PBL Netherlands Environmental Assessment Agency

NATURAL CAPITAL ACCOUNTING FOR THE SUSTAINABLE DEVELOPMENT GOALS

Current and potential uses and steps forward

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Contents

Main Findings

INTRODUCTION

The '2030 Agenda for Sustainable Development' aims to transform our world for the better. It defines 17 Sustainable Development Goals (SDGs) and 169 sub-targets. All the goals and sub-targets are directed at improving the lives and future prospects of everyone, everywhere. Designing and implementing the SDGs demands substantial policy effort. As the spectrum of the Agenda is broad, including economic, social and environmental aims, it is essential to have a thorough understanding of the interdependencies between these aims, as well as of trade-offs between them. This includes the impact the economy has on the long-term health of natural systems. Economies need nature: economic prosperity and human well-being are underpinned by natural capital. Water, forests and minerals are just a few examples of natural capital.

Natural Capital Accounting (NCA) is a tool that can help public and private actors to gain an understanding of the interaction between the economy and the environment. It can be used to measure the state of ecosystems, flows of ecosystem services as well as the changes in stocks and flows of natural resources in relation to economic changes. NCA comprises of a system of accounts and includes the compilation of supply and use tables, functional accounts (such as environmental protection expenditure accounts) and asset accounts for natural resources. Accounts may be compiled in both physical and monetary terms.

In this discussion note, we provide a brief overview of current and potential uses of NCA in national policy processes for the SDGs. NCA in itself does not create mechanisms to reach the SDGs. Yet , it can provide valuable elements, lessons, and practices that can be used to develop and implement the policies needed to attain the SDGs at the country level. We investigate which developments take place to design and implement evidence-based SDG policies and what role NCA currently plays or can potentially play herein. Moreover, we examine which institutional hurdles prevent to shape an enabling environment in which NCA can help to improve national policies directed at achieving the SDGs.

This discussion note is prepared as an input to the 2nd NCA Policy Forum, held on 22 and 23 November 2017, in the Netherlands. The lessons presented in this document are preliminary and indicative and provide a starting point for discussion. All the relevant examples information, suggestions, remarks et cetera that we will obtain during the forum will help to concretize, develop new or fine tune our existing key messages.

CHALLENGES TO REACH THE SDG

To examine where NCA plays a role in the national SDG policy processes, we distinguish three challenges countries face to reach the SDGs and for which NCA provides a relevant information base. These relate to (a) monitoring and projecting status and trends of the SDGs, (b) identifying the interlinkages – trade-offs and synergies – between the SDGs, and (c) evaluating the impacts of potential governance arrangements. From the scientific and international literature about the SDGs, we distil a number of interesting general observations about how NCA helps or can help countries to deal with these SDG challenges. These observations may help countries to assess their position on how they can use NCA to help improve their SDGs policies.

OBSERVATION: FOCUS ON MONITORING STATUS AND TRENDS

We observe that internationally, most attention goes to SDG-indicator development for monitoring status and trends, challenge (a). Most attention so far has been paid to measuring progress towards achieving a target (report card), and less to help countries with developing implementation strategies for achieving the SDGs (policy tool). Translating this into the terminology of the policy cycle – which consists of the stages (i) issue or problem identification; (ii) policy response; (iii) policy implementation; (iv) policy monitoring and (v) policy review – this implies that most countries focus on the stages where the problems to be solved are identified (i) and progress towards the SDGs is monitored (iv).

NCA has the potential to be helpful for this challenge by delivering several SDG indicators. Current use of NCA for monitoring the progress of SDGs is, however, largely limited to the environmental SDGs (6, 13, 14 and 15), of which not all are quantitatively measurable (yet). NCA can potentially also be used for SDG indicators related to agriculture, energy, employment and sustainable production and consumption (2, 7, 8, 9, 11, and 12). Moreover, reaching the SDGs requires both top-down and bottom-up processes. So far, monitoring the progress of SDGs by using existing NCA, however, seems to be mainly top-down, and less bottom-up. Despite of some regional applications, NCA supports mainly national policymakers and is hardly used by people from other walks of society. This is a lost opportunity.

OBSERVATION: NCA IS HELPFUL FOR POLICY PREPARATION

The challenges (b) and (c), on trade-offs and synergies and on governance arrangements, are especially linked to the policy stages of identifying, implementing and review policy responses (stage (ii), (iii) and (v)). Despite of growing attention for these challenges, we only observe limited attention for the potential role of NCA herein.

The SDG agenda stresses that the SDGs and sub-targets are integrated and indivisible, meaning that they are inter-related and mutually dependent and must be considered and implemented as a whole. There is increasing attention for the positive and negative links between the SDGs and for the SDGs that have the strongest links with the various targets. This, however, seems to be used mainly for the policy stages of monitoring and awareness raising. There is less evidence that this information is also used in public policy decision-making.

NCA can potentially be helpful for designing, implementing and reviewing evidence-based SDG policies at the country level. The methods currently promoted for analysing the impacts of SDG policies, however, pay limited attention to the potential uses of NCA and the accounts most needed for this (e.g. physical flow or asset accounts). Moreover, most national SDG-processes seem to pay little attention for the methods that most closely relate to the setup of NCA, like footprint analysis, input-output analysis and general equilibrium analysis. These methods are systems-based approaches and are particularly suitable for analysing synergies and trade-offs of a broad range of SDG policies, from pricing measures, to regulations, to technological developments and changes in consumption behaviour. The structure of the data used for these methods is consistent with the setup of the supply and use tables. Finally, there seems to be an unexploited potential of analytical methods for which NCA provides important data and that are helpful in the different stages of the SDG policy process, to review policies, examine trends and explore future development scenarios.

OBSERVATION: INSTITUTIONAL CHALLENGES

Thinking only from a decision-making cycle perspective, includes the risk of overlooking key institutional issues. By examining, as an example, how NCA plays a role in South Africa for

realising the SDGs, we observe that there are several challenges that prevent an enabling institutional environment in which NCA can help to improve policies directed at achieving SDGs. In South Africa as in many other countries, SDG implementation is aligned with their National Development Plan 2030. Yet, implementation is hampered by a number of institutional hurdles relating to poor coordination and siloed, top-down implementation of activities, scattered or non-existent data that are often of poor quality or not shared with others, and a lack of skills to use data to their full potential. These hurdles are certainly not unique for South Africa, but apply to many more countries. Experiences in South Africa learn us that setting up natural capital accounts can be helpful to enforce enabling institutional conditions as NCA brings rigour to foundational data, strengthens statistical skills and appeals to policy makers due to their direct link with the national accounts. Moreover, we also learn that the NCA and national SDG processes can benefit from one another as both use a system-based policy frame and need collaboration beyond departmental and organisational boundaries. Therefore, NCA implementation activities should not be limited to criteria's, methods, and techniques, but should cover governance issues as well, to create shared ownership, institutional cooperation, to involve those who use the accounts and to create a demand-led NCA process. This helps to develop an enabling institutional environment in which NCA can provide the evidence-base needed for designing national SDG policies.

CONCLUSIONS

From all this, we learned that there is an unexploited potential to use NCA for supporting national SDG policy processes. Given NCA's coherent and structured set up, it can help these processes by promoting a system-based approach and enabling institutional conditions for more integrated policy-making with multiple stakeholders and accountability bodies. Although not complete and perfect yet, indicators and analytical methods to support the national SDG process exist but are waiting for countries to develop their natural capital accounts. But there is more. Increasing the use of NCA for SDG policies, requires national SDG policy processes that move beyond monitoring and look at synergies and trade-offs, that cross borders of ministries and scales, that allow for learning by doing, and that create institutional conditions to foster transition to a system of integrated SDG policy making. Here the SDG and NCA development processes can go along the same lines. Both processes go beyond the mandate or competencies of one single institution or ministry, are dependent on organisations with skilled people for collecting data and compiling accounts, and require strong political support and powerful lead agencies to promote evidence-based policy making and crossing sectoral boundaries.

Complexity, data problems, lack of skills and unfamiliarity may represent obstacles to the use of NCA for enabling SDGs at the country level. Therefore, it is a prerequisite that organisations participate that have the skills to use NCA or apply analytical methods to estimate SDG indicators or evaluate potential synergies, trade-offs and distributional effects of policy instruments like environmental regulations, natural resources pricing or payments for ecosystem services. Moreover, they should have the competencies to produce policy-ready and easily communicable messages. Not only for national and local policy makers so that they understand the use of the accounts and raise the right questions, but also for analysists (to perform the analysis need) and for statistical agencies (to compile the right type of accounts). Last but not least, as partnerships are the key to success in attaining the SDGs, and in particular the involvement of people from different parts of society, the value added of using NCA can be increased if it focusses not only on a top-down perspective (i.e. policy makers) but also on a bottom-up viewpoint, adopting an inclusive and participative approach.

