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Green Bonds as a Legal Mechanism for Sustainable Urban Development

السندات الخضراء كآلية قانونية للتنمية الحضرية المستدامة

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Abstract:

This research examines the role of green bonds as an innovative financial tool introduced by the World Bank in 2007 to channel capital into environmental and climate-related projects. It outlines their main applications in areas such as renewable energy, energy efficiency, waste management, and biodiversity protection

The study finds that green bonds have enhanced portfolio diversification and responsible investment opportunities, with global issuance growing from USD 4 billion in 2010 to USD 259 billion in 2019. While not a complete solution to the financing gap in environmental projects, they represent a significant step toward addressing climate challenges, though their performance remains sensitive to financial market fluctuations

Keywords: Green bonds; Urban; Environmental financing; Investment; Sustainable Cities.

الملخص:

يتناول هذا البحث دور السندات الخضراء كأداة مالية مبتكرة أطلقها البنك الدولي سنة 2007، بهدف توجيه رؤوس الأموال نحو المشاريع البيئية والمناخية. ويستعرض مجالات استخدامها الرئيسية، مثل الطاقات المتجددة، وكفاءة الطاقة، وتسيير النفايات، وحماية التنوع البيولوجي. وتُظهر الدراسة أن السندات الخضراء أسهمت في تعزيز تنويع المحافظ الاستثمارية وتشجيع الاستثمار المسؤول، حيث ارتفع حجم إصدارها عالميًا من 4 مليارات دولار أمريكي سنة 2010 إلى 259 مليار دولار أمريكي

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سنة 2019. ورغم أنها لا تُعد حلًا كاملًا لسد فجوة تمويل المشاريع البيئية، فإنها تمثل خطوة مهمة نحو مواجهة التحديات المناخية، مع الإشارة إلى أن أدائها يظل متأثرًا بتقلبات الأسواق المالية.

الكلمات المفتاحية: السندات الخضراء؛ المناطق الحضرية؛ التمويل البيئي؛ الاستثمار؛ المدن المستدامة

1/ Introduction

In 2007, the World Bank introduced a new type of bond known as the *green bond*, at a time when opportunities for environmental investment were still very limited. These are debt securities issued to raise funds specifically allocated to projects related to climate and the environment. Green bonds attract investors from the sector that focuses on sustainable and responsible investment, and the World Bank is considered one of the largest issuers of green bonds worldwide.

Green bonds constitute an innovative mechanism for financing green investment, as they open the door for investors seeking a safe haven for their capital on the one hand, and for those wishing to diversify their portfolios and enter environmentally oriented projects on the other. In November 2008, the World Bank issued the main principles governing these bonds, allowing banks, international institutions, governments, and corporations to issue this category of securities. Eligible projects include renewable energy, energy efficiency, sustainable waste management, sustainable land use, biodiversity conservation, climate change adaptation, and other environmentally oriented initiatives. Investment through green bonds has witnessed remarkable growth, estimated at USD 4 billion in 2010 and reaching USD 259 billion in 2019.

A bond, in its legal nature, is a form of debt instrument. A debt instrument is a legally binding contract establishing a borrowing relationship that may be traded through sale and purchase among parties. Entities seeking financing generally have two principal options to raise capital: shares (equity) and bonds (debt). Bonds represent a form of indebtedness, while shares represent a form of ownership. Investors in bonds become creditors of the issuing entity, receiving a fixed interest rate (coupon payments) and recovering their initial investment (the principal) upon maturity. Because bonds usually provide a fixed income stream over their lifetime, they are often referred to as *fixed-income*

securities. Once purchased from the issuer (via financial institutions acting as selling agents), they may continue to be traded in the securities market. Conversely, investors in shares acquire a proportional ownership stake in the issuing company, with returns depending on dividend distributions and fluctuations in the company's value; shares are also traded on the securities market.

The green bond, which is the subject of this study, is a debt instrument issued to raise funds exclusively to support projects related to climate and the environment. This specific use of proceeds to finance designated projects is what distinguishes green bonds from conventional bonds. Thus, in addition to evaluating the standard financial characteristics (such as maturity, coupon rate, price, and credit rating of the issuer), investors also assess the defined environmental objectives of the projects that these bonds aim to support.

