

An Introduction to the Assessment of Sustainable Paths, Models and Metrics

Andrea Bassi^{1,3}, Emira Bečić² & Niccolò Lombardi¹

¹ KnowlEdge Srl, Castellanza (VA), Italy

² Ministry of Science, Education and Sports of Croatia, Zagreb, Croatia

³ Extraordinary Associate Professor of System Dynamics Modelling, Stellenbosch University, South Africa

Correspondence: Andrea Bassi, 1, Rue des Photographes, 1207 Geneva, Switzerland. Tel: 41-7-9953-8546.
E-mail: andrea.bassi@ke-srl.com

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Abstract

This paper aims to present the concept of Sustainable Futures, which grew out of global dialogues to more recently transfer into policy making. The paper seeks to discuss how foresight is used to understand the implications of global changes, focusing on the role of green economy strategies in fostering societal, economic progress and environmental conservation. In particular, the use of green economy indicators is reviewed, focusing on the measuring frameworks proposed by different organizations. Finally, an integrated approach is proposed to carry out a systemic and cross-sectoral assessment of key policy instruments aimed at facilitating the transition to a more sustainable future.

Keywords: green economy, sustainability indicators, social responsibility, measurement, sustainable development

1. Introduction

In the last decades, the world has experienced a series of crises, which raised awareness about the increasing interconnectedness of economic, social and environmental dimensions. From an economic point of view, the global financial crisis confirmed that national economies are inextricably linked, and sounded the alarm on the urgent need to find common financial regulatory systems. Furthermore, blurred national borders and the rapid diffusion of information and communication technologies have intensified social and rule of law challenges, such as global criminal networks intended for drug trafficking, human trafficking, illegal arms transfers etc., thereby making increasingly clear the need for global research and legal instruments against transnational organized crime. Finally, the impacts of climate change are challenging the lives and livelihoods of a growing portion of the world's population: rising average temperatures have contributed, among other things, to an increase in the frequency of natural disasters such as floods and droughts, which are threatening human security, and shaping the debate on global and national climate change adaptation and mitigation strategies (United Nations Environment Programme [UNEP], 2011a; Intergovernmental Panel on Climate Change [IPCC], 2013). These are only some examples of globalized phenomena that highlight the interconnectedness of threats, risks, and dangers that in turn create many challenges for security, human development, and well-being.

The international community has already taken important steps towards the establishment of global platforms, institutions and common spaces for dialogue on current and future threats for the prosperity of human beings. In particular, the debate on sustainable development (SD) has driven a profound transformation in the way nations and international organizations approach economic growth, widening the scope to include considerations on the progressive depletion of natural resources and degradation of ecosystems, driven by demographic growth, technology acceleration and production and consumption patterns. Since the United Nations Conference on the Human Environment, held in Stockholm in 1972, the debate has evolved towards the recognition of the environment as an essential component of human development and well-being (United Nations [UN], 1972). The concept of sustainable development has then evolved from its first appearance in the World Commission on Environment and Development (WCED) report "Our common future", also known as Brundtland Report (World Commission on Environment and Development [WCED], 1987), until becoming a widely shared vision of

human progress during the 1992 UN Conference on Sustainable Development, when the Agenda 21 was adopted as a 300 page plan for achieving sustainable development in the 21st century (UN, 1992).

In 2000, the Millennium Development Goals (MDGs), which focused the international development agenda on progress and results in well-defined areas, included environmental sustainability as one of the eight overarching goals to be achieved by 2015. Twelve years later, the 2012 UN Conference on Sustainable Development, also known as Rio+20, acknowledged the importance of the MDGs in providing a measuring framework for key global development objectives, but at the same time stressed the need for the establishment of a more integrated, holistic and context-sensitive post-2015 agenda. In particular, the outcome document of the Rio+20 conference called for a global approach to sustainability, and launched a process for the establishment of sustainable development goals (SDGs) (UN, 2012). The debate on the definition of the SDGs is based on the recognition that a more balanced global order is emerging, in which the terms of mutual accountability have to be renegotiated on the basis of common economic, social and environmental challenges. In particular, economic sustainability implies changes in the way goods and services are produced and exchanged in the global arena, with particular attention to the impacts of current production and consumption modes on future generations. Social sustainability refers to wide-ranging considerations on issues such as global population growth, respect for universally recognized human rights, the management of migration flows, the spread of new technologies, the comprehensive approach to human health, among others. Finally, the goals of environmental sustainability are related to the need for reducing global greenhouse gas emissions and adapting to climate change, the conservation of natural capital and ecosystem services, and, more in general, the shift to a less resource-intensive future.

