

Green Banking: Towards a Green Financial Engineering

Tabeti Mimouna*

Mascara University,

tabeti9629@gmail.com

Boularedj Souhila

Mascara University,

Sboularedj2@yahoo.fr

Abstract

With the increasing risks of climate change and its negative repercussions on the global economy, there has been a growing interest in the environmental and climate-friendly economy over the past few years. This interest in climate issues has stimulated the trends of global financial markets, international financial institutions and banks to produce and innovate financial instruments to provide the necessary financing to keep pace with these developments.

This research aims to introduce green banking and green banks and shed light on green financial innovations as, according to researchers, a building block of green financial engineering.

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* Corresponding author

1. Introduction

The emergence of green banking began after many civil society organizations and non-profit organizations condemned banks for financing projects harmful to the environment and put pressure on them to integrate environmental considerations in their financing and banking programs in a way that confirms the responsibility of banks towards protecting the environment. Green banks use modern technology, products and services that take into consideration the environment, energy efficiency, reducing polluting emissions and recycling, which is why green banks combine the financial sector, environment and economic growth. (أسامة سلام، 2020، صص 42، 43)

Thus, green banking represents a new trend in banking that seeks to provide low-cost and long-term financial support for low-carbon clean energy projects, increase the efficiency of the use of public funds, and orient financial markets towards investment in clean energy. It works to achieve growth for both the banking sector and the economy as a whole, while preserving as much as possible the safety of the environment, as well as adhering to the standards of rationalizing the

consumption of natural resources. (الرفاعي وآخرون، 2019، ص 452)

Thus, we ask, is it possible for green banking to lead to the establishment of a green financial engineering?

Objectives of the study:

- Raising awareness of the challenges related to climate change.
- Supporting climate solutions through safe investment.
- Expanding the idea of green bonds.
- Define the concept of green financial engineering.

Research Methodology:

In this study, we relied on the descriptive approach by collecting information and literature from several references, Arab and Western articles, in addition to reports and websites.

2. Green Finance and Green Banks

2.1 Green Finance

The concept of green finance focuses on reshaping and correcting economic activities to be more supportive of the environment and social development. It

has found a basis for supporting the protection and preservation of the environment and is seen as a mechanism to achieve sustainable development. It is also known as the use of financial products and services such as loans, insurance, shares, capital investments, bonds and others for Financing green or environmentally friendly projects, also known as those production or service investments related to the environment that aim to provide green products that do not harm the environment. It also includes preventive projects to prevent environmental pollution or depletion of its resources. (البناء وعبد الأمير، 2019، ص148، 149)

"green finance is defined as financial products and services, under the consideration of environmental factors throughout the lending decision making, ex-post monitoring and risk management processes, provided to promote environmentally responsible investments and stimulate low-carbon technologies, projects, industries and businesses".

(Nannette, 2014, p1)

The importance of green finance is highlighted by the following (البناء وعبد الأمير، 2019، ص149):

- Green finance provides the necessary financing for investment in the field of agriculture, fresh water, fisheries and the industry of forests and reserves, and over time that results in improving the quality of the soil and increasing the returns from the main crops.
- Green finance works to raise the level of efficiency in the sectors of agriculture, industry and municipalities from the demand for water, which reduces pressure on ground and surface water in both the short and long term.
- Green finance contributes to reducing poverty rates through optimizing the use of natural resources and ecosystems and ensuring sustainable development through the flow of benefits from natural capital and their delivery directly to the poor.
- Works to provide and increase new jobs, especially in the sectors of agriculture, plants, energy and transportation.
- Separation between resource use and environmental impacts and economic growth. It is characterized by a significant increase in investments in the green sectors, supported in this by enabling reforms at the level of economic policies.

- Redrawing the features of business, infrastructure and institutions by increasing the share of green sectors of the economy.

Reducing the quantities of energy and materials in unclean production processes, which leads to a reduction in waste and greenhouse gas emissions.