The central research problem raised in this context may be stated as follows: To what extent can green bonds be relied upon as an instrument for financing green investment?

This study seeks to achieve several objectives, most notably:

- Clarifying the concept of green bonds and their distinctive characteristics compared to conventional bonds.
- Analyzing their role in mobilizing financial resources directed toward environmental and climate-related projects.
- Highlighting their advantages and associated risks, and the extent to which they can promote sustainable investment.
- Reviewing selected experiences from global green bond markets.

With respect to methodology, the study adopts a descriptive-analytical approach, by examining the relevant legal, economic, and financial frameworks, as well as analyzing data and reports issued by international institutions. This allows for a comprehensive perspective on the current state of green bonds and their future prospects.

Accordingly, the study attempts to answer the research problem through the following outline:

- The Concept of Green Bonds.

- Principles of Green Bonds
- Investment Assessment in the Green Bond Market
- The Role of Green Bonds in Financing Sustainable Urban Development
- The Use of Green Bonds to Build Sustainable Cities (International Experiences)

2/ The Concept of Green Bonds

In recent years, numerous terms reflecting the environmental dimension have emerged and become widely circulated, such as: green economy, green investment, green cities, green buildings, and green bonds. All of these fall within the framework of sustainable development and environmentally friendly investments. The growing focus on environmental issues and their enhancement has become a global demand, largely due to the damage inflicted on ecosystems as a result of pollution caused by industrialization and transportation emissions, which constantly release exhaust gases, leading to an increase in carbon dioxide levels in the atmosphere and the deterioration of the ozone layer.

2.1. The Origin of the Green Bonds Concept

In the evolving landscape of global development, a significant shift has taken place since the dawn of the new millennium. The United Nations, in 2000, launched the Millennium Development Goals (MDGs), which encompassed eight core objectives, including ensuring environmental sustainability and fostering a global partnership for development. However, despite their notable achievements, these goals were regarded as limited in scope, as they primarily focused on social aspects without providing a comprehensive treatment of the economic, environmental, and institutional dimensions of development. Following extensive international consultations, the United Nations General Assembly adopted in 2015 the 2030 Agenda for Sustainable Development, comprising 17 goals that build upon and expand the previous framework [1] These new goals address emerging global priorities such as climate action, clean energy, innovation, sustainable cities, peace, and justice, thereby achieving greater inclusiveness and

integration in responding to the challenges of the modern era, including those related to the environment.

In late 2007, the Treasury Department of the World Bank received an unexpected phone call from a group of Swedish pension funds. They wished to invest in projects addressing climate change but were unable to find a pathway to achieve their goal. In collaboration with the World Bank, what became known as green bonds was developed. The World Bank subsequently issued its first green bonds, pioneering a new method to link investor financing directly to climate-related project . [2]

Since the Paris Climate Agreement in 2015, banks worldwide have invested more than USD 3.6 trillion in fossil fuel projects, which is nearly three times the total value of bonds and loans supporting green projects, according to data from Bloomberg. [3]

2.2. Definition of Green Bonds

Green bonds have emerged as a pivotal financial instrument aimed at mobilizing capital for environmentally sustainable projects. Understanding their definition and identifying the entities that issue them is essential to grasp their role in promoting green investment. This section provides a clear explanation of what constitutes a green bond and highlights the key actors responsible for their issuance, including international institutions, governments, banks, and corporations.

Bonds fundamentally constitute contractual agreements through which the issuers obtain funds from investors and undertake to repay them, together with a predetermined interest, at specified maturity dates. Numerous definitions of bonds exist; this study will examine three (3) of them to provide a precise and legally grounded understanding of the concept.

2.2.1. Definition 01:

green bonds are in many ways similar to their conventional counterparts, it is a fixed-income instrument that raises debt capital and is repaid after a defined period, including interest. in contrast to conventional bonds, green bond proceeds are to be allocated to green project [4].

