



Technology Executive Committee

14 September 2018

Seventeenth meeting

Bonn, Germany, 25–28 September 2018

Draft TEC Brief on innovation

Cover note

I. Introduction

A. Background

1. As per activity 4 of its updated rolling workplan for 2016–2018, the Technology Executive Committee (TEC) held, in conjunction with TEC 16, a thematic dialogue on climate technology incubators and accelerators. The dialogue was co-hosted by the TEC, the Green Climate Fund (GCF) and the Climate Technology Centre and Network (CTCN), and brought together 16 expert speakers from around the world. The TEC, the GCF and the CTCN also jointly published a 12-page brief on catalysing financing for climate technology incubators and accelerators, which is available in English, French and Spanish. They also published a detailed report on climate technology incubators and accelerators. Both publications are available on TT:CLEAR at: www.unfccc.int/tclear/incubators.

2. At TEC 16, the TEC considered the findings which emerged from the dialogue and the publications and agreed to develop a TEC Brief and key messages and recommendations to COP 24, to inform policymakers on ways to enhance the effectiveness of climate technology entrepreneurship and climate technology incubators and accelerators.

B. Scope of the note

3. The annex to this note contains the draft TEC Brief on innovation.

C. Possible action by the Technology Executive Committee

4. The TEC will be invited to provide comments on the draft TEC Brief, with a view to finalizing it after TEC17.

TEC Brief: Energizing entrepreneurs to tackle climate change

A person who sees a problem is a human being;

A person who finds a solution is visionary;

And the person who goes out and does something about it is an entrepreneur.

Naveen Jain, Indian Entrepreneur

Why this TEC Brief?

From the back streets of Addis Ababa to the offices of Silicon Valley, people are transforming ideas into products that are used by society. The entrepreneur, as this person is known, is vital to the growth and prosperity of communities. But what role can the entrepreneur play in addressing climate change? How can we help the entrepreneur to do this? This policy brief aims to answer these questions. It highlights the entrepreneur's role in developing technologies, business models and services that society uses to achieve low-emission and climate-resilient sustainable development. It also describes how we can encourage, guide and boost the entrepreneur in their efforts to innovate climate technologies. In this publication, the Technology Executive Committee continues its long-running series on innovation by focusing on the central actor of the innovation process: the entrepreneur.

Key messages and recommendations

(Note: the TEC will complete this section once the text of the brief is finalized.)

Key messages

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Recommendations

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Meet a climate entrepreneur: Gloria Asare Adu



Photo: Infodev

Gloria Asare Adu is the founder and owner of Global Bamboo Products Limited, which has developed an innovative way to turn bamboo into charcoal. She started her dream of a bamboo and rattan business in Ghana 12 years ago. Compared to firewood and other fossil fuels, her bamboo briquettes burn longer, develop more heat and are smokeless. This solution helps preserve forests, cut emissions, and reduce the health risks connected with indoor fires. Her company has won international and local awards, including a UN Environment SEED Initiative Award in 2010 and a World Bank Ghana Climate Innovation Center award in 2015. Ms. Adu received support from an incubator, the Ghana Climate Innovation Centre, to develop her business and low-emission technology (sources: Infodev, 2017; SEED Global Partnership).

The need for innovation

In 2015, countries adopted the Paris Agreement and the 2030 Agenda for Sustainable Development, setting out a vision of a low-carbon, climate-resilient and sustainable future for all. The goals of these groundbreaking instruments need to be urgently pursued. 2017 was the third hottest year on record, with the average global temperature now almost 1 °C above pre-industrial levels. Climate change effects of growing intensity are being observed with rising frequency in all corners of the world, threatening prospects for sustainable development. Under the Paris Agreement, countries have developed nationally determined contributions, national adaptation plans and mid-century strategies. Now, countries and the international community are focused on implementing them.

Technological innovation is a critical accelerator and enhancer of the efforts to implement national climate actions and achieve the above-mentioned global objectives. The Paris Agreement explicitly refers to innovation in its Article 10. In the 2030 Agenda for Sustainable Development, technological innovation is

referred to under various sustainable development goals, particularly goals 7 (affordable clean energy), 8 (decent work and economic growth), 9 (industry, innovation and infrastructure) and 17 (partnerships for the goals).