1 Introduction

In September 2015, the United Nations General Assembly adopted the '2030 Agenda for Sustainable Development'. The agenda is a broad sustainability action plan for all countries, focusing on the poverty-development-environment nexus and with an overarching objective of leaving no one behind. It contains 17 Sustainable Development Goals (SDGs) – see figure 1.1 – which consist of 169 sub-targets, including ending poverty and hunger, improving health and education, combating climate change, environmental sustainability and inclusiveness (United Nations, 2015). These goals, along with their targets and indicators, provide a detailed dashboard in the transition to sustainable development (Costanza et al., 2016).

Figure 1.1 The Sustainable Development Goals

Governments at multiple scales, businesses and many others are working on the 2030 Agenda. Individual countries are called upon to translate the global ambitions into long term visions with clear targets and integrated policy agendas based on country circumstances (Gable et al. 2015). This process is multifaceted, with work being done in the fields of creating awareness, setting targets, designing and implementing policies, and monitoring progress. So far, internationally, there is much emphasis on developing a solid framework of indicators and statistical data to monitor progress of the SDGs and inform policy.

UNSD (2015) states that 'the SDGs represent a step towards closer integration of policy frameworks and programmes, requiring more integrated information on the inter-linkages between the economy, the environment and society'. Hence, designing and implementing the SDGs also requires an understanding of the interdependencies between the economy, the environment and society, as well as of trade-offs between various socio-economic groups. This includes the impact the economy has on the long-term health of natural systems. After all, economic prosperity and human well-being is underpinned by its natural capital (i.e. its biodiversity, including ecosystems that provide essential goods and services – the so-called ecosystem services).

Natural Capital Accounting (NCA) is a tool that potentially provides such a common, integrated approach.[1] It measures the changes in the stock of natural capital at a variety of scales. But maybe more importantly, it integrates the value of ecosystem services into accounting and reporting systems at a national level (rather than maintaining a strict borderline between the economic sphere and the natural environment). As such, NCA provides insights into the economic importance of natural capital in wealth creation, employment, livelihoods, and poverty reduction. Through NCA, the contribution of natural capital to economic development and the SDGs can be made explicit (Bann, 2016). Further details on NCA, in particular regarding the linkages with SEEA and efforts by the WAVES Partnership and the UNSD to support countries to construct NCA, can be found in the textbox 'NCA and SEEA'.

NCA and SEEA

The internationally agreed methodology for natural capital accounting at the national level is the System of Environmental-Economic Accounting (SEEA). SEEA contains the standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics on the environment and its relationship with the economy. One of the major pillars of SEEA is the Central Framework (SEEA CF), a statistical framework consisting of a comprehensive set of tables and accounts, which guides the compilation of consistent and comparable statistics and indicators for policymaking, analysis and research (United Nations et al., 2014a). The SEEA CF allows for compiling physical and monetary accounts for a range of natural resources like minerals, timber, and fisheries and linking these to the System of National Accounts. Next to that, the SEEA Experimental Ecosystem Accounts (SEEA EEA) presents a measurement framework for integrating biophysical data and linking changes in ecosystems to human activity (United Nations et al., 2014b).

The World Bank led WAVES partnership and the United Nations Statistics Division (UNSD) program of work aim to promote sustainable development by mainstreaming the value of natural capital accounting in development planning and national accounting systems. WAVES and UNSD use the SEEA CF to implement NCA in countries as an important tool to inform economic decision-making on natural resources like minerals, timber, and fisheries. Both organisations work to build capacity in countries to implement the SEEA and to demonstrate its benefits to policy makers. Next to that, UNSD, jointly with the UNEP TEEB office, UN regional commssions and the CBD, assist a number of countries to initiate pilot testing of the SEEA EEA and ecosystem valuation.

Source: *www.wavespartnership.org/en/system-environmental-economic-accounting-seea* and *unstats.un.org/unsd/envaccounting/eu_project/*.

A growing number of low, middle and high-income countries are compiling natural capital accounts based on the SEEA to inform economic decision making on natural resources. Many countries also want to use the accounts as a basis for compiling indicators to monitor progress of sustainability policies and for assessing *ex ante* the possible effects of new policies related to for example the SDGs. Yet, because many related ministries and agencies are working according to sector or departmental mandates, there is a risk that such SDG policies are approached separately, as silos, without considering trade-offs or potentials for synergy between the SDGs. Reaching synergy requires cooperation – between ministries, between different levels of government both nationally and internationally, and between government, business and civil society. Cooperation would be enhanced if SDG governance were tailored to the reality of the complex systems of interdependencies between the economy, environment and society and if insights over the pathways to follow would be based on a common, integrated approach.

[1] Throughout the text, NCA is short for environmental-economic accounting following the System of Environmental-Economic Accounting Central Framework or Experimental Ecosystem Accounting (SEEA CF and SEEA EEA). NCA includes the physical and monetary accounts, but also the thematic and economic accounts as described in United Nations et al., (2014a,b).

This discussion note provides a brief overview of current and potential uses of NCA in national SDG policy processes.[2] NCA in itself does not create mechanisms to reach the SDGs. Yet , it can provide valuable elements, lessons, and practices that can be used to develop and implement the policies needed to reach the SDGs. We investigate which developments take place to design and implement evidence-based SDG policies and sketch the current uses of NCA therein. We also identify and describe opportunities for NCA to fill gaps in current SDG policy processes. Moreover, as the institutional delivery mechanisms for the environmental SDGs are not so clear (see Waage et al., 2015), we also examine which institutional hurdles prevent to shape an enabling environment in which NCA can help to improve national policies directed at achieving SDGs, i.e. in which NCA may help to create system-based, integrative governance arrangements spanning multiple departments, involving public and private actors, and navigating across variable spatial scales. From these analyses, we derive a number of general observations that may help countries to evaluate where they stand and how they can use NCA to help improve their SDGs policies.

To identify current and potential policy uses of NCA for reaching the SDGs, we first identify the policy issues in relation to national SDG processes and in which stage of the decision making cycle these issues play a role (Section 2). Next, we focus on the indicators and analytical methods that are or can be used to address the policy issues (Sections 3 and 4). In Section 3, we make a number observations about how NCA is helpful for estimating the SDG indicators that follow from the 169 SDG targets and what the indicators are used for (for monitoring progress, as management tool to identify integrated policy agendas, or something else). In Section 4, we assess which analytical methods can be used to address the policy issues and how NCA does or could benefit these methods. Finally, in Section 5, we illustrate for the case of South Africa which institutional hurdles may prevent to shape an enabling environment in which NCA can help to improve policies directed at achieving SDGs. Our methodology comprised desk research, literature reviews and policy analyses, complemented in Section 5 with semi-structured interviews with knowledgeable resource persons in South Africa.

We note that both the SDG and the NCA process are still in their infancy. At this early stage we cannot expect a widespread application of NCA for informing SDG policies, or for well-developed SDG policy processes within countries, as it takes time for the accounts to mature both in their development and in their integration within the decision-making process (Virto et al., 2018). This has also affected the literature used in this discussion note. We consulted the limited scientific literature, international reports from e.g. the World Bank, United Nations and OECD and websites related to the SDG-indicators and SDG policy analyses. Availability of literature reporting about national SDG or NCA processes is still extremely limited. To stay as close as possible to the SDG policy process, we decided not to consult literature on green growth or sustainable development, that might also provide useful insights about the way NCA can support integrated policy making. Moreover, we focus mostly on national SDG processes, although we note that internationally, UNSD (2015), the United Nations (2017), the World Bank (2017) and OECD (2016, 2017) emphasize the need for coherent ways to produce indicators to measure progress towards the SDGs. NCA provides such a coherent framework on the basis of which indicators can be estimated. A key consideration going forward is that many countries do not yet have NCA and to create them will take time.

Furthermore, for reasons of brevity and space, we limit our analysis to a macroeconomic perspective. That is, the role of NCA in reaching SDGs is for application at a national level. Natural capital accounting for business – here defined in its widest sense as 'taking the environment into account of business decision-making and reporting' – will not be explicitly

[2] Note that these processes not necessarily have to lead to new policies, but may also relate to activities to link or embed existing policies to the SDG agenda.

taken into account here, albeit we are fully aware of its relevance for the process of achieving the SDGs and for producing the national natural capital accounts. And although we aim here at linking NCA with macro level sustainability decisions, our focus at a national level will prove highly relevant to apply NCA at the regional or lower levels. This may demonstrate more easily the potential for NCA to aid in the development of specific sustainability policy themes or issues. A reduced scale focus may be of particular interest in the two case studies of section 5.

Finally, we discuss here the observations we made from both literature and interview analysis, but it is good to realise that these lessons are certainly not cast in stone. This discussion note is prepared as an input to the 2nd NCA policy forum (held on 22 and 23 November 2017, in the Netherlands) and all the relevant examples, information, suggestions, remarks et cetera that we will obtain during this forum will help concretize, develop new, or fine tune our existing key messages. After processing the input received from the participants of the policy forum, we will finalise this discussion note before the end of this year.

