

# Towards Integration at Last? The Sustainable Development Goals as a Network of Targets

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## ABSTRACT

In 2014, United Nations member states proposed a set of Sustainable Development Goals (SDGs), which will succeed the Millennium Development Goals (MDGs) as reference goals for the international development community for the period 2015–2030. The proposed goals and targets can be seen as a network, in which links among goals exist through targets that refer to multiple goals. Using network analysis techniques, we show that some thematic areas covered by the SDGs are well connected with one another. Other parts of the network have weaker connections with the rest of the system. The SDGs as a whole are a more integrated system than the MDGs were, which may facilitate policy integration across sectors. However, many of the links among goals that have been documented in biophysical, economic and social dimensions are not explicitly reflected in the SDGs. Beyond the added visibility that the SDGs provide to links among thematic areas, attempts at policy integration across various areas will have to be based on studies of the biophysical, social and economic systems at appropriate scales. Copyright © 2015 John Wiley & Sons, Ltd and ERP Environment

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## Introduction

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**I**N 2014, FOLLOWING A DECISION TAKEN AT THE RIO+20 CONFERENCE AND AFTER MORE THAN A YEAR OF INTERGOVERNMENTAL work of what was called an Open Working Group, United Nations member states proposed a set of Sustainable Development Goals or SDGs (United Nations, 2014a). The SDGs will succeed the Millennium Development Goals (MDGs) as reference goals for the international community for the period 2015–2030. The development of the new set of goals was widely seen as an ambitious challenge, as these goals cover a much broader range of issues than their predecessors, aim to be universal – that is, applicable to all countries and not only developing countries – and have to serve as guideposts for a difficult transition to sustainable development, which has eluded the international community since the Earth Summit in 1992.

Lack of integration across sectors in terms of strategies, policies and implementation has long been perceived as one of the main pitfalls of previous approaches to sustainable development. Insufficient understanding of and accounting for trade-offs and synergies across sectors have resulted in incoherent policies, adverse impacts of devel-

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opment policies focused on specific sectors on other sectors, and ultimately in diverging outcomes and trends across broad objectives for sustainable development. In terms of the MDGs, for example, it is well acknowledged that many of the targets encapsulated in MDG7, which relates to environmental protection, have not been achieved and have in some cases been negatively impacted by policies and actions aiming to achieve other goals (United Nations, 2014b; UNEP, 2012). Correspondingly, achieving greater integration at various levels was a core concern of the international community at the Rio+20 conference, held on the 20th anniversary of the Earth Summit, and this is reflected in the outcome of the conference (United Nations, 2012).

More broadly, previous development agendas have been criticized for failing to fully integrate the key dimension of sustainable consumption and production (SCP), which has been identified since the first Earth Summit as a key ingredient of sustainable development paths. The political difficulty of addressing SCP issues, as well as its weak institutional anchoring due to its cross-cutting and systemic nature and lack of grounding of SCP considerations in other sector policies, have contributed to this outcome (Victor, 2008; Jackson, 2010; United Nations, 2011).

This article explores the extent to which the structure of the proposed goals and associated targets does indeed reflect the objective of better integration across sectors. The proposed goals and targets can be seen as a network, in which links among goals exist through targets that explicitly refer to multiple goals. The objective is to show where links between goals were made by the political process that created the SDGs. The resulting network and mapping, which reflect the results of negotiations in an intergovernmental context, can be thought of as a 'political mapping' of the sustainable development universe, as opposed to, for example, a mapping purely based on natural and social science insights about how the system works (see below).

Using network analysis techniques, I show how the SDGs seen through this lens are unequally connected, with some goals being connected to many other goals through multiple targets, while other goals are weakly connected to the rest of the system. I show that two of the proposed goals, SDG 12 on sustainable consumption and production (SCP) and SDG 10 on inequality, provide critical connections among other goals and make the SDGs more tightly linked as a network.

The presence in the set of SDGs of targets that refer to multiple goals and sectors may facilitate integration and policy coherence across sectors, in particular at the level of international development agencies. Such links among goals through targets may also facilitate real mainstreaming of dimensions that previously suffered from not having strong sectoral anchoring in development institutions, such as sustainable consumption and production. However, important links that exist among sustainable development areas through the biophysical, social and economic systems are not explicitly reflected in the proposed SDGs.

The remainder of this paper is constructed as follows. The following section describes the methodology used for the analysis. In the next section, I present the mapping of the SDGs as a network of related targets. The fourth section discusses the implication of the structure of the SDGs for cross-sectoral integration. The fifth section highlights some of the differences between the mapping presented here and other mappings of the sustainable development universe based on biophysical and socio-economic realities. The sixth section concludes.

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## Methodology

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As discussed above, the goals and targets proposed by the Open Working Group can be seen as a network, with links among goals through the targets.

The proposal of the Open Working Group comes in the form of 17 goals, with several targets under each goal, amounting to a total of 169 targets. The basis for the analysis presented here is a matrix that links every target of the SDGs to all the goals to which its wording refers. Thus, each target, in addition to being linked with its own goal, may be linked to other goals. To take an example, target 12.4 under goal 12 of the SDGs, 'Ensure sustainable consumption and production patterns', states 'by 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment'.

This target explicitly refers to health, and is recorded as being linked to SDG 3, which reads: 'Goal 3. Ensure healthy lives and promote well-being for all at all ages'.

