G20 Green Finance Synthesis Report

G20 Green Finance Study Group

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Summary

The G20 Green Finance Study Group (GFSG)'s work supports the G20's strategic goal of strong, sustainable and balanced growth. The challenge is to scale up green financing, which, based on a number of studies, will require the deployment of tens of trillions of dollars over the coming decade. The GFSG was established to explore options for addressing this challenge.

"Green finance" can be understood as financing of investments that provide environmental benefits in the broader context of environmentally sustainable development. These environmental benefits include, for example, reductions in air, water and land pollution, reductions in greenhouse gas (GHG) emissions, improved energy efficiency while utilizing existing natural resources, as well as mitigation of and adaptation to climate change and their co-benefits. Green finance involves efforts to internalize environmental externalities and adjust risk perceptions in order to boost environmental friendly investments and reduce environmentally harmful ones. Green finance covers a wide range of financial institutions and asset classes, and includes both public and private finance. Green finance involves the effective management of environmental risks across the financial system.

Green finance faces a range of challenges. While some progress has been made in green finance, only a small fraction of bank lending is explicitly classified as green according to national definitions. Less than 1% of global bonds are labeled green and less than 1% of the holdings by global institutional investors are green infrastructure assets. The potential for scaling up green finance is substantial. However, the development of green finance still faces many challenges. Some are largely unique to green projects, such as difficulties in internalizing environmental externalities, information asymmetry (e.g., between investors and recipients), inadequate analytical capacity and lack of clarity in green definitions. Others are more generic to most long-term projects in some markets, such as maturity mismatch.

Options to address these challenges are emerging. Many countries have adopted measures such as taxes, subsidies and regulations to deal with environmental challenges. These actions make significant contributions to enhancing green investment, but overall the mobilization of private capital remains insufficient. Over the past decade, various complementary financial sector options have emerged in many G20 countries, from both private and public actors, to support the development of green finance. These include, among others, voluntary principles for sustainable lending and investment, enhanced environmental disclosure and governance requirements, and financial products such as green loans, green bonds, green infrastructure investment trusts,[1] and green index products. International collaboration among central banks, finance ministries, regulators and market participants is also growing, focused in large part on knowledge sharing of country experiences and capacity building.

The GFSG has been launched under China's Presidency of the G20. Its mandate is to *"identify institutional and market barriers to green finance, and based on country experiences, develop options on how to enhance the ability of the financial system to mobilize private capital for green investment."* An initial program of five topics has covered three sectoral issues namely banking, the bond market, and institutional investors, as well as two cross-cutting topics, i.e., risk analysis and measuring progress. The GFSG recognizes, due to differences in local conditions, some options that are considered as good practices in one country may not be suitable for another country. It

therefore has focused on stocktaking, knowledge sharing, and developing voluntary options for countries to choose from and for bilateral/multilateral collaboration. The GFSG has reviewed various country experiences and market practices, engaged with market participants, benefited from active participation from international organizations, and drawn contributions from research institutions. It has also worked closely with other international initiatives and G20 work streams, notably the Financial Stability Board (FSB) Task Force on Climate-related Financial Disclosures and the G20 Climate Finance Study Group (CFSG).

Emerging from the GFSG's work are a number of options for the G20 and country authorities, for consideration for voluntary adoption, to enhance the ability of the financial system to mobilize private capital for green investment. Key options are highlighted below:

1. **Provide strategic policy signals and frameworks:** Country authorities could provide clearer environmental and economic policy signals for investors regarding the strategic framework for green investment e.g., to pursue the Sustainable Development Goals (SDGs) and the Paris Agreement.
2. **Promote voluntary principles for green finance:** Country authorities, international organizations and the private sector could work together to develop, improve, and implement voluntary principles for and evaluate progress on sustainable banking, responsible investment and other key areas of green finance.
3. **Expand learning networks for capacity building:** The G20 and country authorities could mobilize support for the expansion of knowledge-based capacity building platforms such as the Sustainable Banking Network (SBN), the UN-backed Principles for Responsible Investment (PRI), as well as other international and domestic green finance initiatives. These capacity building platforms could be expanded to cover more countries and financial institutions.
4. **Support the development of local green bond markets:** On request of countries that are interested in developing local currency green bond markets, international organizations, development banks and specialized market bodies could provide support via data collection, knowledge sharing and capacity building. This support could include, in working with the private sector, the development of green bond guidelines and disclosure requirements as well as capacity for verifying environmental credentials. Development banks could also play a role in supporting market development, for example by serving as anchor investors and/or demonstration issuers in local currency green bond markets.
5. **Promote international collaboration to facilitate cross-border investment in green bonds:** Country authorities or market bodies could promote cross-border investment in green bonds, including through bilateral collaboration between different green bond markets, where market participants could explore options for a mutually-accepted green bond term-sheet.
6. **Encourage and facilitate knowledge sharing on environmental and financial risk:** To facilitate knowledge exchange, the G20/GFSG could encourage a dialogue, involving the private sector and research institutions, to explore environmental risk, including new methodologies related to environmental risk analysis and management in the finance sector.
7. **Improve the measurement of green finance activities and their impacts:** Building on G20 and broader experiences, the G20 and country authorities could promote an initiative to work on green finance indicators and associated definitions, and to consider options for the analysis of the economic and broader impacts of green finance.

1. Why Green Finance?

1.1. Financing environmentally sustainable growth

The G20 Green Finance Study Group's work supports the G20's strategic goal of strong, sustainable and balanced growth. Pollution, natural resource depletion and effects from climate change impose significant economic stresses and costs. As a result of human pressure on Earth's resources, natural capital has declined in 116 out of 140 countries, including the deterioration of natural resources such as freshwater and arable land.[2] Approximately four million people die prematurely every year due to air pollution exposure,[3] and natural disasters displace tens of millions of people annually.[4]

Financing environmentally sustainable growth requires substantial amounts of investment. Currently there is neither a systematic estimate of global financing needs for environmentally sustainable growth, nor indicators of actual green finance flows on the global level (a subject to be explored later in this report). Numerous studies from the International Energy Agency (IEA), World Bank, Organisation for Economic Co-operation and Development (OECD) and World Economic Forum (WEF), however, provide directionally similar indications of what is required, pointing to the need to deploy tens of trillions of dollars over the coming decade to finance green projects in key areas such as construction, energy, infrastructure, water and waste.[5]

On a conceptual level, 'green finance' can be understood as financing of investments that provide environmental benefits in the broader context of environmentally sustainable development. These environmental benefits include, for examples, reduction in air, water and land pollution, reductions in GHG emissions, improved energy efficiency while utilizing natural resources, as well as mitigation of and adaptation to climate change and their co-benefits. Beyond the financing of green investments, green finance also involves efforts to internalize environmental externalities and adjust risk perceptions in order to boost environmental friendly investments and reduce environmentally harmful ones. As regards the functioning of the financial markets, green finance also means an improved understanding and pricing of financial risks related to environmental factors.

Green finance may provide growth opportunities in addition to delivering environmental benefits. Enhancing green finance could facilitate the growth of high-potential green industries, promote technological innovation and create business opportunities for the financial industry**.** For example, renewables represented approximately 62.5% of net additions to global power capacity in 2015[6] and the market size of electric vehicles expanded 60% in 2014.[7] Providing adequate financing to such green sectors with high market potential could therefore be growth enhancing. Clean technology, energy saving and environmental remediation sectors tend to be high-tech and associated with high R&D spending that spur technological progress. The development of green financial instruments, such as green loans, green bonds, green investment trusts and funds as well as green indices and ETFs, also mean business opportunities for many financial firms.

Green finance may alter the way in which environmental factors impact financial institutions. Inadequate recognition of financial risks due to environmental factors may pose a challenge to the soundness and safety of financial institutions. There is also a growing recognition that traditional approaches to incorporating environmental factors into risk management systems by financial institutions may be insufficient as environmental risks reach new levels of scale, likelihood and

interconnectedness. As the greening of the financial system will likely accelerate the re-allocation of resources, it may impact the risk-return profiles (both positively and negatively) of some economic activities and financial assets, as well as the credit and market risks faced by financial institutions. It is therefore important for policy makers and financial institutions to better understand and respond effectively to both the opportunities and risks associated with green finance.

Green finance covers a wide range of financial institutions and asset classes, and includes both public and private finance. Banks, institutional investors and other market players could improve the "greenness" of their operations – this could include specific financial products, asset classes and instruments, such as labeled green loans/bonds and designated green infrastructure funds (Chapters 2-4). Emerging areas such as financial technologies (FinTech) and Islamic finance are also finding applications in green finance. Governments may choose to deploy public finance resources to realize positive environmental externalities through direct green investments or by incentivizing private green finance. Private green financial flows, the focus of the GFSG,[8] however, will likely make up the bulk of future green finance, largely because of the fiscal constraints in many countries. For example, in China it is estimated that over 85% of the country's total green investment will need to be financed by private capital.[9]

While some progress has been made in green finance, only small fractions of bank lending and investments made by institutional investors are explicitly classified as "green".[10] Only 5-10% of bank loans are "green" in a few countries where national definitions of green loans are available. Less than 1% of total bond issuance is made up of labeled green bonds and less than 1% of the holdings by global institutional investors are specific green infrastructure assets. While in some areas significant investments and stocks of capital that fulfill environmental criteria are not explicitly labeled as green, what is clear is that substantial further efforts are needed to re-orient the capital allocation towards green investments across the economy. A key driver for this capital reallocation is for banks and institutional investors to take fuller account of environmental risks and environmentally driven returns in their decision-making process.