An innovative measuring framework was advocated in occasion of the Rio+20 Conference, stating that “progress towards the achievement of the goals needs to be assessed and accompanied by targets and indicators while taking into account different national circumstances, capacities and levels of development” (UN, 2012). In this sense, a post-2015 development agenda is expected to be guided by indicators and analytical tools capable of projecting impacts of current production and consumption modes on the economy, society and environment, thereby facilitating the understanding of complex dynamics and the identification of possible alternative scenarios for more sustainable futures. On the other hand, while it is clear that new global challenges require concerted efforts, national realities remain the central elements in the development discourse. In this sense, each country should be able to plan its sustainable future according to its development vision and priorities.

As a result, the main challenge of the post-2015 agenda and related measuring framework will be to align national and regional development goals with global vision. In this sense, the green economy paradigm is conceived as a tool that can support the shift towards more sustainable production and consumption modes at the national level, in line with global priorities for sustainable development. Indeed, green economy policies and investments can be tailored to the national context, and assessed with the help of a number of tools, including indicators, scenarios and simulation models, which allow for a holistic approach to sustainable development.

Starting from these considerations, this paper aims to discuss how foresight is used to understand the implications of global changes focusing on the role of green economy strategies in fostering societal, economic progress and environmental conservation at the national level. The use of indicators is reviewed, in that they support policy formulation, assessment, as well as monitoring and evaluation. An integrated approach is proposed to identify and quantify the challenges to overcome to move towards a green economy and a more sustainable future.

This study mainly consists of a desk review, and proposes an approach designed and implemented by the authors. Per se, the paper does not provide new indicators, but it does emphasize the need to implement a more systemic approach in the policymaking process, namely one that considers policy impacts across sectors and actors, and involves a wide variety of stakeholders in all its phases.

2. Measuring Sustainable Futures

2.1 Key Issues in the Measurement of Sustainable Futures

The ongoing debate on the definition of a post-2015 development agenda is raising a number of issues that need to be addressed in order to ensure the creation of an effective measuring framework for sustainable development, one that is capable of capturing all aspects of the complex reality in which development policies, strategies and plans have to be implemented. First of all, the debate focuses on the identification of adequate indicators and targets to support the achievement of broad development goals (United Nations Economic Commission for Europe [UNECE], 2013), such as those tentatively proposed by the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda in its recently published report, namely: (1) ending poverty, (2) empowering

girls and women, (3) providing quality education, (4) ensuring healthy lives, (5) ensuring food security and nutrition, (6) achieving universal access to water and sanitation, (7) securing sustainable energy, (8) creating jobs and equitable growth, (9) managing resources sustainably, (10) ensuring good governance, (11) ensuring stability and peace, and (12) creating an enabling financial environment. As stated by the Panel, the collection of “up-to-date development data with national and international statistics communities will allow sustainable development practitioners to better track advances, integrate evidence into decision-making and provide more transparency” (UN, 2013). In particular, the debate is focusing on the best use of new technologies to collect and disseminate relevant information across different sectors, possibly improving the connection between grassroots data collection and national efforts via crowd sourcing innovations.

Secondly, the discussion around the role that should be played by the scientific community in devising new international targets for the post-2015 agenda is gaining increasing relevance (SDSN, 2013). There is growing acceptance on the part of policymakers that scientific fact-finding should constitute the basis of political discussions on the definition of the SDGs. The use of scientifically sound information to inform the identification process of targets and measurements frameworks for the SDGs would certainly strengthen the role of scientists in demonstrating the strict relation existing between the environment and socio-economic development.