In addition to this financial definition of green bonds, the allocation of their proceeds to environmentally oriented projects constitutes a contractual commitment of a specific legal nature, and any breach thereof may lead to the liability of the issuing entity or the erosion of investors' confidence in its credibility**.**

2.2.2. Definition 02:

Bloomberg defines agreen bond as "a bond specifically earmarked to be used for climate and environmental projects" **[5]**, As can be observed from the definition, itis a definition that focuses on the purpose of this type of bond or on the nature of the projects to which these bonds are allocated. Therefore, it is not a legal definition but rather one that leans toward economic definitions.

2.2.3. Definition 03:

Bonds where the proceeds raised ara allocated to environmental uses or projects **[6]**, This definition also focuses on the type of projects to which the proceeds of green bonds are allocated.

Thus, if we were to provide an appropriate definition of green bonds, it could be said that, from a legal standpoint, bonds are debt instruments representing a loan from the investor (the bondholder) to the issuing entity (such as a company, bank, Municipalityor government). The bondholder benefits from a fixed income, and the bond has a specified maturity period at the end of which its face value is repaid, regardless of the profits or losses of the project. Green bonds are similar to conventional bonds in terms of issuance mechanisms, fixed income, and defined maturity; however, the key difference lies in the fact that the proceeds of green bonds are exclusively allocated to financing environmentally friendly projects, such as renewable energy, energy efficiency, clean transportation, sustainable water management, green buildings, and similar initiatives.

2.3. Entities Authorized to Issue Green Bonds:

Green bonds can be issued by banks as well as public and private institutions, as follows:

2.3.1. Banks:

Both national and international banks are authorized to issue green bonds. Prominent examples include the World Bank, the European Investment Bank, the African Development Bank, among others.

2.3.2. Institutions:

This category encompasses private companies and financial institutions such as commercial banks, investment banks, and development banks.

2.3.3. Governments and Municipalities:

Governmental bodies can issue green bonds as a means to finance specific local projects or achieve environmental objectives. Similarly, municipalities may issue green bonds to engage local stakeholders in funding sustainable solutions

It is observed that there is a diversity in the entities issuing green bonds, as they may be issued by banks, governments, or private institutions. This reflects the flexibility of this financial instrument and its ability to adapt to different legal and economic systems. Such diversity is considered a strength, as it allows for the expansion of green financing in accordance with the specific characteristics and developmental needs of each system.

3/ Investment Assessment in the Green Bond Market

The green bond market has been attracting increasing attention as an effective tool for sustainable financing, given its role in supporting environmentally friendly projects and promoting economic and social development in a sustainable manner. These bonds offer numerous advantages for both investors and countries; on the other hand, investing in green bonds faces several challenges, which may limit the market's expansion and ease of adoption. To provide a realistic view of this market, the World Bank's 2024 report presents precise statistics, offering a comprehensive understanding of the market's potential and future trends in green bond investment.

3.1. Advantages

Since green bonds have already proven their effectiveness as a financing tool that supports the transition toward a sustainable economy, it is essential to highlight their main advantages, which have made them a preferred choice for both governments and investors. These bonds go beyond achieving environmental goals; they combine financial, social, and regulatory dimensions within a single framework that strengthens economic stability and promotes sustainable development.

- **Green** bonds enable investors to support green investments that contribute to maintaining ecological balance [7].
- They can be used as a tool to finance sustainable infrastructure projects, particularly when governments choose green bonds as a financing instrument.

Green bonds help raise awareness of issuers' environmental programs [8]

- Beyond financing environmental projects, green bonds also serve as a tool to reduce energy costs through the development of alternative energy projects.

Green bonds represent a pioneering experience in terms of the types of projects they target, which encourages investors to commit to ethical and socially responsible projects [9]

- Investment in green bonds attracts sectors focused on sustainable and responsible development, as well as investors interested in environmental and social standards.
- Green bonds are considered a low-cost financing source, providing the issuing company with tax advantages by allowing bond yields to be deducted from corporate taxes [10].
- They guarantee a fixed and periodic income stream.
- Green bonds are regarded as a safe investment instrument [11].

