"Identifying Interactions for SDG Implementation in Ireland"

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D2.2. Report on SDG interactions in context of Ireland sustainable development goals

Martin Le Tissier & Hester Whyte

Contents

Preamble

Ireland's first Sustainable Development Goals National Implementation Plan (NIP) [1] sets out how Government will implement the Sustainable Development Goals (SDGs) domestically and internationally. Ireland has adopted a whole-of-Government approach as the SDGs are relevant to, and will require coherent contributions from, all Departments for their successful implementation.

The EPA funded "*Identifying Interactions for SDG Implementation in Ireland*" project specifically addresses SDG target 17.14 to "enhance policy coherence for sustainable development". The project will analyse the SDGs in the context of national priorities and circumstances to facilitate integration of sustainability goals with those of social and economic development. The challenges for policy coherence have been set out in the report D2.1: Report on international review of SDG interactions. This document is "D2.2. Report on SDG interactions in context of Ireland sustainable development goals" and provides a synthesis of existing policies in the context of national development, the environment and their relationship to SDG goals/targets.

Project background

Sustainable development in Ireland has its policy origins in the "Sustainable development: A strategy for Ireland" published in 1997 [2] in response to Earth Summit in Rio in 1992 and the EU Fifth Action Programme for the Environment. The strategy provided a focus for the concept of sustainable development and its integration into key economic sectors. In 2012 Ireland published "Our sustainable future: A Framework for Sustainable Development for Ireland" [3] to take into account developments at international and EU level designed to deliver an effective transition to an innovative, low carbon and resource efficient future that decouples environmental degradation and resource consumption from economic and social development. 'Our Sustainable Future' sets out the challenges facing Ireland and proposes actions across some seventy measures to promote clean energy, more sustainable approaches to agriculture and transport, and for the conservation and management of natural resources to ensure their sustainability for future generations. This framework sets out eight national themes and principles for achieving sustainable development (Table 1) to be implemented across government and tasks a SDG inter-departmental working group with ensuring that the vision set out in the policy document is translated into clear and effective action through a coherent cross-sectoral, whole-of-Government approach. These themes reflect economic, social and environmental dimensions of sustainability, and are closely aligned with the SDGs. Ireland's NIP has mapped existing national policies against the SDGs in order to mainstream them across all policy areas and ensure coherence to promote policies and initiatives across government which contribute towards meeting the Goals domestically and internationally.

Table 1. Ireland's Our Sustainable Future - Principles for Sustainable Development. (reproduced from [3])

Themes	**Principles**
Economy	Promote an innovative, competitive and low-carbon economy with the aim of achieving smart, sustainable and inclusive growth.
Satisfaction of human needs by the efficient use of resources	Prices should reflect the real costs to society of production and consumption activities and polluters should pay for the damage they cause to human health and the environment.
Equity between generations	The needs of current generations should be addressed without compromising the ability of future generations to meet their needs.
	Resources should be used within the capacity for regeneration.
Gender equity	Women have a vital role in environmental management and development and their full participation is therefore essential to advance sustainable development.
Respect for ecological integrity and biodiversity	The abundance of wildlife and extent of habitats should be maintained, improved and restored where necessary, through sustainable management.
Social equity	Social inclusion promoted to ensure an improved quality of life for all.
Respect for cultural heritage /diversity	The quality of landscapes, the heritage of the man-made environment and historic and cultural resources should be maintained and improved.
Equity between countries and regions	Promote fundamental rights, by combating all forms of discrimination and contributing to the reduction of poverty.
	Promote coherence between local, regional, national, EU and global actions in order to increase their contribution to sustainable development.

Drivers for policy coherence originate from awareness of the interconnections in objectives and regulatory mechanisms between different economic, social and environmental policy areas [4]. Coherence is aimed at improving the environmental sustainability of policies, and to enhance synergies and reduce conflicts between other interacting policy domains to achieve the outcomes associated with jointly agreed objectives.

There are different perspectives on the meaning of policy coherence and, in many cases, there is little or no clarity on what needs to be measured (processes, policy changes or efforts, or policy impacts): The OECD defines Policy Coherence for Sustainable Development (PCSD) as [5];

> *PCSD is [a framework that describes] an approach and policy tool to integrate the economic, social, environmental and governance dimensions of sustainable development at all stages of domestic and international policy-making.*

Within the framework of PCSD, a horizontal programme of policy coherence that involves "the systematic promotion of mutually reinforcing policy actions, across government departments and agencies, creating synergies towards achieving the agreed objectives" and avoiding competing and conflicting interests and values is important. [6–9]. In the context of implementing the SDGs at a national-level this is critical as there are numerous possible interactions/interlinkages between SDG targets based both on their empirical associations with each other (Figure 1) and connections across multiple policy areas (Figure 2) [10]. The outcome of this study (op. cit.) is that:

- Policies aimed at achieving SDGs require simultaneous and coordinated transformations in several domains, which can only be reached by adopting a policy coherence approach.
- Sustainability is inherently complex, going beyond traditional policy areas meaning that any given sustainability path is unlikely to be achieved by any one policy area alone.