Green finance faces a range of general and specific challenges. Many challenges limit green financial activities. These include general challenges that restrain financial flows in most market segments as well as those inhibiting green finance in specific market segments. Examples of these challenges include: (a) inadequate internalization of environmental externalities, (b) maturity mismatches, (c) lack of clarity of green finance definitions, (d) information asymmetries (e.g., between investors and recipients), and, (e) capacity constraints.

Financial sector options are emerging. Historically, many policy actions — such as fiscal measures (taxes and subsides), environmental regulations, and emissions trading schemes — were taken to address environmental externalities. These actions are critical to improving the environment but remain insufficient in mobilizing private capital for green investment in many countries. In the past decade, a range of financial sector options has emerged to help address some of the above-mentioned challenges to green finance. Many have been market-led to secure improved risk-adjusted financial returns for green investments. Examples of these options include voluntary commitments and principles, better risk assessment methodologies, and innovative financial products such as green bonds and green infrastructure investment vehicles. Some have sought to advance market effectiveness and integrity, such as the incorporation by stock exchanges of so-called "ESG" (environmental, social and governance) disclosure requirements for listed

companies. Others have been supported by public finance to address externalities and risk misperceptions, including via tax credits, credit enhancement, Public Private Partnership (PPP) arrangements and demonstration projects.

International collaboration among market participants, central banks, finance ministries and regulators is growing, focused in large part on knowledge sharing and capacity building. For example, the SBN, the PRI and UNEP Finance Initiative (UNEP FI) are promoting sustainable lending, investment and insurance practices. The FSB has convened a private sector led task force that is investigating how best to disclose market-relevant information on climate-related financial risk and will deliver its recommendations by the end of this year. The International Capital Markets Association (ICMA) has coordinated the development of the Green Bond Principles that helped catalyze the rapid growth of the green bond market.

Many of these green finance initiatives are at an early stage of development and currently only cover a limited range of financial activities. However, the country experiences and market practices reviewed by the GFSG and its five research subject teams have already provided some indications that these initiatives have facilitated green finance activities, improved information flows and analytical capabilities. Such evidence and the results from a few GFSG surveys[11] also suggest **the potential for some of these practices to be adopted elsewhere on a voluntary basis.**

1.2. The G20 Green Finance Study Group

The proposal to launch the Green Finance Study Group under China's Presidency of the G20 in 2016 was adopted by the G20 Finance and Central Bank Deputies meeting on 15 December 2015 in Sanya, China. The Study Group is co-chaired by China and the United Kingdom, with support from UNEP as secretariat.

G20 Finance Ministers and Governors reaffirmed the mandate of the Study Group in their Communiqué issued after the Shanghai meeting on 28 February 2016, by asking the GFSG "*to identify institutional and market barriers to green finance and, based on country experiences, develop options on how to enhance the ability of the financial system to mobilize private capital for green investment*."[12]

The diversity of local conditions means some practices that work well in one country may not be suitable in another country. Country contexts vary, including national priorities and the stage of development of their financial systems. As a result, the relative weight of different challenges to green finance will vary between contexts, as will the reasons and importance for actions in the financial system to overcome these challenges. The GFSG has therefore focused on mapping existing practices and emphasizing voluntary options for country action and international cooperation.

The GFSG agreed to explore five topics at the launch of the GFSG in Beijing in January 2016. Three areas of research have a sectoral focus – banking, bonds and institutional investors – and two are cross-cutting: risk analysis and measuring progress. For each area, G20 and broader experience has been mapped and analyzed, and implications drawn for possible national action and international cooperation. The GFSG received a total of 14 input papers and a scoping note prepared by knowledge partners, which do not necessarily represent the consensus views of members of GFSG. These input papers cover diverse aspects of the five topics, in large part based

on case work drawn from G20 members and more broadly, and including a G20-wide survey focused on approaches to measuring progress and an industrial survey on green bonds. A number of international organizations (IOs) and research institutions have made significant contributions across the five work streams. Inputs have also been sought via consultation with the private sector through subject-specific engagements and several convenings in Shanghai, London, Washington, D.C. and Bern. Finally, the work of the GFSG has benefited from outreach to non-G20 countries and non-governmental organizations (NGOs) that have highlighted specific concerns and needs, as well as innovative practices.

Green finance topics are interlinked. Definitional issues and environmental risk analysis, for example, affect green finance activities of various financial institutions and markets and are therefore woven throughout the three sectoral research topics. The importance of other key related topics not included in the initial work program was also appreciated. For example, disclosure and public finance were excluded pending the conclusions of on-going work under the FSB and G20 CFSG respectively. Although the GFSG focus on green finance and financial market development is distinct in the context of the G20, it has important linkages with other G20 work streams (including the CFSG, as well as the Infrastructure and Investment Working Group and the Energy Efficiency Finance Task Group) as well as the work ongoing under the Task Force on Climate-Related Financial Disclosures set up by the FSB. Emphasis has been placed on drawing lessons from these work streams.

Structure of this report

The next five chapters are organized as follows. Chapter 2 summarizes the GFSG's findings on key institutional and market challenges to green finance under five general categories and highlights where these challenges can be addressed by solutions within or related to the financial sector. Chapter 3 analyses country and market practices in greening banks. Chapter 4 looks at the green bond market. Chapter 5 looks at green investment by institutional investors. Each of these three chapters concludes with a set of options to address specific challenges. Further, each of these chapters sees risk analysis, one of the cross-cutting themes, as a key element and a driver of decision-making. Chapter 6 looks at issues related to risk analysis and measuring progress and offers some insights for ways forward on these two cross-cutting issues.

2. Challenges to Green Finance

Although some progress is being made, the development of green finance still faces many challenges. We highlight below five types of challenges to green finance and provide some examples drawing from country and market practices of how they have been or might be addressed within the financial sector. Four of these challenges (externalities, green definitions, information and analytical capacity) are largely specific to green projects, while maturity mismatch is generic to most long-term projects.

Clear public policy directives and signals can address some of these challenges, however fragmented policy responses in many countries are a key concern and sometimes distractions from efforts to developing effective responses. It should also be noted that, in addition to those discussed in this chapter, challenges arise from inappropriate public policy measures that aggravate environmental externalities; however, these issues need to be addressed separately.[13]

2.1. Externalities

The first and most fundamental challenge is how to appropriately and cost-effectively internalize environmental externalities. Such externalities can be positive for green investments as their benefits accrue to third parties, and negative when polluting investments inflict harm on third parties. Difficulties in internalizing these externalities result in under-investment in "green" activities and over-investment in "brown" activities. The following provides two examples of positive externalities and one example of a negative externality:

- A renewable energy project may have higher construction costs than conventional alternatives and in the absence of measures to internalize the benefit of reduced pollution, the project return may be too low to attract private investment. Some countries have used subsidies, tax credit, feed-in-tariffs, emission-trading systems (ETSs), renewable portfolio standards (RPSs) and environmental regulations to address such externalities with varying degrees of success.[14] At the same time, financial sector measures such as credit enhancements and guarantees, concessional loans, grants, and interest rate subsidies have been experimented with in some countries to improve risk-adjusted returns of such projects.[15]

- A water treatment or a land remediation project may improve the quality of living for a community and the market value of the residential properties in the region. However, without proper mechanisms to monetize some of these positive externalities, the project may not yield sufficient return to attract private capital. To address such problems, some countries adopted the PPP approach, which involves, for example, a real estate developer in a water treatment or land remediation project. The excess return from the property project (due to future improvement of the environment) is effectively used to compensate investors of the green project. Similar business models have been used in some countries and regions to subsidize subway projects (clean transportation) by combining them with residential and commercial property projects near the subway stations, as the former would boost the market value of the latter.[16]

- Some manufacturing firms pollute the environment, but their negative externalities are not fully internalized. For example, if residents of the region whose health is affected are not in the position to seek compensation from the polluting firms, it would lead to excessive investment

and production in polluting activities. Such cases are more common in countries where environmental rights are not well defined and the capacity of enforcing environmental policies is weak. Examples of financial sector actions to help mitigate some of these negative externalities include the Equator Principles for project finance in the banking sector (see Chapter 3) and disclosure requirements for listed companies by stock exchanges.

In some case such externalities can be exacerbated by "perverse subsidies" such as for fossil fuels or water use that further tip the balance away from a level playing field.

2.2. Maturity mismatch

Maturity transformation, between savers demanding liquidity, and long-term projects requiring investment is among the key functions of financial system, in particular through the banking sector and through bond markets.[17]

However, maturity mismatch, due to inadequate supply of long-term funding relative to the demand for funding by long-term projects, is a common challenge in some markets and have sometimes resulted in the lack of infrastructure investment, including green infrastructure projects. The problem arises due to the fact that, in these markets, the financing of long-term green infrastructure projects relies heavily on bank lending, while banks are constrained in providing sufficient long-term loans due to relatively short tenor of liabilities.[18]

The problem of maturity mismatch is aggravated in cases where green investments are more dependent on long-term finance than traditional investments in the same sectors. For example, the upfront cost of constructing a typical energy efficiency building is higher than a less energy efficient building; a solar or wind project has higher percentage of combined capital expenditure (capex) and operational expenditure (opex) invested up-front compared to a coal-fired power plant.[19] For the latter, a significant share of the total lifetime cost would be spent on paying for energy to operate it, which can be financed with shorter tenors, while for sustainable construction and wind or solar projects, that would not be the case.