They serve as a tool to reduce borrowing costs, as increased demand for these bonds lowers the cost of borrowing for issuers [12]

Green bonds act as a mechanism to create an economy resilient to environmental risks, allowing investors to participate actively in projects

that address climate and environmental challenges, thereby enhancing financial stability while mitigating economic and environmental risks [13]

3.2. Challenges Facing Green Bonds

Despite the growing interest in green bonds, the market faces several challenges that may hinder its growth and effectiveness these challenges reflect structural and regulatory issues, as well as awareness-related factors, affecting both issuers and investors. Among the main challenges are:

Liquidity constraints: One of the primary risks facing the green bond market is limited liquidity. The market remains relatively small, and in some regions, the scarcity of green bonds available for trading represents a significant barrier, despite the presence of willing investors. This often reflects a lack of eligible green projects that can be financed or refinanced through green bonds [14].

Lack of awareness: Many market participants remain unaware of the benefits of green bonds, as well as the related guidelines and international standards, which limits their adoption.

Absence of local guidelines: In many jurisdictions, local regulatory frameworks or national standards for green bonds are missing, creating uncertainty for both issuers and investors.

Cost of compliance: Evaluating green bonds and verifying their effectiveness and contribution to sustainable environmental development often requires engaging external experts or third-party verifiers. This verification process can be expensive, posing a significant barrier for small and medium-sized enterprises seeking to issue such bonds [15].

3.3. Investment Assessment in the Green Bond Market

The World Bank has been publishing an Impact Report for Green Bonds since 2015, and in 2020 it published its first Impact Report for Sustainable Development Bonds, thereby effectively covering all bond issuances. The World Bank uses the Handbook: Harmonised Framework for Impact Reporting, coordinated by the International Capital Market Association (ICMA). This handbook builds on the initial guidance and

impact reporting templates launched by the World Bank and other multilateral development banks, which were first published in March 2015. [16]

In fiscal year 2024, the World Bank issued $51.1 billion in Sustainable Development Bonds and $1.3 billion in Green Bonds, bringing the total issuance to $52.4 billion. This included the issuance of a new outcome-linked bond, the Plastic Waste Reduction Bond, as well as new catastrophe bonds for the governments of Jamaica and Mexico [17].

4/ The Role of Green Bonds in Financing Sustainable Urban Development

Green bonds have become one of the most innovative instruments for financing sustainable urban development. By channeling investments into renewable energy, clean transport, and resilient infrastructure, they provide cities with a practical mechanism to align urban growth with environmental and social sustainability objectives.

4.1. Green Bonds as a Legal-Financial Instrument for Financing Sustainable Cities

Green bonds are increasingly recognized as a promising legal-financial instrument that enables cities to attract private capital and channel institutional investors' funds towards environmentally sustainable infrastructure projects.[18]

Multilateral development banks, such as the World Bank and the European Investment Bank, have pioneered the issuance of highly rated green bonds (AAA), which have been employed to finance urban green initiatives, including district heating systems in Paris. In the United States, the tax-exempt municipal bond market has played a pivotal role in supporting projects for clean and renewable energy, as well as energy efficiency. [19]

Certain cities, such as Chicago, have also established their own green bond programs to advance municipal sustainability objectives. Nevertheless, the implementation of such instruments generally presupposes robust credit ratings, thereby making cooperation between

municipalities and national governments a prerequisite for legal and financial viability particularly in low, and middle-income countries, where the World Bank provides green bonds within the framework of sovereign development assistance portfolios [20] .

In addition, specialized Green Infrastructure Banks, such as the United Kingdom's Green Investment Bank, serve to address market failures by providing long-term financing under commercially viable yet flexible terms for projects including waste and water management [21].