A particularity of the SDGs as proposed by the Open Working Group is that under each of the goals some of the proposed targets relate to the so-called 'means of implementation' (in the sustainable development legislation that has come out of the Earth Summit, this term tends to encompass finance, trade, technology transfer and capacity building). A dedicated goal, SDG 17, was also dedicated to cross-cutting means of implementation for the whole set of SDGs. For the purpose of this paper, all the targets related to means of implementation are discarded from the analysis. This restriction leaves us with 107 targets under 16 goals (all the SDGs except goal 17).<sup>1</sup> One reason is that we want to focus on links between thematic areas. Another reason is that it is difficult to apply the methodology described above to targets relating to means of implementation. This is not, of course, to say that means of implementation across the set of SDGs do not deserve an analysis of their own. Additionally, links among goals could be created through means of implementation.

This method, while seemingly straightforward, is of course subject to different interpretations of the wording of the targets. For example, whether a target referring to 'hygiene' is recorded as having a link to the health goal depends on whether one considers that hygiene clearly and explicitly belongs to the health area. This implies that the matrix which is the basis for the network analysis may vary slightly according to the sensibility of the coder. However, the number of cases that are open for interpretation is, from experience, relatively limited. The coding of the links between targets and goals was re-examined several times by the author and reviewed by another person, in order to ensure that the same criteria for deciding on the presence of links were applied as uniformly as possible across targets. In addition, the author checked that different coding of the few 'borderline' cases does not distort the picture that is presented here in a significant manner. Nonetheless, it is good to keep this caveat in mind when looking at the results presented below.

Once the matrix of links is created, it is used as the basis for two-mode network analysis (de Nooy *et al.*, 2005). Maps and graphs presented later are derived from simple network analysis techniques.

It is worth emphasizing that the mapping here is not based on consideration of important e.g. economic or physical links between goal areas (for example, between energy use and climate change), but purely on the wording of the targets. Indeed, one of the main pitfalls that one encounters when establishing the matrix of links is to avoid inferring links that are obvious from socio-economic or physical considerations but are not made in the SDGs themselves. In the section 'Where Are the Gaps?' we come back to the difference between these two types of mapping.

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## The SDGs as a Network of Targets

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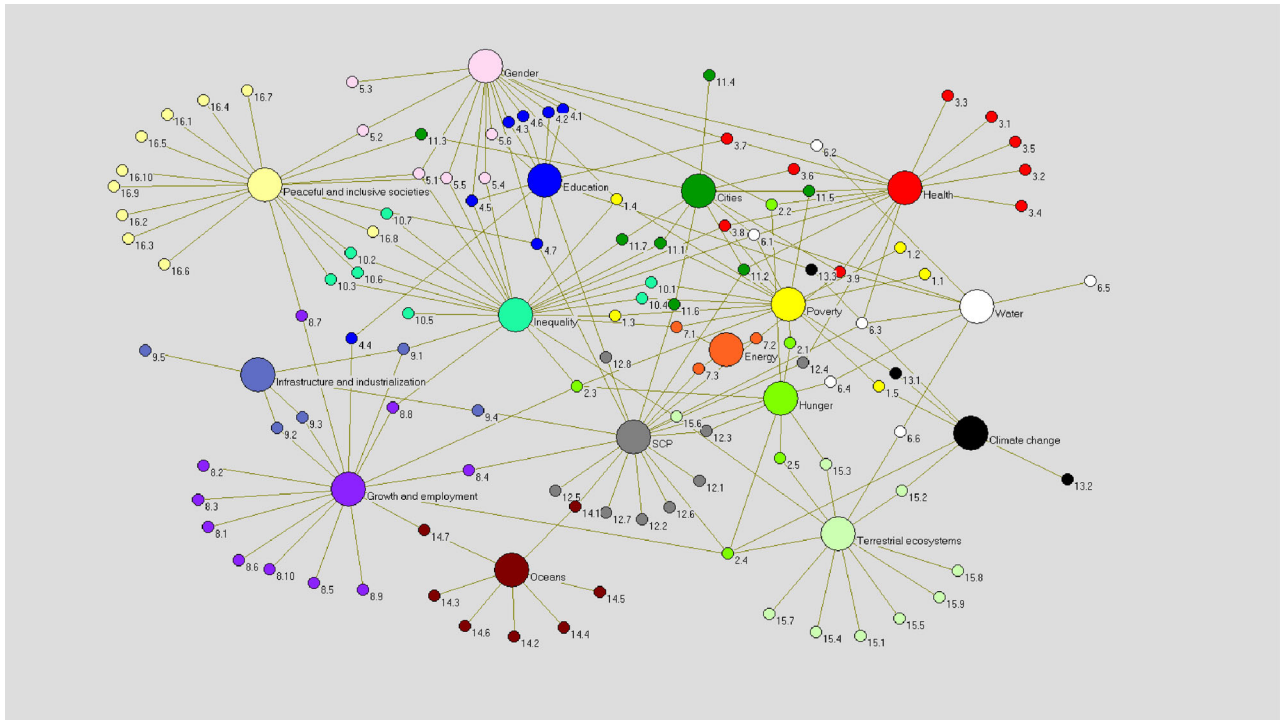
The map of the SDGs as a network of targets is shown in Figure 1. The 16 SDGs are represented as larger circles of differing colors, while targets are shown as smaller circles and have the color of the goal under which they figure. For readability reasons, on this general map the targets are labelled with their numbers as in the report of the Open Working Group. More explicit labels are used below when we examine specific areas of the map. Around each SDG, a number of targets are linked only to that goal, giving rise to flower-like structures around the goals. Other targets are linked with more than their own goal and provide the structure of the network.