Examples of financial sector innovations that can help address this challenge include green bonds (see Chapter 4), green infrastructure investment trusts ("yieldcos")[20] and collateralized loans.

2.3. Lack of clarity in green finance

In many countries and markets, the lack of clarity as to what constitutes green finance activities and products (such as green loans and green bonds) can be an obstacle for investors, companies and banks seeking to identify opportunities for green investing. Without appropriate definitions of green finance, which is the basis for internal budgeting, accounting and performance measurement for financial institutions, it is difficult for them to allocate financial resources for green projects and assets. In addition, the lack of clarity may also deter the efforts of environmental risk management, corporate communications, and policy design. Single definitions suffer from the danger of not adequately reflecting differing contexts and priorities in different countries or markets. On the other hand, too many definitions – e.g., each financial firm defines green assets by itself – could also make it very costly for comparison across institutions and markets and for cross-border green investment.

Examples of countries that have taken initiatives to develop national-level definitions of green credit include Bangladesh, Brazil and China (see Chapter 6).

2.4. Asymmetric information

Many investors are interested in investing in green projects/assets but the lack of disclosure of environmental information by companies increases the "search costs" for green assets and thereby reduces their attractiveness. For example, if investors do not have information about their portfolio companies' environmental performance (such as emissions, and energy and water consumption), they cannot effectively identify and proactively finance green companies as well as assess and manage environmental risks. In addition, when company or project level environmental information is available, the lack of consistent and reliable "labeling" of green assets also constitutes a barrier to green investment. In some countries, the segregation of data management by different agencies (e.g., data collected by environmental regulators is not shared with banking regulators and investors) also exacerbates the information asymmetry.

Some progress has been made in addressing information asymmetry. For example, more than 20 stock exchanges have issued environmental disclosure guidance for listed companies and a number of countries have introduced mandatory disclosure requirements.

Another important kind of information asymmetry includes the financiers' lack of information or knowledge of the commercial viability of green technologies as well as policy uncertainties on green investment. This lack of information and policy uncertainty results in excessive risk aversion by investors towards projects in renewable energies, new energy vehicles and energy saving technologies.

Practices adopted to address this problem in a number of countries include demonstration projects by government-backed entities (such as the UK Green Investment Bank) or Multilateral Development Banks (MDBs), clarity on policy outlook for sustainable development (such as Malaysia's National Green Technology Policy and the Kingdom of Saudi Arabia's Vision 2030), anchor investments by promotional banks (e.g., green bond investments by Germany's KfW), as well as credit guarantees by government agencies (e.g., the loan guarantee program of the US Department of Energy for renewable energy projects) or Development Finance Institutions (e.g., International Finance Corporation's (IFC) CHUEE program).

2.5. Inadequate analytical capabilities

The general understanding of the financial implications of environmental risks by financial institutions is still at an early stage. Many banks and institutional investors have yet to develop the capacity to identify and quantify the credit and market risks that may arise from their environmental exposure, and therefore often underestimate the risks of "brown" investments and overestimate the risk profile of green investment opportunities. Partly as a result, there remains an overinvestment in polluting and greenhouse gas-intensive projects and an underinvestment in green projects. A better understanding of environmental risks is essential for better risk mitigation, enabling a more effective internalization of environmental externalities in decision-making, and thus for mobilizing finance for green investment.

Examples of steps to build capacity in environmental risk analysis include ICBC's modeling of the impact of environmental exposure on credit risk, the analysis by the Natural Capital Declaration on the impact of drought on corporate bonds (see Chapter 6), and the incorporation of environmental factors into credit ratings (e.g., the recently published green credit rating methodologies by Moody's and Standard & Poor's).

3. Greening the Banking System

3.1. Stocktaking

Across the G20, green banking practices are at different stages of development. The response of banks to environmental and social challenges is profoundly influenced by the size and capacity of banks, as well as the market and regulatory context.

Currently, most green investment is financed through banks. Across the G20, banks are increasingly taking environmental risks and opportunities into account in their business models, often as part of wider strategies for sustainable banking. By incorporating environmental factors into their decision-making, banks can more effectively manage the risks associated with lending to polluting sectors and could help improve the resilience of the financial system. Further, by providing green credit to responsible borrowers, banks can contribute to and benefit from environmentally sound projects, in turn supporting sustainable growth. Key catalysts for action include rising public expectations, the recognition of environmental issues as real drivers of financial risk and the identification of green loan origination opportunities. Looking across banking practices in G20 countries, two main priorities emerge:[21]

1. Integrating environmental factors into banking operations. There is no universally accepted framework for green or sustainable banking. However, key initiatives such as the Equator Principles on the management of environmental and social risks now cover over 70% of international project finance in emerging markets, while UNEP FI has worked with the banking industry to put in place systems to manage so-called “environmental, social and governance” (ESG) issues. More recently in December 2015, the Principles for Mainstreaming Climate Action were launched by a coalition of financial institutions, but participation from private sector banks remains limited.[22] Some of the major banks are incorporating environmental factors into investment research as well as exploring enterprise level environmental “stress testing” tools.

2. Supplying credit and raising capital for green investments. In Brazil and China, approximately 10% of bank loans are currently classified as “green loans” according to national definitions.[23] Globally, banks are the primary source of funding for renewable energy, with debt transactions reaching US$104 billion in 2015. In 2015, over 100 banks and leasing companies formed the Alliance of Energy Efficiency Financing institutions, with a new focus on funding residential and industrial energy efficiency. For some banks, these efforts are now becoming strategic – with a number of major US banks recently making commitments to each mobilize in excess of US$100 billion in green finance by 2025.[24]

Banking associations often play an important role in spreading good practice, issuing voluntary protocols and guidelines in a range of G20 and other countries, including Brazil, India, Mexico, Singapore and Turkey.[25] A small, but growing number of G20 members such as Brazil, China, France and Indonesia, are also starting to incorporate environmental factors into banking policy and regulation.[26] In a number of G20 countries, national development finance institutions (as well as specialist green investment banks) have proved instrumental to improve management of environmental risks and crowd-in funding from the private sector.

3.2. Challenges to green banking

A number of challenges stand in the way of green finance in the banking industry:

1. Limited application of sustainable banking principles: Although there are a number of voluntary initiatives on sustainable banking, some involving sustainable banking principles, their application remains limited due to reasons such as the lack of understanding of their importance, the lack of consistency between risk management and green lending guidelines (at the country or bank level), and the lack of reporting practices, resulting in difficulties in measuring the provision and performance of green lending.

2. Maturity mismatch for green lending: Some banks are constrained in their ability or interest in extending long-term loans due to relatively short maturity on the liability side of their balance sheets and the need to avoid excessive maturity transformation. On the other hand, many green projects (such as water and waste treatment, clean energy, clean transportation, and some energy efficient buildings) are long-term in nature[27] and tend to have higher capex and lower opex than conventional projects. Where capital markets are less developed and/or banks are not effectively tapping the bond market to increase their sources of long-term funding, such a maturity mismatch could be a major constraint on the financing of long-term green projects.

3. Information asymmetries created by a lack of data: In many countries, the lack of borrowers' environmental information (e.g., borrowers' emissions data and environmental technologies they employ) limits banks' ability to assess the materiality of environmental risks involved in project and corporate finance. Centralized data collection is often lacking at the industry level to enable more efficient analysis of business and market risks related to the environment. These problems often arise due to the lack of collaboration within the country, as environmental information disclosures are mandates of different public and private institutions (e.g., government mandated environmental disclosure or stock exchange requirements) and cannot be resolved by banks alone.

4. Lack of analytical and implementation capacity: The inability of the banking sector to fully assess the risks associated with a highly complex and evolving risk is a major barrier. For example, analytical tools to quantify the environmental benefits and costs of new projects, modeling tools to estimate how environmental costs could translate into future default risks, and tools for reporting and ranking the green performance of projects and business lines are often not in place. The lack of capacity in such areas can result in overinvestment in pollution intensive sectors and underinvestment in green sectors.

3.3 Emerging options

Our analysis of country experiences suggests that a number of options for voluntary adoption can help overcome these challenges, notably:

1. Promote voluntary sustainable banking principles: Country authorities could work with international organizations and the private sector to develop, improve and implement voluntary principles for and evaluate progress on sustainable banking, with a view to enhancing the ability of the banking system to extend green credit and reduce risks from

resource and pollution intensive sectors. This could help level the playing field within countries and provide the foundations for scaling up green banking. The Equator Principles currently offer the most recognized benchmark for risk management, but only cover project finance. More banks and other financial institutions could adopt similar commitments and oversee them at board level, such as assessing climate change risks they face and only financing projects that went through proper environmental due diligence. Building on the experience in the investment community, a comprehensive set of principles could help drive the development of risk management tools with an expanded green lending focus. Implementation could be encouraged through a periodical review of risks and opportunities at the board level along with annual reporting.

2. Deploy innovative instruments to support the provision of financing for long-term investment and overcome maturity mismatch. Banks could explore the issuance of green bonds as a way to mitigate the constraint of maturity mismatch on their ability to extend long-term green loans in some markets (see more details in Chapter 4). Other options for banks in this regard include issuing securitized products (with reasonably long maturities) on the back of green loans, and extending collateralized loans backed up by future revenue streams such as those from energy management contracts or the sale of GHG permits.[28]

3. Promote ways to coordinate policy responses at the country level: Country authorities could consider initiatives to promote coordinated domestic responses to the challenge of green finance in the banking sector, in consultation with key stakeholders such as banking associations, banking regulators, relevant ministries, securities exchanges, and credit bureaus. Based on country circumstances, such initiatives could help to define key concepts for green finance, identify policy options to incentivize market action, build up stakeholder awareness and capabilities as well as enhance market discipline through improved disclosure of environmental information. Such collaborations could also result in more efficient centralized data collection (e.g., hosted by a national level data center) that serves as a basis for banks' risk analysis and management.