2.2 Green Banks (محمد الشرايبي، 2021) :

Green banks are public capital entities created specifically to facilitate private investment in local, low-carbon, climate-resilient infrastructure and other green sectors such as water and waste management, taking into account not only financial gains but the environment as well, taking into account other sustainable development goals such as achieving Economic growth and job creation.

There are 27 green banks operating around the world, and these banks have invested more than \$20 billion so far in new technologies ranging from solar energy to electric vehicles and more.

Types of green banks:

There are 3 different types of models that are currently in use:

- ✓ Public banks: such as the Clean Energy Finance Corporation CEFC in the United States, whose mission includes investing in clean energy projects and clean technology companies.
- ✓ Private banks: that offer eco-friendly versions of traditional bank accounts or credit cards. For example, the Italian MPS Bank that offers loans for solar and wind energy, green mortgages, or investments in clean technologies.
- ✓ Hybrid banks: that combine the two, such as MUFG Bank, a subsidiary of Mitsubishi Financial Group.

These banks have other services where customer deposits are pooled to fund sustainable projects such as renewable energy plants with up to \$500 million, and they also offer environmental awareness seminars on topics including recycling and home energy efficiency.

Other institutions, such as the German Wuppertal Institute, offer research into green banking models, which can be used by organizations around the world looking for ways to provide responsible banking services to their customers.

Green Bank Activities (البناء وعبد الأمير، :
(2019، ص159، 161)

Projects related to alternative energy:

Energy is the main engine for any production project, so choosing a renewable and clean energy source is a continuous and inexhaustible source of energy, for example solar energy, wind energy, sea wave energy and others.

Environmental protection projects:

through banks financing environment-friendly projects, as follows:

A - Financing green agriculture in developing countries, which has an impact on reducing poverty rates.

b- Increasing investments in the natural assets used by the poor in their daily lives.

C - Reliance mainly on clean energy as it provides energy in countries that suffer from energy poverty.

D- Supporting projects that aim to develop water resources because of their vital role in continuing agriculture and supporting the local economy, and thus activating the industrial sector in the field of food.

Supporting food security projects: Green banks focus on increasing agricultural

production capacity in order to provide food at the local and regional levels, in addition to ensuring the preservation of agricultural land and water.

Supporting programs to combat poverty and unemployment: Green banks adopt programs to support the poor by including them in granting micro loans based on the principle of trust and without the guarantees and restrictions imposed by traditional banks.

A- Determining the target class from the poorest of the poor and according to the method followed by the bank in proportion to the social situation

B- Adopting a single mechanism that does not require any guarantees or mortgage of property in return for obtaining the loan.

c- Giving the borrowers complete freedom to choose their own projects according to their experience, knowledge and skills.

Supporting training and education

programs: Green banks adopt education programs by following global standards and principles that provide sustainable development in the field of providing financial resources to existing cadres for education and skills development by

providing good infrastructure and modern equipment for the education mission, and providing supportive training courses for distinguished individuals as well as giving them value in the process of career advancement and promotion.

Supporting small business projects: These are projects managed by one owner who bears full responsibility for managing them in the long term, and the number of employees in them ranges between 10 and 50 workers.

Supporting housing projects: Green banks support urban projects that use environmentally friendly building materials and that are produced from projects that use clean energy.

Green Bank Loans (2021، محمد الشرابي) :

Green bank loans are characterized by financing any project that contributes or helps reduce global warming, preserve the environment and reduce pollution. The most important of these loans are:

- ✓ Green lending: is the practice of providing funds for a project that has an environmental benefit.
- ✓ Eco Loans: Eco Loans This type of loan offers low interest rates to those consumers who have low credit

scores and ask them to do things like save water or reduce coal use.

- ✓ Carbon offset: Reducing your carbon footprint by paying companies like TerraPass and Native Energy, social enterprises that provide carbon offset products to individuals and businesses, use proceeds from members' purchases to fund greenhouse gas reduction projects such as wind farms.
- ✓ Loans for sustainable agriculture or renewable energy projects, which may have trouble qualifying with other types of lenders.