Thirdly, the approach adopted for assessing progress towards the achievement of the SDGs should be more holistic compared to the MDGs. In particular, the MDGs tend to be considered as fragmented and isolated goals, which failed to adequately represent the complex interactions between different spheres of human development. As stated by the joint Lancet-LIDC report, “future goals should be centred on wellbeing, which has human, social and environmental components” (Lancet & London International Development Centre [LIDC], 2010). Therefore, an integrated and systemic approach is required to support the formulation of policies that take into account possible synergies and complementarities between different development goals, as well as potential unintended consequences and side effects.

Fourthly, post-2015 development policies, investments and initiatives need to be adapted to national contexts, and aligned with key development priorities identified at the national level by relevant stakeholders (UN, 2013). The identification of policy instruments available to create the enabling conditions for the transition towards sustainable futures should be done following an inclusive and participatory process, which takes into account the needs and perspectives of a variety of national stakeholders.

Finally, the discussion on the most suitable approach for supporting the achievement of the SDGs is focusing on the use of the green economy as an effective tool to shape national policies (e.g., as an action oriented approach to sustainable development), at the same time taking into account global perspectives on development, and ensuring a holistic approach to human well-being. In light of these considerations, the following section provides an overview of the green economy principles, with a specific focus on green economy indicators for the assessment of progress towards sustainable futures (UN, 2012).

2.2 Green Economy Indicators to Measure Sustainable Futures

In the 20 years since the term “green economy” appeared in the report “Blueprint for a Green Economy” (Pierce, Markandya, & Barbier, 1989), interest in a green transition has evolved and intensified. As a result of the global market and financial crisis in 2008 calls were made in the global policy arena for a Global Green New Deal (GGND). This was the focus of a report commissioned by UNEP in 2009 (Barbier, 2010). Implementation of green economic action was described as a long-term strategy for moving national economies out of the crisis. The GGND set out three concrete objectives:

- Economic recovery;
- Poverty reduction; and
- Reduced carbon emissions and ecosystem degradation.

The document proposed a framework for green stimulus programs as well as supportive domestic and international policies, including support to least developed countries. Following the GGND, UNEP’s Green Economy Report was published in 2011 (UNEP, 2011b). The Report elaborates the concept of a green economy, analyzes key sectors of a green economy and identifies global as well as sectoral recommendations for action. At the visionary level, UNEP considers the green economy as: “*An economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities*” (UNEP, 2011b).

At the operational level, the green economy is seen as one whose growth in income and employment is driven by

investments that:

- Reduce carbon emissions and pollution;
- Enhance energy and resource efficiency;
- Prevent the loss of biodiversity and ecosystem services (United Nations Environment Management Group [EMG], 2011).

These include investments in human and social capital, and recognize the central position of human well-being and social equity as core goals promoted by growth in income and employment (Organisation for Economic Co-operation and Development [OECD], 2011a). The approach is based on an economic analysis of current trends, risks and opportunities as well as on taking stock of national experiences in applying more integrated policy tools effectively.

Given the trends of environmental degradation and widespread poverty, the nature of economic growth in the coming decades will have to be fundamentally different from the resource-intensive growth of the past. Future growth will need to be assessed more broadly, against the criterion of whether it satisfies demands for higher living standards for a larger global population, while adapting to tightening environmental and natural resource constraints. In particular, public policies will need to be used strategically to orient the process of economic growth towards such a sustainable pathway, and issues of fairness in income distribution and social investment as well as planning for long-run energy and resource efficiency need to be included in the redefined set of economic policy goals. This approach requires a systemic shift rather than incremental improvements alone.

For governments, a green economy transition would include leveling the playing field for greener products by phasing out antiquated subsidies, reforming policies and providing new incentives, strengthening market infrastructure and market-based mechanisms, redirecting public investment, and greening public procurement. For the private sector, a green economy approach would involve understanding and seizing the opportunity represented by green economy transitions across a number of key sectors, and responding to policy reforms and price signals through higher levels of financing and investment.