The grouping of interlinkages suggested by Figures 1 and 2 not only points to a conclusion that SDGs and their Targets cannot be treated in isolation, but that it is likely to be necessary to contextualise groupings of interactions to specific political contexts which integrate the SDGs priorities in a broader context of policy priorities.

The "*Identifying Interactions for SDG Implementation in Ireland*" (SDGs4I) project will analyse the SDGs as a complex chain of interlinked goals to better understand how to implement the SDGs in a more integrated way, and avoid having to choose between allocating efforts [11,12] whilst meeting both international and national objectives. The 17 SDGs are broken down into 169 associated targets that describe the action required to achieve a sustainable future state [13,14]. Although the intent of the SDGs and targets are integrated and indivisible, governments can adjust the targets and adapt their indicators to reflect their particular situation and circumstances, to achieve at a national level the global intent. Policy implementation towards national strategies and SDGs is presented by a number of challenges:

1. Many of the individual targets contribute to several goals, and while in some cases interactions can lead to synergistic outcomes in others goals and targets may conflict; action to meet one target could have unintended consequences on others if they are pursued separately [11,12,15].
2. Individual policies that connect to one target could lead to an outcome from that target which then has negative (or conversely synergistic) outcomes on other targets [16,17].
3. Individual policies may connect to multiple targets such that a focus on its action on individual goals and/or targets could lead to perverse outcomes and progress across multiple elements of the 2030 Agenda [16,18,19].
4. How policies, that are usually designed to address a specific sector purpose, can be implemented in the context of a wider 'systems' perspective as required by the SDGs [20,21].

These challenges could lead to contradictions integrating the SDGs into national policy, and ensuring compatibility between the SDGs and Ireland's current national Sustainable Development Strategy "Our Sustainable Future"[3]; The National Planning Framework [22]; and The National Development Plan [23] amongst the portfolio of Ireland's policy strategies (see p.19 [1]).

Environmental pressures affect every country, and climate change, pollution and the loss of natural habitats undermine prosperity and security nationally and internationally, for instance threatening , food and freshwater supplies and contributing to the spread of disease. Humanity is hosted within a closed biosphere and is entirely dependent on provisioning and regulatory processes of planetary ecosystems to sustain life. Given this background and Ireland's recognition of the importance and place of the environment in its future a theme of biodiversity, climate change threats and the environment has been chosen to frame the SDGs4I project. The fundamental underpinning role of biodiversity and the biosphere to sustainable development and the SDGs has been widely promoted [24–30], and is reflected in the "Our Sustainable Future" Theme: Respect for ecological integrity and biodiversity [3] and Ireland's Biodiversity Plan [31,32]. Biodiversity and healthy ecosystems are central to many economic activities (e.g. SDGs 8, 9, 12) and societal objectives (e.g. SDGs 1, 2, 3, 5, 7), and is directly affected by climate change (SDG 13) as well as providing significant mitigating potential.

Ireland's approach to sustainable development, the role the environment plays coupled with the exacerbating challenges presented by climate change, is compliant with the aspirations of the European Union's 7th Environment Action Programme -EAP and the EU Green Deal, including; 1) to protect, conserve and enhance natural capital; (2) become resource-efficient, green with a competitive low-carbon economy; and (3) develop resilience to environment-related pressures and risks to health and well-being [33,34]. The United Nations (UN) SDGs provide a framework and logic for transformative change that are required to evolve policy outcomes that acknowledges the interdependence of social, economic and environmental targets. It has been recognised that success in achieving such transformative changes are in large part dependent on Government's ability to integrate environmental goals into sectoral policy through improved policy coherence.

Report Structure

This report builds upon *D2.1 Report on international review of SDG interactions* to focus more specifically on the policy portfolio in Ireland in the context of the environmental setting of the 2030 Agenda and the SDGs. The document first introduces the policy setting of the SDGs (Section 1) in the context of the SDGs4I project, followed by Section 2 that will describe the context of biodiversity and the environment in the SDGs. The report concludes with an analysis of the progress and situation in Ireland with regard to the environmental dimension of the SDGs (Section 3).

Figure 1. Dashboard of inter-linkages (synergistic, ambiguous and trade-off) based on analysis of goals and targets made in the literature. Note: the literature covers all SDGs at the Goal level but not all the respective Targets suggesting that there remains considerable uncertainty and unknowns that have to be addressed in any form of decision making around SDG implementation. The analysis revealed that 2,548 out of 3,490 entries indicated positive inter-linkages between the SDGs, while the remaining 942 indicated potential trade-offs. Each single column and each single row correspond to one of the 169 targets of the SDGs framework. Most of the interaction are synergies (73%). There are numerous targets (2.c, 3.1, 3.2, 3.5, 3.6, 3.a, 5.b, 5.c, 8.6, 8.7, 8.10, 8.a, 8.b, 9.6, 10.4, 10.5, 10.6, 10.a, 10.b, 11.3, 11.4, 11.7, 11.a, 11.b, 11.c, 15.4, 15.6, 15.7, 16.3, 16.7, 16.8, 16.9, 16.10, 16.a, 16.b, 17.3, 17.4, 17.5, 17.7, 17.8, 17.9, 17.10, 17.14, 17.15, 17.16, 17.17, 17.18, 17.19) whose potential inter-linkages with other targets or goals have not been addressed yet in the reviewed literature. The level of disagreement (orange cells) is also very high (around the 50% for the SDG7, SDG 8, SDG 14 and SDG 15).Source: Source: https://public.tableau.com/profile/steve.borchardt#!/vizhome/Dashboards_115/Story1.

