2 The importance of green entrepreneurship

The Danish Council on Climate Change estimated that only one-third of Denmark's targeted reductions in greenhouse gas emissions by 2030 can be achieved through existing policy measures. This means that technological innovation is critical if Denmark is to achieve its climate objectives. Green entrepreneurs can have a key role to play both in developing these innovations and in bringing them to market. This chapter provides an introduction to the need for and drivers of green entrepreneurship. It also develops the definition of green entrepreneurship that is adopted throughout this report.

Highlights

- The United Nation's (UN) Intergovernmental Panel on Climate Change's (IPCC) most recent report has re-affirmed that human activities have fuelled changes in climate that are "unprecedented in thousands, if not hundreds of thousands of years". This is already having a devastating global impact through an increased prevalence of natural disasters and extreme weather events.
- Combatting climate change is of critical importance to maintaining wellbeing and standards of living across the world. In order to avoid the most severe economic, social and environmental consequences, climate experts warn that the temperature rise must be limited to 1.5°C. The IPCC assesses that this will necessitate rapid and large-scale reductions in greenhouse gas (GHG) emissions.
- Entrepreneurs can be a significant driving force behind efforts to lower GHG emissions through their capacity to develop and propagate innovative green solutions. Public policies that promote green entrepreneurship can therefore play a decisive role in the global effort to mitigate human-induced climate change.
- Definitions and terminologies used to describe the notion of green entrepreneurship vary widely across different countries and studies. This report adopts the following definition of green entrepreneurship:
  - Green entrepreneurship encompasses the development and deployment by new start-ups of green products, services and processes, i.e. those that either:
    - reduce or prevent any type of environmental damage; or
    - emit less pollution and waste, or are more resource-efficient than equivalent normal products, services and process that have the same result. Their primary use, however, is not one of environmental protection.
- There is an array of factors that influence and drive green entrepreneurship. These include the policy landscape, economic conditions, societal attitudes, technological developments, legal and regulatory frameworks, and environmental pressures.

The need for green entrepreneurship

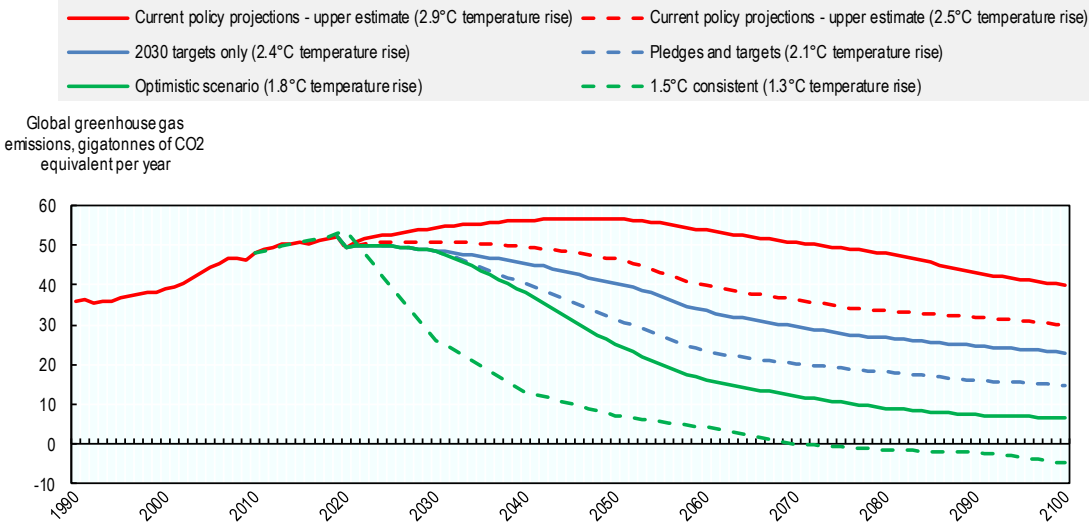
Entrepreneurs have an important role in bringing new ideas to the market and driving change in economies. This is particularly true for green entrepreneurship, where new start-ups have the potential to disrupt established practices (Phan, Siegel and Wright, 2005[1]). However, entrepreneurship always entails risk and it is estimated that only 1-2% of inventions reach the market (Braunerhjelm et al., 2009[2]). Technology innovation – including climate technology – is subject to even greater levels of risk due to higher uncertainty (e.g. unclear market demand, regulatory uncertainty). This is further complicated for climate technologies because social returns typically exceed private returns (Gompers and Lerner, 2001[3]). Thus, the promotion of green entrepreneurship is complex. There are high fixed costs in the research and development stages and high risks in the commercialisation phase, suggesting that a reliance on private markets alone without government intervention would be suboptimal (Popp, 2012[4]).