3. Green financial markets

3.1 The green bond market:

A green bond, first issued by the European Investment Bank in 2007, is a fixed income instrument that is specifically earmarked to raise money for climate and environmental projects, including renewable energy, energy efficiency, and resource conservation. They also finance the cultivation of environment-friendly technologies and the mitigation of climate change. From less than \$3 billion in 2012, the total global issuance of green bonds surged to almost \$160 billion in 2019. Issuing green bonds has been documented as

a signaling device of environmental commitment by various stakeholders, such as managers, shareholders, clients, and society, and helps the issuer gain positive investor recognition. Investors are found to be less sensitive to financial returns, and more patient in fund flows when investing in socially responsible companies. In capital markets, there is evidence that firms which issue green bonds experience favorable stock price reaction and improved trading liquidity. (Jihong Lee et al, 2021, pp. 3, 4)

Green bonds are one of the relatively recent financial instruments, which have gained increasing interest in recent years, as they are directed specifically to support projects related to climate or the environment. It is this specific use of funds mobilized to support the financing of specific projects that distinguishes green bonds from conventional bonds. Therefore, in addition to evaluating standard financial characteristics (such as maturity, dividend value, price and the credit rating of the issuer of the bond), investors also evaluate the specific environmental objectives of the projects the bonds are intended to support. (اتحاد هيئات الأوراق المالية العربية، 2016، ص4)

Green bonds are a type of innovative debt financing instrument, usually tax-exempt, to encourage investment financing in green

projects (green investment). They are also called environmental bonds, or bonds of investments with social and environmental responsibility, or climate bonds, all of which are synonymous and carry the same meaning. They emerged as a result of the natural development and maturity of development and financing thought in particular, and the development of the bond market in general. (بكدي وخبازي، 2020، ص309)

3.2 Investors and the market:

The growth of the green bond market - which tripled worldwide issuance, from \$11 billion in 2013 to more than \$36 billion in 2014 - reflects an increase in the diversity of both bond issuers and investors.

American investors, such as the California Department of Treasury, and responsible and sustainable popular investors such as the California State Teachers' Retirement Fund, Trillium, and the Teachers' Insurance and Pensions Association were among the first investors in green bonds. Bond managers such as BlackRock, Merova and Nikko Bond Management are also increasing their support for this market.

Another group of investors showing a growing interest in green bonds is insurance companies, with contributions ranging from

15 to 20 percent in standard green bonds issued by the World Bank with maturities ranging from five to ten years. Zurich Insurance has announced plans to double its investment in green bonds to more than \$2 billion as the sector grows, and recently purchased a 30-year World Bank green bond.

While green bonds are generally in high demand, investors are checking high standards in project selection, due diligence and follow-up over the process green bonds go through to identify “green” projects, and allocate funds to eligible projects. The World Bank is a pioneer in this market with a transparent approach to reporting on projects that help clients adapt to climate change and mitigate its effects. It also supports market development by collaborating with investors and bond issuers in setting principles and standards. (البنك الدولي، 2015)

In order to attract private investors to these markets, banks issuing green bonds use a range of financial instruments, such as shares of renewable energy companies, stock CFDs and ETFs. Renewable energy, to avoid risks

As a result, green banks have attracted, on average, more than \$2 of private investment for every \$1 of private capital they have

invested in the project, so crowdfunding is the third pillar of the Paris climate agreement, and a necessary precondition for the success of the other two.

