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Establishing Framework: Sustainable Transition Towards a Low-Carbon Economy

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2.1 Introduction

Regardless of the scepticism from some of the emerging global political players, i.e. the new US administration, there is an overall recognition of the need to address the global challenge presented by the climate change. The 2015 UNFCCC Paris agreement embodies this recognition and highlights the need for global action. The global green agenda has been emerging as a response to this challenge. This chapter offers a framework that facilitates the recognition and purpose of sustainable innovations and their significance to the global green agenda. The framework also enables an analysis to determine of how different business methods, mechanisms and tools can be employed in order to facilitate the transition to a

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low-carbon economy. While Section 2.2 delves into the significance of this global green agenda, Section 2.3 reviews the literature on sustainability transitions to explore the implications of such a transition to a socio-economic system. A brown–green spectrum is proposed for a better understanding of the transition from our current ‘way of living’ to a desired one. Section 2.4 explores concepts from innovation and regional studies and proposes a green regional innovation system (GRERIS) as a mechanism that facilitates the transition to a low-carbon economy. It also highlights the challenges of the multilevel approach and the ‘agency’ problem (Laffont and Martimort 2009). Section 2.5 concludes and points out to further research avenues for an effective operationalisation of the proposed framework.

2.2 Significance of the Global ‘Green’ Agenda

In order to make sense of the ‘global green’ agenda (United Nations (UN) 2015) and the different concepts related to it, it is important to first define the term, ‘sustainable development’. It was first introduced in 1980 by the International Union for Conservation of Nature and Natural Resources in their World Conservation Strategy report (Church et al. 2008). This report defined sustainable development as ‘the integration of conservation and development to ensure that modifications to the planet do indeed secure the survival and well-being of all people’ (Dresner 2008, p. 30). On this basis, the term was widely promoted by the United Nations in 1987. In the Brundtland report, ‘Our Common Future’, sustainable development is defined as the development that meets ‘the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply ... limitations imposed by the present state of technology and social organisation on environmental resources and by the ability of the biosphere to absorb the effects of human activities’ (Brundtland 1987, p. 24).

Other concepts, such as green growth (Organisation for Economic Cooperation and Development (OECD) 2011) and green economy

(United Nations Environment Programme (UNEP) 2011) have also been introduced aiming to increase the awareness of this green agenda. More recently, the ‘sustainable competitiveness’ concept was coined by the World Economic Forum (WEF) (2015b) to stress the importance of ‘productivity’ as a driver of prosperity and long-term growth ensuring high-quality growth. The WEF defines sustainable competitiveness as the ‘set of institutions, policies and factors that make a nation productive over the longer term while ensuring social and environmental sustainability’. Social sustainability, in turn, is defined as ‘the institutions, policies and factors that enable all members of society to experience the best possible health, participation and security; and that maximise their potential to contribute to and benefit from the economic prosperity of the country in which they live. In the same vein, environmental sustainability relates to the institutions, policies and factors that ensure an efficient management of resources to enable prosperity for present and future generations’ (WEF 2015b, p. 1).

All these interrelated and overlapping concepts (e.g., sustainability, green growth and green economy) have in common a main issue which they are trying to address: at the current pace and trajectory, the global economy is undermining its asset base (environmental assets and natural resources), hence increasing the threat on its future economic growth. Some reports, such as the US Environmental Protection Agency (EPA 2014) and the World Health Organisation (WHO 2014), have established a clear link between air pollution and negative effects on health, environment and the economy. The United Nations Intergovernmental Panel on Climate Change (IPCC 2013) has identified that humans have been the dominant cause of global warming since the 1950s. According to the IPCC report, more than half the increase in global surface temperatures from 1951 to 2010 is attributed to human activities, with a dominant role of fossil fuel burning as a key driver for climate change. This situation is not sustainable as it is likely to undermine the long-term economic growth prospects of the world economy. This view is supported in some emerging economies, such as China, where the country’s chief weather scientist, Zheng Guogang, has warned that climate change is putting China’s economic future at risk (BBC 2015).