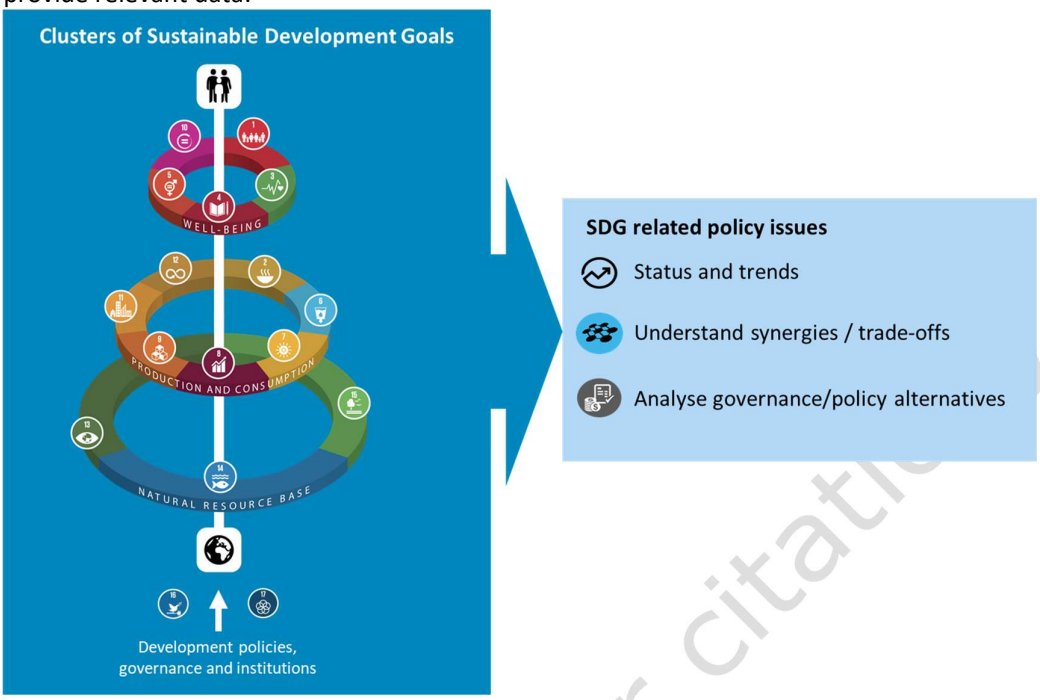
2 Challenges to reach the SDG

To reach the SDGs, countries face many challenges that are not easily solved and these challenges differ between countries, Research is required to develop a better understanding of what needs to be done to achieve the targets of the SDGs. Building on this fact, several frameworks have been created to cluster related goals and arrive at sets of interrelated governance questions (see e.g. Waage et al., 2015, Oldekop et al., 2016, Reid et al., 2017, PBL, 2017). Broadly speaking, they boil down to one cluster of SDGs focusing on social objectives (SDG 1, 3-5 and 10), one cluster focussing on sustainable production and consumption (SDG 2, 6-9, 11, 12), and a third cluster of goals addressing the management of the natural resources base (SDG 13-15). A fourth cluster is more intersecting and contains the goals addressing governance and the institutional perspective (SDG 16 and 17).

To get to grips with the challenges countries face to reach the SDGs, three types of SDG related policy issues can be distinguished for which natural capital accounts provide relevant information – see figure 2.1. Of course, more types of policy issues can be defined, but here we restrict ourselves to those that have a direct link with NCA. Policy issues that are not typically related to NCA but require other information sources are left out of account. The SDG policy issues are:

1. What is the status and trend of the SDGs?
2. What are the interrelations – the trade-offs and the synergies – between the SDGs, not only between reaching goals, but also between various socio-economic groups?
3. Which forms of governance are available to reach the targets? This can be a broad range of governance arrangements, like introducing economic or regulatory instruments, creating institutions, stimulating innovation or instigating transition.

Figure 2.1 SDG clusters and SDG policy issues for which natural capital accounts potentially provide relevant data.

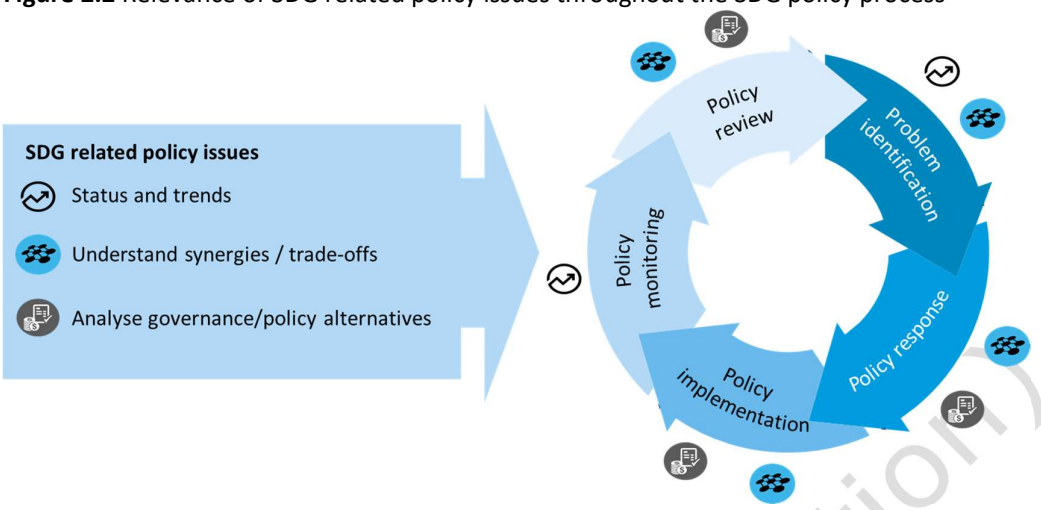


These three policy issues may be invoked at various stages of the policy cycle (see Vardon et al., 2017), which are: (i) issue or problem identification; (ii) policy response; (iii) policy implementation; (iv) policy monitoring and (v) policy review. The first issue, about status and trends, is especially relevant in the stages where the problems are identified (i) and progress is monitored (iv). The second and third policy issues – about the trade-offs and synergies and the forms of governance – are typically related to policy response (ii), policy implementation (iii) and policy review (v). In Section 3 and 4, we investigate to what extent NCA is currently or can potentially play a role for dealing with these challenges.

Interestingly, and as presented in the case studies and synthesis presented by Vardon et al. (2017), NCA have been (or could be) used in all of the stages of the policy cycle. For example, NCA can be deployed to quantitatively project and evaluate trends (for issue or problem identification), identify entry points for interventions and set targets (for policy response), as well as monitor and evaluate the impact of the interventions chosen (for policy monitoring and policy review) – see figure 2.2.

Thinking only from a decision making cycle perspective, however, includes the risk of overlooking crucial institutional issues. According to Termeer et al (2017), such crucial institutional risks include rigid and fragmented instead of system-based policy problem frames, lack of leadership and authority to collaborate beyond departmental and organisational boundaries, inadequate resources and skills, lack of involvement from marginalized groups and local communities, inflexible governance processes and the absence of conditions to foster transition to a system of integrated SDG policy making that addresses path dependencies. In order to evaluate whether these pitfalls prevent to shape an enabling environment in which NCA can help to improve policies directed at achieving SDGs, we diagnose in section 5 the role of NCA in the governance of the SDG process, using South Africa as an example.

Figure 2.2 Relevance of SDG related policy issues throughout the SDG policy process



3 NCA for developing SDG-indicators

SDGs are reflected in more than 200 indicators of performance. Together they form a framework which includes indicators for reporting at the international level and a range of national and thematic indicators that countries may compile based on capacity and depending on their policy priorities. At the national level, indicators are mainly used for monitoring, as barometers, of how well a country is doing on the SDGs.

The relevance of NCA for SDG-indicator development is asserted by Bann (2016). She indicated, for example, that for SDG 6 – clean water and sanitation – many of the indicators can be directly measured using the SEEA-Water methodology. More specifically, target 6.3 ('Improved water quality by reducing pollution'), can be assessed against a SEEA-Aligned Global Indicator related to the percentage of wastewater that undergoes treatment and is informed by the SEEA Water Physical Supply and Use Tables (PSUT) and emission accounts. As such, "adopting the SEEA-Water methodology for global reporting on water-related SDG targets promotes methodological consistency across different levels of reporting and between global datasets" (Bann, 2016, p. 7). So, when NCA is based on the UN SEEA Central Framework, it produces consistent and internationally comparable statistics through the use of an established statistical standard. It makes NCA an useful to guide the development and estimation of relevant SDG indicators. But not only that. By providing economic and environmental data in a consistent framework, NCA is particularly suited for analytical purposes (see section 4). Yet, despite of this, a recent report of the UN Sustainable Development Solutions Network about data needs for the SDGs does not mention NCA as a source of information, let alone as a vehicle for the implementation of SDG policies (SDSN & TRENDS, 2017).