For funding to be equitable and sustainable, it must meet local and national needs, and be connected to international networks. (محمد الشرابي، 2021)

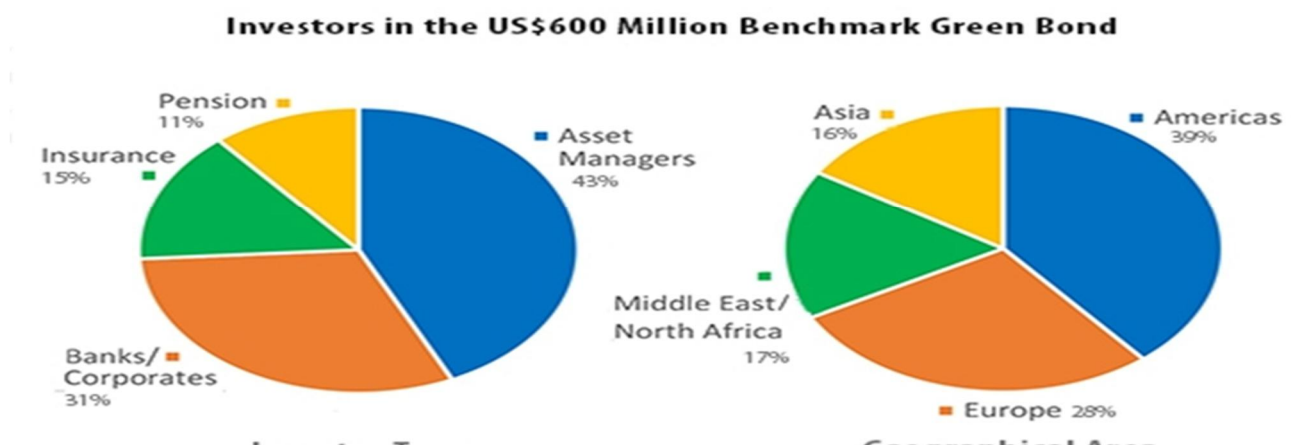
Statistics and data indicate that since the issuance of the first green bond in 2007 at a value of \$800 million, the market for these bonds has continued to grow steadily, reaching nearly \$81.5 billion in 2016 and then amounting to about \$155.5 billion in 2017. The latest Bond Initiative reports indicate Climate: The volume of these bonds reached a record level at the level of 269.5 billion dollars in 2020, the share of the United States of America was 51 billion dollars, followed by Germany with 40.5 billion dollars, then France with 32 billion dollars, and it is expected to exceed the 400 billion dollars barrier in 2021.

This type of investment is linked to financing projects with economic and social returns that help combat climate change, mitigate it and achieve sustainable development goals. The International Finance Corporation estimates that the volume of these investments managed by the

private sector exceeded \$70 billion, while there are approximately \$8 trillion in investments for the family sector, a large part of which is employed in green projects that take into account the environment, while the investments of public development finance institutions (state-owned) amount to about \$4 trillion, and the total of these investments is likely to exceed the \$25 trillion barrier over the next few years. (النصراوي، 2021)

These investors play an important role in mobilizing private sector financing, which is the primary objective of the green bond market. With each new green bond issued, the volume of mobilization and interest from investors increases. (البنك الدولي، 2015)

FIGURE 1 Investors in the Green Bonds:



Source: world Bank, 2015

The success of the new World Bank green bond was the result of seven years of work by the World Bank Treasury developing the green bond market. It started with the World Bank issuing the first labeled green bond in 2008 in response to requests from large institutional investors who were looking for a liquid investment that explicitly supported the financing of climate-related projects.

The World Bank has since issued nearly US\$8 billion in green bonds through 80 transactions in 18 currencies.

The proceeds are helping to finance a range of climate- and environment-friendly projects, including sustainable urban transportation in India, geothermal power development in Indonesia, energy efficiency improvements in China, sustainable forest

management in Mexico, and disaster-risk management in the Dominican Republic, among many other projects. (البنك الدولي، 2015)

3.3 Principles Governing the Green Bond Market (بكي وخبازي، 2020، ص309، ص310):

A set of voluntary guidelines was established by a group of insurers, issuers, investors and investment banks in 2014; Today under the supervision of the International Capital Market Association, these Principles were updated in 2018. They are a way to provide guidance to both issuers and investors in understanding what to expect.