Overall, the concept of green economy and its metrics is still relatively new, and evolving. Several organizations have coined their green economy definition (UNEP, OECD, Global Green Growth Institute [GGGI], and more), creating confusion at the national level. As a result, there is a widely recognized necessity for a comprehensive review of current efforts, including the definition of principles and objectives, as well as the review of existing tools to effectively measure the progress towards a more sustainable future (United Nations Department of Economic and Social Affairs [UNDESA], 2012a, 2012b, 2012c, 2012d). Further, several work streams are emerging on green economy, including the development of assessment methods and modeling tools customized at the national level, the provision of advisory services on public policies and medium to long term investment strategies, the identification of key indicators to be used throughout the integrated policy cycle, etc.

Among the various areas covered by green economy research, the one that has received more attention in the last years is the development of methodologies and tools for the prompt identification of worrying economic, social and environmental trends, and the evaluation of potential interventions through the analysis of alternative future scenarios. As a result, discussions are being centered on the development of a coherent framework of indicators and simulation models, which can be adapted to national realities and priorities, at the same time responding to the need for the alignment of policies, strategies and plans at national, regional and global levels.

In light of the ongoing debate on the establishment of a measuring framework for the post-2015 development agenda, several international organizations have proposed sets of green economy indicators as essential tools to measure progress towards a green economy and sustainable development. The OECD green growth measurement framework proposes the combination and simultaneous use of different types of indicators, including:

- Indicators of environmental and resource productivity, which measure the efficiency of natural resource use in economic activities, and thus identify potential worrying trends related to the intensive exploitation of natural capital;
- Indicators of the socio-economic context, which allow the monitoring of employment, demographic, education, health and other key trends, in view of analyzing their connection with simultaneous environmental and economic trends;
- Indicators of natural asset base, focused on renewable and non-renewable natural resources stocks, and biodiversity indexes;

- Indicators of environmental quality of life, which quantify the impacts of environmental degradation on well-being, including impacts on health, access to natural resources, and losses caused by natural disasters
- Indicators of economic opportunities and policy responses, which allows a comparative analysis of different policy, investment and technology options to address key sustainability issues (OECD, 2011b).

The Global Green Growth Institute (GGGI) proposed a measurement approach based on three main categories of indicators, namely Diagnostic Indicators (DIs) for the identification of environmental pressures and worrying trends; Planning Indicators (PIs) for the measurement of costs and benefits of alternative policy interventions; and Monitoring and Evaluation Indicators (MEIs) for the assessment of actual policy impacts during and after implementation (Green Growth Knowledge Platform [GGKP], 2013)

The World Bank genuine savings indicators, or adjusted net savings (ANS) are used to measure changes in wealth through savings, and account for changes in all assets depreciation of produced capital, including depletion of natural resources, and future losses owing to carbon emissions (World Bank, 2011).

Green economy indicators are being developed by UNEP to support governments in the elaboration of sound and inclusive green policies. In particular, UNEP's green economy indicators are designed to support each step of the integrated policymaking (IP) cycle, going from issue identification to policy formulation, assessment, monitoring and evaluation. Particular attention is paid to the measurement of cross-sectoral and distributional impacts of green policies, considering that a green economy approach should be integrated and inclusive (UNEP, 2012).

The System of Environmental and Economic Accounting (SEEA), adopted by the UN Statistical Division (UNSD) in 2012, is an international standard for the inclusion of environmental indicators into the System of National Accounts. The purpose of SEEA is to incorporate sustainability issues, such as the depletion of natural resources and ecosystems, into the assessment of national economic performance (UNSD, 2012).

The practical implementation of the SEEA approach to the measurement of national economic performance requires the establishment of common criteria for the economic valuation of natural capital and ecosystem services. Several initiatives have been launched in this respect, including, among others, the World Bank-led Wealth Accounting and Valuation of Ecosystem Services (WAVES) initiative, a global partnership that aims to promote sustainable development by ensuring that the national accounts used to measure and plan for economic growth include the value of natural resources; and The Economics of Ecosystems and Biodiversity (TEEB), a global initiative that brings together expertise from ecology, economics and development to support the mainstreaming of biodiversity and ecosystem considerations into policy making (TEEB, 2010a).

