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Business-Driven Ecological Innovations in Green Growth Strategies

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Introduction

Green growth and green economy are two key terms that describe a recent sustainability paradigm aimed at linking growth in the private sector with addressing increasing environmental problems and the minimisation of its impact on the ecosystem. Through so-called ecological innovations (eco-innovations), a win-win situation of both job creation (and hence growth) and environmental protection can be achieved. While green growth has been criticised for being a repackaging, or a

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green-washing, of (old) neoliberal ideas, the novelty and merits of the concept can be highlighted by relating it to the envisioned business models and innovations behind it. Concepts such as green growth and eco-innovations are closely related, while the link between the two is poorly understood. In fact, both ideas reflect the increasing demand for alternatives to the business-as-usual growth path. Such a path fails to effectively combat challenges of resource depletion, rising carbon emissions, destruction of ecosystems and environmental disasters. If businesses do not change the current path, 5–10% of the global GDP could be lost annually due to the climate change impacts alone, especially in developing countries (Stern 2007).

Green growth offers a compromise between growth and sustainability. At the same time, the concept of eco-innovation takes a central role in the current green growth debates, since technological and organisational innovations can help save resources and lower negative impacts of production and consumption. In this chapter, we analyse this link between green economy and business-driven eco-innovations in order to clarify prerequisites and demands on businesses that seek to drive the change towards a more balanced and sustainable growth pathway. In fact, green growth is a controversial term which is understood in widely varying ways, while eco-innovation serves as a concretisation of the means of achieving it. Similarly, green growth is often seen as an operationalisation strategy of the overarching paradigm of sustainable development (UNESCAP 2012; OECD 2011a). At the same time, green growth has many interlinkages with other paradigms and sub-concepts (Loiseau et al. 2016), and other related principles and concepts (e.g. circular economy, decoupling, strong or sustainable development reflected in the Sustainable Development Goals (SDGs)), as we discuss in this chapter.

The debate about the concepts of green growth and green economy will be presented, with eco-innovations and sustainable business models as the pragmatic core of green growth debates. Here, the assessment of business models and certain industries with regard to their potential of embodying the green eco-innovation and growth idea is explained. Building on this, we recommend how public policies and adequate regulations can incentivise and promote business-driven eco-innovations.

Emergence of Green Growth in Environmental Policy

As global challenges of resource depletion, climate change and environmental pollution further threaten human well-being, the environment and economies, new growth paradigms have evolved in the international arena to offer alternative pathways for our economic systems. Green growth and green economy are two important and much-debated concepts of today. In the aftermath of the global financial crisis of 2008, green growth attracted significant attention towards the environment as a motor for growth, attracting new investment opportunities and establishing new industries that are in line with the idea of sustainability (Jacobs 2012). The basic idea of green growth lies in the harmonisation of economic growth with environmental sustainability (Kwon 2010). The concept was also a key theme of the Rio+20 conference in 2012, which spawned many initiatives aimed at mainstreaming green growth into national strategies. Since then, several governments around the globe have adopted green growth/green economy as a guiding principle for their economies (Megwai et al. 2016).

In fact, green growth and green economy are closely related, and the terms are often used interchangeably. Often, green economy is a term used to describe the result or output of the process of green growth. Essentially, green economy is one that is characterised by green growth processes. Both terms put the economy at the centre of attention, while the potential for innovation plays a crucial role (Jänicke 2012). Business-driven eco-innovations as an instrument for economic growth therefore represent the pragmatic core of the green economy and will thus be analysed in this chapter.

Green growth and green economy are sometimes negatively reviewed for their overemphasis on the role of businesses and also for presumed conceptual ambiguities. In fact, there is rich debate on the contents and merits of this concept; for example, green growth is criticised for "repackaging of sustainability" (Gupta 2014) or even trying to replace it. In contrast, the Organisation for Economic Cooperation and Development (OECD) sees it not as a replacement for sustainable

development, but rather a subset of it, entailing an "operational policy agenda" at the intersect of economy and environment, as well as promoting "conditions for innovation, investment and competition" (OECD 2011a) to achieve growth in harmony with ecological considerations. On the other hand, critics of green growth note that the concept neglects the social dimension and limits its effect on poverty reduction. In this regard, Hallegatte et al. (2011) recognise the emphasis of green growth on the economic and environmental dimensions, while pointing out significant improvements in people's lives, e.g. through job creation or improved water quality. In fact, if one looks at some famous definitions as summarised in Table 6.1, the economy–environment emphasis is clear despite some definitions incorporating social inclusiveness or equity. Jänicke (2012) and Boström (2012) explain the negligence of social dimensions, *inter alia* due to practical reasons, because international experience so far has revealed difficulties in realising and operationalising the social dimension in growth. Table 6.1 summarises the definitions of key institutions that are leading the debate on green growth.