Parallel to this, carbon finance mechanisms under international legal frameworks, such as the Clean Development Mechanism (CDM) and Joint Implementation (JI) under the Kyoto Protocol, offer cities supplementary revenue streams for greenhouse gas mitigation initiatives. However, urban engagement in global carbon markets remains limited due to institutional and legal constraints, including restricted authority over emission regulation, lack of access to initial capital, insufficient technical capacity, and the absence of standardized methodologies for urban-level measurement. Despite these limitations, integrating innovative financing instruments, such as green bonds and carbon finance, within urban planning and fiscal frameworks can provide a legally sound and financially sustainable pathway for advancing resilient and low-carbon urban development.[22]

4.2. Green Bonds and the Support of Sustainable Urban Development

In recent years, there has been a marked expansion in the adoption of green bonds and sustainability-linked bonds as innovative financial instruments for financing sustainable development projects, particularly in developing countries and emerging markets. These bonds have emerged as an effective means of mobilizing capital from investors to finance low-carbon urban infrastructure projects in areas such as renewable energy, mass transit, sustainable water and waste management, and environmental protection. Statistics indicate that since 2016, nineteen emerging market countries including Egypt, India, Indonesia, and Colombia have issued green bonds, benefiting from the

technical support provided by the World Bank to strengthen their institutional capacities in this field. [23]

Practical experiences in these countries illustrate how green bonds may serve as a strategic tool for achieving sustainable urban development. In Egypt, for instance, the issuance of a sovereign green bond in 2020, valued at USD 750 million, was directed to finance clean public transport projects such as the Cairo Monorail, with the dual objectives of reducing carbon emissions and alleviating traffic congestion, while simultaneously creating thousands of jobs. The proceeds also supported water and sanitation projects that benefited approximately 17 million people, thereby highlighting the direct nexus between green financing, public health, and the urban environment [24].

Indonesia, on its part, issued a sustainability bond in 2021 to support the Sidrap Wind Farm in South Sulawesi, which now provides electricity to more than 70,000 households. This project exemplifies the role of green bonds in strengthening renewable energy security within cities and in reducing reliance on coal and diesel, in line with the country's strategic plans to transition towards a low-carbon electricity grid.[25]

Similarly, Colombia issued its first sovereign green bond denominated in local currency in 2021, allocated to support strategic urban projects such as the first metro line in Bogotá, in addition to initiatives for biodiversity protection and ecosystem management. This issuance reflects Colombia's recognition of the importance of integrating environmental sustainability into urban planning policies [26].

India more recently joined this trajectory with the launch of its first sovereign green bond at the beginning of 2023, amounting to nearly USD 2 billion, dedicated to financing projects aimed at both climate change mitigation and adaptation, such as the protection of natural resources, biodiversity conservation, and advancing its national objective of reaching net-zero emissions.

At the global level, the volume of financing mobilized through green bonds surpassed USD 2.5 trillion as of January 2023,

demonstrating the growing strength of this instrument in attracting investment flows towards sustainable infrastructure projects. Its importance is particularly salient in the urban context, where cities face mounting pressures from rapid urban expansion, transportation challenges, waste management, and climate change. In this regard, green bonds provide a practical mechanism for restructuring urban economies by financing projects that reduce emissions, improve quality of life, and enhance public health and social security.

The diverse experiences of Egypt, Indonesia, Colombia, and India reveal that green finance is no longer a mere financial instrument; rather, it has evolved into a strategic mechanism for reshaping the very concept of urban development. It integrates economic, environmental, and social dimensions, contributing to the construction of cities that are more resilient to climatic and health-related crises, and more sustainable in their urban fabric.[27]

5/ The Use of Green Bonds to Build Sustainable Cities (International Experiences)

In addition to the previous examples discussed in this article regarding the use of green bonds to finance projects related to environmental sustainability whether within or beyond the urban sphere several countries have demonstrated integrated experiences in this field. Among them are the United Arab Emirates and China, which have successfully employed this financial instrument to support the transition toward more sustainable cities by financing clean energy projects, sustainable transportation, waste management, and the development of green infrastructure. These experiences serve as reference models that can be leveraged to strengthen sustainable financing policies in developing countries.