4. Expand learning networks for capacity building: The G20 could promote international and domestic knowledge sharing through the expansion and deepening of knowledge-based capacity building platforms such as the SBN. These platforms could cover more countries and extend beyond banking regulators and banking associations to work with bank training centers and institutes to train bank CEOs and risk managers. These initiatives could also share technical guidance to support assessment of environmental costs/benefits at the project level by banks, as well as risk analysis and performance reporting.

4. Greening the Bond Market

4.1. Stocktaking

Green bonds are debt instruments used to finance green projects that deliver environmental benefits. The proceeds of green bonds are dedicated for "green projects", the purposes of which should be transparent to investors in order to maintain market reputation.[29]

The green bond market emerged in 2007-08 with the first few issuances by MDBs. From 2007-2012, the market was mainly characterized by the issuance of green bonds by supranational organizations such as the World Bank, IFC and European Investment Bank (EIB), along with a few governmental entities and municipalities and national development banks. With growing market appetite for such bonds, there has been an increasing diversification of issuers and investors participating in the green bond market. The years 2013 and 2014 saw more active participation from private sector issuers, including corporates and banks. Annual issuance of labeled "green bonds" rose from just US$3 billion in 2012 to US$42 billion in 2015 with issuance occurring in 14 of the G20 markets. In the first quarter of 2016, total issuance of labeled green bonds rose further to about US$17 billion, up 66% year-on-year.[30] In MENA and Indonesia, Green Sukuk bonds (Islamic green bonds) investing in renewable energy and other environmental assets are also being developed.

Country experiences suggest the green bond market can offer several important benefits for green projects and investors:[31] 1) providing an additional source of green financing to bank lending and equity financing, and also a source of funding for bank lending; 2) enabling more long-term financing for green projects, especially in countries where demand for green infrastructure investment is high but supply of long-term bank loans is limited; 3) providing incentives for issuers to dedicate bond proceeds to green projects in exchange for reputational gains; 4) upgrading issuers' environmental risk management process due to their commitment to "green" disclosure; and 5) providing a class of green assets for investors, especially long-term and responsible investors, and opportunities for bond investors to engage with issuers on sustainability issues related to the financed projects.

Green bond definitions and requirements for disclosure of the use of proceeds are the basis for developing a credible green bond market by avoiding "green washing". Globally, the most widely accepted standards are the Green Bond Principles, a set of voluntary guidelines elaborated by key market participants under the coordination of ICMA, and the Climate Bonds Initiative (CBI)'s standards. In December 2015, China released its guidelines for the issuance of green bonds as well as its local definition of green bonds (Green Bond Catalogue). In January 2016, the Securities and Exchange Board of India (SEBI) approved the disclosure requirements for issuance and listing of green bonds. These efforts marked the launch of local currency green bond markets in the two largest developing countries. In March 2016, Mexico's Stock Exchange launched the green bond segment to support the local issuance and listing of green bonds. Brazil, Singapore, Hong Kong and a few other countries or regions are evaluating the potential of green bonds to facilitate green investments. Some countries showed interest in developing and implementing local legislation or administrative rules to guide the growth of their green bond markets.

An ecosystem of second-party verifiers and third-party assurance providers that provide the services of "labeling" green bonds and monitoring the use of proceeds has emerged.[32] According to the OECD, a dozen green bond funds have been launched in the last two years. Several green

bond benchmark indices have been launched to track performance and help formalize what qualifies as green. Some rating agencies have developed methodologies to evaluate and rank the environmental impact of green bond-finance projects. Furthermore, several credit rating agencies including Moody's, Standard & Poor's and Dagong are now working with investors to integrate environmental issues into bond, company and sovereign credit ratings.[33]

4.2. Challenges to scaling- up the green bond market

Many medium and long-term green projects with steady cash flows are good candidates for financing by the bond market. However, the bond market, which currently provides about one third of total financing for corporates globally,[34] has yet to play a significant role in green financing. Currently less than 1% of bonds issued globally are labeled as "green bonds". The potential for scaling- up the green bond market is significant, if market and institutional challenges constraining its development are addressed. For example, an OECD quantitative analysis examining the potential for the bond markets to finance a 2-degree energy investment scenario[35] estimates that bonds for low-GHG investments in the renewable energy, energy efficiency and low-emission vehicle sectors (a subset of "green bonds") have the potential to scale to around US$700 billion in annual issuance in four markets by 2030 (China, Japan, the EU, and US).[36] In the following paragraphs we discuss several challenges to the growth of the green bond market, recognizing that their importance may vary for different markets. The selection of these challenges is supported by the results of a GFSG survey on green bonds.[37]

1. **Lack of awareness of benefits of green bonds and existing international practices**. A reasonably clear and implementable set of green bond criteria and associated disclosure requirement are the basis for "labeling" qualified bonds as green bonds. For some countries, the lack of knowledge of existing international practices is an important barrier. In addition, in some countries, there is a lack of understanding of the potential benefits of the green bond market by policy makers, regulators, as well as potential bond issuers and investors.

2. **Lack of local green bond guidelines.** For a variety of reasons, some countries may need to develop their local currency green bond markets. For example, in countries where the capital account is not fully open, the local green bond markets will involve mainly local investors. In other countries, the priorities of their environmental challenges are somewhat different from those countries that focus on controlling greenhouse gas emissions. For these countries, the first barrier is the lack of local definitions and disclosure requirement for green bonds.

3. **Costs of meeting the requirements underpinning the green bond market.** The verification of the "green bond" status and the monitoring of use of proceeds by issuers for green purposes are performed mainly by second opinion or third party assurance providers. In some markets, the relatively high cost of obtaining a second opinion or third party assurance (ranging from US$20-100k) is a barrier for smaller issuers.[38] Some issuers have also complained about the high costs of managing disclosure requirements. That said, these cost frictions are often found in developing markets and with new financial products and they are declining as scale and market awareness increase.

4. **Lack of green bond ratings, indices, listings.** Green ratings, by providing an assessment of the environmental benefits from the use of the bond's proceeds, have the potential to reduce funding costs for green bonds. Green bond indices may facilitate the identification and

assessment of high-quality green bonds by offering a benchmark, and thus may also help reduce their funding costs. Another way to improve demand for green bonds is to list them on stock exchanges. However, as of now, these options have only been explored by a very small number of rating agencies, index companies and stock exchanges

5. **Difficulties for international investors to access local markets.** While global green investors exist, they often find it difficult to access some local currency markets. One problem is the differences in green bond definitions and disclosure requirements across markets. These differences may entail increased transaction costs as bonds recognized as green in one market may not be automatically recognized as green in another market leading foreign investors to perform additional due diligences. Moreover, there are also broader issues (such as capital controls, lack of FX hedging instruments, differences in trading hours, etc.) constraining cross-border investments in a wide range of asset classes, including fixed income.

6. **Lack of domestic green investors.** In markets where green bonds are mostly bought by local investors, the existence of green institutional investors – which have expertise about and/or investing preferences for green assets – is important in providing sufficient demand. However, due to the factors such as the limited disclosure by institutional investors on their practices for integrating environmental factors into their investment strategy, and the lack of capacity to quantify the environmental costs/benefits of their investments, many investors remain indifferent between green and brown assets.

4.3. Emerging options

The following presents a number of options that have been explored by some countries or markets in overcoming the challenges mentioned above:

1. **Raise awareness of benefits of green bonds via promotion and demonstration.** Promotion efforts can be organized by government agencies, market associations, financial institutions and other market players. Development banks' demonstration issuances can also play an important role in educating potential investors and issuers, and form a highly-rated segment in the green bond market that other corporate issuances can then build on.

2. **Support the development of local green bond markets.** On request of countries that are interested in developing their local currency bond markets, international organizations, development banks, and specialized market bodies could offer support via data collection, knowledge sharing and capacity building. This support could include, in working with the private sector, the development of green bond definitions, taxonomies, and disclosure guidelines. MDBs and national promotional banks could also play a role in supporting market development, for example, by serving as anchor investors and/or demonstration issuers in local currency green bond markets.

3. **Reduce risk premiums and facilitate cost-efficient verification and reporting.** Besides existing market-driven processes that could result in cost reductions in due time the public sector and development banks also can consider, within their mandate, additional measures to reduce risk premiums reflecting market failures (e.g., by offering credit enhancement facilities, acknowledging the associated costs and risks with these measures), help develop qualified second-opinion or third-party assurance providers, mobilize donor support for green bond

verification (e.g., by covering part of the costs), and provide training on disclosure and reporting.

4. **Develop green bond indices, ratings, and stock exchange lists.** Index companies and financial institutions can develop green bond indices as a basis for green bond ETFs and other fund products. Rating agencies could further develop technical expertise in launching green bond ratings that cover the full spectrum of bonds, and provide assessments of investor exposure to environmentally related credit risks. Securities exchanges could consider green bond listings as a future business driver.