In this section, we discuss the general observations we derive from the literature and reports on the role of NCA in developing, fine tuning and implementing SDG indicators.

Observation 1: NCA has the potential to deliver SDG indicators, whereby most attention so far seems to be paid to measuring progress towards achieving a target (report card), and less to help countries with developing implementation and monitoring strategies for achieving the SDGs (policy tool).

As said in the previous section, natural capital accounting can help deliver the SDGs in three ways, which correspond to three stages of the policy cycle as described in section 2. These are:

1. making explicit the links between the economy and the environment (stage (i) of the policy cycle: issue or problem identification),
2. developing and formulating sustainable policy decisions and actions (stage (ii): policy response), and
3. evaluating and reporting progress (stage (iv):policy monitoring).

Of these three practices, monitoring progress towards achieving the SDGs receives, by far, the most attention in the literature (e.g. SDSN, 2014; UNSD, 2015; Bann, 2016; Graveland et al., 2016; 2017). Many scholars and experts acknowledge that, as an information system, NCA provides the necessary data to move towards sustainable development and supports evidence-based policy making. However, despite the fact that there is plenty of theoretical work on how NCA can contribute to SDG-indicator development, in practice users are not always certain how adequately the developed indicators measure the monitored phenomena.[3] The reason for this is that the term (and role of) monitoring can be considered ambiguous. Is the role of monitoring merely aimed at describing trends in indicators relevant to specific SDG targets, or is its role also to report on accountability with regard to societal and policy developments underlying the trends observed (Lucas et al., 2016)?

NCA can also be used to make the links between the economy and the environment explicit, and to raise awareness about which natural assets and ecosystem services are threatened. As such, it can be a useful tool to motivate key actors who are affected by these assets and services, or who are in a position to act on or affect them. This is especially relevant in the first stage of the policy cycle (issue or problem identification, see section 2). This first stage is a critical stage in the policy cycle since its dynamics have a decisive impact on the whole policy process and the policies resulting from it. Hence, NCA can play a fundamental role in determining the problems or issues requiring action on the part of the government (see also observation 3). The efficiency of NCA in raising awareness is, however, difficult to assess, partly because problem identification is not only influenced by objective and quantifiable data but also by ideologies, which play a fundamental role in determining the problems or issues that require action. In addition to the (statistical) rhetoric to raise awareness there is further substance in that NCA data can also be used to guide sustainable policy decisions and actions (stage (ii) of the policy cycle). That is, as the SDGs require an evidence-based approach to governance, national and local policy makers can use NCA to help inform their target setting, decision-making, and policy design (SDSN & TRENDS, 2017). Section 4 will delve deeper into this issue.

NCA, which are comprised of sets of unbiased data for material natural resources, such as forests, energy and water at various levels and scales, can be helpful for SDG indicator development in at least two ways. First, NCA provides the necessary data to move towards sustainable development. That is, based on the SEEA-framework, NCA presents data that have particular strengths in policy relevance and methodological soundness, due to the statistical rigour provided by the accounting approach. Second, ongoing work to further develop NCA will also benefit the SDG review process. For example, the 'NCA experience' in developing a

[3] A major consequence of this is that it appears difficult to develop indicators that satisfy the needs of the policy makers, and hence, that are relevant and useful for policy decisions.

consistent way of data-driven monitoring and measuring our natural assets provides useful lessons for collecting the SDG information required. However, in order to increase the value added of NCA for the benefit of the SDGs, it is particularly important that the intended use of NCA is detailed as soon as possible. This not only makes communication easier, but also ensures a greater likelihood of the NCA having an impact and continuing to be used for achieving SDGs (for example by monitoring progress or raising awareness) .

Observation 2: Monitoring the progress of SDGs by using NCA relates mainly to the environmental SDGs (6, 13, 14 and 15), but not all the indicators for assessing progress against these goals can be (quantitatively) measured.

The environment cuts across all the SDGs and is directly reflected in seven goals. Hence, the role of NCA in delivering the SDGs is recognized in several SDG targets. SDG target 15.9, for instance, calls for ecosystem and biodiversity values to be integrated into national and local planning, development process, poverty reduction strategies and accounts. This integration of 'green' values can be implemented in spatially explicit form and can be valued in different units, including monetary units. To be more specific, the SEEA Central Framework comprises three main accounts that can be integrated with the existing United Nations System of National Accounts (SNA), and each focuses on a different aspect of the interaction between the economy and the environment: physical flow accounts (physical supply and use tables); functional accounts for environmental transactions (such as such as environmental protection expenditure accounts); and asset accounts for natural resources in physical and monetary terms. It appears that all accounts are useful. So, for most SDGs, not only the assets accounts directly related to the resources are suitable, but also others (e.g. material accounts) (see Table 3.1).

Bann (2016) gives a couple of examples for this and shows how NCA can support the delivery of SDGs. A fisheries account, for instance, could inform the conservation and sustainable use of the oceans and marine resources (SDG14) by assessing the value of stocks over time, alternative management practices and employment opportunities. And forest accounts can inform a number of the SDGs, for example: SDG 15.2, which says that by 2020 a country should promote the implementation of sustainable management of all types of forest, halt deforestation, restore degraded forest and substantially increase afforestation and reforestation globally.

A Dutch report – 'Measuring the SDGs: An Initial Picture for the Netherlands', compiled by Statistic Netherlands (2017) – describes the baseline measurement of where the Netherlands stands in terms of achieving the targets set for the SDGs. This report shows that currently, 37 percent of the SDG indicators can be measured using the available data, of which several are based on the Dutch environmental accounts. For many indicators, data must still be collected. It is expected, however, that not all indicators can be measured. For instance, some of the targets are still qualitative, making it difficult to gauge their success, and for others no national policy targets have been set (Lucas et al., 2016). It is worthwhile to note that the SDG process started from the goals to be reached and not from the indicators that can be measured or from a common measurement framework. Next to that, not all goals are equally relevant for all countries. Hence, not all countries translate the global goals into national targets, neither do they estimate all (the same) indicators to monitor progress. Therefore, the low percentage of targets that currently can be monitored (37 percent) is not only the case for the Netherlands, but for other countries as well.

Table 3.1 Possible use of NCA for estimating the SDG indicators and targets

Account	Type of account	2. Agriculture	6. Water	7. Energy	8. Decent work & economic growth	9. Industry, innovation & infrastructure
Land	Asset accounts	% land under sustainable agriculture				
Energy	PSUT			-pop. with energy access -% renew. energy -energy intensity		energy intensity
	Economic accounts			-% of pop. with energy access		
	Asset accounts			-% of pop. with energy access		
Water	PSUT + Economic accounts		-% of population using water/sanitation services -water use efficiency -time spent in collection -% of wastewater treated			
	Asset accounts		-% of water resources used			
Materials	Material Flow accounts				-resource productivity -material effic.	Intensity of material use per unit of value added
	Emission accounts		% of water bodies with ambient water quality			
	Air emission accounts			carbon intensity		carbon emission per unit of value added
	Solid waste accounts					
Aquatic resources	Asset accounts					
Agriculture, forestry and fisheries	All	Value of production per labour unit				
Environmental Activities	Env. protection expenditures acc.					
	Res. Man. expenditures acc.					
	Env. taxes and subsidies acc.					
Ecosystems	Condition accounts					
	Ecosystem extent accounts		%change in wetland extent			
	Ecosystem services accounts					
	Biodiversity accounts					
SNA	All	Agric. Orientation index	water use efficiency			-energy intensity -carbon emission per $
	Value added			energy intensity		
	Tourism				-% of GDP from tourism -tourism labor	

PSUT = Physical Supply and Use Table

Account	Type of account	11. Cities	12. Sustain. product. & consumption	14. Marine and coastal	15. Ecosystems
Land	Asset accounts	-efficient land use -share of built up area		coverage of protected areas	-forest + protected area -forest sustainbly managed -green cover index
Energy	PSUT				
	Economic accounts		-fossil fuel subsidies		
	Asset accounts				
Water	PSUT + Economic accounts				
	Asset accounts				
Materials	Material Flow accounts		Material footprint		
	Emission accounts			nitrogen use efficiency	
	Air emission accounts				
	Solid waste accounts	-% of solid waste collected	National recycling rate		
Aquatic resources	Asset accounts			% of fish stock with sustainable level	
Agriculture, forestry and fisheries	All			Fisheries as % of GDP	
Environmental Activities	Env. protection expenditures acc.	-% of budget dedicated to natural heritage and to sustainble buildings		Budget to research in sustainable marine technology	
	Res. Man. expenditures acc.	-% of budget dedicated to natural heritage			
	Env. taxes and subsidies acc.		Fossil fuel subsidies	Fishery subsidies	
Ecosystems	Condition accounts				trends in land degradation
	Ecosystem extent accounts				plans and processes integrating biodiversity and ecosystem services values
	Ecosystem services accounts				
	Biodiversity accounts				
SNA	All		fossil fuel subsidies		
	Value added				
	Tourism		Residual flows due to tourism		

PSUT = Physical Supply and Use Table

So, no country currently has all the necessary data. Not surprisingly therefore that worldwide, national statistics bureaus and other bodies (national and international) are still compiling data to measure progress on the many SDG indicators and authorities are setting target levels for some of the goals (SDSN & TRENDS, 2017). As the OECD (2016) correctly notes on its website: "many of the SDG targets are complex, interlinked and multifaceted, requiring the development of new concepts and measures" (http://www.oecd.org/forum/oecdyearbook/how-to-reach-the-sdgs-we-need-a-gps.htm). Moreover, the SDGs will also require disaggregated data across multiple dimensions, such as ecological or environmental, spatial or territorial or geographical, institutional and planetary.