Since 2015, the Technology Executive Committee has analyzed how we can accelerate and scale-up technological innovation for achieving the aims of the Paris Agreement and the sustainable development goals. The outcomes of this work are captured in a series of publications which focus on issues such as strengthening national systems of innovation and enhancing financing for the research, development and demonstration of climate technologies. In 2018, it worked with the Green Climate Fund and the Climate Technology Centre and Network to understand the role that incubators and accelerators play in supporting entrepreneurs to innovate climate technologies. This helped the Green Climate Fund to explore how it may support such incubators and accelerators. The outcomes of this joint work were captured in a publication by the three organizations called *catalyzing finance for climate technology incubators and accelerators*. This TEC Brief complements that publication by highlighting policies and actions that can support the entrepreneur in innovating climate technologies.

Who is an entrepreneur?

An entrepreneur is someone who transforms an idea into a product that has practical use. In the case of technology, this generally means that the entrepreneur takes an invention and turns it into a technology that benefits and is used by society. However, their activities are not limited in this way. An entrepreneur might develop and implement a new business model that uses existing technologies in innovative ways. They might also work to adapt an existing technology to the needs of a new market or community. The entrepreneur is not an inventor (although they can be). Instead, they are the individual that works to translate an invention into a product that meets the needs of certain users. Similarly, the entrepreneur is not a financier (although they can be that too). Rather, they develop a product that they hope will be attractive to investors and receive their financial support. Through this injection of capital, the entrepreneur transforms their prototype into a product that is used on a broad scale. An entrepreneur can be an individual undertaking the above activities or a team of people engaged in an entrepreneurial pursuit. Furthermore, they can perform these activities under their own enterprise or as part of the operations of an existing company or organization.

There are many reasons why actors engage in entrepreneurship. Being an entrepreneur is a profession and thus an entrepreneur generally seeks to generate an income from the activities they undertake. However, an entrepreneur may undertake entrepreneurial activities for a variety of reasons beyond financial gain. For instance, recognition of their efforts and the associated prestige that may come with it can be just as important as (or more than) the economic benefits. Furthermore, entrepreneurs may seek to address social or environmental challenges, such as to create jobs for women or lift local people out of poverty. While the entrepreneur may innovate for a variety of reasons, they are inevitably engaging in a high-risk activity. Trial and error, often leading to failure, is an essential part of the process. Failure often leads to the discovery of new solutions or solutions to different problems. It also means that not all potential entrepreneurs are successful in achieving their objectives (be it financial, recognition or social).

It is well documented that entrepreneurs play an important role in contributing to a country's growth and prosperity (Baumol, 1993). By engaging in innovation activities, entrepreneurs bring new and improved technologies into broad usage, facilitating economic growth and disrupting the stagnation and hegemony of existing technologies. Given that addressing climate change will require economic and social transformation, the entrepreneur has the potential to play an important role in developing climate technologies which support communities to reduce greenhouse gases and adapt to climate change. With the right encouragement, guidance, and support, the entrepreneur may channel their efforts into developing climate-friendly solutions.

There are many ways in which entrepreneurs may strengthen the global response to climate change. For instance, an entrepreneur may develop a new climate technology or adapt an existing one to the needs of a community which has not used the technology before. The use of a drought-tolerant lentil crop in Bangladesh might be such an example. Another entrepreneur might develop a new business model which revolutionizes the use of an existing climate technology. The development and implementation of pay-as-you-go solar panels in Indian villages is an example of such a model. Alternatively, an entrepreneur might develop a service that enables the use of an existing technology in a climate friendly-way. For instance, the development of innovative car-sharing models might be such a service. Or a climate entrepreneur might harness the power of emerging technologies which have the potential to transform the way we live, such as artificial intelligence, blockchain, the internet of things, big data and nanotechnology.¹ In all the activities just described, the entrepreneurs identified an opportunity and demonstrated a willingness to grasp it, applying creativity to develop a ready-to-use solution.