Figure 2. EU policy interlinkages with SDG Goals and Targets according to the number of shared policies between pairs of Targets. Source: [12]. The dashboard indicates synergies on the basis of policies in common between two targets. Insert top right: Detail showing the variation and complexity of the level of policy relevant interactions between SDGs and Targets. Source: https://public.tableau.com/profile/steve.borchardt#!/vizhome/Dashboards_115/Story1.

1 The SDGs and policy implementation

This section provides an overview of the policy context provided by the SDGs for a national setting and reviews Ireland's approach and progress with respect to implementing the SDGs.

The UN Sustainable Development Goals (SDGs) provide an evidence-based framework for global sustainable development planning and programming [35]. The SDGs are more than an extension of the Millennium Development Goals (MDG) by virtue of their acknowledgement that sustainable development is both a challenge shared by all countries of the world, and not only an issue faced by the global south, and that it addresses requirements equally across social, economic and environmental dimensions [36–38].

The SDGs 1 - 16 have 109 outcome Targets, which capture the ambition of the relevant Goal and translate it into more concrete commitments. The outcome targets of each SDG are complemented by 43 Means of Implementation (MoI) Targets and SDG 17 (Strengthen the means of implementation and revitalize the global partnership for sustainable development) that describe the specific actions needed for each Goal to be achieved [39,40]. Growing understanding of the dense interconnections, interactions and dependencies between ecosystems and resources within and across governed contexts (i.e., between sectors and/or different areas of policy), and their reflection across the 17 SDGs and Targets, has raised awareness of the importance of coherent, integrated governance.

1.1 The policy setting for the SDGs

The role and principles of international law was recognised in 1959 as an instrument for broadening the perspectives and bases of power of national decision makers, thereby facilitating the wider and more secure achievement of those fundamental human desires and goals which transcend national boundaries [41]. A commitment to the rule of international law is enshrined in the Constitution of Ireland (Article 29.3 of the Constitution). The four international instruments that came into existence in 2015 – the Sendai Framework[1], the Addis Ababa Action Agenda[2], the 2030 Agenda and the SDGs[3],

[1] The Sendai Framework is a 15-year, voluntary, non-binding agreement which recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders (https://www.unisdr.org/we/coordinate/sendai-framework).

[2] The Action Agenda establishes a strong foundation to support the implementation of the 2030 Agenda for Sustainable Development. It provides a new global framework for financing sustainable development by aligning all financing flows and policies with economic, social and environmental priorities (https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=2051&menu=35).

[3] The 17 Sustainable Development Goals are a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. They were adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development which set out a 15-year plan to achieve the Goals (https://www.un.org/sustainabledevelopment/development-agenda/).

and the Paris Agreement[4] are recent manifestations of those principles, although they carry different responsibilities and obligations on Ireland's government. The 2030 Agenda has assumed dominance over other international instruments to the extent that it provides direction for national, regional and international policy design such that they become aligned to the aims and objectives of the SDGs and their Targets. This is largely in recognition that the 2030 Agenda is a plan of action for people, planet and prosperity, peace and partnership, and is universal and indivisible to address the complex interactions and feedback loops between climate change, ecosystem fragility, rapid urbanization, disaster risk fuelled by the interconnectivity of global systems [42,43].

Countries report on progress to meeting the objectives of the SDGs by the submission of a periodic Voluntary National Review (VNR) that is reviewed by the high-level political forum (HLPF) [44]. The review process aims to facilitate the sharing of experiences, including successes, challenges and lessons learned, with a view to accelerating the implementation of the 2030 Agenda (see para. 79 [38]). The VNRs also seek to strengthen policies and institutions of governments and to mobilize multi-stakeholder support and partnerships for the implementation of the SDGs. A review of countries Voluntary National Reviews reveals some significant barriers to national implementation of SDGs faced by Governments [45–49]:

- Many countries view the SDGs as an extension of the Millennium Development Goals and, therefore, a foreign policy issue.
- There remains limited reference to linkages between the dimensions of sustainable development and contested visions of what constitutes sustainable development.
- The SDGs are addressed in the context of the global articulation of the goals and not identified against national sustainable development priorities.
- SDGs are reported solely against the global indicators for individual targets which have not been developed as national and sub-national targets and indicators to complement global targets and indicators.
- National policy areas are examined against alignment to SDGs and are not fully integrated into national plans and strategies based on an evaluation of existing policies, approaches and progress to identify gaps, adapt policies and target areas where further progress is needed.

[4] The Paris Agreement is the first-ever universal, legally binding global climate change agreement, adopted at the Paris climate conference (COP21) in December 2015. The Paris Agreement sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. It also aims to strengthen countries' ability to deal with the impacts of climate change and support them in their efforts (https://ec.europa.eu/clima/policies/international/negotiations/paris_en).