Many countries produce national reviews and assessment reports on how they are currently performing against their SDG goals and targets (see https://sustainabledevelopment.un.org/memberstates). From these national performance reports, it appears that little experience is documented so far on the role of NCA in the comparison of critical trade-offs in ecosystem service provisioning. Even stronger, there is barely knowledge of whether the four environmental SDGs can be achieved simultaneously or whether they conflict, let alone how realizing these environmental SDGs can either promote or detract from the realization of the societal or economic SDGs. So, a critical note here with regard to NCA is that, although it helps to create an improved evidence base on the links between biodiversity and ecosystems on the one hand and economic and human wellbeing on the other, its use concentrates mainly on environmental SDGs, less on economic SDGs and hardly on societal SDGs.

Here, we should be aware of the fact that some of the metrics of ecosystem and biodiversity values in which we are interested have very long and slow degradation and recovery times (e.g. cod stocks), so it is not apparent whether targets are achievable within the time frames set (Collen et al., 2015). Moreover, a causal relation between SDG policy action and environmental performance is hard to establish, which makes informing policy decisions through accurate accounting a daunting task. Thinking on natural capital brings an added dimension to our understanding of the economic role of ecosystems and biodiversity but also reveals important gaps in evidence on how these natural assets should best be managed in the future to be beneficial for implementing the SDGs.

Observation 3: Monitoring the progress of SDGs by using existing NCA is mainly top down, and less bottom up.

Without wishing to deny that the bottom-up approach taken worldwide to formulating the SDGs is indeed considerable, the SDGs can nonetheless be seen as a top-down driven international agenda. Reaching the goals, however, requires both a top-down and bottom-up process. As many problems and solutions are probably most pertinent at the regional level, effort is needed to decentralise analysis and data-driven monitoring. Of course, country specific-targets require country-specific indicators. It is essential, however, that these indicators are developed locally by a participative process to generate more transparent governance and greater accountability. Locally conceived indicators might be the best way forward to achieve the country specific-targets (Fitchett & Atun, 2014). Such a participative and 'inclusive' process, however, takes time and is not always an easy task.

SDGs are thus to be realised through locally driven plans that reflect the priorities and contexts of individual member states, and which are based on a bottom-up perspective from policymakers and practitioners. As the economist Jeffrey Sachs says in his Kapuscinski lecture on sustainable development: "There shouldn't be anything top-down in the Sustainable Development Goals. They should inspire actions of individuals, businesses, NGOs, governments, local authorities, everyone" (http://kapuscinskilectures.eu/lectures/new-age-of-sustainable-development/).

So far, NCA supports mainly national (and local) policymakers. It is hardly used for, say, raising awareness among practitioners or private actors (except for natural capital accounting at a corporate level). So, from a bottom-up perspective NCA appears of less value added than from a top-down viewpoint. Although this observation seems to be beyond the scope of this discussion note – with its emphasis on the (national) governmental use of NCA – it is nevertheless an important observation. It is claimed after all that for monitoring and attainment of SDGs, a multi-stakeholder approach is needed in which "private companies, academia, multilateral institutions and civil society supports governments with the production, cleaning, composition, dissemination and analysis of data" (SDSN & TRENDS, 2017: 4). As such, the information that NCA reveals, namely the relationship between natural capital stocks and the flows of benefits which they generate, is not only relevant for policymakers or business decision makers. The question therefore is how NCA can contribute positively to changing our *own individual* behaviour so that SDGs come into reach?

4 NCA for analysing SDG policies and integration

The previous section shows that internationally, most emphasis goes to analysing status and trends of the SDGs for awareness raising and monitoring purposes – the first policy issue identified in Section 2. NCA is already used for developing some indicators for the SDGs but potentially more indicators can be estimated from the accounts. In this section, we investigate to what extent the other policy issues identified in Section 2 –synergies and trade-offs and governance arrangements – are considered in the SDG-processes and how NCA can play a role.

For this, we list methods that are regularly used for economic policy analysis and that could be used as well to analytically assess the SDG policy issues. This list is not exhaustive, but is limited to those methods that could potentially use data from the natural capital accounts. Using this list, we investigate which methods are currently used or promoted to analyse the SDGs, thereby exploring on which SDGs they focus and what types of data they use. Next to that, we diagnose for which stage of the policy cycle the results are useful and to what extent they support or oppose the governance questions raised in Section 2.

Methods to analyse the SDGs

Figure 4.1 shows a (not exhaustive) list of analytical methods that are potentially available for analysing the policy issues identified in Section 2. These methods provide useful insights for one or more stages of the policy cycle. They are applied regularly for a broad range of policy analyses and problems, but as the SDG policy process is still in its infancy, their use for analysing the SDGs is limited so far. Next to that, all these methods can use information that can be taken from the natural capital accounts. If these accounts are not available, they can also be based on other data sources, however. For most methods, required data needs not (necessarily) to be presented in the form of an account. Only for footprint analysis, input-output analysis and general equilibrium analysis, the accounts can almost directly be incorporated in the analyses.

Figure 4.1 Overview of phases for which the research methods provide relevant insights and the accounts providing relevant data.

	Decision making phase	1. Identification of issues *Why take action?*	2. Policy response *How to solve the natural capital problems?*	3. Policy implementation *What action to take?*	4. Policy monitoring *What results are achieved?*	5. Policy review *How to adapt the policies?*	Accounts needed
<-- Increasing integration of multiple issues <--	Indicators						*Thematic extent and condition accounts*
	Interaction / network analysis						*Thematic extent and condition accounts*
	Trend analysis						*Time series for thematic extent and condition accounts*
	Projections / extrapolations						*Time series for thematic accounts*
	Footprint analysis						*Supply and use tables for particular resources or ecosystem services*
	Scenario Analysis						*Time series for thematic extent and condition accounts*
	Integrated assessment						*Suite of natural capital extent, condition and supply and use accounts*
	Business case						*Suite of natural capital and economic accounts*
	Cost-Benefit Analysis						*Suite of natural capital and economic accounts*
	Econometric analysis						*Time series analysis of a suite of natural capital accounts*
	Environmentally Extended Input Output Analysis						*Time series analysis of a suite of natural capital accounts*
	Partial Equilibrium models						*Full set of NCA and SNA*
	General equilibrium models						*Full set of NCA and SNA*

From the literature review we distil four general observations about the current direction of policy use of NCA for the SDGs.

Observation 4: There is increasing attention for interlinkages between SDGs, but more for measurement than for management purposes.

As the 2030 Agenda says: "The Sustainable Development Goals and targets are integrated and indivisbile (...)." Indivisible means that SDGs are inter-related and mutually dependent, and must be considered and implemented as a whole. Moreover, Goals and targets are contingent upon one another and influence each other (Pfeiffer et al., 2016). To understand how the SDGs interact, insight in synergies (green in figure 4.2) and trade-offs (red in figure 4.2) between the SDGs is needed.

Figure 4.2 SDG interactions: trade-offs (red) and synergies (green).

Goal	1†	2†	3	4	5	6	7	8	9	10	11*†	12†	13†	14*	15*	16*†	17*
1†																	
2†	0.69																
3	0.84	0.55															
4	0.71	0.51	0.80														
5	-0.07	-0.11	0.17	0.04													
6	0.74	0.63	0.79	0.80	0.09												
7	0.90	0.67	0.85	0.84	0.07	0.83											
8	0.52	0.44	0.60	0.33	0.26	0.46	0.41										
9	0.10	0.22	0.53	0.24	0.25	0.41	0.30	0.56									
10	0.34	0.10	0.24	0.15	0.10	0.25	0.26	0.28	0.19								
11*†	0.74	0.65	0.71	0.80	0.07	0.80	0.80	0.62	0.36	-0.43							
12†	-0.45	-0.40	-0.51	-0.40	-0.04	-0.38	-0.46	-0.42	-0.44	-0.21	-0.44						
13†	-0.53	-0.35	-0.49	-0.39	-0.03	-0.47	-0.49	-0.56	-0.37	-0.33	-0.54	0.66					
14*	0.19	0.09	0.27	0.19	0.31	0.19	0.20	0.32	0.34	-0.14	0.28	-0.09	-0.13				
15*	0.12	-0.03	0.18	0.10	0.27	0.12	0.10	0.20	0.23	-0.27	0.12	-0.02	-0.04	0.37			
16*†	0.16	0.15	0.38	0.29	0.15	0.46	0.33	0.41	0.34	-0.30	0.24	-0.33	-0.23	0.45	0.42		
17*	-0.16	-0.03	0.07	0.15	0.21	0.03	0.10	-0.06	0.22	-0.37	0.34	0.27	0.09	0.35	0.09	n.a.	