Out of the 107 targets, 60 explicitly refer to at least one other goal than the one to which they belong. 19 targets link three goals or more. Such targets create indirect, or 'third party' links among goals. For example, target 3.8 under SDG 3, which relates to achieving universal health coverage, refers to both inequality and poverty. It is therefore counted as a link between SDG 10 and SDG 1, even though it does not belong to either goal.<sup>2</sup> Such indirect links are included in all the counts of links among goals provided below.

The map conveys a sense of an unequally knit network, with some goals being linked to many other goals, while others have fewer links with the rest of the network. At first sight, the map is reminiscent of traditional 'core-periphery' structures, as have been identified in other contexts (e.g. for international trade). While we do

<sup>1</sup>See Table 1 later for a list of the SDGs.

<sup>2</sup>For other examples, refer to Figures 3 and 4 later.



Source: author's elaboration.

**Figure 1.** The SDGs as a network of targets

not push the comparison here, it is clear that inequality, SCP, poverty, hunger and education belong to the 'core' of the SDG network as defined here.

Table 1 and Figure 2 provide more aggregate pictures of the links among goals. Table 1 ranks the 16 goals according to the number of other goals to which they are linked. SCP, inequality, poverty and growth and employment top the list and all have links with 10 other goals or more. At the bottom of the list are energy (three links), infrastructure and industrialization (three links) and oceans (two links). In between, SDGs 2, 3, 4, 5, 6, 11, 13, 15 and 16 are all connected to six to eight other goals, either directly or indirectly.

Figure 2, which is a one-mode reduction of the initial network, provides an additional perspective by showing the strengths of the links among the goals. The thicker the link between two goals on the map, the more targets are linking the two goals, directly or through a third goal. The thickest links are between gender and education (SDGs 4 and 5) and between poverty and inequality (SDGs 1 and 10). There are also strong connections between SDG 10 and SDG 16 on peaceful and inclusive societies. Figure 2 once again highlights the centrality of SDGs 10 and 12 on inequality and SCP.

We now describe in more detail the links that exist within the network, focusing on SDG 12 (SCP) and SDG 10 (inequality). For this, we focus on a particular SDG and extract from the broader network the targets with which the goal is linked, as well as the goals to which such targets belong. The results of this reduction for SDGs 12 and 10 are shown in Figures 3 and 4 respectively.

Focusing first on SDG 12, the map shows where the connections with other goals come from. Interestingly, most of the links come from targets that are listed under other goals. For example, the links between SCP and SDG 6 on water are provided by two targets under the water goal: Target 6.3, 'By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally', and Target 6.4, 'By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity, and substantially reduce the number of people suffering from water scarcity'. This means

Rank	SDG	Number of other goals to which the goal is connected
1	12. Ensure sustainable consumption and production patterns	14
2	10. Reduce inequality within and among countries	12
3	1. End poverty in all its forms everywhere	10
4	8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	10
5	2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	8
6	3. Ensure healthy lives and promote well-being for all at all ages	8
7	5. Achieve gender equality and empower all women and girls	8
8	4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	7
9	6. Ensure availability and sustainable management of water and sanitation for all	7
10	11. Make cities and human settlements inclusive, safe, resilient and sustainable	6
11	13. Take urgent action to combat climate change and its impacts	6
12	15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	6
13	16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	6
14	7. Ensure access to affordable, reliable, sustainable and modern energy for all	3
15	9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	3
16	14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	2

**Table 1.** Links between the SDGs through targets: an aggregated picture

Source: author's elaboration.

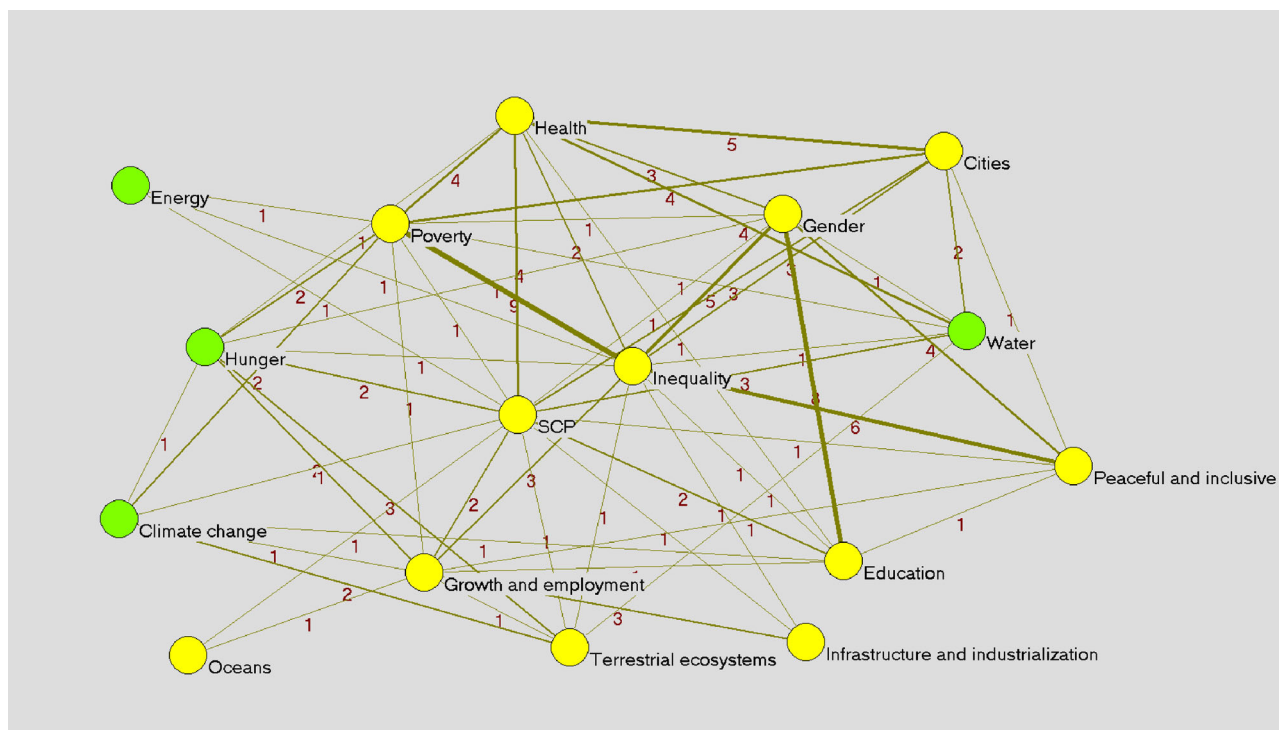
that SCP-related concerns are factored into targets belonging to other goals. Importantly, SCP is linked with SDG 8 on growth and employment through Target 8.4, 'Improve progressively through 2030 global resource efficiency in consumption and production, and endeavour to decouple economic growth from environmental degradation in accordance with the 10-year framework of programmes on sustainable consumption and production with developed countries taking the lead'.