5. **Promote international collaboration to facilitate cross-border investment in green bonds.** Country authorities or market bodies could promote cross-border investment in green bonds including through bilateral collaboration between different green bond markets where market participants could discuss options for a mutually-accepted green bond term-sheet.

6. **Incubate local green investors.** For markets that rely mostly on local investors, IOs and NGOs can help incubate domestic green institutional investors, via building capacity for them to identify green assets, to improve transparency of holdings, and to adopt ESG principles in the investment decision-making process.

5. Greening Institutional Investors

5.1. Stocktaking

Institutional investors, including mutual funds, insurance companies, pension funds, and sovereign wealth funds, manage over US$100 trillion in assets globally. A growing number of investors, some large and influential, are taking efforts to develop long-term responsible investment strategies by managing relevant Environmental, Social and Governance ('ESG') issues.[39] It is within this broader context of responsible investment and 'ESG' that investors are beginning to increasingly addressing the specific challenge of green finance. Looking across investor practices in the G20, two complementary green finance strategies emerge:

1. **Integrating material environmental factors** into their core investment decision making process as well as their engagement with corporations. Investor interest in such a move is partly driven by a growing focus on long-term value creation and enhancing risk-adjusted returns. Environmental factors are increasingly recognized as a driver of investment performance. Although correlation does not imply causation, 62% of meta-analyses show positive links between 'ESG' and corporate financial performance.[40] The weighting of 'ESG' factors by investors, however, varies according to investor profile, client priorities, investment objectives, region and the materiality of different factors. A small, but growing group of impact investors are also seeking to deliver positive environmental performance alongside financial returns.

2. **Allocating assets to green investments** across listed equities, fixed income, infrastructure, real estate and private equity. Allocations to green assets are currently small, but growing. For example, a recent survey of leading asset owners has identified US$138 billion in low-GHG investments. This is likely to be an under-estimate due to limited investor disclosure and an absence of common definitions.[41] In addition, a growing number of investors are focusing on the alignment of their funds to long-term policy signals, notably the SDGs and Paris Agreement.

Collaborative action by investors is a key tool for strengthening commitment, building capacity and improving performance. For example, over US$59 trillion in assets under management are now committed to the PRI, with signatories across the G20. National level initiatives are also important for building capacity and commitment, along with thematic initiatives, such as the Global Investor Coalition on Climate Change,[42] the Green Infrastructure Investment Coalition or the Portfolio Decarbonization Coalition. Investors have also called on stock exchanges to improve disclosure by listed companies and credit rating agencies to integrate material 'ESG' factors into their credit analysis.[43] Investors are also working together in their engagement with corporate management, including through the filing of shareholder resolutions, to ensure that material environmental risks are being addressed. Taken together, these initiatives can improve market efficiency and the availability of green assets.

A number of G20 countries are reflecting environmental factors in financial policies and regulations. Eight countries within the G20, for example, have introduced pension fund regulations requiring 'ESG' disclosure. France is now requiring its institutional investors (every insurance company, pension fund and asset manager) to disclose how they take into account 'ESG' criteria into their investment strategies, with a particular focus on climate-related risks and how asset allocation is consistent with the low-GHG transition. A few countries have introduced stewardship codes and some G20 countries such as South Africa and the USA have clarified that fiduciary duty can

incorporate the assessment of material value drivers such as the environment.[44]

The OECD has developed recommendations for policy makers on how best to channel institutional investment into long-term green investment (such as sustainable energy).[45] A stock taking analysis done by the OECD on behalf of the GFSG identified 33 case studies of institutional investment in green finance where the public sector used some forms of intervention to enable or facilitate these transactions, either through mitigating risks or lowering transaction costs. The results of the case studies suggest that there are many ways in which governments have worked to help mobilize institutional investment in green infrastructure. A wide range of public or official sector actors, including development banks, green banks, agencies, and national and local governments, have played such a role.

The OECD has also started a stocktaking and assessment of the governance of investment in relation to ESG factors and risks by institutional investors, building on the OECD's Principles of Occupational Pension Regulation.[46] This project will provide an evidence-based analysis of the impact of various regulatory frameworks and market practices on 'ESG' integration by pension funds, insurance companies and asset managers in OECD member and selected non-member jurisdictions.

5.2. Challenges to green investing

A number of challenges prevent the full incorporation of material environmental and broader sustainability factors into the decision-making of institutional investors, notably:

1. **Lack of strategic policy signals.** The lack of visibility and predictability of country policy for green investment can impact upon investor confidence. Policy uncertainties can translate into increased risk premiums, higher financing costs and lower funding for green projects. So far, there have been relatively few signals from national governments or from the G20 on green investment, potentially creating "first mover" inertia for investors. The SDGs and Paris Agreement are useful in providing a long-term direction of travel for investors, but need to be translated into specific plans and strategies to help mobilize green investment.

2. **Inadequate delivery of responsible investment principles.** The adoption and implementation of responsible investment principles by institutional investors can be constrained by misaligned incentives, inadequate capacity and information asymmetries. First, conflicts of interest and lack of incentives can result in short-term investment decisions and inadequate consideration of long-term environmental issues within asset allocation and investment analysis. Second, difficulties in embedding skills throughout organizations can prevent taking full account of sustainability issues in company assessment and valuation. Third, in most countries, disclosure by institutional investors on their policies and performance to beneficiaries and clients has been limited.

3. **Limited information and product offerings.** Disclosure of environmental information by companies remains limited in many countries, resulting in difficulties for investors to identify green assets or take informed decisions on environmental risks. In addition, the incorporation of environmental risk factors into investment analysis by investment consultants, equity analysts or credit rating agencies is often inadequate and fragmented. There is also a limited range of green investment products, which meet the liquidity and risk/return expectations of investors,

particularly for emerging economies, new technologies and infrastructure sectors. Concerns about "green washing" and the need for additional expertise to check green credentials can hold back allocations to new areas such as green bonds in the absence of clear principles, standards and verification.[47]

5.3. Emerging options

Our analysis of country experiences suggest that a number of options can help address these challenges, notably:

1. Provide strategic policy signals and frameworks. Country authorities could provide clearer environmental and economic policy signals for investors regarding the strategic framework for green investment, e.g., to pursue the SDGs and the Paris Agreement. Examples in this regard include strategies developed by China's Green Finance Task Force and Indonesia's Sustainable Finance Roadmap. Complementary reporting practices, such as France's sustainability reporting requirements, could also contribute to the appropriation of environment-related issues by institutional investors and asset managers.

2. Promote voluntary adoption of responsible investment principles: Country authorities and international organizations could encourage market participants to promote the adoption and implementation of voluntary responsible investment principles, including reporting on implementation of such principles. Existing international knowledge hubs, such as the PRI, could be expanded to cover a larger number of institutional investors and to provide capacity building services for investors in more countries.

3. Strengthen market responsiveness and product innovation: Country authorities and market participants could promote increased awareness and capacity building among key market intermediaries such as stock exchanges, credit rating agencies, equity analysts and investment consultants to meet green investment needs. This could include supporting their efforts to enhance information disclosure by listed companies, integrating environmental factors into credit ratings and developing analytical tools to quantify the environmental costs/benefits of investments/assets. Governments could also encourage product innovation in green assets, focusing initially on listed fixed income and equity products that institutional investors require, particularly in emerging economies.[48]

6. Cross-Cutting Issues

The GFSG has also addressed two cross-cutting issues: first, methodologies for environmental risk analyses by financial institutions; and second, measuring progress of green finance activities. For each of these two subjects, we conduct a stocktaking analysis of recent practices in G20 countries and comment on the emerging trends for their development in the medium term.

6.1. Risk analysis

6.1.1. Stocktaking

Environmental risk analysis remains an evolving and complex area of attention within financial institutions. A growing number of banks, insurance companies and institutional investors, as well as other actors such as credit rating agencies, are developing innovative tools to better understand the financial implications of environmental risk. This is key to delivering an environmentally consistent capital allocation. These tools include various quantitative models and methodologies to understand environmental risks within financial firms. These financial actors are also starting to incorporate their findings into their financial decision-making process. Examples include:

- The insurance sector in general has the deepest experience analyzing the physical and climatic sources of risk, with stress tests to assess the financial impact of natural hazards such as hurricanes, storms and floods. More specifically, the methodology for analyzing the impact of climate change on natural occurrences has been established in the re-insurance sector. Climate and environmental research goes back decades and has been led by companies such as MunichRe and SwissRe. Most recently, the Lloyd's insurance market has conducted a landmark analysis of how global food price shocks could suppress stock market values for a sustained period.[49]

- Institutional investors have developed particular experience in understanding the financial implications of the energy transition, including scenarios to evaluate the consequences of government policies. In Germany, Allianz Global Investors, in coordination with the Investment Leaders Group at the University of Cambridge has modeled the impact of different GHG and energy regulation scenarios on the margins of individual GHG-intensive firms.[50]

- In the banking sector, experience includes analyses of a broad range of environmental risks, including pollution, depletion of natural capital and water stress. In China, ICBC has developed a "stress test" methodology to assess how environmental policy changes may increase the credit risk to borrowers in polluting sectors.[51]

- In the bond market, a number of credit rating agencies and other stakeholders have explored the implications of water stress and climate change for corporate and sovereign ratings.[52] This work is being driven in part by increasing demands from institutional investors for the integration of environmental factors.