The United Nation's (UN) Intergovernmental Panel on Climate Change's (IPCC) most recent report has re-affirmed that human activities have fuelled changes in climate that are "unprecedented in thousands, if not hundreds of thousands of years" (Intergovernmental Panel on Climate Change, 2021[5]), with the UN Secretary General describing the report as a "code red for humanity". Global average temperatures are

approximately 1.1 degrees Celsius (°C) above 1850-1900 levels, with this change attributable to greenhouse gas (GHG) emissions associated with human activities (Intergovernmental Panel on Climate Change, 2021[5]).

Climate change is already having devastating impacts on societies across the world, including an increased incidence of wildfires (Abatzoglou and Williams, 2016[6]) (Jan Van Oldenborgh et al., 2021[7]) and droughts (Dai, 2011[8]). With global temperatures increasing at a rate of nearly 0.2°C per decade (Lindsey and Dahlman, 2021[9]), these impacts are set to become significantly more severe over the coming decades (Dellink, Lanzi and Chateau, 2019[10]) (Intergovernmental Panel on Climate Change, 2021[5]). In order to avoid the most severe economic, social and environmental consequences, climate experts warn that the temperature rise should be limited to 1.5°C (IPCC, 2018[11]). However, the IPCC's Sixth Assessment Report finds that "unless there are immediate, rapid and large-scale reductions in greenhouse gas emissions, limiting warming to close to 1.5°C or even 2°C will be beyond reach" (Figure 2.1) (Intergovernmental Panel on Climate Change, 2021[5]).

Figure 2.1. Global warming by 2100 depends on climate policies



Source: (Climate Action Tracker, 2021[12])

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Reducing greenhouse gas emissions is the principle way in which the world's environmental crises can be mitigated. Some initial progress has been made on this front, with GHG emissions from OECD countries having fallen since 2007 as a result of a strengthening of climate policies and the economic slowdown associated with the global financial crisis in 2008 (OECD, 2020[13]). In the medium- to long-term, economic growth and reductions in GHG emissions are complementary rather than conflicting objectives. Indeed, it is estimated that the GDP of G20 countries would be 4.7% higher in 2050 in a scenario where policy interventions ensure that climate damage is avoided relative to a scenario where no actions are taken (OECD, 2017[14]).

Entrepreneurs can be a significant driving force behind efforts to lower GHG emissions through their capacity to develop and propagate innovative green solutions. Green entrepreneurship is therefore an emerging field of interest in a world confronted with the need to achieve economic growth while making frugal use of natural resources and minimising pollution (Potluri and Phani, 2020[15]). Public policies that

promote green entrepreneurship can play a decisive role in the global effort to mitigate human-induced climate change.

Defining green entrepreneurship

A number of broader concepts such as green growth and sustainable development need to be clarified before turning to green entrepreneurship. The OECD Green Growth Strategy notes that green growth implies fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies (Box 2.1). This is more narrow than sustainable development, which considers a wider range of social factors as outlined in the UN's Sustainable Development Goals (SDGs).