The SDGs provide a framework for responding to change using existing knowledge, but not in relation to either balancing technical and policy responses or how to address trade-offs between multiple desired outcomes that may be 'owned' by separate parts branches of Government/International Agencies [50–52]. This has led some to debate on whether countries should approach the SDGs from the perspective of short-term priorities in the context of longer-term aims, trends, threats and opportunity in order to avoid potential conflict and contradiction between the objectives of existing policy plans and strategies with the objectives of the SDGs. A review of VNRs has suggested that there remain challenges to integrate not only the SDGs but also the broader 2030 Agenda and its transformative principles into national plans and strategies based on existing policies beyond identifying alignment between existing policy instruments and individual SDGs [47]. Addressing these challenges requires greater confluence between existing policy instruments with national sustainable development priorities, and alignment of those priorities with the SDGs and the 2030 Agenda. In part this also requires identification and development of national and sub-national targets and indicators to complement global targets and indicators.

1.2 Ireland and the SDGs

Ireland's approach to the 2030 Agenda and SDGs recognises that sustainable development relates to equitable approaches to the economy, society and environment within limits where the needs of the present do not jeopardise the needs of the future. The 17 SDGs have been aligned to the 2012 strategy "*Our Sustainable Future: A framework for sustainable development for Ireland*" [3] (Figure 3).

Theme	Principle	SDGs
Economy	Promote an innovative, competitive and low-carbon economy with the aim of achieving smart, sustainable and inclusive growth.	
Satisfaction of human needs by the efficient use of resources	Prices should reflect the real costs to society of production and consumption activities and polluters should pay for the damage they cause to human health and the environment.	
Equity between generations	The needs of current generations should be addressed without compromising the ability of future generations to meet their needs.	
	Resources should be used within the capacity for regeneration.	
Gender equity	Women have a vital role in environmental management and development and their full participation is therefore essential to advance sustainable development.	

Theme	Principle	SDGs
Respect for ecological integrity and biodiversity	The abundance of wildlife and extent of habitats should be maintained, improved and restored where necessary, through sustainable management.	
Social equity	Social inclusion should be promoted to ensure an improved quality of life for all.	
Respect for cultural heritage /diversity	The quality of landscapes, the heritage of the man-made environment and historic and cultural resources should be maintained and improved.	
Equity between countries and regions	Promote human rights and fundamental freedoms, by combating all forms of discrimination and contributing to the reduction of poverty.	

Figure 3. Themes and principles for sustainable development outlined in "Our Sustainable Futures" aligned against relevant SDGs as identified in Ireland's NIP [1].

Figure 4.The Vision, Aim and Strategic Priorities for Ireland's Implementation Plan for the Sustainable Development Goals.

Ireland has released a *Sustainable Development Goals National Implementation Plan 2018-2020* (NIP) that provides an overarching strategic framework within which Ireland will work to achieve the Goals, both domestically and internationally (Figure 4) [1]. The NIP identifies how Government Departments, through existing national policies, are already contributing to achieving the SDGs and how national policies and targets correspond to the SDGs global vision. The NIP commits to further integrate the SDGs into national policy through a new Sustainable Development Strategy [3, p11].

The complex equation of synergies and trade-offs across the whole spectrum of policy areas and individual Department portfolios covered by the SDGs requires prioritisation and negotiation involving all parts of government [53] to address increasingly complex economic, social and environmental challenges. Ireland's Implementation Plan identifies policy coherence as a strategic priority and the Government has established a Senior Officials' Group on the SDGs, supported by an SDG Interdepartmental Working Group, to ensure coordination across government departments through a whole-of-government approach [54]. The SDG Working Group aims to facilitate information sharing, discussion and negotiation on a coordinated response to SDG implementation and address (potential) trade-offs to promote policy coherence. Within this arrangement, line departments retain responsibility for implementing the elements of the SDGs most relevant to their work [1].

Ireland has defined a national vision for what constitutes sustainable development, that supports policy-making across all sectors to ensure cohesive, rigorous and soundly-based decision making:

> "*Sustainable development is about ourselves. It is about inhabiting a place where there is economic stability based on a model of national progress and development that respects the three core pillars of sustainability: the environment, the economic, and the social*." [3]

This is further elaborated by a 2030 Vision for Ireland that addresses equity and equality coupled with wellbeing for Ireland's citizens in a competitive, low carbon, climate resilient and environmentally sustainable economy contributing to a fairer, more just, more secure, more sustainable world [1].