Several international organisations have launched initiatives aimed at creating awareness of this issue and to promote the participation of key stakeholders, such as governments and businesses. This is the case of the United Nations Global Compact, which is considered the largest corporate citizenship initiative in the world. Other international organisations have explored these issues and have contributed with important insights to inform the global green agenda. Examples include reports, such as: 'Towards a Green Economy—Pathways to Sustainable Development and Poverty Eradication' (UNEP 2011); 'Towards Green Growth' (OECD 2011); The World Bank's 'Inclusive Green Growth: The Pathway to Sustainable Development' (WB 2012); 'Circular Economy' (WEF 2015b) and 'Sustainable Competitiveness' (EMF 2012).

Many reports use the terms 'green, sustainable, low carbon, environmental, ecological, circular, eco, etc.' interchangeably. Innovations aimed at supporting the global green agenda are also referred to by a plethora of different terms. In their review of 'green' innovations, Schiederig et al. (2011) carried out a quantitative analysis of all published articles in the field of green innovations. Interestingly, they found that the three different notions of 'green', 'eco/ecological' and 'environmental' innovations are used largely synonymously and tend to incorporate both economical and ecological aspects. Schiederig et al. (2011) found that eco-innovation seems to be the most precise and well-developed concept; whereas green innovation remains rather less well defined. More interestingly, they found that the notion of 'sustainable' broadens the concept of innovation and includes, along the other two aspects—economical and ecological—a social dimension.

Looking more broadly at terminology applied at a macroeconomic level, literature reviews carried out by Shi and Lai (2013) and Schiederig et al. (2012) determined that the terms 'low-carbon economy' and 'green economy' are used interchangeably by many contributors. However, the Green Economy Group (2013) highlights the difference between these two. By definition, a low-carbon economy is different from a green economy as it still generates carbon emissions and considers only two aspects of sustainable development, namely, economic and ecological. However, a green economy (UNEP 2011) encompasses a restorative effect on the environment and considers all three aspects of sustainable development (i.e., economical, ecological and social). In this regard, a

green economy may be considered as the ideal ultimate goal to be reached on the 'green path', while a low-carbon economy may be regarded as a stepping-stone towards the ultimate goal of zero carbon emissions during the production, distribution, exchange and consumption of goods and services. Another concept of the 'circular economy' 'is one that is restorative by design and which aims to keep products, components and materials at their highest utility and value, at all times' (EMF 2012, p. 1). It could be argued that the circular economy (WEF 2015a; EMF 2014) is one example of an environmental–organisational innovation that proposes radical changes to the way in which our economic systems work to satisfy our needs. It promotes changes in business models, from a linear 'take-make-dispose' economic approach to industrial systems which are restorative and regenerative by intention and design. However, it still only focuses on two of the sustainable development aspects: economical and ecological.

All these concepts refer to at least two of three dimensions related to sustainable development: people, planet and profit (Fisk 2010). The people dimension refers to social equality, the planet dimension encompasses environmental issues and the profits' dimension considers economic efficiency. If an economy, industrial organisation or business works to achieve the highest levels of performance in all three of these dimensions and balances them, then it will achieve a state in which it can preserve its asset base and avoid undermining its future economic growth.

A general consensus among the international community is that the global economy in its current form should adapt to keep environmental assets and natural resources intact in order to reduce the threat to future economic growth and stability. These international bodies (e.g., UNEP, OECD, WB and WEF) recognise this issue. Furthermore, they suggest alternatives and guidelines for the adaptation of the world economy through a global green agenda. This agenda includes environmental policies, indicators and development of sustainable innovations, among other policy instruments. If adaptation is at the core of the agenda, it prompts the question: how fast can an economy adapt itself in order to keep its asset base (environmental assets and natural resources) intact, thereby reducing the threat on its economic growth? This adaptation implies a transition of states, which the emerging literature of

sustainability transitions explores (STRN 2015); the main elements of this literature are presented in the following section.