Turning to SDG 10, Figure 4 shows a similar pattern, indicating that many targets referencing inequality are listed under other goals. Of note is the strong link between inequality and peaceful and inclusive societies (SDG 16), with no fewer than six targets explicitly linking the two, including two from SDG 5 on gender. As can be seen in Figure 2, the strongest numbers of links is with the poverty goal, with nine links in total. What is interesting is that most of the links between SDG 10 and SDG 1 are through universal access targets on energy, water, health, housing and green space and equal access to resources, which are listed under other goals.

## The SDGs as an Enabler for Integration?

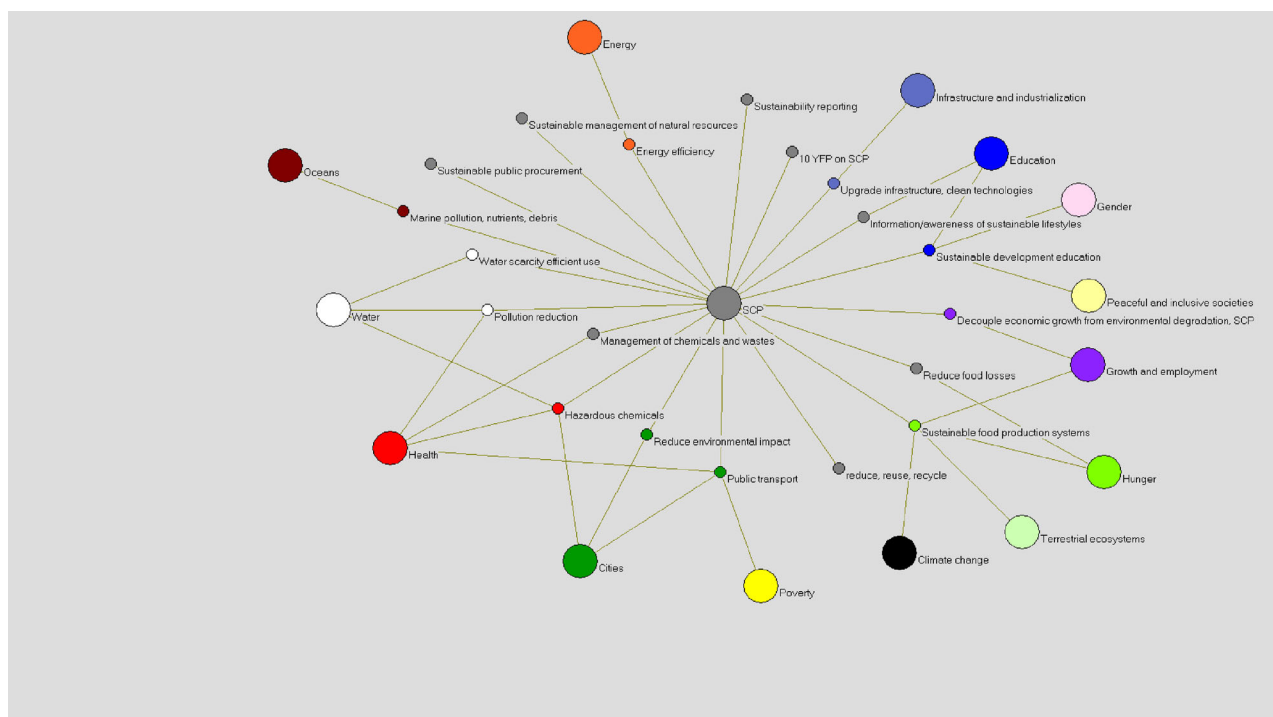
Internationally agreed goals and target have both a political value and an instrumental value. For institutions tasked with the monitoring and reviewing of the international development agenda and for the international community