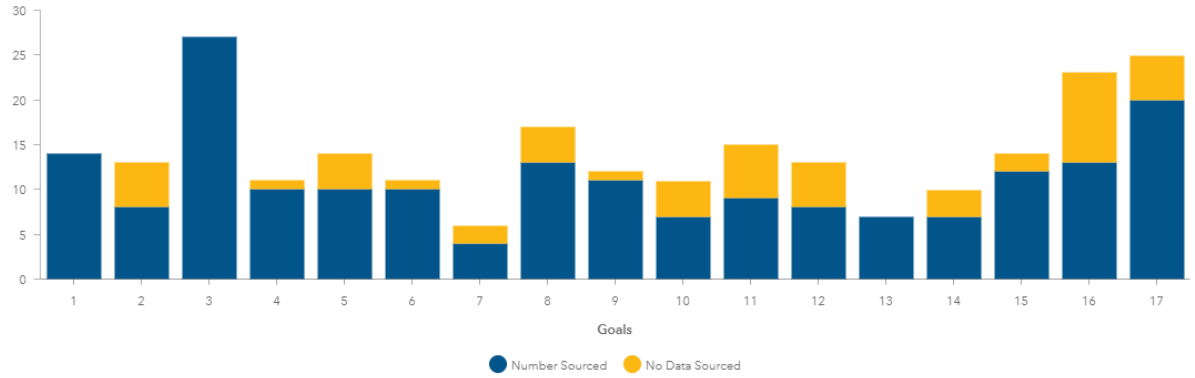

Figure 5. Ireland's progress towards sourcing data for indicators to the Targets of each SDG. Source: https://irelandsdg.geohive.ie.

1.3 Ireland's progress on SDG implementation

The SDGs were designed within a broad, overarching framework from which individual nations could identify their own priorities, as well as localize targets and indicators to guide the focus and coordination of national implementation through existing and new policies [48].

Ireland has aligned its approach to the SDGs with its existing policy for sustainable development and aligned the SDGs against its portfolio of existing and planned policy. Ireland is actively engaged in sourcing data to measure its progress towards achieving the SDGs (Figure 5) using both the UN global indicators for each SDG Target [55] and a set of indicators developed by the EU [56]. The 'down-scaling' of the UN global indicator set to an EU indicator set, which compromises 100 indicators structured along the 17 SDGs focussed on the EU policy context and priorities, is consistent with the 2030 Agenda that re-affirms the alignment of international aspects of sustainable development with national and regional policy and priorities [38]. The juxtaposition of SDG reporting against both UN Global and EU indicator sets is important because Ireland is required to align its policy with that of the EU.

A recent assessment by the OECD [57] found that based on 126 available indicators allowing a coverage of 99 of the 169 SDG targets, Ireland has currently achieved 10, and many of the remaining targets have a small shortfall to achievement (Figure 6). In common with the EU in general, however, data availability is variable in regard to environmental SDGs[5]; SDG 6 (Water) has 7 of 11 indicators sourced and data available for 4, SDG 13 (climate action) 7 of 7 indicators sourced with data available, SDG 15 (life on land) 7 of 14 indicators sourced with data available for 4, and SDG 14 (Life below water) 5 of 10 indicators sourced with data available for 5. In common with assessment across the EU[6], the situation in Ireland also suggests that positive advances in some SDG Targets are counterbalanced by negative developments in others. For instance, positive trends in greenhouse gas emissions are cancelled out by trends in energy efficiency and renewable energies and biodiversity-related

[5] Data sourced from https://irelandsdg.geohive.ie/ (accessed 12 March 2020)
[6] https://ieep.eu/news/eurostat-2019-report-shows-mixed-picture-of-eu-s-progress-on-sdgs