Source: https://www.icsu.org/publications/a-guide-to-sdg-interactions-from-science-to-implementation

Indicators do only partly show these synergies and trade-offs. Consequently, what remains underexposed so far is the fact that the SDGs do not make trade-off relationships visible between the economy, the environment and society. The same goes for a country that (heavily) relies on and profits from the natural resources of other countries, and for the effect on future generations – these trade-offs are not explicitly captured by SDGs. Only by comparing indicators for different regions or countries, or over a series of years, trade-offs and synergies can be shown. Attention for the various trade-offs that may arise between economic, environmental and social objectives, as well as between 'here' and 'elsewhere' and between 'now' and 'later' is required for attaining the Sustainable Development Goals.

In the light of this observation, there is an increasing attention for the interrelations between the SDG targets. Research on interlinkages from e.g. ICSU (2017), Zhou and Moinuddin (2017), Niestroy (2016) and Nilsson (2016a, 2016b) shows which SDGs are especially interrelated and reinforce or counteract one another. Zhou and Moinuddin (2017) conclude on the basis of a social network analysis with 108 of the 169 SDG targets that the targets having the strongest links with other targets are those related to:[4]

- agricultural productivity (target 2.3),
- sustainable food production (target 2.6),
- access to safe drinking water (target 6.2),
- access to energy (target 7.1), and
- resilient infrastructure (target 9.1).

For these analyses, in most cases time series data have been taken from global data sets like the Indicator set from the UN Sustainable Development Solutions Network, World Bank Development Indicators, Millennium Development Goals Indicators, Global Health Observatory and the Food and Agricultural Organization statistics.[5] Whether interlinkages are reinforcing,

[4] These targets are the most influential in the sense that they play multiple central roles in terms of having wider connections with other targets by exerting and receiving influences, and place at strategic positions in connecting with other influential targets (Zhou and Moinuddin, 2017). Note that it depends on the scope of your analysis which targets turn out to be central targets that dominate the results in the other targets. For example, the CD-LINKS project focusses on the links between climate change and the SDGs (www.cd-links.org) which results in other dominating targets.

[5] See unsdsn.org, data.worldbank.org/data-catalog/world-development-indicators, mdgs.un.org, www.who.int/gho and www.fao.org/faostat.

counteracting or something in between is based on a network analysis comparing the correlations between each pair of targets.

Individual countries can do similar analyses to assess which targets are central for their situation, if sufficient data are available. As indicated in the previous section, for this, use can be made of the system of national accounts and of the natural capital accounts to estimate a part of the required indicators, if they are available for a sufficiently long series of years and for sufficient natural resources and ecosystem services. To that end, the extent and condition accounts and the supply and use tables show changes in the targets over time, e.g. for targets related to crop production, greenhouse gas emissions, share of renewable energy, protected areas, land cover, water quality, water use intensity or waste generation.

These insights in the interactions among SDG targets show the importance of an integrated approach for SDG implementation and can be used for identifying the central SDG targets. They also reveal the importance of adopting a systems-based problem framing approach and of spanning the boundaries over multiple ministries and multiple scales, issues that may benefit from a process to compile natural capital accounts. After all, experience learns that such an NCA-process can be characterised as a system-based approach that explicitly deals with an institutional reform to allow for more integrated policy making with multiple stakeholders and accountability bodies (Bass et al., 2017). Moreover, measuring interlinkages provides evidence about the policy themes that should be prioritized because of their reinforcing effects on various targets and about the themes for which attention should be paid to counteracting effects. These measurements, however, only provide a starting point for learning which policy instruments or governance arrangements are useful for managing these synergies and preventing trade-offs. They do not foster change. Additional policy analyses are needed to assess the effects of the various policy instruments available.

Observation 5: The methods currently promoted for assessing the SDGs, seem to pay limited attention to the potential uses of NCA and the accounts most needed for this.
Since the adoption of the SDGs, several UN organisations as well as a number of other consortia have developed model suites to analyse the SDGs and assess the effects of SDG policies. These examples all attempt to promote a more systems-based approach in the SDG process and span the boundaries of the SDG process over the different scales and institutes that are at stake. They can also be used to show the importance of including multiple stakeholders in the process and adapt existing policies to better consider their system-wide effects. We discuss three examples. UN-DESA has developed a suite of tools to address inter-linkages that influence trade-offs and synergies between sustainable development policies, including the SDGs – see un-desa-modelling.github.io. These include economic models, environmental models, integrated assessment analyses and system dynamics models that rely on social accounting matrices. Furthermore, the UN Development Group provides an SDG Acceleration Toolkit, which provides a suite of models and system-level diagnostics for analysing interconnections among SDGs – see undg.org/2030-agenda/sdg-acceleration-toolkit. This also contains a tool focussing on the water-energy-food nexus and a dynamic social accounting matrix approach to explore interrelations between investment planning and economic and environmental SDGs. A third example of an integrative approach that is capable of analysing and elucidating the dynamic effects of interdependencies, and that is grounded in systems thinking, is the iSDGS model from the Millennium Institute and the Stockholm Resilience Centre (Collste et al., 2017; see www.isdgs.org). This model is also based on a social accounting matrix to simulate economic flows and balance supply and demand and its environment modules track pollution due to production processes and assesses renewable and non-renewable natural resource use and environmental degradation. All three modelling

approaches mentioned above are used for national level assessments focussing on development planning and policy questions related to the SDGs.

Even though for most of these model suites, the natural capital accounts can almost readily be incorporated in the social accounting matrices, or provide otherwise useful information for the models or approaches, e.g. through some of the physical flow or asset accounts on CO_2 emissions, water, energy or materials use, most of them do not mention the potential use of these accounts. It is not that the model suites do not recognize this potential, but they are not developed for it in the first place. The supply and use tables are especially suitable for these modelling exercises given their direct link with the system of national accounts and the social accounting matrix that is the basis of many of the modelling approaches. Yet, as long as countries lack natural capital accounts, or focus on extent, condition or thematic accounts instead of supply and use tables, other sources of information are needed on trends and uses of natural capital by the economic sectors.

Observation 6: Within the SDG-processes there seems to be limited attention for the methods that most closely relate to the setup of NCA.
Of the methods listed above, footprint analysis, input-output analysis (IO) and general equilibrium analysis (GE) are the methods most closely related to the setup of the natural capital accounts. Their data needs are consistent with the setup of the supply and use tables. A literature search shows that, currently, these methods are used relatively little for assessing SDG policies. The main reason for this is that the SDGs are launched in 2015 and it requires time to gear the models to the sustainability issues at hand. Clearly, finding a 'match' between appropriate methods and the reality of SDGs, in order to solve practical problems, is a time consuming process.

It is to be expected that more material footprint analyses will emerge in the coming years as for SDG 8 and SDG 12, on economic growth and on responsible consumption and production, indicators are proposed on the material footprint (see e.g. Statistics Sweden, 2016). Besides that, the ecological, carbon, water or biodiversity footprints are also useful for monitoring targets related to SDG 6 on water, SDG 13 on climate action and SDG 15 on life on land. These footprint indicators show the links between consumption or production and the environment and are helpful for prioritizing and targeting SDG policies (see e.g. Hoekstra et al., 2017, Wilting et al., 2017), but so far their use for monitoring the SDGs remains relatively modest. For these footprint analyses, the supply and use tables linked to the system of national accounts can be used to relate intermediate resource use and emission to end users (Edens et al., 2015).