A number of regulatory bodies are also conducting their own assessments of the implications of environmental risks for the financial institutions they supervise. For example, the Bank of England review of the insurance sector shows how climate change might impact the valuation of the assets held by insurers.[53]

An emerging consensus from the industry is that environmental sources of financial risk can be mapped on two key axes. The first axis shows the long-established risk typology: "business" (including operational and reputation risk), "legal" (including liability risk), "credit" (including underwriting and counterparty risk), and "market" risks (see Table 1). And the second axis includes two environmental triggers of these risks:

1. **Physical:** Risks that arise from the impact of climatic and geologic (i.e. seismic) events (such as natural disasters and the rise in sea levels) and changes in ecosystem equilibria, such as soil quality or marine ecology. As the FSB Task Force Phase I Report notes,[54] these triggers can be event-driven (acute) or longer-term in nature (chronic).

2 **Transition:** Risks which arise from efforts to address environmental changes, including but not limited to abrupt or disorderly introduction of public policies, technological changes, investor sentiment, and disruptive business model innovations.

Table 1: Taxonomies of Environmental Triggers and Financial Risks

		Financial Risks			
		Business	Legal	Credit	Market
Environmental Triggers	**Physical** - Climatic - Geologic - Ecosystems				
	Transition - Policy - Technology - Sentiment				

Inter-linkages can emerge *between* different environmental sources of risks (e.g., an extreme event triggering policy changes) as well as between the risks that result for different financial sectors (e.g., the impact of uninsured losses on the collateral values of bank loans).

Overall, this stocktaking analysis, which reviewed over a dozen illustrative case studies of practices being undertaken by financial institutions, industry bodies and central banks, revealed several innovation approaches:

- For **risk identification**, a range of actors are using qualitative "strategic reviews" to identify relevant risks.

- For **risk assessment** and **risk exposure**, different approaches to "total exposure estimation" have been developed and firms are adapting "stress testing" techniques to analyze the impact of environmental sources of credit and market risk on their loans and holdings.

- For **risk management**, some financial institutions have begun to employ such analyses to impact decision-making on asset allocation, client/investment selection and future business development. Some are using models to understand how systems behave under different scenarios so they can identify what is common in explaining increasing risk levels. For example, land use change can be as important in increasing vulnerability to wildfire as rising temperatures and is far easier to manage.

6.1.2. Challenges to and options for enhancing environmental risk analysis

Environmental risk analysis remains an evolving and complex area of attention within financial institutions. According to exchanges with private sector financial institutions at a workshop on 'Modeling and Assessing Environmental Risks' held in Bern, Switzerland, in May 2016,[55] many of these institutions are facing challenges in developing and applying risk analysis tools to assess environmental risks. Some of these challenges, such as uncertainty about public policies, are outside the control of financial institutions. However, within the financial system, key challenges include the lack of capacity, complexity and the absence of adequate data. Developing credible analyses on how complex environmental threats can create financial risks requires expertise that is often not found in any one institution. Collaboration among financial, environmental and policy specialists as well as international knowledge sharing may be required for developing and improving environmental risk methodologies. Further, the lack of accurate, meaningful, comprehensive and consistent data is a major obstacle in the development and application of risk analysis tools.

To help address some of these challenges, the G20/GFSG, jointly with the private sector and research institutions, could encourage further dialogue on environmental and financial risk, to facilitate knowledge exchange on methodologies for environmental risk analysis and management within the financial sector. Such a dialogue would engage efforts by different types of financial intermediaries (e.g., banks, re-/insurances, and institutional investors) to address some of the common challenges by improving data availability, developing and improving commonly accepted methodologies for more forward looking analyses of risks, and raising awareness of environmental risks in the mainstream of the financial sector.

6.2. Measuring progress

6.2.1. Stocktaking: defining green finance

There is no universally accepted definition of green financial activities, either internationally or even at the country or market level, largely because different countries have different priorities in their environmental agenda and approaches to implementation.[56] However, some definitions of green finance and improvement in their clarity and comparability may help investors, firms, governments and the wider public, for at least the following reasons:

- **Identification/labeling of green investments and assets:** If green financial activities are not or poorly defined, banks and institutional investors may incur additional costs to identify and allocate capital to asset classes such as green loans, green bonds and green investment trusts.
- **Risk management:** growing numbers of financial institutions are conducting environmental risk analyses, which require data that describe environmental aspects of green finance activities. These data need to be compiled based on agreed categories and definitions.
- **Evaluating progress and effectiveness:** company owners and management need data to measure the progress and effectiveness of green investment and related financial performance (e.g., returns on equity (ROE) or non-performing loans (NPLs) of green investments), and adjust their investment strategies based on quantitative evaluations.

- **Analyzing economic and social impact:** understanding the social and economic implications of green and non-green investment activities also requires clear definitions to enable effective analysis.

- **Corporate communication:** increasingly corporates and financial firms will need to report data on green financial activities responding to policy, regulatory or market demands for example resulting from listing requirements in place in India, Singapore and South Africa.

- **Designing policies and regulations:** in some countries, to develop effective policy or regulatory incentives for green finance, such as through France's Energy Transition Law, or the Brazilian central bank's environmental risk regulations, public bodies need clarity of definition and measurement to assure that the desired outcomes are achieved.

- **Positive environmental impact on the ground:** green finance is a mean to an end; hence, there needs to be a link between green finance data (which is still very variable and often lacks common metrics) and environmental data (which have been collected for many decades).

On a conceptual level, "green finance" can be defined as financing of investments that deliver environmental benefits in the broader context of environmentally sustainable development. These environmental benefits include, for example, reductions in air, water and land pollution, reductions in greenhouse gas emissions, improved energy efficiency while utilizing natural resources, as well as mitigation of and adaption to climate change and their co-benefits. Such a definition is directionally clear whilst allowing for different technical interpretations by countries and markets.

Results from a survey on definitions and measurement approaches undertaken for the GFSG by the IFC indicate that some sectors are included in green finance definitions by most countries and markets.[57] These sectors include, for example, renewable energy, sustainable construction, energy efficiency and waste management. However other sectors such as carbon capture and storage, transport and adaptation are less consistently included. Yet, other themes identified less frequently include noise abatement, nuclear power plants and crop insurance. Most respondents include pollution treatment or prevention (such as sewage and solid waste management, air pollution treatment, and land remediation) in green finance, but several of the respondents limit themselves to defining and measuring climate finance, with some focusing this narrowly to sectors contributing to climate mitigation. Some definitions, such as that taken by the Brazilian Federation of Banks (FEBRABAN), can be driven by data availability.

Green finance can be usefully distinguished from other forms of finance associated with sustainable development. Green finance overlaps with, but is more extensive than "climate finance" which aims to "reduce GHG emissions, enhance GHG sinks and reduce the vulnerability of human and ecological systems to negative climate change".[58] Green finance is also to be differentiated from the term "ESG", which refers to environmental, social and governance [59] aspects of business performance and impacts. Sustainable and responsible finance is also used by some policy makers, such as the Indonesian Financial Services Regulator (OJK) and the European Union, and market actors such as the PRI, but these terms are taken to include economic (financial and broader economic) as well as environmental and social considerations.

6.2.2. Stocktaking: Indicators for measuring progress

Our review of country experiences suggests that various **indicators have been developed to measure green financial activities at three levels**:

1) **Financial flows and stocks** (e.g., lending, bond issuance, equity investment, and assets): Stock and flow information provides the basis for countries and financial institutions to know what and how well they are doing in green finance, to reduce the costs of search and risk pricing for financial actors, and enable policy makers and regulators to evaluate policy options on green finance.

   The IFC survey undertaken for the GFSG suggests very few countries are systematically measuring or estimating green financial flows or stocks. Green finance measures are more widely measured with specific financial products and sectors. ICMA, CBI and China Green Finance Committee have developed green bond principles and green (climate) bond taxonomies. Several index companies have developed green equity indices that identified eligible green categories. Examples of the categories included in the indices are: energy efficiency, clean fuels, renewable energy generation, natural resources, water, and pollution mitigation.

2) **Mainstreaming of green finance:** These indicators could map financial institutions' incorporation of environmental factors in decision-making processes, adoption of environmental risk management tools, disclosure practices, etc. This information could be used to measure the "green" governance of financial institutions. Various approaches and data sets exist for measuring aspects of mainstreaming of green finance. Several global entities such as the UNCTAD, through the Sustainable Stock Exchanges initiative, publish an annual analysis of progress by the world's stock exchanges in integrating sustainable (including environmental) reporting into listing requirements.[60]

3) **Impacts of green finance,** which include the broad economic and social impacts of green finance.[61]

6.2.3. Next steps

As discussed above, more clarity about green finance definitions is demanded from the market and policy makers, although it does not require a "one size fits all" approach. Some internationally comparable indicators are also useful in facilitating cross-border and cross-market green investment, for evaluating green performance of financial firms, and for analyzing the macro implications of green finance activities.

Emerging from the GFSG's initial work are a number of steps that can be taken in improving the definitions, taxonomies, and indicators for measuring and reporting on green finance activities and their impacts:

1. **Establish a basis for the measurement of green finance activities and associated definitions.** Building on G20 and broader experience, including the on-going work of the FSB-initiated task force, the G20 and country authorities could promote an initiative to work with the private sector on green finance indicators and associated definitions and improved data availability, possibly with the assistance of selected international organizations.[62]

2. **Assess impacts of green finance.** The G20 could consider options for the analysis of the economic and broader impacts of green finance.