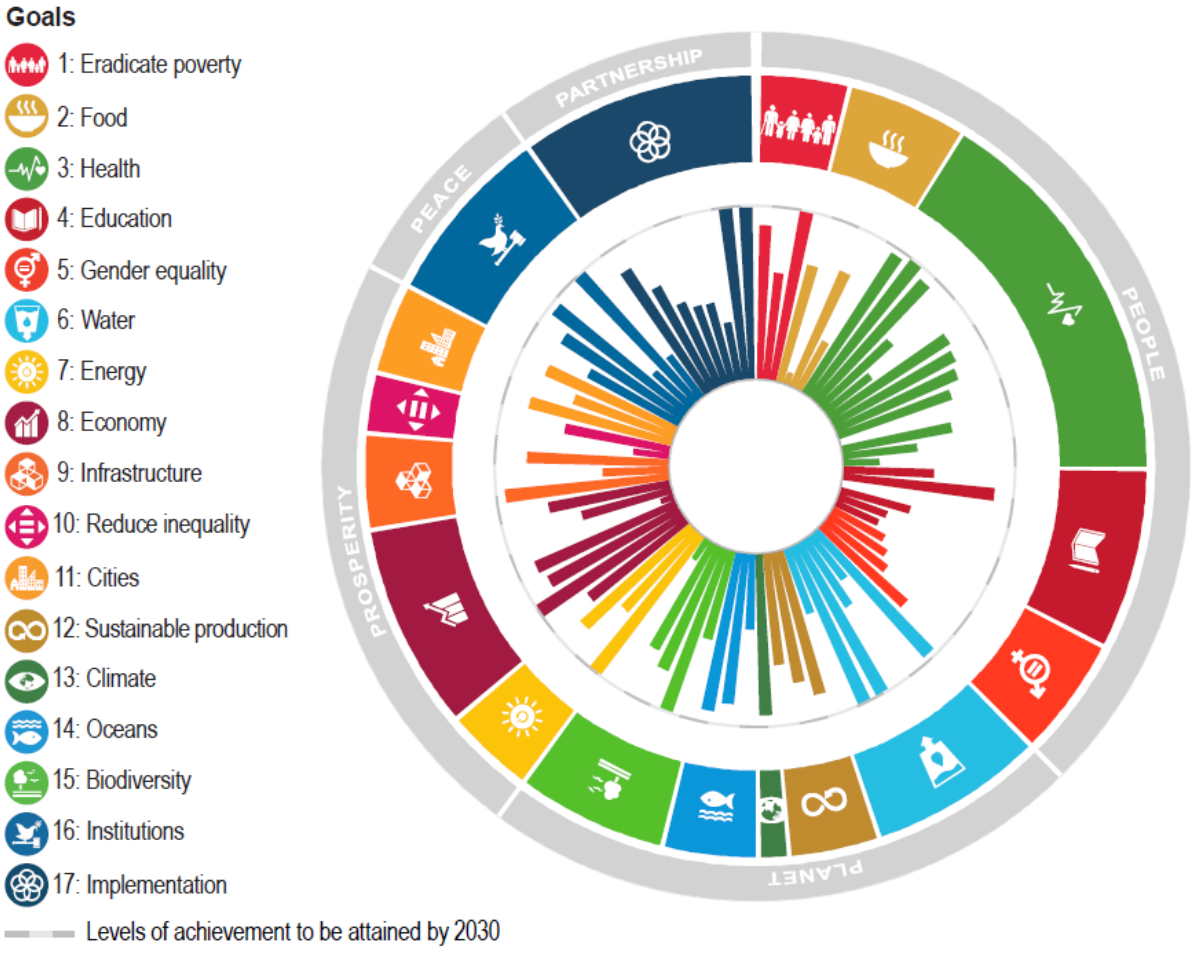

Figure 6. Ireland's distance from achieving 99 SDG targets. The chart shows current level of achievement on each available target. The longer the bar, the shorter the distance still to be travelled to reach 2030 target (dotted circle). Targets are clustered by goal, and goals are clustered by the "5Ps" of the 2030 Agenda (outer circle). Source: See www.oecd.org/sdd/OECD-Measuring-Distance-to-SDGs-Targets-Metadata.pdf for detailed metadata.

indicators show a concerning decline[7]. This indicates that performance in any given SDG is dependent on and associated with trends in related SDGs; for instance, poor performance on SDG 13 and 15 is clearly linked to the mixed trends in related SDGs, namely SDG 12 (responsible consumption and production) and SDG 7 (affordable and clean energy). The implication is that policy design and implementation for sustainable social, economic, as well as environmental, development should fully consider connectivity between SDGs. For instance, policy design for energy (SDG 7) and advancing sustainable consumption (SDG 12), which currently largely happen independently of each other, are connected and also have implications for other policy areas directly, such as climate (SDG13), marine and land development (SDGs 14 and 15), and indirectly towards many others.

This section has provided a snapshot of where Ireland stands in terms of implementing the SDGs and introduced some of the challenge areas that faced with respect to inculcating the environment into Ireland's approach for sustainable development.

[7] For instance, see https://www.epa.ie/newsandevents/news/pressreleases2019/name,67351,en.html and http://www.epa.ie/mobile/irelandsenvironment/climate/

2 Policy coherence and the SDGs

This section develops the notion of policy coherence specifically in the context of the reality of the policy and planning environment in Ireland, where the SDGs do not exist in isolation but are one instrument within a portfolio of national policy and planning frameworks, and identifies more specially the policy environment that will shape the project

A fundamental evolution of the SDGs from the MDGs is centred on the role of the global north (Developed Countries) in sustainable development over and beyond Overseas Development Aid (ODA), which is articulated through the principle of indivisibility and universality of the SDGs [38]. This change recognises that domestic policies and actions of all countries have important trans-boundary implications in areas such as trade, investment, and agriculture affecting co-operation objectives and negatively impact on the sustainable development prospects of all countries [16,58–60].

Accepting that there are interlinkages between both SDGs and their Targets, and that these can lead to degrees of synergistic (positive) and trade-off (negative) interactions is important. More important, perhaps, is finding ways to qualify the analysis to determine what characteristics policies should be seeking to enhance synergies and mitigate trade-offs. Policy Coherence for Sustainable Development (PCSD) has been promoted as a framework to break out from institutional and policy silos to realise the benefits of synergistic actions, identifying unintended negative consequences of policies, and effectively manage unavoidable trade-offs across the SDGs [59–61]. PCSD is promoted as a framework and an approach to understand the barriers to, and the drivers for, sustainable development; and as a policy tool to integrate the economic, social and environmental dimensions of sustainable development at all stages of policy-making. From this perspective, PCSD has three main objectives, to: (i) foster synergies and minimise trade-offs across sectors; (ii) reconcile domestic policy objectives with internationally agreed objectives; and (iii) address the transboundary and long-term effects of policies [62].