Also for IO and GE models focussing on natural resources, use can be made of the natural capital accounts. The environmentally extended input-output table or the environmentally extended social accounting matrix used in a GE model is based on the supply and use tables from the natural capital accounts. Moreover, some of the constraints in the model need data from the extent accounts. The use of IO and GE models for resource related issues is not new, but the availability of NCA makes it easier to set up models that are also capable of analysing the interrelations between the economy and natural capital. IO analysis is not applied much for analysing SDGs so far, even though UN ESCAP (2015) promotes its use. They are easier to set up than an GE model and provide good first order estimates of the effects of changes in demand, technological growth or economic instruments. A growing number of GE models is used for analysing at a national or regional level the environmental and economic effects of SDG related policy choices. Examples include the IEEM model (Banerjee et al., 2016) and the Inclusive Green Economy Model (IGEM) from the UNEP Partnership for Action on Green

Economy (PAGE).[6] The IEEM model is for example used to assess the interlinkages between policies related to food security, sustainable agriculture and water and sanitation in Guatemala (Banerjee et al., 2017) and the relation between sustainable park management and tourism in Rwanda. IGEM is an instrument to achieve transition to inclusive green growth and delivering on the SDGs. It has been used amongst others in Peru to assess policies to reach sustainable development, diversify the economy and create employment.[7]

The above methods, rely especially on the supply and use tables of the natural capital accounts. An example of a widely applied approach that can use the extent and condition accounts, is the InVEST model.[8] InVEST uses land use maps and information on e.g. soil, water and erosion that can be taken from the extent and condition accounts, to assess in a spatially-explicit way the consequences of alternative land use choices and to identify areas where investments in natural capital can enhance human development and conservation. An example where InVEST is used for an analysis of SDGs is the Myanmar Natural Capital Assessment that used it for multiple scale development planning and for strategic environmental assessment (Mandle et al., 2016). Moreover, the Green Growth Knowledge Platform (Narloch et al., 2016) and the WAVES Forest Accounting Sourcebook (WAVES , 2017) mention InVEST as a tool for ecosystem services modelling and valuation that can be based on NCA information and used for SDG assessment.

These examples illustrate a growing number of methods that directly depend on NCA – whether it are the supply and use tables or the extent and condition accounts – that are particularly suitable for analysing the natural capital related SDGs. Especially the IO and GE models are equally suitable for analysing the economic and socially oriented SDGs. The disadvantage of these approaches is, however, that they require analytical skills and that it takes time to set up these methods and to come to policy ready results. Many statistical agencies nor policy makers have the skills or time for this, due to which the tasks has to be taken by other institutes. In practice, you see many international organisations taking up this task, but to come to actual policy use of these modelling results it is important that also national research institutes or universities have the skills and resources for such analyses. A growing awareness about the potential value of these approaches in the SDG processes may provide triggers to further develop and spread the existing approaches mentioned above.

Observation 7: There is an unexploited potential of NCA based methods that are helpful in the different stages of the SDG policy process.

Next to the above mentioned methods, there is an unexploited potential of methods that can help different stages of the SDG process. The stage of problem identification and policy monitoring can be strengthened by backward looking analyses like **trend analysis** and forward looking exercises such as **trend extrapolations**. For this, time series are needed for the different indicators. As many countries do not yet have a sufficiently long time series of accounts, they are currently not used to their full potential. If not available from natural capital accounts, other sources are used for obtaining trend analysis, like the UN Global Indicators Database, the World Bank World Development Indicators or OECD databases. Also for international comparisons, nowadays, such global data sets are used. Also **scenario analysis** may provide further insight into potential synergies and trade-offs between various goals and targets (Joshi et al., 2015; Lucas et al., 2016). Scenario analysis shows the need for horizontal policy integration to reach coherence between the different SDGs. For scenario analysis, use

[6] An example of a GE model at a global scale is the IFPRI model for analysing the water-energy-food nexus (see e.g. Willenbockel, 2016) that is used to assess the impact of climate change mitigation scenarios on energy prices, economic growth, food security and water availability.
[7] See www.greengrowthknowledge.org/sites/default/files/IGEM%20Webinar%20Final.pdf, accesses 25-10-2017.
8 See www.naturalcapitalproject.org

can be made of the different natural capital accounts to predict natural capital developments for given scenario assumptions, but if not available, other data sources and assumptions can be used as well. Use can also be made of the analytical methods discussed in this section to evaluate the economic and environmental consequences of different scenarios assumptions. For reviewing policies, **econometric analysis** can be used to look backwards at the causality of relations between certain interventions and for example economic and natural capital developments. For such analysis the micro-level data underlying the accounts are necessary. The aggregate accounts aren't useful for such analyses.

So, material and resource accounts can be used for all these analyses. However, as not many countries already have enough accounts available for a sufficiently long period of time, so far, for most studies other ways to order data are used, mostly based on international data sets. Due to the coherence of the SEEA-framework its reliability is higher, however, and NCA better shows the extent of the linkages between sector activities and resource use and the economic, environmental and social consequences of changes therein. These insights are important for reaching SDG policy coherence.

5 Institutional process

Chapter 5 is still preliminary due to difficulties of getting the interviews organized. During the forum, we plan to interview more people to learn more about the institutional side of the use of NCA in the SDG process.

In this chapter, we focus on the institutional challenges that may prevent to shape an enabling environment in which NCA can help to improve policies directed at achieving the SDGs. To this end, we carried out a limited internet search and document review, and performed two interviews with resource persons. The interviews aimed to get a better understanding of the current status of implementing the SDGs in South Africa. We illustrate what difficulties the SDG process faces at the country level, and particularly the challenges they face around the availability and quality of data and statistics and data sharing mechanisms.

SDGs in South Africa

South Africa is a middle-income country with a GDP per-capita of USD$13,300 in 2016 and GDP growth was estimated 0.3% in 2016, down from an estimated 1.7 in 2014. The slowdown of economic growth impedes the country's efforts to address the huge challenges South Africa faces: unemployment, poverty, and inequality. Moreover, Reuter et al. (2016) reports that 34% of terrestrial ecosystems, 65% of marine bio zones, 80% of wetlands and 82% of rivers are under degradation threat. Prolonged droughts and water scarcity are among major environmental hazards. The impacts of climate change will further aggravate degradation.

South Africa aligned the SDGs with its National Development Plan (NDP 2030), which was affirmed in 2015. The development of the NDP 2030 involved a broad multi-stakeholder consultation process and provides a long-term strategic framework within which detailed planning takes place. The plan aims that all South Africans attain a decent standard of living through elimination of poverty and reduction of inequality by 2030. A range of national policies contributes to the implementation of the NDP 2030. Examples include the so-called Operation Phaksia to fast track the implementation of solutions on development issues highlighted in the NDP 2030, and policies underlying green economy planning such as New Growth Path. It also provides a framework for other plans of national, provincial and local

government. The NDP 2030 itself is not a legal document and so called delivery agreements signed by sectoral ministers and the President of South Africa drive its implementation. The implementation is led by Secretariat of the National Planning Commission, which is housed in the Department of Planning, Monitoring and Implementation (DPME) in the Presidency.

Main institutional challenges

The previous showed that the government of South Africa promotes SDG implementation through its NDP 2030 and related policies (see Statistics South Africa, 2017). The implementation itself, however, appears to be hampered by a broad number of institutional hurdles. According to the information obtained from the interviews, these include:

- Limited human and budgetary capacities for the implementation of policy, plans and programmes through all spheres of government, due to low economic growth.
- Poor coordination and integration of programme implementation.
- Shortage of skills in key sectors of the economy, which limits sustainable development.
- Data to support the monitoring of implementation NDP programmes is weak or non-existent. Data gaps on key NDP programmes exist or the data available is of poor or unknown quality. For example only 62% of Tier I and Tier II SDG indicators could be reported on, and many of them only as proxy indicators or qualitative, and where quantitative data exist they may not be reported on as regularly as is required.

Evidence suggests that South Africa needs better data and a culture of measurement in the public sector, with people who have the necessary skills that will ensure that the national development programmes will have a measurement component built into the programme to enable monitoring the efficacy of policy-decisions. Moreover, failure to comply with governance arrangements to foster integrated implementation, monitoring and review of the NDP 2030 on the part of sectoral departments are without consequences. No sanctions can be imposed by the lead agency DPME to enforce compliance and participation. In reality, implementation of the NDP seems to be still fragmented and uncoordinated.

Use of NCA

Both environmental accounting and ecosystem accounting play a pivot role for NCA application in South Africa. Resource persons suggested that data and information on ecosystems is quite strong, but that ecosystem accounting is in its early days. Main agencies currently involved in ecosystem accounting (i.e. ecosystem assets and services) are Statistics South Africa (Stats SA), South African National Biodiversity Institute (SANBI), Council for Scientific and Industrial Research (CSIR), Department Water and Sanitation (DWS), Department of Environmental Affairs (DEA) and the provincial conservation authority Ezemvelo KZN Wildlife. Environmental accounting (i.e. individual environmental assets: renewable and non-renewable and biotic and abiotic), also called environmental-economic accounting in South Africa include energy, fisheries and minerals. A water account is underway. Various governmental bodies play a role in natural capital accounting (see Table 5.1), showing that available information and datasets are restricted to natural resource accounts produced by Stats SA and specific fields (i.e. land-cover, fish stocks, biodiversity, ecosystem services and water quality and water levels in dams).

