of the total loan amount, the green credit policy allows green companies to obtain more credit resources than polluting companies, this reflects an improvement in the allocation of financial resources that supports green growth.

In summary, green credits are fundamental for sustainable development and the transition to a low-carbon economy, foster the development of the green economy, help central banks manage climate risks, facilitate the management of energy-intensive and high-pollution industries, and improve the allocation of financial resources to support green growth.

Policies for the adoption of Green Credits by financial institutions

Government regulations and incentives

Green credits are of great importance in the category of policies for the adoption of green credits by financial institutions. Next, the importance of green credits will be analyzed based on the information provided by several authors.

From a business development perspective, commercial banks provide preferential loans or preferential low interest rates to environmental protection enterprises with energy conservation, emission reduction, and clean production. (Zheng, Zhang and Hu 2022). In other words, green credits encourage the adoption of sustainable business practices and promote environmental conservation.

The government plays a key role in promoting environmental pollution projects through green financial instruments, including green credit. This implies that government policies can influence the adoption of green credit by financial institutions and promote the optimization of industrial structure and sustainable economic development.

In China, the government has implemented green credit policies since 2012, requiring commercial banks to strictly control credit lines to highly polluting enterprises and increase support for environmentally friendly enterprises. (Liu, Song and Xin 2022). These policies have proven effective in improving the financing of companies implementing green governance measures.

Financial institutions, such as banks, play a vital role in the adoption of green credit, as they are the main providers of financing for most businesses in China. (Liu, Song and Xin 2022). Since financial institutions have the capacity to provide financial support to companies with better environmental performance and promote sustainable economic development.

The policies of central banks and financial regulators are also important in the adoption of green credit. (D'Orazio 2023). It is widely recognized that these policies should promote green finance and develop regulations for climate-related financial risks, as climate change affects monetary policy and financial regulation.

International participation in climate finance policy-making has also increased in recent years (D'Orazio 2023). Different countries have adopted green finance policies and principles to create a financial market aligned with climate change concerns.

Green credit allocation policy can play an important role in promoting sustainable development and environmental protection (D'Orazio and Thole 2022). Some countries have implemented credit allocation policies that encourage financing of specific sectors, such as agriculture and domestic energy conversion, contributing to the sustainable economy and emission reductions.

In China, green credit policy reduces banks' credit risk and promotes sustainable growth by directing resources to the green and new energy industries (Luo, Yu and Zhou 2021). In addition, green credit improves the competitive position of banks in the market and strengthens their reputation.

Green credit policies can also have an impact on bank management, business production and economic development. (Luo, Yu and Zhou 2021). Commercial banks, as executors of these policies, are affected by their implementation and their financial performance influences their core competence.

In sum, green credits are of great importance in the adoption of sustainable business practices and sustainable economic development. Government policies and the actions of financial institutions are critical to promoting the adoption of green credit. In addition, the policies of central banks and financial regulators, as well as green credit allocation policies, also play a crucial role in this area.

Strategies and commitments of financial institutions

The importance of green loans in the category "Strategies and commitments of financial institutions" is highlighted based on information provided by several authors.

According to (D'Orazio 2023), it is necessary to establish consistent principles and reliable taxonomies to assess the real impact of investments on the environment and promote green financial markets. In addition, the importance of sustainability reporting guidelines and compliance practices is mentioned.

(Dikau and Volz 2021) They point out that the financial sector plays a central role in financing sustainable and green investments, and should also avoid financing environmentally harmful activities. Without public intervention, financial institutions could allocate their resources to activities that are not socially desirable to maximize their private profitability.

(D'Orazio and Thole 2022) They highlight that the efforts of central banks and financial regulators are crucial to address climate risks. Climate change can affect the conduct of monetary policy and financial stability, and it is important to develop policies and regulations that address these challenges.

In relation to climate-related financial policies, (D'Orazio and Thole 2022) Some countries, such

as Saudi Arabia, Argentina, Turkey, Italy, Canada, Russia and the United States, require greater commitment to align with the goals of the Paris Agreement. These policies can contribute to stable economies and financial markets and support the transition to a low-carbon economy.

(Chen, Wang and Liu 2022) They point out that the securitisation of green credit assets can improve the capital adequacy ratio of commercial banks and promote sustainable development. They also highlight the positive impact of the adoption of the Equator Principles on banks' competitiveness and improved profitability.

(Luo, Yu and Zhou 2021) They mention that the implementation of green credit can force highly polluting companies to switch to more sustainable practices and contribute to the optimization of the industrial structure. In addition, green credit can have a significant impact on banks' competition, improving their position in the market.

(Zhou et al. 2021) They highlight the responsibility of banks to shareholders, depositors and public welfare companies. Social responsibility can improve shareholder confidence, attract investors and contribute to banks' long-term financial performance.

(Bai, Wu and Yan 2023) mentioning different financial incentive policies, such as green credit subsidies and price-based incentives, which can promote green finance and ease capital constraints, these incentives are more effective for companies with better environmental performance.

(Yang et al. 2019) They provide examples of low-interest policies and subsidies for green projects in different countries. These policies encourage investment in renewable energy and contribute to the transition to a more sustainable economy.

In summary, green loans are central to the strategies and commitments of financial institutions. They help finance sustainable investments, curb environmentally damaging activities and address climate risks. In addition, green loans can improve banks' competitiveness, strengthen their market position and promote sustainable economic development. On the other hand, government policies, sustainability principles and financial incentives are key tools to promote the adoption of green credits and achieve a transition towards a more sustainable economy.

Conclusions

Green credits represent a financial tool of vital importance in the promotion of sustainable and environmentally friendly projects. There is a growing interest on the part of the scientific community in its implementation, as evidenced by the distribution of keywords in the reviewed articles.

Green credits play a critical role in developing a green and sustainable economy by providing financing for projects that reduce pollution, promote energy conservation, and foster innovation in green technologies.

These financial instruments are essential to drive the transition to a low-carbon economy, enabling

climate risk management and optimising energy-intensive and highly polluting industries.

To promote the adoption of green credits and achieve a more sustainable economy, the effective implementation of government policies, as well as strategies and commitments by financial institutions is required. In addition, financial incentives play a crucial role in encouraging the adoption of these sustainable financial practices.

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