These principles consist of four components:

The criteria for using the proceeds: the use of the proceeds to finance or refinance green projects or to support research and development (green development), and the principles of the bonds explicitly specify the eligible categories under which projects can be included in the green color field, so that these projects are clear environmental benefits and contribute to achieving development goals sustainable development, such as mitigating climate change, conserving

natural resources and preventing and combating pollution

Project evaluation and selection process:

Green bond issuers must communicate transparently, clearly and impartially with investors to achieve sustainability goals,

Revenue Management: The net bond proceeds are added to a sub-account, and the proceeds are managed by an auditor or other party to verify the internal tracking method and allocate the proceeds of the green bond (external audit).

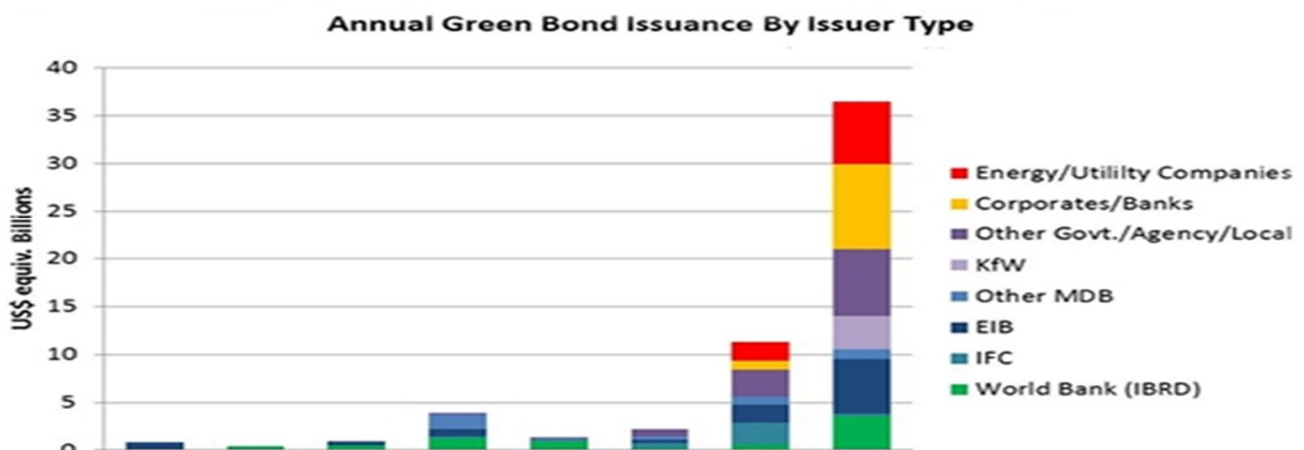
Reporting or actual use of funds: The issuer is required to report on the allocation and use of proceeds for eligible green projects, and identifies the list of projects supported by bond proceeds, as well as a brief description of those projects, the amounts allocated to them and their expected impact, usually in an annual report via newsletters Site updates or financial reports on specific investments obtained from bond proceeds, where a list of green projects can be identified, a brief description of the projects and allocations for each can be made.

To achieve greater transparency and integrity in the market for this type of bond, several countries and institutions

have worked collectively and independently to develop their standards that define best practices for issuing green bonds; Some countries have organized

their own local bases, such as India and China.

FIGURE 2 Investments in green bonds by type of issuer



Source: world Bank, 2015.