7. Key Options for Developing Green Finance

Earlier in this report, we identified five general challenges to green finance – externalities, maturity mismatch, lack of clarity about green finance, information asymmetry, and lack of analytical capacities. These challenges, relevant to most financial market segments and players, are summarized in Table 2, which also shows the specific forms they may take and how they have been addressed by countries and/or financial institutions. These existing practices highlighted in bold in Table 2 are largely based on specific country and market practices and were discussed in more detail in the concluding sections of Chapters 3-6. This table offers a simple framework for understanding the linkages between the general challenges and specific actions.

Table 2: General Challenges to Green Finance and Selected Country/Market Practices to Address such Challenges

Challenges				**Practices**
	Banking	**Bond market**	**Institutional investors**	**Country/market practices to address challenges**
Externalities	Inadequate compensations for positive externalities of green projects; Inadequate penalties for negative externalities of polluting projects Inadequate price signals			In addition to fiscal and environmental policies: guarantees, concessional loans, PPP, **demo projects**, **adoption of risk management principles and methods**, green labeling, etc.
Maturity mismatch	Lack of appropriate financing instruments for long-term green projects			**Green bonds**, yieldcos, **collateralized lending**
Lack of clarity in green definitions	Lack of green loan definition	Lack of green bond definition	Lack of green asset definition	**Development of green definitions and indicators**
Information asymmetry	Lack of info on borrowers; excessive risk aversion	Lack of info and monitoring on use of proceeds	Lack of info on assets (environmental impacts and risks)	Voluntary disclosure guidelines for environmental impact and related financial risks, **green bond verification, risk mitigation, policy signals, demo projects, anchor investments**
Lack of analytical capacities	Lack of capacity to assess impact on credit risk	Lack of capacity to assess impact on credit risk	Lack of capacity to assess impact of asset valuation	**Risk modeling, training, ratings, indices**

Many green finance options such as the development of green financial products, as well as risk analysis and management methodologies involve innovations by the private sector. However, wider application of green finance could be facilitated by improved knowledge sharing, capacity building, stronger policy signals and improved clarity in definitions of green finance activities. In our view, these elements constitute the bulk of the “enabling environment” for green finance. In the following,

we consolidate a number of **key options to be considered for voluntary adoption by the G20 and country authorities on how to create an enabling environment for mobilizing private capital for green investment:**

1. **Provide strategic policy signals and frameworks:** Country authorities could provide clearer environmental and economic policy signals for investors regarding the strategic framework for green investment, e.g., to pursue the Sustainable Development Goals and the Paris Agreement.

2. **Promote voluntary principles for green finance:** Country authorities, international organizations and the private sector could work together to develop, improve and implement voluntary principles for and evaluate progress on sustainable banking, responsible investment and other key areas of green finance.

3. **Expand learning networks for capacity building:** The G20 and country authorities could mobilize support for the expansion of knowledge-based capacity building platforms such as the Sustainable Banking Network, the Principles for Responsible Investment as well as other international and domestic green finance initiatives. These capacity building platforms could be expanded to cover more countries and financial institutions.

4. **Support the development of local green bond markets:** On request of countries that are interested in developing local currency green bond markets, international organizations, development banks and specialized market bodies could provide support via data collection, knowledge sharing and capacity building. This support could include, in working with the private sector, the development of green bond guidelines and disclosure requirements as well as capacity for verifying environmental credentials. Development banks could also play a role in market development, for example by serving as anchor investors and/or demonstration issuers in local currency green bond markets.

5. **Promote international collaboration to facilitate cross-border investment in green bonds:** Country authorities or market bodies could promote cross-border investment in green bonds, including through bilateral collaboration between different green bond markets, where market participants could explore options for a mutually accepted green bond term-sheet.

6. **Encourage and facilitate knowledge sharing on environmental and financial risk:** To facilitate knowledge exchange, the G20/GFSG could encourage a dialogue, involving the private sector and research institutions to explore environmental risk, including new methodologies related to environmental risk analysis and management in the finance sector.

7. **Improve the measurement of green finance activities and their impacts:** Building on G20 and broader experiences, the G20 and country authorities could promote an initiative to work on green finance indicators and associated definitions, and to consider options for the analysis of the economic and broader impacts of green finance.

References

[1] Investment trusts are a form of closed-end (i.e. they issue a fixed number of shares) collective investment that can facilitate a longer-term investment horizon compared to open-ended investment vehicles. Investment trusts are traded on exchanges, managed by fund managers, and often organised along thematic lines.
[2] UNU-IHDP/UNEP (2014). The Inclusive Wealth Report 2014. Cambridge University Press. http://inclusivewealthindex.org/.
[3] WHO (2014). Burden of disease from the joint effects of Household and Ambient Air Pollution for 2012. WHO press release, March 2014. http://www.who.int/phe/health_topics/outdoorair/databases/FINAL_HAP_AAP_BoD_24March2014.pdf?ua=1.
[4] Norwegian Refugee Council – Internal Displacement Monitoring Centre (2014). Global Estimates Report 2014. http://www.internal-displacement.org/assets/publications/2014/201409-global-estimates2.pdf.
[5] UNCTAD estimates that realizing the SDGs will require US$5-7 trillion annually over the next 15 years. Estimates from the IEA, OECD, World Bank and World Economic Forum indicate that over the coming 15 years, the world will need to invest around US$90 trillion in sustainable infrastructure assets– more than twice the current stock of global public capital.
[6] REN21, 2016, "Renewables 2016, Global Status Report". Online at: http://www.ren21.net/wp-content/uploads/2016/06/GSR_2016_Full_Report_REN21.pdf
[7] Bloomberg Finance News, "Electric Vehicles to be 35% of Global New Car Sales by 2040," February 25, 2016
[8] It was agreed in the first GFSG meeting that, to avoid duplication with work of the Climate Finance Study Group, the GFSG would not include "the role of public finance for leveraging private green investment" as a research subject in its first year work program.
[9] China Green Finance Task Force (2015). Establishing China's Green Financial System, China Finance Publishing. http://www.unep.org/newscentre/default.aspx?DocumentID=26802&ArticleID=34981.
[10] Data sources: IFC for green loans, CBI for green bonds, SSE for green equities, and OECD for green infrastructure investment.
[11] These include the GFSG surveys on "measuring progress (green finance definitions and indicators)" and "challenges to scaling up the green bond market".
[12] http://www.g20.org/English/Documents/Current/201603/t20160302_2182.html
[13] We acknowledge that many other factors also contribute to the lack of green investment. These include, for example, fossil fuel subsidies, ineffective environmental regulations, incoherent public policies, failure of the accounting system to capture environmental costs/benefits, underdevelopment of financial markets and institutions, and the silos approach to education for finance and environment. Some of these issues need to be addressed with policy actions beyond the finance area and others could be topics for future study by the GFSG.
[14] According to PBOC studies, fiscal resources can only cover less than 15% of the green investment in China, and the current level of green investment only meets half of the green investment demand in the country.
[15] Examples include green loan guarantees (Netherland, US, India), guarantee for green bonds (IFC), interest subsidies (Australia, Belgium, China, Germany), concessional loans (China, India), and tax credit for green bonds (US). Sources: IISD and China Green Finance Committee.
[16] Examples of PPP green projects include those on waste treatment (Canada), high-speed rail (France, Spain, South Africa, and Japan), and subways (Hong Kong, Singapore, and the Philippines). See OECD, 2013,"Mobilising Private Investment in Sustainable Urban Transport Infrastructure."
[17] The average maturity of bank loans in several major markets is only about two years, based on data from the US Fed (https://research.stlouisfed.org/fred2/series/EDANQ), the PBOC (http://www.pbc.gov.cn/diaochatongjisi/116219/116319/3013637/3013643/index.html), and BIS (BIS international banking statistics at end-December 2015). On the other hand, the average maturity of the 178 green bonds issued in 2015 was 9.4 years (Source: OECD).
[18] According to IJGlobal and Thomson One Banker, 66%-90% of global project finance are funded by bank loans from 2007-2015. Sources: Q1 2016 League table Analysis (April 15 2016), IJGlobal; Project Financial International, Thomson One Banker
[19] Source: IFC.
[20] Green Infrastructure investment trusts are investment trusts that manage income-generating green infrastructure assets. They offer regular yields (normally in the form of dividends) and a liquid method of investing in infrastructure projects. A yieldco is a similar investment vehicle to a green infrastructure investment trust that is often used to manage income-generating renewable energy assets. Yieldcos have come to prominence in the US over the past few years as a liquid means to generate exposure to renewable energy assets.
[21] See GFSG background paper 9 (UNEP): 'Greening the Banking System: Taking Stock of G20 Green Banking Market Practice'
[22] See http://www.worldbank.org/content/dam/Worldbank/document/Climate/5Principles.pdf
[23] For more detail, see GFSG background paper 4 (IFC): 'Greening the Banking System: Experiences from the Sustainable Banking Network'
[24] See GFSG background paper 9 (UNEP): 'Greening the Banking System: Taking Stock of G20 Green Banking Market Practice'