However, whilst policy coherence challenges siloed and fragmented government action it does not comprehensively reverse an absence of integrated cross-sectoral strategies for implementation [43]. Complex issues are such because they are difficult (wicked) and usually reflect differing opinions and perspectives about their cause, nature and extent [63,64], as well as being technically demanding to both understand and address. Policy coherence should integrate technical knowledge in a way that leads to solutions that reconcile conflicts and inconsistencies between diverse policy goals, and exploits synergies. It should avoid diluting expertise and spreading of influence at the expense of other agencies/areas of interest. A challenge is to improve the flow and exchange of information across existing technical siloes of knowledge and organisation without diluting and/or losing expertise to exploit synergies and optimize trade-offs while avoiding policy weakening [65,66].

As countries engage with the SDGs to develop sustainable development pathways, they need approaches that assess the sustainability dimension of national policies and interventions, including their contribution to multiple sustainable development aims [43]. Such approaches should allow an assessment of how interventions in one domain or sector affect others ('policy coherence'), and to assess the factors that contribute to a policy or intervention's expected or unexpected impacts.

The purpose of policy coherence is often cited as an approach and policy tool for integrating the economic, social, environmental and governance dimensions of sustainable development at all stages of domestic and international policy making [16]. The goal of policy coherence is less clear and requires a definition that is more than the achievement of sustainable development. In the context of the SDGs, policy coherence should describe the point where the interacting SDGs and targets should ultimately converge. Articulating this point as a vision is largely absent or at best vaguely articulated around concepts of promoting sustainable development to balance its three dimensions – economic, social and environmental [20,67–69]. Such ambiguity to an extent originates from a process founded on various international agreements and other "soft" law instruments that have become transposed into national law, or at least considered by national strategy and planning documents [67]. The consequence is that the way SDGs are implemented could mirror the fragmented and compartmentalized structure of international and national policy making and proceed without an approach to policy coherence that evolves a clear set of priorities for achieving systems integration.

The 2030 Agenda [10,38] recognises that each national government should (a) decide how the SDGs should be incorporated into national planning processes, policies and strategies; (b) set their own

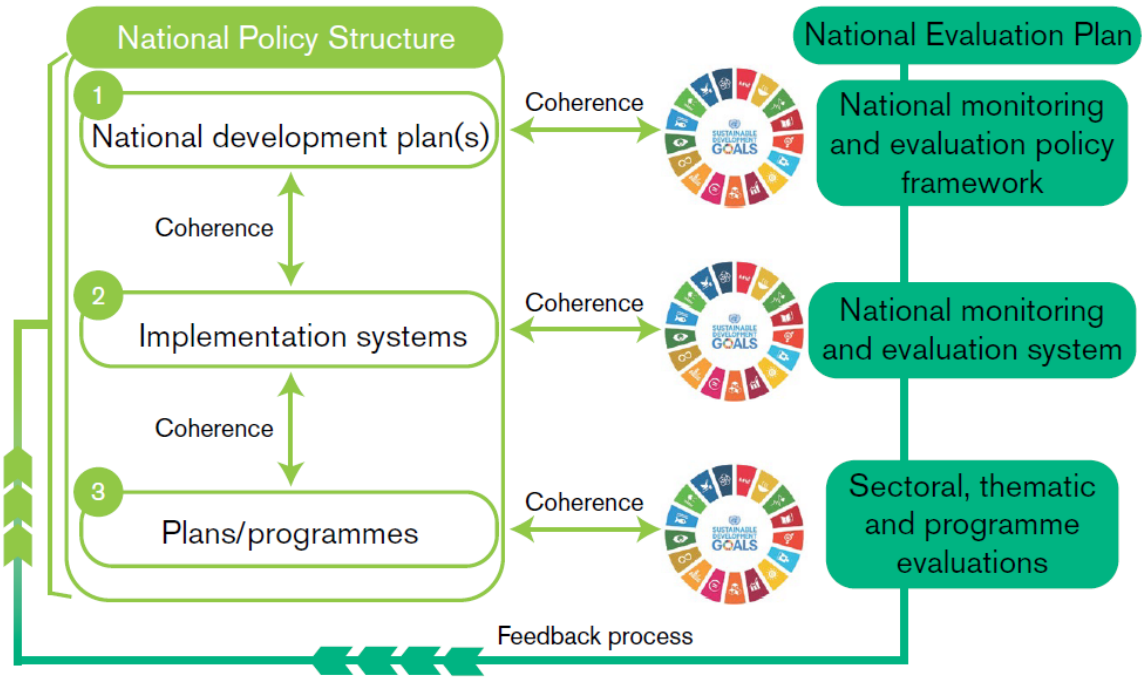

Figure 7. Integrating the SDGs into national evaluation plans to show how national policy can be linked to, and informed by, an evaluation plan aligned to the 2030 Agenda. The left side shows different levels of national policy and reform agendas. The right side shows the analogous components of a 2030 Agenda national evaluation plan. Source: IIED [43].

national targets guided by the global level of ambition, but taking into account national circumstances [48,49]. This requires an analysis of how well existing national plans and sectoral strategies align against the comprehensive scope of the 2030 Agenda and SDGs to examine internal coherence between the different national policy structure levels to avoid 'disconnects' and unintended consequences (Figure 7).