Group Treasurer of Deutsche Bank "Alex von zur Muehlen» says: " Landmark green issuances from triple-A issuers such as the World Bank further enhance the appeal of the green bond market, promoting investment in sustainable projects that mitigate the effects of climate change at commercially appealing returns. "

3.4 Ways to promote green bonds in financial markets (بكاري، 2020، ص150، 151):

1. Support the process of developing markets for green bonds.

2. Strengthening international cooperation in order to facilitate cross-border investment in green bonds.

3. Encouraging and facilitating the exchange of knowledge on environmental and financial risks.

4. Improving the way green finance activities and their impacts are measured.

5. Promote environmentally friendly investments.

6. Pushing capital into the green economy.

7. Develop an ecosystem to support the creation of green capital markets.

8. Enhancing transparency and disclosure of information related to green investments.

TABLE 1 INSTITUTIONAL STRUCTURE OF THE GREEN FINANCING MARKET

Green funding market Participants	Composition
Financial institutions	State and public organizations; Banks (global and national development banks, commercial and state owned national banks) Funds (national, specialized) Insurance companies
Financial tools	Green bonds, green lending, guarantees for financing green projects, state-owned green funds, grants, loans, Green insurance tools, green venture funds Indices, pollution allowances
Infrastructure and service organizations	Organizers of the auction Multifunctional trading platforms Crowdfunding platforms Rating agencies Verifiers Certification agencies Research institutes

Source: Joanna Koczar et al, 2019, p605

4. Green Financial Instruments The Path to Green Financial Engineering

4.1 Definition of green innovation:

It is also known as environmental innovation, ecological innovation, environmental technologies, or green technologies. It means creating products or production processes aimed at addressing environmental problems resulting in the product life cycle.

It is an innovation that falls within the broad innovation that relates to the delivery of a new green process, a new green product that is sustainable, or that is more environmentally efficient compared to the product. Green innovation also includes improvements to existing

products to be less harmful to the environment.

Green innovation can be considered as a subset of all innovations, as this group works to expand new areas by introducing radically new products and encroaching on the ground of traditional innovation by removing markets for non-green alternatives or completely phasing out products and processes harmful to the environment. (كواش، 2021، ص516)

Green innovation refers to innovation in technologies, products, services, organizational structures or management patterns adopted by enterprises to achieve sustainable development, in order to contribute to reducing environmental burdens, and to achieve a sustainable advantage in the target market, enterprises

need both technological innovation and management innovation. (بوطرفة وفرحي، 2020، ص240)

green financial innovation is defined as the process of developing and commercializing new financial products following various financial technologies, financial institutions, and financial markets same with the concept of green products innovation. Furthermore, defined green financial innovation as a process change that includes a change in various types of financial products. Furthermore, the consequence is related to financial institutions' costs decreasing or increasing, because every change in their operations through financial technology leads to a change in their financial position. More specifically, these innovations are helpful in decreasing risks, lowering transaction costs, and improving products and services. (Goshu and Anita, 2022, P 98)

4.2 Green Digital Finance:

Digital finance has turned into an unexpected revolution, simply by enabling low-cost financial inclusion. Thanks to the new financial technologies Fintech, consumers can shop with ease, immigrants can send cash cheaply to their families, small businesses can get credit in minutes with big data, and savers can set their own investment goals. But if fintech is to enhance its ability to serve the global common good, it must consider another factor: the environment.

The United Nations Environment Program recently published a report, 'Fintech and Sustainable Development:

Assessing the Implications', exploring how digital governance can deliver environmental benefits. The report also indicates, by reducing costs and increasing efficiency, that Fintech has started working on activating green finance, enabling the poor to access clean energy through innovative payment systems and facilitating green savings for the rich and the poor alike. (سايمون زادك، 2017).

4.3 Products and Services (البنك المركزي المصري، 2012، ص4، ص5 وأسامة سلام، 2020، ص45-47):

Green Current Account: Banks may offer a higher interest rate for current and savings accounts if customers are doing online banking activities. A customer can also get an interest rate on his current account if he follows some environmentally friendly procedures that may include receiving an account statement electronically or Pay bills online or use computer cards.

Green Savings Account: Banks make donations based on the savings made by customers and motivate them to save. The more savings, the more contributions and donations from banks directed to preserving the environment.

Green Mortgage Loans: These are loans that help motivate individuals to buy green homes that have water and energy efficiency technology or recent modifications. Green mortgage loans can also cover the cost of converting a traditional home into a green home. Banks offer green mortgage loans at

better rates and terms for homes. Energy efficient.