2.3 Literature on Sustainability Transitions

A body of research and literature under the banner of sustainability transitions has emerged in recent years, which acknowledges that adaptation and change are necessary prerequisites to achieving sustainable development. Such sustainability transition studies propose a set of radical, mutually reinforcing and long-term changes in the economical, technological, socio-cultural and institutional domains of society. The literature places transition (rather than revolution) as the cornerstone to a significant long-term change (Wieczorek and Berkhout 2009; Elzen and Wieczorek 2005).

The field of sustainability transition studies has expanded in the last 10 years with a rapid growth in the number of publications. The Sustainability Transitions Research Network (STRN 2010, pp. 3–4) highlights that ‘the starting point for transitions research is a recognition that many environmental problems, such as climate change, loss of biodiversity, resource depletion (clean water, oil, forests, fish stocks), are formidable societal challenges, whose solution requires deep structural changes in key areas of human activity, including our transport, energy, agrifood, housing, manufacturing, leisure and other systems’. Furthermore, it recognises that the crucial challenge for sustainable development is the fact that existing systems tend to be very difficult to ‘dislodge’, because they are stabilised by various lock-in processes that lead to path-dependent developments and entrapment.

These mutually reinforcing processes are known as a ‘socio-technical regime’. Socio-technical regimes make innovative sustainability alternatives difficult to find a space, develop and influence radical structural transformations. Nevertheless, changes in these socio-technical regimes—transitions—actually do occur. The emerging research on sustainability transitions has proposed concepts and theories aimed at understanding how to unlock processes and stimulate path-breaking changes towards more sustainable systems. It has developed co-evolutionary approaches

that highlight multidimensional interactions between industry, markets, technology, policy, culture and civil society. The sustainability transition literature conceives markets, technologies, political and social institutions, behaviour and values as temporary and changeable outcomes of evolving long-term co-evolutionary processes. The analytical emphasis of this literature is on processes, such as learning, radical innovation, experimentation, searches for new paths, participatory approaches, multi-actor interactions, selection processes, reactions and network evolution (STRN 2010).

The key issue that sustainability transition research is trying to address is how sustainable innovation practices—in behaviour and policy—struggle against existing systems or regimes. Incumbent systems in economic sectors or industry domains are difficult to dislodge leading to path dependence and entrapment (Unruh 2000; Walker 2000). This entrapment is often due to various ‘lock-in mechanisms’, such as vested interests, low costs, established beliefs, sunk investments and institutional settings. Therefore, the implementation of sustainable innovations and new practices is difficult on several dimensions that include scientific, technical, economical, political and cultural (STRN 2010).

The research on sustainability transitions adopts two important frameworks: (i) the ‘multi-level perspective’ (MLP) and (ii) the ‘technological innovation systems’ (TIS) approach (Markard et al. 2012; Smith et al. 2010; Markard and Truffer 2008). On one hand, the MLP framework argues that transitions happen through interacting processes within and between three analytical levels: (1) niches, the locus for radical innovations; (2) socio-technical regimes, which are locked-in and stabilised on several dimensions, but which nevertheless exhibit incremental innovations; and (3) an exogenous socio-technical landscape. This MLP framework attempts to address two important issues: (a) regimes (which can be practices, pathways, patterns and changes in structure or trajectories with typologies of transitions) and (b) the agency problem, which is related to power and legitimisation. On the other hand, the TIS framework focuses on emerging technological innovations. A technological innovation system (Bergek et al. 2008; Hekkert et al. 2007) is defined as a network of agents interacting in the economic/industrial space under a

particular institutional infrastructure and involved in the generation, diffusion and utilisation of technology.

Given the increasing claims that the pace and way in which current economic systems are evolving are not sustainable, then the question posed previously becomes more critical: how quickly can an economy adapt itself in order to keep its asset base (environmental assets and natural resources) intact, thereby reducing the threat to its economic growth? The clock is ticking and if we, as society, do not promptly change as required, then the situation could become irreversible. Moreover, in order to gauge progress in sustainability transition, it is crucial to establish a conceptual and measurement framework, which, together with an analysis of the processes and determinant factors of transition, enables us to determine the stage and efficacy of such transition.