Box 2.1. Green growth and sustainable development

Sustainable development provides an important context for green growth. The OECD Green Growth Strategy leverages the substantial body of analysis and policy effort that flowed from the 1992 Rio Earth Summit. It develops a clear and focused agenda for delivering on a number of the summit's key aspirations.

Green growth has not been conceived as a replacement for sustainable development. It should instead be considered as a subset of sustainable development. It is narrower in scope, entailing an operational policy agenda that can help achieve concrete, measurable progress at the interface between the economy and the environment. It provides a strong focus on fostering the necessary conditions for innovation, investment and competition that can give rise to new sources of economic growth that are consistent with resilient ecosystems.

Policies need to pay specific attention to many of the social issues and equity concerns that can arise as a direct result of greening the economy – both at the national and international levels. This is essential for the successful implementation of green growth policies. Measures should be implemented in parallel with initiatives centred on the broader social pillar of sustainable development.

The OECD Green Growth Strategy develops an actionable policy framework that is designed to be flexible enough to be tailored to differing national circumstances and stages of development. In partnership with initiatives by other international organisations, including UNEP, UNESCAP and the World Bank, the OECD's work on green growth has been planned to contribute to the objectives of the 2012 UN Conference on Sustainable Development (Rio+20).

Source: (OECD, 2011[16])

Entrepreneurship has an important role to play in making progress towards green growth objectives. In general, entrepreneurship is widely recognised as boosting economic activity and stimulating job creation (OECD, 2020[17]). Increasingly, entrepreneurship is also being recognised as a means of addressing societal challenges, including environmental sustainability. The role of entrepreneurs in this area is twofold:

1. By developing and bringing to market innovative products, entrepreneurs can propagate environmentally sustainable solutions throughout the economy;
2. By taking steps to improve the environmental sustainability of their businesses, entrepreneurs can collectively have an impact on progress towards green objectives.

Despite much discourse over the past 20 years, a consensus on the definition of green entrepreneurship has yet to emerge. A range of definitions have been proposed for green entrepreneurship and related

terms in the academic literature and other research (Table 2.1) and there have been many calls to move towards a consensus (Demirel et al., 2017[18]).

Table 2.1. Defining green entrepreneurship

Definition	Source
"Both Entrepreneurship and Environmentalism are based on a perception of value. The attitudes which inform environmental concerns create areas of value that can be exploited entrepreneurially. 'Environmental Entrepreneurs' not only recognise opportunities, but also construct real organisations to capture and promote changes in society."	(Anderson, 1998[19])
"An ecopreneur is a person who seeks to transform a sector of the economy towards sustainability by starting business in that sector with a green design, with green processes and with the life-long commitment to sustainability in everything that is said and done."	(Isaak, 2002[20])
"We distinguish between two types ecopreneurs… 'environment-conscious entrepreneurs' are well aware of environmental issues, but they are not in the environmental marketplace… The second category of ecopreneurs, called 'green entrepreneurs', are those who are both aware of environmental issues and whose business venture is in the environmental marketplace."	(Thierry Volery, 2002[21])
There are four types of green entrepreneurs: • Ad-hoc enviropreneurs, who are "accidental green entrepreneurs" primarily motivated by financial concerns; • Ethical mavericks who are driven by sustainability considerations and influenced primarily by friends, networks and experience; • Innovative opportunists who are financially oriented and have identified a green opportunity, and; • Visionary champions, who set out "to change the world" and are "active in the transformation of society.	(Walley and Taylor, 2002[22])
"Green community entrepreneurship is…the collective ability to mobilise resources, including social capital, to provide products or services that achieve environmental rather than profit maximising goals."	(Gliedt and Parker, 2007[23])
"Green entrepreneurs exploit the opportunities that are inherent in environmentally relevant market failures; however, the paradox of green entrepreneurship may also emanate from the fact that environmental wellbeing that results from born greens is a public good and, therefore, non-excludable. This property of non-excludability may push green entrepreneurs (along with their nascent breakthrough innovations) into liminal spaces, where additional costs render green entrepreneurs at a competitive disadvantage and, thus, limit their economic impact vis-à-vis non-green actors."	(Demirel et al., 2017[18])
Green entrepreneurs can be mapped to four broad types along 2 dimensions: i) Profit-seeking vs. Social mission; ii) Start-ups vs. Established firms. Each type of green entrepreneurs has different incentives and desired outcomes.	(Nikolaou, Tasopoulou and Tsagarakis, 2018[24])