There are thus many types of entrepreneurs and entrepreneurial activities that can contribute to achieving the Paris Agreement and the sustainable development goals. Notwithstanding this, entrepreneurs face many challenges to become successful. A lack of encouragement to undertake their role, limited incentives to operate in the climate space, and a lack of support (including access to finance), are three key challenges that exacerbate the risks they face. These challenges are amplified in developing countries, which often face a shortage of capacity, knowledge and resources to address them. In addition, developing country entrepreneurs have large challenges in accessing financing, beyond those that all entrepreneurs face in uncovering financial opportunities. Challenges related to financing are addressed in a separate policy brief by the Technology Executive Committee, the Green Climate Fund, and the Climate Technology Centre and Network (see box 3 below).

In the context of the need to act urgently to address climate change, what can be done to help entrepreneurs overcome such hurdles? The following sections aim to help policymakers identify ways to address these three challenges in the climate technology space. They provide policy guidance on the three interconnected activities of encouraging entrepreneurship, guiding entrepreneurs to focus on tackling climate change, and supporting them as they engage in their endeavors. By encouraging, guiding and supporting entrepreneurship, governments may provide local talent – young and old, women and men, poor and marginalized – with opportunities to gain employment, build livelihoods, and address climate change.

¹ The Technology Executive Committee is currently analyzing the innovation of such emerging technologies for addressing climate change. This work includes a consideration of zero-emission and negative-emission technologies.

1. Encourage the entrepreneur

A key challenge that many developing countries face is in developing a constant supply of capable local entrepreneurs. While enthusiasm for entrepreneurship will always exist, often would-be entrepreneurs in developing countries look to alternative professions, as the risks of entering the profession are too high. Societal pressure, local culture and a lack of economic incentives can reduce an entrepreneur's willingness to fulfil their interest in entrepreneurial pursuits. If they do decide to take the risk, often these new entrepreneurs lack education and training to effectively develop the opportunities that they have identified. Female entrepreneurs often face additional challenges in engaging in entrepreneurial activities and globally are underrepresented in this space (GERA, 2018).

The foundation for encouraging new entrepreneurs is the country's entrepreneurial ecosystem. The entrepreneurial ecosystem is the set of actors, institutions, social networks, and cultural values that produce and sustain entrepreneurial activity' (Roundy et al., 2018). It is system within which governments and other agencies do not target individual firms or sectors, but agglomerations of enterprises and entrepreneurs. They provide holistic, systemic support based on the recognition that innovation and its commercialization comes about from interaction and collaboration among a range of agents (GCF, 2017). Hence, entrepreneurial ecosystems are not direct, top-down tools for entrepreneurship promotion, but a "complex adaptive system" that emerges from the "uncoordinated, semi-autonomous actions of individual agents" (Roundy et al., 2018) in which governments are actors and the shapers of the institutional framework.

A healthy ecosystem plays two major roles: it encourages individuals to engage in entrepreneurial activities and supports them as they undertake these (the latter considered in section 3). A strong entrepreneurial ecosystem encourages individuals to become entrepreneurs by providing them with incentives and a supportive culture. This includes access to education and training, infrastructure, sources of finance, and supporting policies and regulations (such as a safety-net when entrepreneurs inevitably fail). At the same time, an ecosystem works to ensure that there are few free-riders, discouraging those without entrepreneurial talent from continuing to participate.

Actions

To encourage local entrepreneurship, a government, with the support of the international community, may:

- Promote opportunities for entrepreneurship through targeted communication and awareness programmes;
- Incentivize actors to become entrepreneurs by introducing supporting policies for entrepreneurship and job-creation. These may include tax-cuts for small businesses, micro-financing, social protection programmes; and business environment regulatory reform that increases the ease of doing business;
- Build the capacity of would-be entrepreneurs by implementing training and education programmes;
- Encourage the participation of female entrepreneurs by introducing tailored niche-support programmes;
- Increase access and strengthen infrastructure required for effective entrepreneurship, for example IT connectivity;
- Increase international networking between local small- and medium-sized enterprises and those of other countries.

Furthermore:

- Non-governmental organizations are encouraged to highlight the opportunities that exist in different countries, regions and sectors for entrepreneurship. They could also showcase country

strengths and opportunities for improvement in facilitating innovation nationally (building on existing initiatives such as the Global Innovation Index).

- Interested potential entrepreneurs (and more broadly the private sector) are encouraged to contact local, sub-national and national offices which promote entrepreneurship to develop greater understanding on potential opportunities in this field.