5.1. The UAE's Experience in Issuing Green Bonds to Support Sustainable Urban Development

The United Arab Emirates is considered a regional pioneer in the field of green finance and the issuance of green bonds. A major milestone was reached in 2017 when First Abu Dhabi Bank launched the first green

bond in the Middle East and North Africa, with a value of approximately USD 587 million.

This issuance represented a foundational step in the country's path toward sustainable finance. It was followed in 2019 by a series of private issuances, accompanied by the development of a comprehensive sustainable finance framework, reflecting the bank's strong commitment to consolidating its leadership in the sector [28].

The bank also played a pivotal role in managing the region's first green sukuk and green credit facilities. Moreover, it contributed to providing renewable credit facilities linked to the Sustainable Development Goals (SDGs) for Etihad Airways, in a groundbreaking global move within the aviation sector. These financial initiatives align with the UAE's broader strategic orientation toward sustainable urban development, as evidenced by the financing of major projects such as Masdar City and the development of large-scale renewable energy and green hydrogen projects [29] .

Collectively, these efforts reinforce the country's position as a regional hub for green finance and underline its commitment to transitioning toward a low-carbon and sustainable economy [30].

5.2. The Chinese Experience in Utilizing Green Bonds to Support Sustainable Urban Development

In the context of the global efforts to mitigate climate change, China has initiated the exploration of green finance instruments as a means to support its low-carbon urban projects. Chinese cities have developed initiatives aimed at mobilizing financial resources towards sustainable infrastructure, including the consideration of issuing

municipal green bonds as an innovative instrument to foster sustainable urban development [31] .

This step constitutes an extension of China's broader commitment to transitioning towards a green economy. Over the past years, China has made use of other mechanisms, such as the Clean Development Mechanism (CDM) and pilot carbon trading exchanges in Beijing, Shanghai, and Tianjin. The integration of green bonds into urban policies

is, however, anticipated to represent a qualitative shift in city financing, as it creates opportunities to channel capital into key projects such as renewable energy infrastructure, clean transport, energy-efficient buildings, and sustainable waste management [32].

This approach underscores China's growing role in linking green finance with sustainable urbanism, thereby consolidating its position as one of the leading global actors in developing cities capable of adapting to climate change and reducing emissions [33] .

6/ Conclusion

Green bonds represent an innovative mechanism for financing green investments, serving as a tool to expand environmentally friendly investments and support the objectives of sustainable development globally, if sufficiently adopted. Despite their numerous advantages, green bonds are still in the process of spreading, with relatively small financial markets, and their structure remains somewhat unclear, even with the principles and guarantees established by the World Bank. Consequently, this market is not free from risks, despite its evident benefits and noble objectives, which include environmental preservation, reduction of pollution and carbon dioxide emissions, and support for renewable energy projects.

Many banks, such as the World Bank, as well as several countries including Arab and Islamic nations have issued green bonds and developed green bond markets to finance environmentally oriented investments. Examples include the United Arab Emirates, Egypt, Malaysia, China, and others, achieving varying degrees of success.

Results:

- Green bonds provide a reliable tool for channeling investments toward environmentally sustainable projects.
- They contribute to raising awareness among investors and governments about environmental and climate-related initiatives.
- Despite their growth, the market for green bonds remains limited in size, with challenges related to transparency, standardization, and liquidity.

Recommendations:

- Expand regulatory frameworks and local guidelines to provide clearer structures and ensure market stability.
- Promote awareness among investors and stakeholders regarding the benefits and principles of green bonds.
- Encourage international collaboration and adoption of best practices to enhance transparency, standardization, and reporting.
- Support small and medium-sized issuers with technical and financial assistance to participate effectively in the green bond market.
- The main recommendation proposed in this article concerns Algeria, which would greatly benefit from adopting green bonds as a tool to finance green investments within the country and to actively encourage their use. This is particularly relevant as Algeria is pursuing development programs aligned with the United Nations Sustainable Development Goals, which extend until 2030, Given Algeria's environmental and energy diversity, these resources are expected to play a key role in supporting the country's green economy, thereby fostering both economic and social development

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