In addition to specific indicators that capture information on a wide-ranging set of observable phenomena, composite indexes are being developed to support governments and policymakers in the analysis of country performance through the measurement of multi-dimensional concepts. Many composite indicators projects, publications and networks were launched in the last years to respond to pressures of the governmental policies/programs to use indicator-based policy-analysis. Recent lists of indicators include (Bečić, Mulej, & Švarc, 2012):

- Canadian Index of Wellbeing
- Capability Index
- Comparing welfare of nations
- Corruption Perceptions Index
- EEA Core Set of Indicators
- European Benchmark Indicators
- Ecological Footprint
- Environmentally Sustainable National Income
- EU set of Sustainable Development Indicators
- Human Development Index
- Index of Individual Living Conditions
- Genuine Progress Indicator
- Happy Planet Index
- JFS Sustainability Vision and Indicators
- The Natural Capital Index framework
- Regional Index of Sustainable Economic Welfare
- MDG Dashboard of Sustainability
- Sustainable Society Index
- Time Distance Method
- World Happiness Index
- Global Peace Index
- The Climate Competitiveness Index
- The International Property Rights Index
- The Better life Index
- Legatum Prosperity Index
- The Global Creativity Index

The great variety of approaches adopted for the development and use of green economy and SD indicators indicates a growing interest on the part of international organizations and states to identify appropriate tools for the formulation of public policies aimed at solving complex problems. However, international efforts generated no general consensus to this date on a more holistic approach to measuring progress towards sustainable development, and the effective use of these tools in policy-making. As a result, harmonization is becoming now a central priority for the creation of a shared international framework of indicators. Discussions are currently being held among key global actors, focusing on the development of broad indicator categories and step-by-step guidance manuals on evidence-based policy-making (GGKP, 2013). In the following section, an integrated approach is proposed for the analysis of green economy interventions, with a framework that would support reaching a more sustainable future. The approach, which is based on the valuation of investments, added benefits and avoided costs generated by interventions, is proposed as a valuable method to conduct a systemic analysis of sectoral and cross-sectoral implications of policy implementation, with careful consideration of distributional impacts, as well as short, medium and longer-term effects.

3. An Integrated Approach to Assess Green Public Policies

3.1 Framework of Analysis

Green economy indicators are instruments used to support the measurement of phenomena that are directly or indirectly related to sustainable development, highlighting the relation and dynamic interplay between economic performance, environmental trends and social dynamics (UNEP, 2012). This section focuses on the possible use of green economy indicators to support the analysis of progress towards sustainable futures, through the assessment of targeted national policies. The approach proposed in this section is one that makes use of relevant indicators to show the economic advantages deriving from green economy investments. Indeed, governments and private actors tend to be generally skeptical when it comes to the incorporation of environmental considerations into economic and/or business development plans, since a trade-off is often perceived between economic development and environmental sustainability (Stern, 2006). Although this might be true in some cases when considering short-term impacts of green policies and investments on a specific sector, it is not necessarily so when an integrated, systemic and multi-stakeholder approach is adopted, one that takes into account synergies and complementarities of policy impacts across different sectors and actors, with a more extended time horizon (TEEB, 2010b; Everett, Ishwaran, Ansaloni & Rubin, 2010).

Three main components of a green economy analysis are described, which can be used to appreciate the multiple advantages of sustainable development policies, and to generate consensus at the national level around green economy integrated strategies and action plans by “leveling the playing field”. These include: (1) the allocation and/or reallocation of public financial resources with aim to create the enabling conditions for a green economy transition; (2) the estimation of added benefits deriving from policy implementation and investments, focusing on short, medium and long-term impacts across sectors and actors; (3) the estimation of potential costs that could be avoided as result of the successful implementation of the policy, including direct savings deriving from a more efficient use of natural resources, as well as indirect avoided costs, e.g. health expenditure, avoided losses from natural disasters, avoided payments for the replacement of key ecosystem services, etc. (UNEP, 2012).

3.2 Capital Investments

The misallocation of capital in the last decades has largely contributed to the unsustainable exploitation of natural resources, and the manifestation of several concurring economic, social and environmental crises (UNEP, 2011b). It is now increasingly acknowledged the need for a reallocation of financial resources from environmentally harmful to less resource-intensive sectors, in order to ensure that economic growth is not pursued at the expenses of natural capital and without any consideration for medium and long-term impacts of current decisions (Brink, Mazza, Badura, Kettunen & Withana, 2012). Consequently, the analysis of possible alternative investment options is a key starting point of any green economy transition, and can be effectively informed by relevant indicators, adequately customized to the national context (UNEP, 2012).