The promotion of green growth has created a new momentum in the debate about pathways towards economic development, which also fulfils the environmental dimension of sustainability (Jacobs 2012). With this in mind, green growth promises to help concretise and operationalise national policies towards a sustainable development pathway. So far, a large volume of literature has focused on defining green growth (Jacobs 2012; World Bank 2012; Livermore 2014) and identifying the potentials of green growth either in general (OECD 2011a; UNEP 2011), or for a specific country (MoEnv and UNEP 2011; GGGI 2013). Current green growth research initiatives and projects mostly deal with questions of technology and innovation, sustainable economic growth, green jobs and metrics to measure green growth performance. In pursuit of this, many institutions have put forward metrics and indicators to operationalise this idea. For example, the OECD has issued several publications on how to measure green growth and developed tools to deliver green growth (OECD 2011b). One of them is "Green Growth Diagnostics", which is a modified version of "Growth Diagnostics" by Hausmann, Velasco and Rodrick (2004).

Table 6.1 Green growth definitions of leading key institutions

Definition	Source	Focus
"…fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies"	OECD (2011a): Towards Green Growth	A highly cited definition emphasising the economy–environment link
"Green economy is one that results in improved human well-being and social equity while significantly reducing environmental risks and ecological scarcities In its simplest expression, a green economy is low-carbon, resource-efficient and socially inclusive"	United Nations Environment Programme (UNEP) (2011): Towards Green Economy	Probably the most comprehensive definition, with instrumental novelty of the concept (low-carbon, efficiency, risks)
"…an implementing strategy to achieve sustainable development that focuses on improving the eco-efficiency of production and consumption and promoting a green economy, in which economic prosperity materializes in tandem with ecological sustainability"	United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) (2012): Low Carbon Green Growth Roadmap for Asia and the Pacific	Definition of green economy as a part of sustainable development and in relation to other concepts
"…growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters"	World Bank (2012): Inclusive Green Growth	A definition through characterisation of the growth process, while adding the factor of resilience against natural hazards
"Green growth is the new revolutionary development paradigm that sustains economic growth while at the same time ensuring climatic and environmental sustainability"	Global Green Growth Institute (GGGI 2013)	Similar to the OECD's definition, while emphasising its novelty

It is a methodology for diagnosing the key binding constraints to green growth in order to derive policy priorities. Sander (2011) questions the use and usefulness of this method being applied on the economy-wide level and proposes rather to apply it at the industry level and to specific environmental challenges. He shows its application using the example of the Chinese energy sector. Pueyo et al. (2015) conducted a research project in which they applied the Green Growth Diagnostics methodology in Ghana and Kenya to identify the binding constraints to private investment in clean energy. Another example of measurement of green growth performance is the "Global Green Economy Index (GGEI)", published by Dual Citizen (2016), which investigates four key dimensions: leadership and climate change, efficiency sectors, markets and investment, and the environment. A pioneering actor in terms of water and green growth is the Republic of Korea, which works in partnership with the World Water Council (WWC) on the "Water and Green Growth Project". They developed the "Water and Green Growth Index" (WGGI), which offers a variety of environmental, economic and social indicators evaluating the extent to which a country is committed to water and green growth (MLTM et al. 2012). However, the index was not applied to other countries, but rather examined the policies and framework for water and green growth.

The Role of Business-Driven Eco-Innovations

Eco-Innovations as a Growth Strategy

Eco-innovations play a crucial role in green economy concepts in terms of practical and conceptual operationalisation. This is demonstrated by analysing the contents of green growth debates in this section and introducing the contribution of eco-innovation in implementing concrete green growth strategies in the next part. We first reviewed key publications in order to identify key principles and concepts that describe the underlying content of green growth. In doing so, we based our definitions on the Prognos (2014) classification of concepts associated

with green growth. Green growth can thus be understood as a purposeful paradigm (political initiative) to promote industries and business models that represent viable eco-innovations, and effectively decouple resource use from economic growth (strategies) in order to contribute to a sustainable, low-carbon economy (economic system view). Figure 6.1 shows these three constituent elements, along with our own understanding of green growth.