Meet a climate entrepreneur: Arun Shenoy and Mandar Kaprekar



Photo: India Today

Arun Shenoy and Mandar Kaprekar are the founders and executive directors of Green India Building Systems and Services. The two entrepreneurs have developed a geothermal heat exchange air-conditioning system that brings up to 60% energy savings and 100% water savings compared to conventional building cooling systems. What started as a three-member team from the living room of an apartment is now a company with 80 staff, offices in Mumbai, Bangalore, Delhi and Singapore, and 85 clients across India. In 2017, the company won the Global Cleantech Innovation Award, a prize supported by the United Nations Industrial Development Organization and the Global Environment Facility (sources: UNIDO, 2017; India Today, 2014; Your Story, 2016).

2. Guide the entrepreneur in the right direction

Even if a country successfully encourages individuals to engage in entrepreneurship, there is no guarantee that they will focus their energies on innovating solutions to climate-related problems. Thus the second challenge relates to direction: how can we guide entrepreneurs to focus on climate technologies? How can we sway entrepreneur preferences? How can we relocate entrepreneurial efforts to the climate technology space? Without encouragement to focus on climate technologies, the entrepreneur (unless they have a particular passion for addressing climate change) will focus on taking advantage of those opportunities and incentives that do exist in a country, irrespective of whether these lead to a positive or negative effect on the climate. For example, continuing support for high-emission and non-resilient technologies may provide opportunities for entrepreneurs in areas that will not help countries to achieve the aims of the Paris Agreement.

The government thus needs to design and implement push and pull policies that create incentives for entrepreneurs to focus on meeting market and societal needs with low-emission and climate-resilient solutions. In its brief: 'Technological Innovation for the Paris Agreement,' the Technology Executive Committee noted that actions to incentivize climate technology innovation may include strategically combining financing and a long-term policy and regulatory framework to encourage actors to focus on a portfolio of options directed towards a specific climate aim (Stern et al., 2007). It may achieve this by designing and implementing policies, regulations and standards that create enabling environments and favorable market conditions for climate technologies (e.g. through feed-in tariffs or auctions) and removing disincentives such as high-carbon subsidies (OECD, 2017). Governments can also stimulate a long-term market pull through instruments that seek to capture the negative externality of greenhouse gas emissions, for instance by putting a price on carbon (OECD, 2017). The Paris Agreement, by providing a shared vision of low-emission and climate resilient world that all aspire to, gives direction and an international framework which encourages countries to implement such push and pull policies. In developing such incentives, it was previously noted that financial benefit is not the only incentive that entrepreneurs respond to. Recognition, prestige and the opportunity to tackle societal challenges are also key drivers (Baumol, 1993).

Actions

To incentivize entrepreneurs to focus on climate technologies, a government, with the support of the international community, may:

- Update national development and innovation strategies and align them with nationally determined contributions, national adaptation plans, mid-term strategies and other national climate plans;
- Create and implement policies, standards, regulations and financial instruments that build markets and provide incentives for entrepreneurship in accordance with the above strategies.² These may include putting a price on carbon and introducing tax breaks for the development and demonstration of climate technologies;
- Encourage market development and demand through mission-based government procurement for climate technologies (noting that a credible process and a long-term focus are key to success on this). This may be especially relevant for climate technologies that are not commercially profitable on a broad scale;
- Encourage market development and stimulate demand by incentivizing behavioral change and guiding end-user preferences towards climate-friendly products and services, including through education and awareness-raising activities;
- Facilitate the provision of 'patient' capital which provide entrepreneurs with longer payback periods for climate technology start-ups with high capital expenditure;

² See also the Technology Executive Committee's working paper on enhancing financing for the research, development and demonstration of climate technologies.

Furthermore:

- Non-governmental organizations are encouraged to highlight the opportunities that exist for climate technology entrepreneurship and draw attention to the potential economic, environmental and social benefits of such efforts.
- Entrepreneurs (and more broadly the private sector) are encouraged to explore opportunities for innovation in the climate technology space. The long-term commitment of all countries to achieve the temperature goals of the Paris Agreement signify that substantial opportunities will continue to arise for facilitating low-emission and resilient development. Local, sub-national and national authorities and governments may be able to provide entrepreneurs with further information.