[25] For more detail, see GFSG background paper 4 (IFC): 'Greening the Banking System: Experiences from the Sustainable Banking Network'
[26] See GFSG background paper 10 (University of Zurich): 'Greening Banking Policy'
[27] According to the IFC and OECD, the average payback periods are estimated to be 2-17 years for water projects, 5-20 years for rail and electrified public transport projects, 10-15 years for renewable energy (grid connected, e.g., solar or wind): 8-13 years for renewable energy (off-grid), 1.5-7 years for energy efficiency contracts (commercial), 4-30 years for energy efficiency buildings (new); and 1.5-10 years for energy efficiency buildings (retrofit/renovations).
[28] Examples of such collateralized lending are found in countries such as Canada, China, Germany, Spain and the UK.
[29] There are narrower and broader definitions of green bonds. The narrow definition includes only "labeled" green bonds, including self-labeled and those labeled by independent reviewers. The broader definition also includes unlabeled "pure play" bonds in sectors that are considered as "green" without controversies. The broadest definition is "climate-aligned bonds" as defined by CBI which includes many unlabeled bonds that are believed by CBI as "green". Some countries have introduced their local definitions of green bonds (e.g., in China), while market participants in other countries opted to the green bond definitions by Green Bond Principles.
[30] All global data quoted in this paragraph are provided by CBI, while China data are sourced from China Green Finance Committee.
[31] See detailed discussions in GFSG background report 6 (OECD/ICMA/CBI/China GFC): 'Green Bonds: Country Experiences, Barriers and Options'
[32] See GFSG background paper 12 (BIS): 'Green Bonds- Certification, Shades of Green and Environmental Risks'
[33] See Statement on ESG in Credit Ratings, May 2016 https://www.unpri.org/press-releases/credit-ratings-agencies-embrace-more-systematic-consideration-of-esg
[34] Estimate based on market data from the US, Europe and China.
[35] An energy pathway consistent with the goal of limiting the global increase in temperature to 2°C by limiting concentration of greenhouse gases in the atmosphere to around 450 parts per million of CO2.
[36] See GFSG Background paper 8 (OECD): 'A Quantitative Framework for Analysing Potential Bond Contribution in a Low-Carbon Transition'.
[37] As of May 24 2016, the GFSG survey on "barriers to scaling up the green bond market" received 24 responses from investors, issuers and intermediaries. According the survey results, 74% of the respondents believe that "lack of awareness of green bond benefits" is an important barrier, 43% believe "lack of local definition of green bonds" is an important barrier, 41% believe "high cost of meeting green bond requirements" is an important barrier, 56% believe "lack of ratings, indices and listings" is an important barrier, 55% believe that "lack of targeted incentives for green bond issuers" is an important barrier, 67% believe that "difficulties for international investors to access local green bond markets" are an important barrier, and 59% believe that "lack of domestic green investors" is an important barrier.
[38] For small issuers that are looking to issue green bonds of less than US$50 million, a US$50k cost of verification is equivalent to over 10bps of the proceeds.
[39] See examples and case studies in GFSG background 3 (PRI/UNEP FI): 'Greening Institutional Investment'
[40] The academic paper *ESG and financial performance: aggregated evidence from more than 2,000 empirical studies* and published by the Journal of Sustainable Finance & Investment can be found here http://www.tandfonline.com/doi/full/10.1080/20430795.2015.1118917. The ESG white paper published by Deutsche Asset & Wealth Management and the University of Hamburg, including a Foreword from PRI managing director Fiona Reynolds, can be found here: https://institutional.deutscheawm.com/globalResearch/investment_strategy_3540.jsp.
[41] Asset Owners Disclosure Project (2016) AODP 2016 Global Climate 500 Index. See also OECD (2016) Annual Survey of Large Pension Funds and Public Pension Reserve Funds.
[42] http://globalinvestorcoalition.org/portfolio/summary/
[43] See PRI & UNEP Statement on ESG in Credit Ratings. Online at: http://www.unpri.org/download_report/17360
[44] See Fiduciary Duty in the 21st Century ttp://www.unepfi.org/fileadmin/documents/fiduciary_duty_21st_century.pdf
[45] See GFSG background paper 11 (OECD): 'Progress Report on Approaches to Mobilise Institutional Investment for Green Infrastructure'
[46] See GFSG background paper 7 (OECD): 'OECD Analytical Report on Investment Governance and the Integration of ESG factors'
[47] For example, the work of the FSB. FSB, Phase I Report of the Task Force on Climate-Related Financial Disclosures, March 2016, https://www.fsb-tcfd.org/wp-content/uploads/2016/03/Phase_I_Report_v15.pdf
[48] Green ratings and indices can provide a more efficient way of identifying and ranking the greenness of financial assets (e.g., stocks and bonds), therefore enabling investors to channel more funds to green assets. Green indices also pave the way for passive investment via instruments such as green ETFs. In addition, these ratings and indices can encourage listed companies and bond issuers to improve their environmental performance in order to be included in or remain on the lists.
[49] Lloyds, Emerging Risk Report – 2015, Food System Shock;
https://www.lloyds.com/~/media/files/news%20and%20insight/risk%20insight/2015/food%20system%20shock/food%20system%20shock_june%202015.pdf
[50] Feeling the Heat, An investors' guide to measuring business risk from carbon and energy regulation, 2016
http://www.co-firm.com/tl_files/cofirm/media/documents/News/Carbon%20Report%20v15%20WEB1.pdf

[51] Impact of Environmental Effects on Credit Risk of Commercial Banks, ICBC, 2016 http://www.greenfinance.org.cn/upfile/upfile/filet/ICBC%E7%8E%AF%E5%A2%83%E5%8E%8B%E5%8A%9B%E6%B5%8B%E8%AF%95%E8%AE%BA%E6%96%87_2016-03-19_08-49-24.pdf

[52] See GFSG background report 2 (University of Cambridge (CISL)) for case studies of risk analysis methodologies and applications in: 'Environmental Risk Analysis by Financial Institutions'

[53] The Impact of Climate Change on the UK Insurance Industry, 2015, http://www.bankofengland.co.uk/pra/Documents/supervision/activities/pradefra0915.pdf

[54] FSB, Phase I Report of the Task Force on Climate-Related Financial Disclosures, March 2016, https://www.fsb-tcfd.org/wp-content/uploads/2016/03/Phase_I_Report_v15.pdf

[55] See GFSG background report 13 (Swiss Federal Department of Finance) on the GFSG – Private Sector Workshop "Modeling and Assessing Environmental Risks" held in Bern May 11-12, 2016

[56] For more detail, see GFSG input paper 1 (UNEP): 'Measuring Progress: Definitions and concepts background note'

[57] See GFSG background report 5 (WBG): 'Outline Framework for Measuring Progress on Green Finance'

[58] UNFCCC Standing Committee on Finance (2014. Biennial Assessment and Overview of Climate Finance Flows" http://unfccc.int/files/cooperation_and_support/financial_mechanism/standing_committee/application/pdf/2014_ba_summary

[59] Taken to include board structure, diversity, skills and independence as well as executive pay, shareholder rights, stakeholder interaction, disclosure of information, and business ethics.

[60] The Johannesburg Stock Exchange (JSE) and Brazil's BOVESPA stock exchange were two of the earliest innovators, with BOVESPA linking requirements on reporting and substantive performance with access to capital-raising opportunities, and the JSE linking comparable requirements to the King Code of Governance

[61] See the IMF background paper 14 (IMF) for a first expert opinion of an international organization related to the basics of the analytical framework necessary for measuring progress from economic and financial points of view:' An Initial Analytical Framework and Research Roadmap: Implications of Green Finance for the Cost of Capital, Growth, and Financial Stability'

[62] This could build upon already existing work, such as the international standards on environmental accounting, the System of Environmental-Economic Accounts (SEEA) 2012, the work of the OECD on green growth indicators (http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH, http://www.oecd.org/greengrowth/greengrowthindicators.htm) and quantitative indicators for long term financing done by the OECD with the BIS, IMF, WBG (https://www.oecd.org/finance/private-pensions/Addressing-Data-Gaps-in-Long-Term-Investment-Research-Agenda.pdf).

Annex 1: List of Input Papers and Scoping Note

The GFSG received a series of input papers and scoping note listed below. These input papers are prepared by knowledge partners and do not necessarily represent the views of the GFSG.

Input papers:

1. Definitions and Concepts: Background Note (UNEP)
2. Environmental Risk Analysis by Financial Institutions (University of Cambridge (CISL))
3. Greening Institutional Investment (PRI/UNEP FI)
4. Greening the Banking System: Experiences from the Sustainable Banking Network (SBN/IFC)
5. Outline Framework for Measuring Progress on Green Finance (WBG)
6. Green Bonds: Country Experiences, Barriers and Options (OECD/ICMA/CBI/China GFC)
7. Analytical Report on Investment Governance and the Integration of ESG Factors (OECD)
8. A Quantitative Framework for Analysing Potential Bond Contributions in a Low-Carbon Transition (OECD, forthcoming)
9. Greening the Banking System: Taking Stock of G20 Green Banking Market Practice (UNEP)
10. Greening Banking Policy (University of Zurich)
11. Progress Report on Approaches to Mobilising Institutional Investment for Green Infrastructure (OECD)
12. Green Bonds - Certification, Shades of Green, and Environmental Risks (BIS)
13. Report on the Swiss Private Sector Workshop (Bern, May 2016)- 'Modeling and Assessing Environmental Risks' (Swiss Federal Department of Finance)
14. An Initial Analytical Framework and Research Roadmap: Implications of Green Finance for the Cost of Capital, Growth, and Financial Stability (IMF)

Scoping Notes:

1. Progress Report on Approaches to Mobilising Institutional Investment for Green Finance: Scoping Note (OECD)

The G20 Green Finance Synthesis Report and the above-mentioned input papers and notes are all available for download at:

English: http://unepinquiry.org/g20greenfinancerepositoryeng

Chinese: http://unepinquiry.org/g20greenfinancerepositorych

Annex 2: Acknowledgements and Contacts

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