Firstly, the economic view of green growth is often related to attributions of a future state or the economy being "green", "low carbon" or "circular". In this regard, "green economy" is a general attribution, while "low-carbon economy" refers to economic production with low (or no) carbon emissions, e.g. by using renewable energies instead of fossil fuels. Reducing carbon emissions is a critical step towards minimising the output of greenhouse gas (GHG) emissions into the biosphere, which are the main cause of global warming (hence climate change), as shown by Pachauri et al. (2014). Lowering of the carbon impact of economic production is a crucial parameter when it comes to green growth. In line with the Paris Agreement to limit global warming to well below 2 °C in this century, reducing the carbon footprint in the countries' economies is essential for growth that is not damaging to the

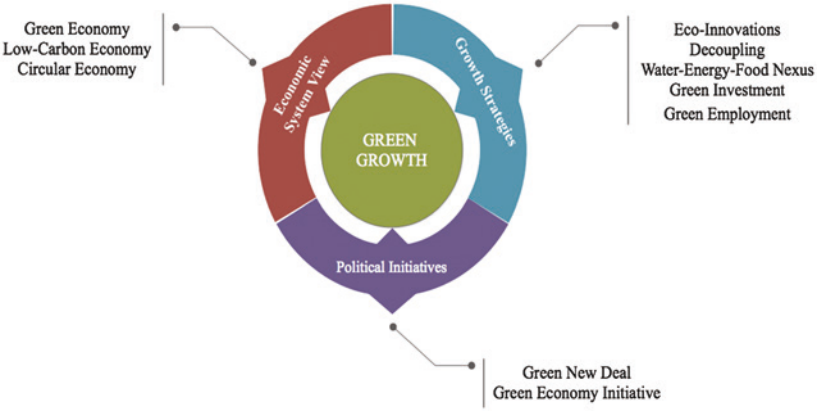

Fig. 6.1 Concepts and principles related to green growth (author's illustration, based on Prognos 2014)

environment or the climate. Low-carbon strategies are also important for specific sectors such as the water sector, which consumes a lot of energy for extraction, desalination treatment, and pumping of water over long distances and elevations (Copeland and Carter 2017). On the other hand, the circular economy concept implies sustainability by using the biological and technical materials from one production or consumption process and circulating it as an input into the same or a different process (UNEP 2006). In other words, it emphasises the most efficient use and recycling of resources in order to protect the environment.

Secondly, green growth can be characterised through associated political or policy-related initiatives. In recent years, several sustainability initiatives have been launched, with organisations such as the United Nations playing a decisive role in this process. For example, the Global Green New Deal emerged with the growing acknowledgement of climate change impacts and the finite nature of oil resources. First introduced by Thomas L. Friedman, in 2008, the UNEP began to popularise the initiative, which calls on governments to turn the crises of the financial and economic systems into an economic opportunity by investing in the green sector to create jobs, promote sustainable and inclusive growth, and achieve the Millennium Development Goals (MDGs) (UNEP 2009). Subsequently, various governments, such as the EU and the Republic of Korea, have invested a majority of their funds in green measures. Closely related is the Green Economy Initiative (GEI), also led by UNEP, which was acknowledged as a tool for achieving sustainable development at the Rio+20 agenda in 2012. The initiative is designed to assist governments in "greening" their economies by reshaping policies and investments in green sectors and technologies, such as renewable energies, water services or waste management. Recently, the notion of "inclusiveness" was emphasised with the aim of ensuring social equity in the GEI process. So far, 65 countries have embarked on the pathway towards a green economy, and 45 have already developed national green economy plans (UNEP 2014). At the same time, green economy can itself be seen as part of a larger political initiative or of broader policies for sustainable development. For example, green growth is embedded in the new sustainable development agenda, in the

guise of the SDGs. Arguably, it is mainly manifested in Goal 8, "Decent Work and Economic Growth", and specifically in its Target 8.4, "to ensure global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation". Furthermore, it is implicitly reflected in a number of other goals, e.g. Goal 6: Clean Water and Sanitation; and Goal 7: Affordable and Clean Energy.