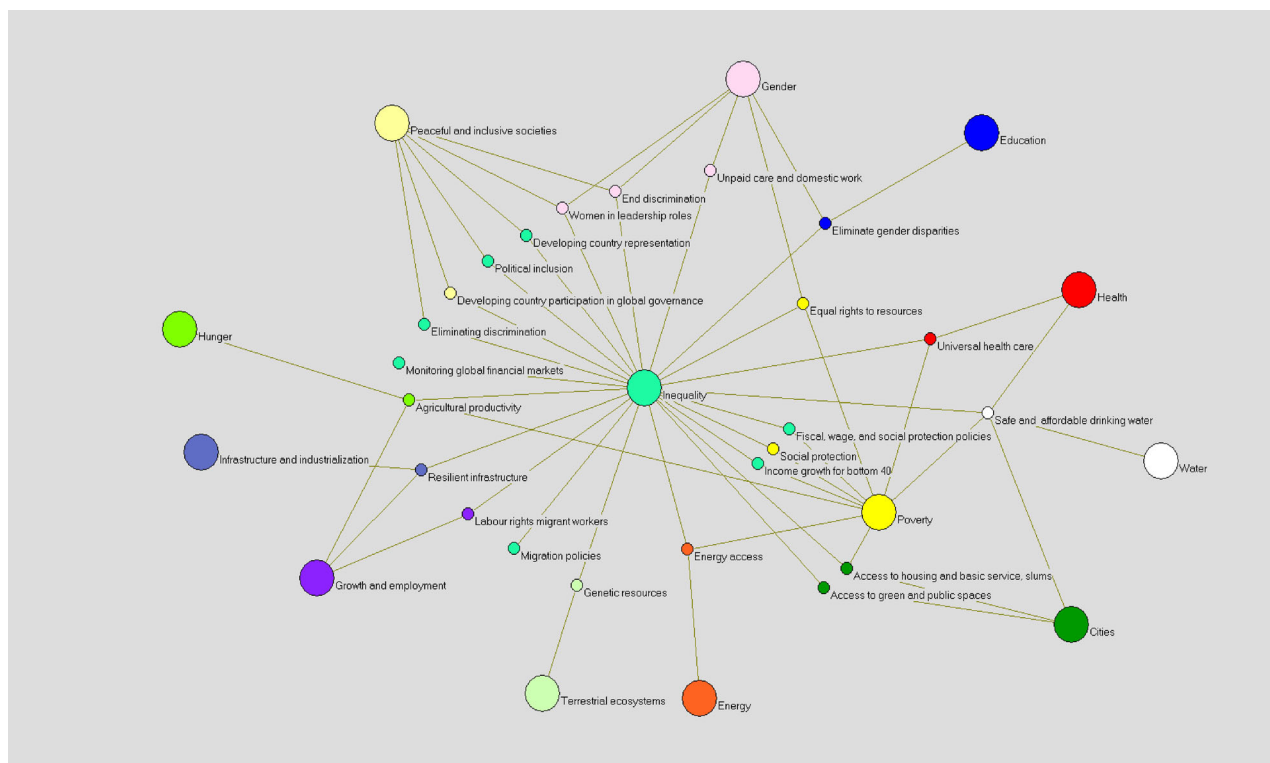
Source: author's elaboration.

**Figure 2.** Links between the SDGs through targets: an aggregated picture



Source: author's elaboration.

**Figure 3.** Links among SDG 12 (SCP) and other goals



Source: author's elaboration.

**Figure 4.** Links among SDG 10 (inequality) and other goals

that they serve, the goals and targets become a common benchmark against which the course of the human enterprise can be assessed, and provide the basis for cooperation and accountability among nations to achieve a common vision. For development institutions that structure their work around internationally agreed goals in particular, the new goals can be expected to provide a framework around which policy and action aiming to improve human well-being will be justified and organized; this is what happened in international development institutions around the Millennium Development Goals (MDGs). As time went by after the Millennium Summit, the MDGs were increasingly used to structure the actions of bilateral and multilateral development agencies, from the broad corporate and sector strategies to project documents.<sup>3</sup>

Because of these connections, the structure of the set of SDGs, as put forward by the Open Working Group, has implications for policy integration and coherence across areas. As seen above, for many of the thematic areas covered by the SDGs, targets relating to these areas are found not only under their namesake goal (when it exists) but across a range of other goals as well. In designing and monitoring their work, agencies concerned with a specific goal (e.g. education, health, economic growth) will have to take into account targets that refer to other goals, which, due to the normative clout of the SDGs for development work coming forward, may provide stronger incentives than in the past for cross-sector, integrated work. Similarly, for institutions concerned with monitoring and evaluation of progress under the goals, it will be necessary to look at multiple goals – indeed, all those that include targets referring to one institution's area of interest. This may enable greater integration across goals.

To take a concrete example, we look at the area of health. This area is covered by SDG 3, 'Ensure healthy lives and promote well-being for all at all ages', which includes nine targets (excluding those on means of implementation). In

<sup>3</sup>Beyond their political and instrumental values, internationally agreed development goals also have an influence on science and science-related policy. The existence of goals and targets contributes to orienting scientific research in specific directions. Among many other examples, this has included improving the measurement of ecological and social phenomena (e.g. climate change and its implications for human societies) and providing directions for public research and development efforts (e.g. for new agricultural technologies and land management practices). Goals also help consolidate and focus the dialogue between research and policy.

addition, seven targets under SDGs 2, 6, 11 and 12 also explicitly refer to health in their wording. These targets can be referred to as 'extended' targets for SDG 3, as opposed to 'core' targets listed under SDG 3. The combined list of targets is shown in Table 2. Arguably, institutions concerned with the health sector and operating within the framework of the SDGs will have to consider both core and extended targets when designing, implementing and monitoring policies.