While these academic concepts are useful for deepening an understanding of green entrepreneurs, including their motivations and activities, it can be difficult for governments to design policy and implement around these notions. In practice, governments tend to use terms and definitions that are based on activities and/or sectors:

- *Cleantech*: This term is commonly used in Canada to describe the types of products and services typically developed by green entrepreneurs. Statistics Canada defines clean technologies as (Statistics Canada, 2021[25]):
  - Any good or service designed with the primary purpose of contributing to remediating or preventing any type of environmental damage;
  - Any good or service that is less polluting or more resource-efficient than equivalent normal products which furnish a similar utility. Their primary use, however, is not one of environmental protection.
- *Greentech*: In Germany, the government tends to use the more narrow concept of greentech, which covers technologies that provide solutions to preserving the environment and/or meet fundamental human needs in a sustainable way (Federal Ministry for the Environment, 2021[26]). This includes technologies in seven lead markets (environmentally friendly power generation, storage and distribution, energy efficiency, material efficiency, sustainable mobility, waste management and recycling, sustainable water management, and sustainable agriculture and forestry), with each lead market further divided into a series market segments and technology lines.

- *Climate tech*: The Israel Innovation Authority defines climate tech companies as those that develop technologies aimed at climate change mitigation and adaptation (Moise, Klar and Siegmann, 2021[27]). Climate change mitigation refers to reducing emissions from various sectors as well as removing CO_2 from the atmosphere. Climate change adaptation refers to building resilience to climate-related risks in order to minimise the adverse impacts of climate change. Climate tech is more a narrow field than cleantech or greentech, which both cover climate-related issues as well as other environmental issues.

Building on previous OECD work on green entrepreneurship (OECD/Eurostat, 1999[28]; OECD, 2011[16]), and recent concepts used in the case study countries, a definition of green entrepreneurship is proposed for Denmark (Box 2.2). This understanding of green entrepreneurship covers entrepreneurs who create and commercialise products by forming new start-ups that help to tackle environmental challenges, rather than the broader population of entrepreneurs and micro businesses who are taking steps to reduce their businesses' environmental footprint. It also focuses on the role of new enterprises in developing green products, as opposed to green innovations taking place within established companies. The definition is not limited to any specific sectors, issues or drivers, and instead seeks to capture the myriad of ways in which the innovative actions of green entrepreneurs can address sustainability concerns. This concept of green entrepreneurship is broadly consistent with previous frameworks for measuring green entrepreneurship (OECD, 2011[29]) but two important advances are put forward. First, it makes a strong distinction between pre start-up and early-stage entrepreneurship activities and those undertaken by existing firms. Second, it does not limit itself to businesses whose primary or secondary activities are in core environmental sectors. Please see (OECD, 2022[30]) for further discussion on measuring green entrepreneurship and the greening activities of SMEs.

Box 2.2. Green entrepreneurship in the Danish context

Green entrepreneurship encompasses the development and deployment by new start-ups of green products, services and processes i.e. those that either:

- reduce or prevent any type of environmental damage; or
- emit less pollution and waste, or are more resource-efficient than equivalent normal products, services and process that have the same result. Their primary use, however, is not one of environmental protection.

"Normal products, services and processes" refers to products, services and processes that are the current standard for the time and context, and as such will vary over time and in different contexts. This definition is therefore dynamic to ensure that it captures *further* progress in improving environmental sustainability.