Finally, green growth can be seen as a term describing a set of growth strategies. The promotion of eco-innovations represents the most prominent growth strategy in this regard, as we explain in the next section. Another related, although more general, strategy is represented by the notion of decoupling resource use from growth. Through such decoupling, economies can continue to grow, while the environmental pressures on natural resource use are decreased (IRP 2015). Decoupling can happen in two ways, as a number of success stories in the water sector have demonstrated (MLTM et al. 2012). On the one hand, it can be achieved through relative decoupling, which means a decrease of resource use per unit of value added. On the other hand, absolute decoupling indicates a decline of resource use or environmental impact, irrespective of the growth rate of the economy. Another prominent topic linked to green growth strategies is the Water–Energy–Food Nexus (WEF Nexus). The WEF Nexus debate can be seen as the newest integrated management paradigm in environmental sciences, and centres around the analysis of the links between the three resources in order to identify opportunities to increase sustainability, encourage resource-efficient growth and minimise impacts (Al-Saidi and Elagib 2017). Furthermore, green investment and green employment represent generic strategies for achieving green growth. Green investment aims at financing companies or productions that have a positive impact on the environment, e.g. by conserving natural resources. Green employment focuses on growth and job creation. Green growth should not only reduce emissions and resource use, but should also stimulate creation of new jobs for the people. Such jobs are characterised as "green jobs" since they contribute to the preservation and restoration of the environment in sectors such as manufacturing and construction or emerging green sectors such as renewable energy and energy efficiency.

Eco-Innovations, Resource Efficiency and Business Models

The development and utilisation of eco-innovations play a crucial role in enabling green growth through industries and businesses and is perceived as one of the main tools for the transition to a green economy (Tarnawska 2013; Beltramello et al. 2013; Sander 2011). The concept of eco-innovations outdates the rise of the green concepts. Eco-innovations are famously understood as invention of new—or optimised—technology, and also the improvement of processes or business models that lead to environmental benefits, such as resource conservation or reuse along the value chain (OECD 2009). Eco-innovations are thus innovative products and processes that aim at reducing impacts on the environment, strengthening resilience to environmental pressures or achieving a more efficient and responsible use of natural resources (European Commission 2012). They cover everything from technological improvements in resource efficiency to societal innovations (Sander 2011). Utilisation of eco-innovation is a central and constituent element of green growth, since it is difficult to fulfil the other criteria if eco-innovations are not utilised. Industries and businesses stand at the core of economic activity and need to incorporate green growth in their value chains. Green growth thus implies establishing and promoting new industries that go hand in hand with the idea of sustainability, resource efficiency and decoupling (UNDESA 2013). It is important to note that eco-innovation need not only be of a technological nature, but can also entail process innovations, such as introducing new product lifecycles. Essentially, it is through business models that incorporate eco-innovations that we achieve resource efficiency and ultimately decoupling. The principle of resource efficiency is recurrent in green growth literature and is often linked to technological and methodological innovations (Beltramello et al. 2013; UNESCAP 2012; OECD 2011a; World Bank 2012). Resource efficiency means the most optimised way of using resources for production, with the ultimate aim of decoupling economic growth from resource use (IRP 2015). Decoupling is therefore the ultimate goal of increased resource efficiency and utilisation of

eco-innovation and is thus referring to future state growth under the green growth paradigm.

In academic case study literature, there are numerus examples of business-driven eco-innovations with promising potential in fields of water efficiency, renewable energy use or recycling processes. Levidow et al. (2016) investigate eco-innovation potential for two manufacturing companies with strong prospects for improvement in water-service processes, especially from wastewater and chemical inputs. Campana et al. (2015) evaluate the use of photovoltaic water pumping systems for irrigation as a means of promoting farmland conservation in China. Furthermore, Mezher et al. (2011) review and assess different desalination technologies with regard to their energy requirement, water production cost and environmental impact; while Fam and Mitchell (2013) investigate nutrient recovery and reuse potentials of wastewater treatment technology.

All in all, these eco-innovations represent viable solutions to minimising environmental impacts, increasing process efficiency and ultimately supporting green growth strategies.