Capital investments can be reallocated from existing budget lines, or added to public expenditure through the injection of additional resources (UNEP, 2011b). The objective of capital investments under a green economy approach should be to create the favorable conditions for the development of a green sector, or the adoption of innovative technologies (Paus, 2013). The use of indicators is needed in this case to estimate the total amount of investment needed to obtain the expected results and achieve the stated goals, as well as to assess whether the sources can be diversified (e.g. including contributions from private actors). Different types of investments can be compared with the help of relevant indicators, in order to identify the most effective and inclusive solution. In particular, financial resources can be invested, among other things, in preserving natural capital and ecosystems,

constructing public infrastructure, and creating capacity in the supply chain for emerging green technologies (Barbier & Markandya, 2012).

For example, different possible investment options can be considered (and measured) to address the problem of unsustainable deforestation (Van Paddenburg, Bassi, Buter, Cosslett & Dean, 2012). Reforestation and afforestation policies could be implemented to avoid the loss of natural capital, at the same time ensuring the continuation of forestry production. On the other hand, protected areas could be established or expanded in order to preserve primary forests from aggressive exploitation. Also, incentives and subsidies could be adopted to support the development of alternative economic activities related to forest, such as eco-tourism. Indicators can be used to quantify each of these investments, thereby providing a coherent framework for informed, evidence-based decisions.

3.3 Added Benefits

Measuring the investment required by sustainable development policies is only one step of the integrated approach proposed for the analysis of different paths towards sustainable futures. Indeed, the identification of potential investment options should be complemented by an estimation of added benefits. In particular, environmental, social and economic advantages resulting from green investments can be identified and measured with the help of key indicators (UNEP, 2012). Moreover, the analysis should take into account delays and non-linearities of system's reaction to different investment policies, so as to prevent possible side effects and unintended consequences (Probst & Bassi, 2014).

First of all, environmental benefits of sustainable development policies can be quantified based on the value of natural capital and ecosystem services. Following the previous example, investments in planted forests are expected to improve the provision of forest goods and services, including timber and non-timber forest products, as well as watershed regulation and carbon sequestration services, among others (UNEP, 2011c). Moreover, the environmental benefits of healthier forests would be enjoyed across key sectors, including water management (e.g., through watershed preservation and better conservation of water resources in protected areas) and agriculture (soil quality would remain higher and erosion decline in the proximity of forests). As a result, relevant national and international data could be used to estimate the economic value of added environmental benefits deriving from forest preservation and sustainable forest management interventions (TEEB, 2010a).

Secondly, investments and policies for the shift to more sustainable production and consumption modes should be identified and analyzed also in the light of expected social benefits. As stated by the Green Economy Report, one of the fundamental aspects of a green economy should be the social inclusiveness, namely an approach to economic growth that is balanced, pro-poor and equitable (UNEP, 2011b). In this sense, the analysis of sustainable development (SD) policies should make use of specific indicators of added social benefits, such as additional employment and income opportunities in green sectors, improved health conditions, enhanced access to natural resources and public services by local communities, among others (Poverty and Environment Partnership [PEP] Working Group, 2013). In the case of sustainable forest management initiatives, for example, social benefits may include employment generation (e.g. in forest protected areas, eco-tourism, sustainable forestry production, reforestation activities, agroforestry etc.), improved access to water resources due to enhanced watershed regulation, health benefits from reduced air pollution, etc. (UNEP, 2011b).