Green loans: Banks provide loans with facilities to environmentally sustainable projects.

Green Commercial Building Loans: It is a loan for green commercial buildings that are characterized by lower consumption of energy and resources, lower waste and green building materials, lower operating expenses, improved performance, longer life associated with green functions and features and less pollution than traditional buildings.

Green Car Loans: Green car loans encourage the purchase of cars that demonstrate high fuel efficiency while promoting pollution control.

Green cards: They are debit and credit cards associated with environmental sustainability activities. Green credit cards from large credit companies are offered to make the environmental NGO donation equal to approximately half a percent of every purchase, balance transfer or cash advance by the card holder. These cards are provided an excellent incentive for customers to use their green cards for high-value purchases, and with it, banks enjoy using the funds of environmentally friendly non-profit organizations.

Mobile or Internet banking: These modern digital banking operations include reducing paper transactions, heading to branches, and not wasting time and effort, all of which has a positive impact on the environment.

green bonds

Green Securitization: Financial investment in a variety of emerging innovative environmental securitization technologies, including forest bonds, ecosystem securitization programs, and terrestrial and aquatic animal securitization bonds.

Green Private Equity: As the capital base and financing for environmental projects through green private equity focusing on clean energy growth markets, investment opportunities in clean environment, clean technology, low carbon approaches, smart cities and more.

Carbon Commodities/Credits: As the definition of carbon was developed under the Clean Development Mechanism with a focus on low carbon investment to address climate change and environmental risks, most investment banks capture carbon credits in order to meet the needs of their corporate clients or provide an environmentally tradable product to trading desks in banks.

4.4 Formulating a definition of green financial engineering:

Financial engineering is defined as: (بوطكوك، 2015، ص5) The design, development and application of creative and innovative financial tools, mechanisms and processes by devising qualitative and quantitative methods to solve financing problems and manage financial risks faced by institutions, and it includes three main activities:

1. Stimulating financial innovation processes

2. Innovating and developing new financial products that suit the needs of all dealers in the financial market

3. Devise solutions to financing and risk management problems

By combining the definition of financial engineering with the term green, we can come up with an updated definition of green financial engineering:

- Creating green, tradable financial instruments that reflect investment opportunities and achieve positive effects on the environment in addition to financial returns.
- Creating green financial operations and strategies that motivate exporters and make it easier for investors to deal in green financial markets.
- Devising solutions to financing problems, managing financial risks and climate change risks.

5. Results:

- Green bonds are among the most prominent tools that have emerged over the past years.
- It represents a debt instrument issued to mobilize funds specifically to support projects related to climate and environment,
- What distinguishes green bonds from traditional bonds is the use of funds mobilized to support environmental projects such as clean energy projects, renewable energy, energy efficiency, pollution prevention and control, sustainable management of water and sanitation, green buildings and

transportation projects that reduce emissions.

- In addition to evaluating standard financial characteristics such as maturity, coupon, price and credit rating of the bond issuer, the investor evaluates the environmental objectives of the projects.

- All exporters assess the social and environmental impact of their investments.

- Providing information to investors and supporting bond issuers.

- The banking sector has now become the main player and ruler in driving the sustainable economic development of any country, and "green banking" is a form of banking from which the country obtains "climate-damaging" environmental benefits.

6. CONCLUSION

There is a need to tackle climate change and accelerate the development of policies that make a difference by shifting to clean technologies, scaling up green investments and achieving zero carbon emissions.

Green banking means enabling environmentally friendly practices and reducing the carbon footprint of banking activities. It aims to protect the environment in a sustainable way, improve processes and technologies, as well as make customers' habits environmentally friendly with regard to banking activities.

On the other hand, the sustainability of green banks requires the pursuit and development of green financial products

and services, and this can only be done through green financial engineering, which during our research we tried to define its own and emphasize its necessity.

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