Public Policies for the Promotion of Eco-Innovations

Green growth is being translated into national and sectoral strategies in many parts of the world in industrial and developing countries alike. The utilisation of eco-innovations hereby plays a crucial role in implementing green growth plans. The European Commission has adopted a plan to enhance sustainable growth and pave the way for Europe to transition towards a green economy. The Eco-Innovation Action Plan within the Europe 2020 framework was issued in order to boost innovations that reduce environmental pressures and to enable more efficient production for European industries (Triguero et al. 2013). Looking at developing countries, Ethiopia, as one of the first African countries, adopted a climate-resilient green economy strategy in 2011 which aims at increasing agricultural productivity, strengthening the industry and fostering export growth while mitigating emissions (Megwai et al.

2016). The strategy emphasises that opportunities for innovation, based on the latest production platforms, need to be seized in order to facilitate leapfrogging to the newest and best technology (FDRE 2011). Jordan also released its own National Green Growth Plan (NGGP) in 2017 to further develop its economy, lessen the dependence on energy imports, and create decent jobs. The NGGP contains a policy framework and capacity development activities in six key sectors, with a specific focus on upscaling opportunities and financing mechanisms. Stimulation of innovation and investment by the private sector in new and adaptive technologies and through innovative business models is a declared target of the strategy (MoEnv 2017).

As a practical example, the wastewater treatment industry in Jordan shows how technological innovation that is promoted by a supporting policy framework has significantly contributed to reducing water stress, avoiding environmental contamination and creating new opportunities for employment and business expansion. Modern technologies for treating wastewater were introduced in Jordan in the late 1960s and have increased the amount of wastewater reused in irrigation or industries to 125 million m^3 in 2014 (MWI 2016). Governmental policies allowed for a progressing reuse of treated wastewater and are also found in the NGGP. New ecological innovations in decentralised treatment technologies, such as systems that recycle nutrients and produce bio-energy onsite, represent attractive and viable opportunities for businesses to expand wastewater treatment services to remote places and apply scalable options to each given context.

The examples above underline that governments have several policy options for incentivising the utilisation of eco-innovations. As shown by Demirel and Kesidou (2011), government-induced regulations help to raise environmental awareness and drive the implementation of "end of pipeline" technologies. Another policy option is "getting research to the market" (Kemp 2011) which means comprehensive R&D support (e.g. subsidies) and technology transfer (e.g. through partnerships and networks). Moreover, environmental tax reform and market-based policies, including tradeable permits, can create important incentives for improving the productivity of natural resources (Sarkar 2013).

Conclusion

Green growth is a contemporary strategy for sustainable development that encompasses a conceptual economic perspective, concrete growth strategies and political initiatives linking economy to environment. Eco-innovations hereby play a crucial role as one of the main tools for enabling a transition to a green economy and are therefore a central and constituent element of green growth. Specifically, eco-innovations represent the key strategy for achieving green growth through incentivising businesses creating economically viable and environmental sound solutions.

In summary, innovative businesses are the important actors that incorporate eco-innovations and spread their use to achieve resource efficiency and eventual decoupling. The adoption of such innovations on a wide scale is seen as a criterion for assessing businesses and industries that bear a great potential for supporting green growth. Many countries worldwide have already started developing green growth strategies, with concrete incentives such as pricing reforms, subsidisation and entrepreneurship programmes aimed at priority industries with high potential for green growth. This prioritisation of economically viable and environmentally sound business solutions should also be examined with regard to the viability of addressing social issues. Eco-innovations represent a strategic growth option for many countries with large ecological footprints and/or declining resource bases. However, particularly in the context of developing countries, affordability of products and services as well as the impacts of sustainability transition on "less innovative" businesses are important considerations for public policies. Often, governments choose to incorporate social welfare spill-overs and distributional issues as additional criteria for their support of green and innovative industries.

To conclude, the transition towards green economy cannot take place without innovative businesses and a strong public engagement in readjusting priorities and designing incentives. Such transition provides opportunities for existing and new companies in adopting innovations that produce a win-win situation in an ecological and economic sense

or capitalise on growth potential in emerging sectors. Technological change and changing public policies produce these opportunities and direct them towards societal goals such as economic growth, reducing ecological footprints, environmental protection or social considerations. (Eco-)innovations imply fundamental changes to the status-quo that are essentially local and driven by businesses exhibiting higher innovation capabilities across the whole production value chain. Yet, creating the enablers of green growth is a crosscutting task that entails, for example, R&D investments, company-level innovation incentives, collaborations between research and industry, adequate regulatory frameworks or specific innovation programmes.

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