In addition to this, the structure of the goals themselves may enable cross-sector dialogue and greater policy coherence. An example of this is the broad formulation of SDG 2, which adds to traditional targets on hunger explicit references to land management, agricultural production methods and terrestrial ecosystems. The fact that this connection

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*'Core' targets*

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	<i>Goal 3. Ensure healthy lives and promote well-being for all at all ages</i>
3.1	By 2030 reduce the global maternal mortality ratio to less than 70 per 100 000 live births
3.2	By 2030 end preventable deaths of newborns and under-five children
3.3	By 2030 end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases
3.4	By 2030 reduce by one-third pre-mature mortality from non-communicable diseases (NCDs) through prevention and treatment, and promote mental health and wellbeing
3.5	Strengthen prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol
3.6	By 2020 halve global deaths and injuries from road traffic accidents
3.7	By 2030 ensure universal access to sexual and reproductive health care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes
3.8	Achieve universal health coverage (UHC), including financial risk protection, access to quality essential health care services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all
3.9	By 2030 substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination

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*'Extended' set of targets: targets from other goals that directly refer to health*

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	<i>Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture</i>
2.2	By 2030 end all forms of malnutrition, including achieving by 2025 the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons
	<i>Goal 6. Ensure availability and sustainable management of water and sanitation for all</i>
6.1	By 2030, achieve universal and equitable access to safe and affordable drinking water for all
6.2	By 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally
	<i>Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable</i>
11.2	By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons
11.5	By 2030 significantly reduce the number of deaths and the number of affected people and decrease by y% the economic losses relative to GDP caused by disasters, including water-related disasters, with the focus on protecting the poor and people in vulnerable situations
	<i>Goal 12. Ensure sustainable consumption and production patterns</i>
12.4	By 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment

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**Table 2.** 'Core' targets and 'extended' targets: example of SDG 3

Source: author's elaboration.



is made, in contrast to, e.g., the MDGs, may encourage, at least to some degree, all those concerned with hunger-related issues to consider the links between agriculture, nutrition, food security and ecosystems much more closely than was the case. It may also facilitate cross-fertilization, for example by providing incentives for organizations concerned with food security and hunger to hire specialists of related areas mentioned in the targets for SDG 2. Inasmuch as actions in some of these areas have been recognized by past experience as involving trade-offs (for example in the case of biofuels), a broader scope for the goal may be conducive to greater accounting for such trade-offs and may enable strategies and policies that are more conducive to synergetic outcomes. This would correct one of the drawbacks of the MDGs, in which 'silo' goals encouraged silo policies and did not make links and trade-offs across areas explicit.

Such links among goals through targets may also facilitate real mainstreaming of dimensions that previously suffered from not having strong sectoral anchoring in development institutions. Especially interesting in this context is the existence of many links between SDG 12 on SCP and other goals. As argued in the introduction, until now SCP has suffered from being weakly integrated with other areas of work and addressed as an 'add-on' (for example, resource efficiency considerations in various sectors were not often given prominence in development strategies and policies). Should the goals and target stand as they were proposed by the Open Working Group, actors in many sectors will have to work with SCP-related targets under their goals, which may finally enable greater integration of SCP across the board. In particular, the fact that resource efficiency is an integral part of SDG 8 on growth and employment can be seen as quite revolutionary, in that this fundamental aspect of SCP, rather than being seen in isolation from growth, may now be more systematically considered by strategies and policies aiming to spur growth and employment, which have both high priority everywhere and strong anchoring in institutions at all levels.

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## Where Are the Gaps?

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As emphasized above, the set of SDGs that was put forward by the Open Working Group is the result of intergovernmental discussions. As such, it constitutes a normative piece, which frames global goals and targets that the international community sets for itself. As a compromise reflecting a multiplicity of concerns and interests, the set of SDGs taken as a whole is not based on any particular interpretation of the world; nor does it reflect a specific, coherent systemic view of how the socio-economic engine works and delivers outcomes along all the dimensions covered by the goals.<sup>4</sup>

The novelty of the SDGs compared with their predecessors is that they aim to cover the whole sustainable development universe, which includes basically all areas of the human enterprise on Earth. This universe can be mapped in a number of ways, the value of which depends on their instrumental purpose. Since the concept of sustainable development was first adopted by the international community in 1992, several mapping methods, or different ways to 'cut the cake', have been proposed. This includes the framework proposed by Kates (1999), mappings based on the economy-in-society-in-nature representation of the ecological economics school (Daly, 1991) and hundreds of mappings of sub-systems designed for the purpose of modelling. Sustainable development modelling and scenario work, in particular, has considered links between some SDG areas in great detail. For example, models supporting the assessments made by the Intergovernmental Panel on Climate Change (IPCC, 2014) or the Global Energy Assessment (IIASA, 2012) consider the links between the energy system, the rest of the economy and climate change, along with a range of other dimensions.<sup>5</sup>

Even outside formal modelling, scientists and practitioners alike have mentioned strong interconnections among goal areas from the biophysical and socio-economic points of view as critical to reflect in the goals and targets

<sup>4</sup>This is not surprising. Sustainable development is a contested field. It accommodates multiple scientific and political roots (Giddings *et al.*, 2002; Quental *et al.*, 2011b). Political agreements on sustainable development at the international level have had to take into account a broad range of views and attitudes, both in the general public and across governments (Hopwood *et al.*, 2005; Leiserowitz *et al.*, 2006; Davidson, 2014). For a perspective on policy cycles and political agreements on sustainable development at the international level, see Quental *et al.* (2011a).

<sup>5</sup>Due to the inherent complexity of the ecological-socio-economic system, there is no universally accepted representation of it and various representations reflect differing world views. For operational purposes, existing models focus on limited sets of dimensions of interest. In particular, our understanding of the possibilities of joint outcomes in more than one dimension (for example, growth, inequality and environment) is limited, and to some extent irreducible (Roehrl, 2013).