The many international organisations previously mentioned have contributed to the global green agenda by suggesting a series of indicators and metrics; however, to date, there is no comprehensive set of indicators and metrics that measure the transition towards a low-carbon economy or a green economy. Therefore, we propose the following conceptual framework that enables the measurement of the speed of sustainability transition. We coin the terms ‘brown–green (BG) spectrum’ and the ‘degree of greenness’ of an economy. Similar frameworks have been developed for other aims, for instance, the transition from command economies to market systems (Davies and Walters 2004). Our framework consists of four dimensions: (1) level of analysis: global, bloc, country, region and city; (2) timeframe; (3) continuum/spectrum; and (4) set of indicators. Previous research (Smith et al. 2010) has focused largely on the first two dimensions: level of analysis and timeframe. Our focus in this chapter relates to the last two elements of this conceptual framework, namely, spectrum and a set of indicators.

Determining the level of analysis is important and not an easy task, given the tension between two criteria: maximisation of benefits and feasibility. We may consider the level of analysis at different levels of aggregation: global, blocs, countries, regions and cities. At a global level, it is reasonable to expect a maximisation of the potential impacts; however, the feasibility (given the complex process of coordination and governance at this level) is more challenging to achieve; this is akin to the agency

problem (Laffont and Martimort 2009). At the other extreme is the city level, for which feasibility is possible, but we cannot guarantee maximising benefits. A compromise could be achieved at a regional level followed by close coordination. Given the dynamic nature of sustainability transitions, however, timeframe is also an important variable in the analytical framework and will influence both maximisation of benefits and feasibility.

As mentioned earlier, our focus is on the spectrum and the set of indicators. In order to introduce the BG spectrum, it is necessary to define the stages that are part of it, which are brown economy, low-carbon economy and green economy. Brown economy (or high-carbon emission economy) is considered as primarily focused on economic growth, with high negative impact to environment, but with no explicit objective to social equity. A low-carbon emission economy has a minimal production of greenhouses gas (GHG) emissions to the environment, especially carbon dioxide (CO₂) (Shi and Lai 2013; Schiederig et al. 2012). A low-carbon economy supports economic growth, has a low negative impact on environment, but also does not make any explicit reference or targets with regard to social equity (Green Economy Group 2013). We assert that the circular economy is equivalent to the low-carbon economy as it aims at extending the product life cycle, hence achieving a higher economic efficiency and at the same time reducing a negative environmental impact. However, it falls short in including the social equity perspective. Finally, a green economy supports an economic growth, zero-sum impact to environment (zero carbon emissions) and addresses social equity (UNEP 2011). Having defined the different types of economies in terms of sustainability, we turn now to introduce the BG spectrum.

The BG spectrum is a continuum with two extremes—brown economy and green economy—and stages in the middle—such as the low-carbon economy—see Fig. 2.1. As commented previously, this spectrum enables the measurement of the sustainable transition of a specific level of analysis, a region, for instance. The basic idea is to identify at least three main stages in this transition. The ‘Brown Economy’ is located at one extreme (dark shaded area), while the ‘Green Economy’ is located in the opposite extreme (lightly shaded area). Somewhere in between the ‘low-carbon economy’ is located, considered as a stepping-stone in the transformation towards the green economy. Future research can fine-tune this ‘brown-green’

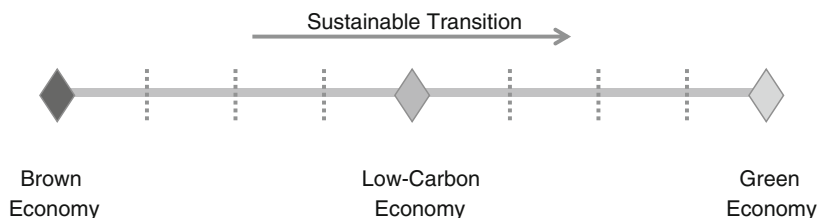


Fig. 2.1 'Brown-Green' (BG) spectrum

spectrum with 'in-between' transition stages from brown to low-carbon and from low-carbon to green economy.