In 2014, South Africa joined six other pilot countries involved in the global initiative called Advancing SEEA Experimental Ecosystem Accounting (see textbox “Ecosystem accounting in KwaZulu-Natal”), led by the United Nations Statistical Division (UNDS).

Table 5.1: Roles of governmental bodies in natural capital accounting

Ministry/Agency	Notes
Agriculture	
Agricultural Research Council	Established procedural guidelines for the implementation of a long-term land-cover updating and change monitoring program for South Africa.
Environment	
Department of Agriculture, Forestry, and Fisheries (DAFF-Fisheries)	Collects fish stock data for over 200 species and provides data for fisheries accounts.
Department of Environmental Affairs and Tourism (DEA/DEAT)	Performs the role of lead agent in environmental governance. Conducted a baseline valuation report on biodiversity and ecosystem services in 2012. *Involved in Ecosystem Accounting efforts*.
South Africa National Biodiversity Institute (SANBI)	Led the National Biodiversity Assessment of 2011. *Involved in Ecosystem Accounting efforts.*
Planning/Science	
Council for Scientific and Industrial Research (CSIR)	Established procedural guidelines for the implementation of a long-term land-cover updating and change monitoring program for South Africa. *Involved in Ecosystem Accounting efforts*.
Statistics/Finance	
Statistics South Africa	Produces South Africa's natural resource accounts. *Involved in Ecosystem Accounting efforts*.
Treasury	Works with the UNDP BIOFIN program.
Water	
Department of Water Affairs and Forestry (DWAF)	National monitoring programs for chemical water quality and water levels in dams.
Department of Water and Sanitation	*Involved in Ecosystem Accounting efforts*.
Wildlife/Biodiversity	
South African National Parks	Assisted with the National Biodiversity Assessment.
Ezemvelo KZN Wildlife	*Involved in Ecosystem Accounting efforts*.

Source: Reuter et al. 2016:146.

Ecosystem accounting in KwaZulu-Natal

KwaZulu-Natal was selected as a provincial pilot in South Africa, because of the availability of high quality land cover data over several years and availability of maps of vegetation types. National leading agencies are the South African National Biodiversity Institute (SANBI) and Statistics South Africa (Stats SA), working in partnership with national departments and the provincial conservation authority Ezemvelo KZN Wildlife. The initiative goes together with a broad stakeholder consultation for discussing the results, including government, civil society, academic and private organisations. Stats SA, is recognized as key partner for land and ecosystem accounting, building on their existing work on environmental accounting.

The same data foundations are used for Ecosystem Accounting and National Biodiversity Assessment (NBA). National Biodiversity Assessments (2004, 2011 and 2018) assessed ecosystems and species across the country, in the terrestrial, inland water and marine realms. An example of how NBA data sets are being used is mapping and classification of ecosystem types – these provide the foundation for ecosystem assessment and headline ecosystem indicators for the country, and for ecosystem accounts.

Source: Interviews and Driver et al. (2015)

From the interviews we learned that that the added value of NCA, includes:

- Strengthening and bringing rigour to the foundational data for the National Biodiversity Assessments, for example by requiring consistent time series data or land cover.
- Facilitating to identify data gaps.
- Facilitating to integrate social, economic and environmental data and information.
- Strengthening ecosystem condition and extent into national planning processes because accounting framework is appealing to policymakers.

General obervations from South Africa

The example from South Africa shows that NCA still plays a very limited role in national policy and in the national development plan in particular. There remain several challenges that prevent an enabling institutional environment in which NCA can help to improve policies directed at achieving SDGs. The example shows that implementation of NCA and the national development plan are hampered by a poor availability and quality of data, insufficient staff with the necessary skills, and lead agencies lacking the authority to enforce data sharing. From the experiences in South Africa we learn that setting up natural capital accounts can be helpful to enforce enabling institutional conditions as NCA brings rigour to foundational data, strengthens statistical skills and appeals to policy makers due to their direct link with the national accounts. Moreover, we also observe that the NCA and national SDG processes can benefit from one another as both use a system-based policy frame and need collaboration beyond departmental and organisational boundaries. Therefore, NCA implementation activities should not be limited to criteria's, methods, and techniques, but should cover governance issues as well, to create shared ownership, institutional cooperation, to involve those who use the accounts and to create a demand-led NCA process. This helps to develop an enabling institutional environment in which NCA can provide the evidence-base needed for designing national SDG policies.

6 Conclusions and steps forward

In this discussion note we provide a brief overview of current and potential uses of NCA in national SDG policy processes. On the basis of a literature review and a number of interviews, we investigate which developments take place to design and implement evidence-based SDG policies and what role NCA currently plays or can potentially play herein. Moreover, we examine which institutional hurdles prevent to shape an enabling environment in which NCA can help to improve national policies directed at achieving SDGs. This discussion note provides a number of observations that are relevant for bringing NCA application in the SDG process a step forward.

From the review, we learn that NCA has the potential to measure several SDG indicators, and especially those related to natural capital (SDG 6, 13, 14 and 15), but also some related to sustainable production and consumption (SDG 2 and 12), energy (SDG 7), economic growth (SDG 8) and sustainable cities (SDG 11). Biophysical systems that underpin sustainable development are crucial for these economic and socially oriented SDGs, and conversely, human-induced activities strongly influence the biophysical systems. Most attention so far has been paid to measuring status and trends towards achieving an (environmental) target. Less attention seems to go to help countries with developing implementation strategies for achieving the SDGs. This has resulted in a more top-down process to monitor the progress of SDGs by using existing NCA, and less to cross cutting and bottom up actions that use the accounts and indicators for developing or improving policy processes.

We observe an increasing attention for analysing interlinkages between SDGs, but more focussing on monitoring and awareness raising, and less on linking or embedding existing policies to the SDG agenda or creating new policies that focus more on synergies between the SDGs. So far, the methods promoted for assessing the SDGs, pay limited attention to the

potential uses of NCA. Due to its integrated approach, capable of showing inter-linkages between the economy, the environment and society, NCA can potentially serve as a useful input in a broad range of analytical tools. This potential seems to be underexploited, and especially the methods that most closely relate to the setup of NCA – footprint analysis, input-output analysis and general equilibrium analysis – are so far not broadly advertised, even though their use is growing. Given its coherent, structured and system-based set up, NCA can help the SDG process by promoting a system-based approach and an institutional reform towards more integrated policy making with multiple stakeholders and accountability bodies.

As illustrated by the case of South Africa, there exist several institutional challenges that need to be addressed to increase the role of NCA in and its contribution to SDG implementation, monitoring and review. The challenges include a poor coordination and siloed implementation of NCA-related activities, scattered or non-existent data that are often of poor quality or not shared with others, and a lack of skills to use data to their full potential. These hurdles are certainly not unique for South Africa, but apply to many more countries. NCA is helpful to some of these hurdles as it brings methodological rigour to foundational data, strengthens statistical skills, and appeals to policy makers due to their direct link with the national accounts. Moreover, building a NCA capable of pinpointing countries' progress against the SDGs and analysing the policies to achieve the SDGs will demand investment in capacity and skills across the entire spectrum–from conceiving and collecting data to interpreting and communicating them clearly, and making them open and accessible to all. It is clear that this discussion note has not been exhaustive in that respect.

From this, we learn that there is an unexploited potential to use NCA within SDG policy processes. Despite the need for further developments, indicators and analytical methods to support the SDG process exist and are waiting for countries to develop their natural capital accounts, such that they can be used to analyse new or improve upon existing SDG policies. It is, however, unlikely, that this will happen overnight. Step by step increasing the use of NCA for SDG policies, requires a number of developments. First, it requires national SDG policy processes that move beyond monitoring but that look at synergies and trade-offs, that cross borders of ministries and scales, that allow for learning by doing and that create conditions to foster transition to a system of integrated SDG policy making. Here the SDG and NCA development processes can go hand in hand. Both processes go beyond the mandate or competencies of one single institution or ministry, but require skilled institutions collecting data and compiling accounts, and requires strong political support and the political will to promote evidence-based policy making and cross institutional boundaries. In most WAVES and UNSD partner countries, the NCA process is set up in such a way, with high-level support, cooperation and a clear allocation of tasks between participating agencies.

Second, for using NCA as well as for analyzing the SDGs, it is a prerequisite that institutions participate that are capable of applying these analytical methods and that have the competencies to produce policy-ready and easily communicable messages. For this, we need not analyze all SDG interactions from the beginning, but countries can start from those that are most relevant for them. This guides the accounts that have to be set up first, the policy questions that should be raised first, the types of analysis that are needed first and the governance arrangements from which countries start. For this, countries do not have to re-invent the wheel over and over, but can use experiences from other countries. Special emphasis should be put to communicating results. Graphically presenting indicators is easy, but it is more challenging to present analytical results in an understandable and attractive way that enables policy makers to understand the use of the accounts and raise the right questions, that enables analysists to do the analysis needed and that helps statistical agencies to compile the right type of accounts.

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