(Griggs *et al.*, 2014; ICSU and ISSC, 2015). Looking at multiple areas in relation to one another can provide critical insights as to the feasibility and ways and means of achieving specific goals. For example, progress on energy efficiency (a target associated with the goal on energy) depends strongly on actions from both producers and consumers in various sectors and on associated regulation, strategies and incentives.

It is thus interesting to contrast the 'political' mapping of the SDGs presented above with other mappings based on physical and socio-economic considerations. It is beyond the scope of this paper to explore related differences systematically. In what follows, we focus on a few examples, starting with the whole system and then focusing on a smaller sub-system.

In a recent paper, the International Council for Science (ICSU) and International Social Science Council (ISSC) asked small groups of expert scientists on each goal in the SDGs to, *inter alia*, mention the links between the goal being considered and targets under all the other goals (ICSU and ISSC, 2015). The report finds that each of the goals has links to many targets under most of the other goals. This shows that there are many more scientifically relevant connections among goals than are explicitly reflected in the SDGs. The contrast is even starker when one focuses on sub-parts of the system. As an example, we use the climate, land, energy and water (CLEW) cluster or 'nexus', as it is often called. The CLEW nexus has been intensively studied, at different geographic scales and using different modelling tools. The number of links considered by planning and modeling tools that have been applied to the CLEW nexus tends to be high (see Bazilian *et al.*, 2011; Welsch *et al.*, 2014; Weitz *et al.*, 2014; Skaggs *et al.*, 2012, and United Nations, 2014b, for references). Overall, the sheer number of interactions among the nexus areas mentioned in these studies is enough to show that most of the relevant interactions in the cluster are not explicitly captured by the SDG targets.

Looking at other parts of the system, another link that is not made by the SDGs is between energy and industrialization. Yet it has long been recognized that use of energy in economic infrastructure drives overall energy consumption, which in turns correlates with climate change drivers and impacts on ecosystems. Any strategy to limit CO<sub>2</sub> emissions, for example, would have to consider this link. Similarly, energy and climate change are weakly linked in the SDGs, even though energy is a critical component of any path aimed at limiting climate change, and most models aiming to shed light on climate change mitigation pathways rely to some extent on representations of the energy system. Another missing link is that between oceans and climate change. While SDG 14 includes a target on limiting ocean acidification, the link is not made with CO<sub>2</sub> emissions (which do not figure explicitly either in SDG 13 on climate change).

Thus, it is clear that the political framework that the SDGs provide does not explicitly reflect the multiplicity of links that matter for policy purposes. Hence, in practice, SDGs will be of limited use in providing guidance to address the various links that exist. This should not come as a surprise. The SDGs, as a political construction for which one parameter was that the goals should be 'limited in number', could not possibly address all the relevant links among goal areas – there are simply too many of them. The absence of some well-recognized links also reflects that agreement on the importance of this links has not been reached in the international political arena. However, for the purpose of reviewing the sustainable development agenda in the future, it will be especially important to keep an eye on areas where strong systemic links are known to exist from a scientific point of view but are not reflected in the goals and targets. A systematic identification of such areas may be a worthy undertaking for the scientific community in coming years. One promising and practical way around this difficulty is suggested by Griggs *et al.* (2014), who suggest linking some of the existing targets under different SDGs through so-called IPAT equations, thus providing potential cross-checks on what progress on some of the targets implies for others (Griggs *et al.*, 2014).

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## Conclusion

The set of SDGs that was put forward by the Open Working Group can be read as a network of targets connecting the different goal areas. The analysis above has shown that some thematic areas covered by the SDGs are well connected with one another. Other parts of the network have weaker connections with the rest of the system. Overall, one can argue that the SDGs are more connected than their predecessors, the MDGs, were. Provided that the final goals and targets that are going to be agreed in September 2015 keep this feature, this could enable more integrated

policies and easier consideration of synergies and trade-off across SDG areas, an aspect that has been identified during the last two decades since the Earth Summit as critical for progress on sustainable development. For each area covered by the SDGs, we have suggested that one can quite straightforwardly identify 'extended' targets, that is, targets linked with the area in question that are located under other goals. Monitoring of 'extended' as well as core targets under any of the goals could facilitate integrated thinking and policy-making. Looking at implications of this for the way development agencies operate would be an important undertaking going forward.

On the other hand, some of the important systemic links among thematic areas, which arguably will have to be considered in any long-term pathway towards sustainable development, are not explicitly made within the political framework of the SDGs. Going forward, alternative means of ensuring that the interdependences among sectors that they imply are taken into account in strategy and policy formulation will have to be found. Efforts towards modelling of the SDGs as a biophysical and economic system, with emphasis on the links between sub-components of the system that have not been systematically explored until now, could inform this effort.

Looking at the SDGs as a system sheds a light on those targets that link two or more of the goals. Such targets reflect the recognition by the international community of the importance of links among the goals. One may argue that they represent the biggest departure from previous approaches. The existence of these targets makes what could have been a collection of unrelated goals a system; in a sense, it grounds the political work that the SDGs represent firmer into a reality that is full of trade-offs and interdependences. Almost by construction, such targets are more complicated than others, and may not easily meet requirements for measurability, simplicity and other criteria that are often put forward in the evaluation literature.<sup>6</sup> While there are good reasons to look for targets that fit such criteria, this has to be weighed against the value of having 'vaguer' targets that make links across goals explicit, as such targets may have very high political and instrumental value.