Thirdly, the economic benefits of green policies can be estimated by means of key indicators of sectoral performance. In particular, the effects of environmental spending on aggregate supply and demand need to be analyzed, considering net returns across sectors in the short, medium and longer-term (UNEP, 2012). A well-informed decision-making process would lead to the selection of policies that generate added economic benefits to such an extent as to offset investment costs. On the one hand, controlling the overexploitation of natural resources might lead to slower economic growth in the short-term for certain sectors (e.g. reduced fishing capacity would lower short-term revenues). On the other hand, however, reduced growth in the short-term might be followed by faster growth in the long run, as renewable natural resources are replenished. Moreover, slower growth in certain sectors could be compensated by an increase in demand and opportunities in other related economic activities (UNDESA, UNEP & United Nations Conference on Trade and Development [UNCTAD], 2012). Continuing with the forestry example, the establishment of protected areas for the preservation of primary forests is likely to have a negative short-term impact on forestry production activities, and revenues. On the other hand, investments in forest plantations for production purposes could progressively compensate losses and generate revenues, at the same time ensuring the protection of pristine forest resources and their key ecosystem services (UNEP, 2013). In addition, the development of eco-tourism businesses in protected areas, as well as enhanced agroforestry productivity due to improved soil quality, might generate additional economic benefits

and counteract possible adverse short-term effects of forest protection (Coad, Campbell, Miles, Humphries, 2008).

3.4 Cost Savings and Avoided Costs

An aspect that is often neglected when measuring the effectiveness of sustainable development investments and policies is the implicit economic benefit deriving from such interventions. More specifically, improving the sustainability of a national economy, or sector, has the potential to both reduce costs currently assumed by public and private actors as result of ineffective natural resources management and use, as well as to avoid potential future costs deriving from the depletion of natural capital and ecosystem degradation (TEEB, 2010a). An integrated analysis of green investments should involve the estimation of costs savings and avoided costs, using historical and current data on environmental, social and economic sectoral performance, in order to assess the effective impact of the intervention, and the distribution of costs and benefits among different targeted actors (UNEP, 2011b).

First of all, saved and avoided costs directly related to the environment can be measured, including costs for the replacement of affected ecosystem services (UNEP, 2014). For example, in the case of investments in forest protected areas and sustainable forest management, the analysis should include saved and avoided costs of replacing watershed regulation services, such as costs of human-engineered solutions to address water quality and quantity, costs of constructing and maintaining waterways to reduce soil erosion, or flood control and flood protection systems such as dams and other types of barriers.

Secondly, unsustainable use of natural resources might be the cause of additional social costs. In particular, the depletion of natural capital and consequent decline of natural resource-based sectors is likely to have an impact on the well-being of people and communities directly depending on those sectors/resources for their livelihoods. Indicators of employment and income can be used to identify worrying trends, and quantify potential income losses across different social groups (International Labour Organization [ILO], 2013). Also, health costs can be saved or avoided as result of the transition to more sustainable production and consumption. Several phenomena, such as air and water pollution, floods, droughts, decline in agricultural productivity etc. can be partially (or totally) determined by unsustainable practices, which lead to significant impact on health conditions and overall well-being of affected communities (Remoundou & Koundouri, 2009). In the case of forests, intensive deforestation is likely to increase the occurrence of floods, thereby causing an increase in injured people, and related health care costs. Moreover, deforestation has an impact on air quality due to reduced carbon sequestration from forests, and possible increase in the occurrence of fires, eventually increasing the number of hospitalized people from air pollution diseases (Eliasch, 2012).

Finally, saved and avoided costs should be measured in relation to the economic performance of key sectors that can be affected by environmental degradation. In particular, indicators of net annual value addition/removal can be used to identify worrying trends and anticipate potential future losses deriving from natural resource scarcity (World Bank, 2012). The performance of key sectors such as tourism, agriculture, energy, forestry etc. is already affected by the harmful impacts of unsustainable practices (UNEP, 2011b). As a result, the analysis of green investments in environmentally friendly innovations, technologies and processes should include an estimation of reduced economic losses that might derive from continued degradation under business as usual. For example, intensive deforestation practices, especially if not compensated by forest planting interventions, would inevitably lead to a progressive reduction in the availability of timber and non-timber forest products for extraction. Moreover, other sectors related to forests and biodiversity, such as eco-tourism or drug production from medical plants, would in turn be affected by deforestation, further increasing economic losses (UNEP, 2013).

4. The Way Forward

This study aimed at reviewing current approaches used for the measurement of progress towards more sustainable production and consumption modes, in light of the ongoing debate on the post-2015 development agenda. In particular, different organizations are effectively contributing to the dialogue on indicators for sustainable development, proposing conceptual and thematic categorizations, as well as specific methodologies that can be followed to detect potentially worrying trends, and to assess public policies and investments in light of sustainability concerns. As a result, it was observed that the international community is demonstrating a growing interest towards the creation and implementation of strategies and plans that envision sustainable futures, namely alternative paths towards socio-economic development in harmony with the environment.