An integral part of this framework is the set of indicators needed to determine in which stage an economy is in terms of this transition. Although international organisations, such as the OECD (2011) or European Environmental Agency (EEA 2013), offer measures for green growth indicators, they focus only on one or two aspects of the green economy as defined by UNEP (2011); these are economic efficiency (i.e., profits) and environment impact (i.e., planet). The reality is that they fall short in combining them with the third aspect of the green economy and social equity (i.e., people). Subsequently, future research should aim at developing a coherent set of indicators. This can be achieved by considering existing ones from Kemp and Pearson (2008), UNEP (2011), WB (2012), OECD (2011), EC (2013) and EEA (2013), to combine the three aspects of a green economy: economic efficiency, environmental impact (negative externalities) and social equity. The combination of these three aspects into one coherent set of indicators will enable the measurement of the 'degree of greenness' of an economy and operationalisation of the 'brown-green' spectrum. Similar spectrums have been proposed, see, for instance, Davis and Walters (2004); however, they relate to transitions of environments for firms moving from command economies to market systems. Our spectrum addresses the sustainability transition of regions.

This conceptualisation clarifies that the direction of the transformation is from brown to low carbon to green. Organisations, such as UNEP (2011), WB (2012), OECD (2011), EC (2013) and EEA (2013), have developed indicators. However, to date, there is no consensus on how to

measure transition or to integrate the indicators into a consistent and coherent framework. We propose to continue developing the BG spectrum in order to enable the measurement of the transition and more importantly, the speed of such transition to a low-carbon economy and, consequently, to a green economy.

By paving the way to a conceptual framework that enables the measurement of the transition and the speed of transformation, this chapter now turns to explore the potential determinants that enable or deter such sustainability transitions.

2.4 Determinants of Sustainability Transitions

When adopting the multilevel perspective (MLP) framework from the sustainability transition research field, some determinant factors that enable or deter sustainability transitions can be identified. One factor is leadership, where commitment and collaboration emerge as preconditions. The key to success lies in aligning sustainable objectives among stakeholders. This is where private and social benefits and costs need to be aligned to avoid the free-rider problem. Possible solutions have already been introduced, such as Pigovian taxes/subsidies. These taxes/subsidies aim at changing the behaviour of agents by aligning their private cost/benefits to social cost/benefits. Multiple examples arise, such as congestion charging, fuel tax, private road pricing, city parking charges, workplace parking tax, and so on.

From the technological innovation system (TIS) approach, what seems relevant is the configuration of the process in which our society meets its needs. This relates to technology, where paths can be traced identifying locked-in situations in which it is difficult for the society to change to a low carbon, circular, or green economy. These lock-in situations need to be examined to determine the degree of influence to maintain the status quo and, therefore, determine the degree to which a shift can be achieved. For instance, Parris and Kates (2003) identify driving forces that underline sustainability transitions: poverty gap, education, CO₂

emission levels and fresh water management. The common features of these driving forces are population, affluence and technology. Technological change is an important enabler to break down a locked-in situation. Therefore, innovation arises as a key determinant of such transition and more specifically, the role ‘sustainable’ innovation has, as opposed to ‘green’ or ‘eco’ innovations, in implementing social aspects in addition to economical and ecological aspects.