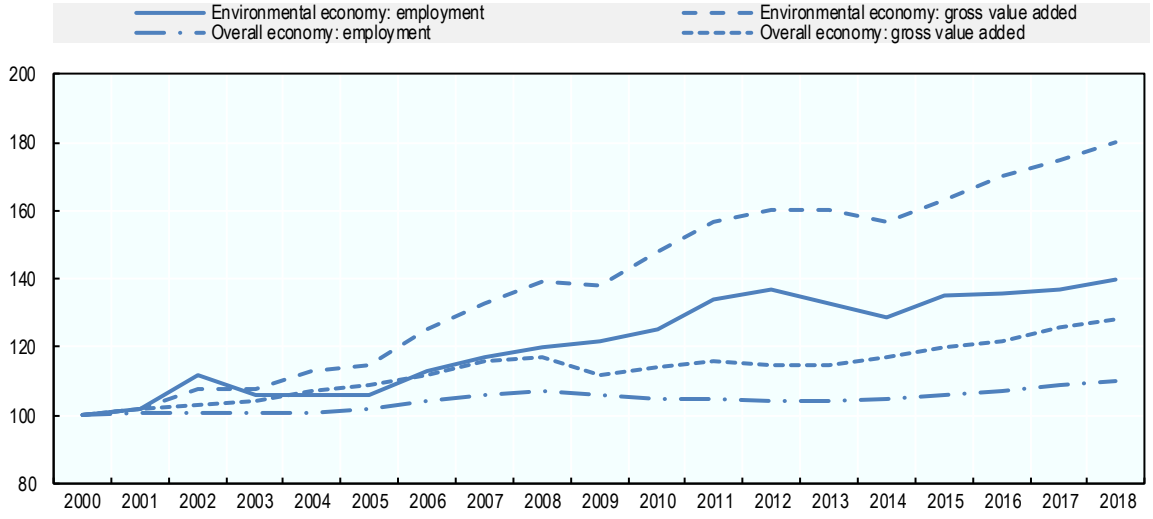
Drivers of green entrepreneurship

There are a number of key factors that influence and drive green entrepreneurship. At a basic level, green entrepreneurship stems from the need for societies to address environmental challenges. As environmental pressures become more acute and societies increasingly seek to adopt a more sustainable way of living, the demand for green products and solutions increases. Global markets for climate-friendly businesses and technologies are growing. For example, it is estimated that the Paris Agreement has opened up USD 23 trillion of climate-smart investment opportunities in emerging markets between 2016 and 2030 (IFC, 2016[31]).

Policy makers influence the development of green entrepreneurship by setting taxes, environmental regulations and trade policies, as well as implementing measures to encourage the development of new technologies and products and the related emergence and growth of green start-ups. Policies can provide direct support to green entrepreneurs through, for instance, improved access to funding, skills or networks. Indirect policy support can be provided by strengthening environmental and climate policies, which in turn create new market opportunities for green entrepreneurs to exploit. For example, legislation relating to natural resource consumption, waste disposal, carbon dioxide emissions, energy consumption and environmental protection are examples of initiatives that may contribute towards a shift to more circular and sustainable modes of production and consumption.

The performance of the economy, and in particular the environmental economy, also has a significant impact on green entrepreneurship. In the European Union (EU), the environmental economy is growing faster than the overall economy, demonstrating that EU Member States are taking action to support a more sustainable model of economic growth (Figure 2.2). The contribution of the environmental economy to EU GDP increased from 1.6 % in 2000 to 2.3 % in 2018 (Eurostat, 2022[32]). During the same period, employment in the EU environmental economy increased from 3.1 million full-time equivalents to 4.4 million full-time equivalents. Green entrepreneurship is a key contributor to such job creation results. In most cases, these new jobs in the clean economy have different skill profiles to those that may become obsolete. For instance, in the automotive sector, jobs are shifting in favour of IT specialists, power electronics, recycling and battery technologies (Joint Research Centre, 2018[33]).

Figure 2.2. The environmental economy is growing faster than the overall economy



Source: (Eurostat, 2022[32])

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