In spite of the favorable environment for policy integration that the SDGs may create, it should be clear from past experience that policy integration will not happen automatically. Integration of thinking across sectors and policy advice represents a challenge to the way development work is usually conducted. Efforts to 'break the silos' in a systemic manner should focus on providing organizations and their staff, both at national and international levels, incentives for collaboration within and outside organizations, from resource allocation mechanisms to broad corporate strategies to operational frameworks and mechanisms for project delivery. Capacity building efforts are probably critical in this respect.<sup>7</sup>

The analysis in this paper was carried out at the global level. Similar analysis could be undertaken at the national level as well. Different countries have different priorities, and they are likely to put different emphases on the various goals and targets depending on their national circumstances. In particular, examining how sectors and links across sectors that have a critical importance in a given country are reflected in the SDGs at the global level could inform the development community on additional missing links that are not apparent from a global analysis. For example, in the context of a small island state, the relative lack of links between SDG 14 on oceans and other goals may be more problematic than appears at the global level. Similarly, it would be interesting to see how some important issues that do not have their 'own' SDG (e.g. youth, disaster risk reduction, and some population issues) are reflected in the different goals, and what this implies for progress in these areas in practice.

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<sup>6</sup>For example, the so-called SMART criteria, an often-used acronym that stands for 'specific, measurable, attainable, relevant, time based'.

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## References

- Bazilian M, Rogner H, Howells M, Hermann S, Arent D, Gielen D, Steduto P, Mueller A, Komor P, Tol RSJ, Yumkella KK 2011. Considering the energy, water and food nexus: toward an integrated modeling approach. *Energy Policy* **39**(12): 7896–7906.
- Daly HE 1991. *Steady-State Economics*, 2nd edn. Island: Washington, DC.
- Davidson K 2014. A typology to categorize the ideologies of actors in the sustainable development debate. *Sustainable Development* **22**(1): 1–14.
- Giddings B, Hopwood B, O'Brien G 2002. Environment, economy and society: fitting them together into sustainable development. *Sustainable Development* **10**(4): 187–196.
- Griggs D, Stafford Smith M, Rockström J, Öhman MC, Gaffney O, Glaser G, Kanie N, Noble I, Steffen W, Shyamsundar P. 2014. An integrated framework for sustainable development goals. *Ecology and Society* **19**(4): 49. 10.5751/ES-07082-190449
- Hopwood B, Mellor M, O'Brien G 2005. Sustainable development: mapping different approaches. *Sustainable Development* **13**(1): 38–52.
- IIASA 2012. *Global Energy Assessment: Toward a Sustainable Future*, Cambridge University Press: Cambridge, MA.
- Intergovernmental Panel on Climate Change (IPCC) 2014. *Climate Change 2014: Mitigation of Climate Change*, contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press: Cambridge, UK and New York, NY, USA.
- International Council for Science (ICSU), International Social Science Council (ISSC). 2015. *Review of Targets for the Sustainable Development Goals: the Science Perspective*. Paris.
- Jackson T 2010. *Prosperity without Growth*, report of the UK Commission on Sustainable Development, : London.
- Kates R 1999. *Our Common Journey: a Transition Toward Sustainability*, National Academy Press: Washington, DC.
- Leiserowitz A, Kates R, Parris T 2006. Sustainability values, attitudes, and behaviors: a review of multinational and global trends. *Annual Review of Environmental Resources* **31**: 413–444.
- de Nooy W, Mrvar A, Batagelj V 2005. *Exploratory Network Analysis with Pajek*, Cambridge University Press: Cambridge, UK.
- Quental N, Lourenço JM, Nunes da Silva F 2011a. Sustainable development policy: goals, targets and political cycles. *Sustainable Development* **19**: 1.
- Quental N, Lourenço JM, Nunes da Silva F 2011b. Sustainability: characteristics and scientific roots. *Environment, Development and Sustainability* **13**(2): 257–276.
- Roehrl R 2013. *Sustainable Development Scenarios for Rio+20. A Component of the Sustainable Development in the 21st Century (SD21) Project*, United Nations Department of Economic and Social Affairs: New York.
- Skaggs R, Hibbard K, Janetos T, Rice J 2012. *Climate and Energy-Water-Land System Interactions*. Technical Report to the U.S. Department of Energy in Support of the National Climate Assessment. Pacific Northwest National Laboratory. PNNL-21185, Richland, WA, USA.
- United Nations 2011. *Sustainable Development in the 21st Century: Implementation of Agenda 21 and the Rio Principles, Detailed Report on the Implementation of Agenda 21*, Department of Economic and Social Affairs: New York.
- United Nations. 2012. *United Nations Conference on Sustainable Development Outcome Document: the Future We Want*, A/CONF.216/L.1: New York.
- United Nations. 2014a. *Report of the Open Working Group of the General Assembly on Sustainable Development Goals*, A/68/970: New York.
- United Nations 2014b. *Prototype Global Sustainable Development Report*, Division for Sustainable Development: New York.
- United Nations Environment Programme (UNEP). 2012. *Global Environmental Outlook 5*. Nairobi.
- Victor P 2008. *Managing Without Growth*, Elgar: Northampton, MA.
- Weitz N, Nilsson M, Davis M 2014. A nexus approach to the post-2015 agenda: formulating integrated water, energy and food SDGs. *SAIS Review of International Affairs* **34**: 37–50.
- Welsch M, Hermann S, Howells M, Rogner HH, Young C, Rammad I, Bazilian M, Fischer G, Alfstad T, Gielen D, Le Blanc D, Röhl A, Steduto P, Müller A 2014. Adding value with CLEWS – modelling the energy system and its interdependencies for Mauritius. *Applied Energy* **113**: 1434–1445.