With this in mind, we introduce the concept of a green innovation system as the one that enables the production of sustainable innovations (incorporating economical, ecological and social aspects) that enable the transition of an economy, at a multilevel approach: from local to regional, to national or supranational from a brown economy to a green economy going through intermediate phases, such as the low-carbon economy. An approach based on systems of innovation is useful for interpreting the social patterns of firms and other organisations engaged in institutional innovation. Therefore, the literature of innovation systems (Edquist 1997; Lundvall 1992; Cooke et al. 1998) and their application to the ‘green’ agenda (WB 2012; OECD 2011; UNEP 2011), embodied in green innovation systems (Cooke 2010), offer insights to the sustainability transitions (Smith et al. 2010). Sustainability transition literature (Markard et al. 2012) is relevant as it enables the understanding of how regions are transformed into more environmental friendly economies. The literature on regional actors (firms or others) and leadership is also significant, as both are considered important for stimulating innovation and economic growth (Blažek et al. 2013; Hart 2009; McKelvey 2004; Sotarauta 2009, 2010). A review of the literature indicates that Green Regional Innovation Systems (GRERIS) are instrumental for the sustainable transformation of economies towards a green economy. Measuring the effectiveness of a GRERIS enables us to respond to the question previously posed, that is, how quickly can an economy adapt itself in order to keep its asset base intact, therefore, reducing the threat on its economic growth? Figure 2.2 shows a GRERIS in action. An effective GRERIS will produce the sustainable innovations—represented by the plant in a bulb—which in turn will enable the transition of a regional economy throughout the Brown–Green Spectrum—represented by the movement of the state of the region from point ‘A’ to point ‘B’. The speed

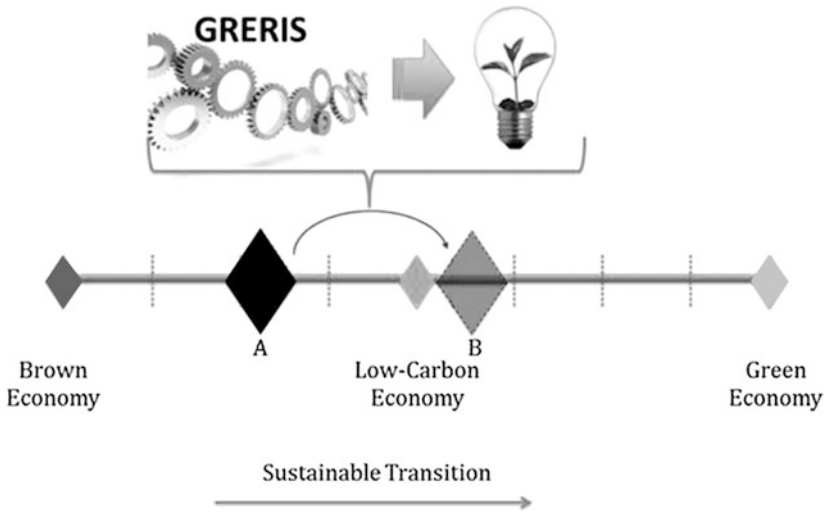


Fig. 2.2 Moving along the 'Brown-Green' (BG) spectrum

of such transition can be measured when considering the time dimension, which is the duration of such transition.

This approach is innovative, novel and relevant to the broader thematic agenda of the green economy. It enables the operationalisation of the concepts of sustainability transitions and those related to the 'green' agenda, such as the low-carbon economy, green economy and sustainability innovations.

The next step in this research agenda is the configuration of the coherent set of indicators needed to determine the 'degree of greenness'. In other words, in which stage the region/economy is located in terms of this transition of this BG spectrum.

2.5 Conclusion

With growing awareness of regard to environmental issues, there is social pressure to transform the way we live to be more sustainable. With this premise, this chapter offers a conceptual framework that enables the measurement of the transition towards green economies. This framework

focuses on a brown–green spectrum that enables the measurement of a ‘degree of greenness’ that depends upon economical, ecological and social aspects that encompass a green economy. Particular attention was placed on notions and definitions of ‘green’ aspects, such as ‘green’, ‘eco/ecological’, ‘environmental’ and ‘sustainable’ innovations. By means of revisiting the literature, this chapter highlighted the main issues surrounding sustainability transitions, such as the multilevel approach and the ‘agency’ problem (Laffont and Martimort 2009) and several enabling determinants of such transition were identified. Finally, this chapter points out to the key role of effective Green Regional Innovation Systems in producing sustainable innovations—including economical, ecological and social aspects—as catalysts of such sustainability transition. When considering the time dimension, the speed and acceleration of such transition can be measured; hence, this enables the identification of key determinants that may boost such a transition towards a green economy. This framework also enables comparative analyses. Future research avenues should focus on determining a coherent set of indicators that measure the ‘degree of greenness’.

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