3. Give the entrepreneur a support boost

A significant challenge remains, even if a country successfully encourages individuals to engage in entrepreneurship and focus on climate technologies. This is, how can we support entrepreneurs to innovate effectively? As noted in section 1, strengthening the entrepreneurial ecosystem is key for supporting entrepreneurs to innovate. As the national system of institutions, actors and linkages focused on entrepreneurship, a strong ecosystem underpins and facilitates entrepreneurial activities. It provides entrepreneurs with continued education and training and connects them to key actors, including the research community, industry (both supply and demand channels) and users. It also unlocks finance for entrepreneurs, helping them connect with the private sector and fostering awareness of each other's needs.

A strong entrepreneurial ecosystem is fundamental for sustained national entrepreneurial success, but such ecosystems in developing countries are often weak, underdeveloped and underperforming, affecting an entrepreneur's chances to innovate effectively. For example, in developing countries entrepreneurs often encounter a lack of local manufacturing capability and weak integration into global value chains. In addition, local investors are generally unwilling to invest in high risk entrepreneurial activities, with high-risk investors such as venture capitalists and angel investors in very limited supply in developing countries. While micro-financiers work to cover this gap, they may have limited scale or reach within a country.

Strengthening the ecosystem is necessary for sustained and successful innovation. But this requires wide-ranging actions and takes time. Thus, is there a way to give entrepreneurs tailored support in parallel to broader efforts to strengthen the ecosystem? In recent years, a mechanism has been gaining traction for providing such support. This mechanism is called 'incubation' and refers to the process of providing the entrepreneur with conditions favorable for the 'hatching' or developing of their idea into a usable and practical solution. This support is generally provided through two similar institutions: the incubator and the accelerator.

While no strict definition exists of either, an incubator is considered any sort of environment designed to support start-up organizations (Malek et al., 2014). It generally offers the following services to an entrepreneur: (1) a physical location; (2) business services; (3) marketing services; (4) technical services; (5) financial support (by linking the entrepreneur to sources of finance and investment); and (6) networking and information services. Generally, an incubator will support an entrepreneur for more than a year, and often for up to five years. The concept of the incubator originated in the early 1950s in the United States. The accelerator is a more recent phenomenon. Arising in the mid-2000s in the Silicon Valley, the accelerator aims to speed up successful venture creation by providing specific support services during an intensive programme of limited duration (Pauwels et al., 2016). An accelerator operates by offering mentoring, peer review and skills transfer over a three- to six-month period to entrepreneurs in exchange for taking a small percentage shareholding in the resulting venture (Mian et al., 2016). Accelerators are often privately owned and financed and have traditionally focused on the IT sector.

While incubators and accelerators have the potential to give a boost of support to entrepreneurs, a key difficulty they face is financial self-sufficiency. It is estimated that fewer than five accelerators worldwide support themselves on revenue generated from equity in their successes. Incubator and accelerators in developing countries are often dependent upon continued public support. Another difficulty is in developing incubator and accelerator models that work effectively in developing country contexts. The current accelerator model aims to support IT start-ups in the Silicon Valley, which has one of the strongest entrepreneurial ecosystems in the world. With a few exceptions, developing countries (and many developed countries) don't have such strong entrepreneurial ecosystems. The current accelerator model may also not suit the innovation of climate technologies, which often have a longer incubation period than information technologies and may have limited (or no) commercial profitability. Thus, there is a need to develop new incubation models that address these financial and contextual challenges in developing countries. Incubators and accelerators in developing countries need to operate contextually if they are to support entrepreneurs successfully.

Actions

To effectively support entrepreneurs, a government, with the support of the international community, may:

- Pilot new incubation models that address the specific needs of and function effectively in developing countries. Such models might serve as a local intermediary institution that plays a leadership, coordination and advocacy role for developing the entrepreneurial ecosystem. They may also focus on market incubation, working to connect entrepreneurs to local and cross-border markets for supply and demand. Furthermore, such models may take into greater account differing cultural contexts, local communities, income levels and gender considerations. These incubation models may provide co-working spaces where entrepreneurs and other actors can participate in joint innovation, mutual learning and the implementation of pilot projects.
- Encourage the co-creation of new incubation models with the participation of public and private financiers, which may lead to greater financial sustainability.
- Incentivize well-functioning existing incubators and accelerators to expand into climate technology markets. Such high-performing incubators and accelerators may have more success in attracting financing due to their proven track record.
- Implement education and training programmes, including through incubators and accelerators, which build the capacity of local entrepreneurs to engage in innovation;
- Strengthen linkages between entrepreneurs and other key actors in the ecosystem, including industry, universities and government;
- Strengthen the leadership of the national entrepreneurial ecosystem and support related coordinating institutions at the national, sub-national and local level;
- Develop financial instruments that reduce the risk and opportunity cost for local financial institutions to invest in the innovation of climate-friendly goods and services, helping the entrepreneur to access cheap capital for such efforts;
- Educate investors (such as micro-financiers, angel investors and venture capitalists) on the nature of climate technology development (e.g. long payback times, type of market demand and broader benefits and returns);
- Facilitate access to foreign exchange for entrepreneurs to purchase technologies not available in local markets that they need for developing their solution on an economically viable scale.
- Connect the national entrepreneurial ecosystem to regional and global ecosystems, supporting entrepreneurs to access ideas, networks, knowledge and scaling opportunities;

Furthermore:

- Non-governmental organizations are encouraged to further analyze effective incubation models for supporting climate technology entrepreneurship with the aim of providing thought-leadership on potential new incubation models. They are also encouraged to advocate for the importance of

supporting climate technology entrepreneurship in developing countries, as a way of creating jobs and increasing national and local prosperity.

- Entrepreneurs (and more broadly the private sector) are encouraged to share their views with national and international actors on their experiences on receiving support for innovating climate technologies. The sharing of such experiences may help governments to design more tailored solutions that effectively respond to the needs of climate technology entrepreneurs.

DRAFT

Strengthening climate technology incubators and accelerators



Photo: UNFCCC

In 2018, the Technology Executive Committee, the Green Climate Fund, and the Climate Technology Centre and Network worked together to determine how climate technology incubators and accelerators may effectively support entrepreneurs in developing countries. They held an event which brought together more than 80 global experts on entrepreneurship, technology innovation and climate change. Based on this, the three organizations developed two publications that provide policy recommendations on strengthening climate technology incubators and accelerators. A key focus of their efforts was on understanding how to catalyze financing for supporting these incubation models. The outcomes of this work informed the Green Climate Fund on how it may provide finance to developing countries for strengthening incubators and accelerators. The three organizations found that:

1. *A strong entrepreneurial ecosystem unlocks financing for incubators and accelerators.* For instance, it strengthens linkages between the private sector and entrepreneurs, and fosters greater awareness and capacity on both the supply and demand side for new products;
2. *Crowding in private finance helps to transform ideas into solutions.* One way to do this is by creating financial instruments that reduce the risk and opportunity cost for local public and private financial institutions to invest in the development and demonstration of climate technologies.
3. *New incubation models should aim for financial sustainability.* Actors should encourage the co-creation of incubators and accelerators with the participation of public and private financiers. Such models might take into greater account the diverse needs of entrepreneurs and technology users in relation to differing cultural contexts, local communities, income levels and gender considerations.

Further information may be found at <http://unfccc.int/ttclear/incubators>.

About the Technology Executive Committee

The Technology Executive Committee is the policy component of the Technology Mechanism, which was established by the Conference of the Parties in 2010 to facilitate the implementation of enhanced action on climate technology development and transfer. Along with the other component of the Technology Mechanism, the Climate Technology Centre and Network, the committee is mandated to facilitate the effective implementation of the Technology Mechanism.

Further information

This brief is based on the following documents, which provide more detailed information:

UNFCCC. 2018a. *Catalysing financing for incubators and accelerators: addressing climate change through innovation*.

Bonn. United Nations Framework Convention on Climate Change. <http://unfccc.int/ttclear/incubators>.

UNFCCC. 2018b. *Climate technology incubators and accelerators*. Bonn. United Nations Framework Convention on Climate Change. <http://unfccc.int/ttclear/incubators>.

UNFCCC. 2018c. *Thematic dialogue on climate technology incubators and accelerators*. Organized by the Technology Executive Committee, the Climate Technology Centre and Network and the Green Climate Fund.

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Citation

UNFCCC. 2018. *TEC Brief [xx] Energizing entrepreneurs to tackle climate change*. Bonn: United Nations Framework Convention on Climate Change.