However, the different approaches proposed for the formulation, assessment and evaluation of public policies conducive to a more sustainable future are likely to penalize the harmonization of methodologies, at the expense of the alignment of national, regional and global sustainable development targets. In this sense, the way forward

should point to the creation of a coherent measurement and analysis framework, one that is able to capture the nexus between the economy, the environment and society in the most effective way. The integrated approach proposed in this paper for the analysis of green economy investments and related benefits and avoided costs is derived from the application of green economy principles and concepts to national public policy formulation. This approach brings together a variety of different methodologies (e.g. cost-benefit analysis, valuation of natural capital and ecosystem services, externality valuation etc.) that can help develop an integrated framework of analysis for the identification of the most effective paths towards sustainable futures.

It is believed that a quantitative, cross-sectoral analysis of economic, social and environmental costs and benefits of public decisions can enhance the understanding of policy impacts over an extended time horizon, and raise considerations on the degree of inclusiveness of current development visions, and plans. Moreover, the estimation of net returns on investments, facilitated by the use of relevant indicators, has the potential to make the economic and business case for the transition to a green, sustainable economy.

Although the indicators analyzed in this study are based on common categories developed by international organizations and research institutes, the need for adapting measurement frameworks to national contexts is acknowledged, also considering the differences that exist between countries with respect to development objectives, priority sectors, and specific environmental, social and economic features. At the same time, however, an overarching common set of sustainable development/green economy indicators is needed in order to allow for vertical (i.e. from global to local) and horizontal (i.e. cross-country) comparative analysis, and the identification of best practices.

In addition to the problem of harmonization of sustainable development measuring frameworks and tools, another key aspect to be considered on the way forward is the improvement of relevant data collection and dissemination methods. Indeed, despite considerable improvements experienced in the latest years thanks to a variety of open source initiatives at the global and regional level focused (e.g. World Bank Little Green Data Book (World Bank, 2013); Eurostat Sustainable Development Indicators, among others), there is still a critical need for decision-makers to have access to harmonized and coherent datasets, organized on the basis of common criteria and shared indicators of sustainable development. In particular, the quality of data should be prioritized in ongoing harmonization efforts; as highlighted by OECD, there are a number of basic features indicators should be assessed upon, including *policy relevance* (i.e. address issue of public concern); *analytical soundness* (i.e. use of the best available science); *measurability* (i.e. use of easily quantifiable information, allowing for temporal and spatial comparison); *usefulness in communication* (i.e. easily understandable by different audiences) (OECD, 2011b).

The collaboration across countries and international institutions is a fundamental prerequisite to provide policymakers with cross-sectoral, contextualized, reliable, and readily available data, based on which sustainable development strategies and plans can be formulated, assessed, monitored and evaluated. The need for international sharing of data was made explicit in the Report of the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda, which calls upon the establishment of a Global Partnership on Development Data in order to “fill critical gaps, expand data accessibility, and galvanise international efforts” towards the establishment of post-2015 development targets by January 2016 (UN, 2013).

Data availability and quality is linked to another essential priority for the achievement of sustainable development objectives, namely the establishment of shared methodologies and frameworks for the valuation of environmental externalities. Environmental impacts should be identified and measured prior to the implementation of any development policy or strategy. The quantification of impacts in terms of potential economic losses and additional costs deriving from the depletion of natural capital and ecosystem degradation, as discussed and analyzed in this paper, is an approach that is becoming increasingly popular thanks to the development of integrated methods for the assessment of green economy investments. However, there is still much to be done to ensure the systematic inclusion of externality valuation into national development visions and plans. Also, more work is needed in the field of measuring externalities across national boundaries. An in-depth analysis of economic, social and environmental interrelations between countries is at the core of the progress towards sustainable futures. In this sense, a coherent set of indicators, combined with integrated and systemic assessment methods, is likely to facilitate the projection of severe externalities that might be caused by unsustainable patterns of interaction between countries.

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