2.1 Policy context for the SDGs4I project

The "Identifying Interactions for SDG Implementation in Ireland" project is focused on providing support to the Government of Ireland specifically on SDG 17 and its Target 17.14 that calls on countries to enhance policy coherence for sustainable development [70]. Enhancing policy coherence is important across all SDGs so that they are implemented in a balanced and integrated manner across all of government and across different sectors. Policy coherence is also important from a transboundary perspective to ensure that domestic policy is supportive towards international policy and impacts. An outcome from policy coherence is to identify trade-offs and mitigate negative impacts between policies, foster synergies and produce policies that mutually reinforce each other.

The proposed indicator for Target 17.14 is centred upon evidence of a relationship between rules and the SDGs and the implementation of relevant SDG targets[8] that leads to coherence between sustainable development policies in general and not just the 2030 Agenda and SDGs [70].

While emerging international practice emphasises the need to adopt evidence-, and science- based approaches to SDG implementation, the challenge remains of how existing policy instruments can be aligned and applied to implementing the SDGs simultaneously in a coherent and integrated manner. [35,71]. Implementation of the 2030 Agenda and the SDGs requires an assessment of outcomes of various policy interactions, some of which may be unforeseen – for instance, policy promoting changes to agricultural practices could unintentionally undermine governmental policies aimed at protecting biodiversity. The SDGs are a more holistic and wide-ranging agenda for sustainable development that present new challenges arising from interactions between different goals and targets, and competing agendas, interests and priorities among the entwined economic, social and environmental protection goals [72]. Strategic guidance provided by the United Nations Development Group[9] recognises the challenges to undertake strategy-making, planning and policy-making that is based in systems thinking and delivers an integrated view that addresses the inherent interconnectedness and complexity of sustainable development. This Group suggested that creating horizontal policy coherence, integration and partnerships has three elements:

[8] http://indicators.report/targets/17-14/
[9] https://undg.org/

1. Integrated policy analysis: to ensure that proposed policies, programmes and targets are supportive of nationally-adapted SDGs;
2. Coordinated institutional mechanisms: to create formal partnerships across sectoral line ministries and agencies;
3. Integrated modelling: to help clarify and articulate the interconnected system of goals and targets and to analyse and inform key policies, programs and projects for their impact on nationally-adapted SDGs.

The "Identifying Interactions for SDG Implementation in Ireland" project aims to address **1** (this report) through an analysis of the alignment of existing Government of Ireland policy to SDGs in the context of strategic issues. The project will also aims to address aspects of **3** (D3.1 and following deliverables) through the development and implementation of a tool to explore the interconnected system of goals and targets in the context of the selected strategic issues.

2.2 Strategic policy issues for analysis by the SDG4I project

Implicit in the design of the SDGs is that each goal and target has various degrees of dependency and influence on others, but it remains unclear exactly how these interlinkages work. The integrated nature of the goals and targets means that progress on one goal or target is linked through causal relationships and feedback loops to other goals and targets [71]. The literature has focussed almost exclusively on the inter-linkages between SDGs and Targets, and their interaction with the policy

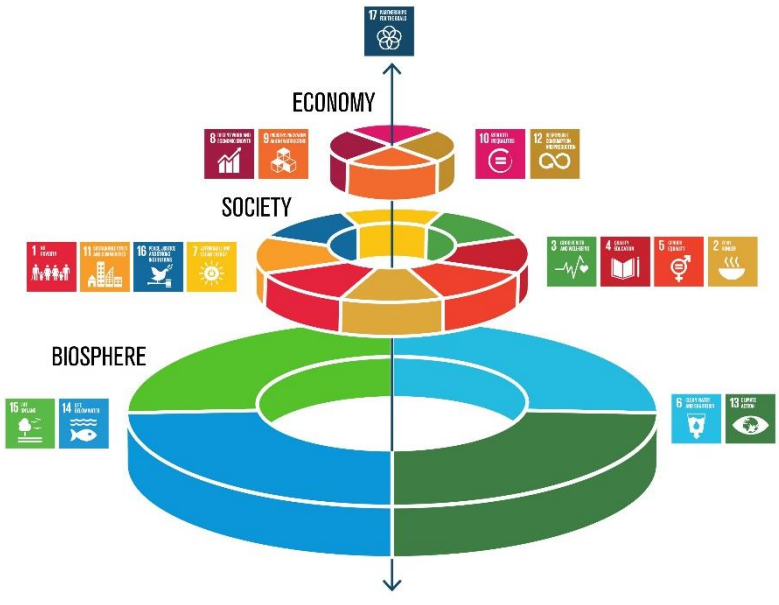

Figure 8. The "wedding cake" illustration of the SDGs to shift the focus to the biosphere (environment/biodiversity) as a precondition for social justice, economic development and sustainability. Source: https://www.stockholmresilience.org/research/research-news/2016-06-14-how-food-connects-all-the-sdgs.html.

instruments that will enable SDG implementation at the national level has received little attention. Most countries have reported progress in establishing alignment of the SDGs with existing development plans and strategies and/or strengthening institutional frameworks and governance

arrangements for coordination and consultation on the SDGs [35]. In contrast there has been little progress at the national level in other important planning stages, including target setting, assessing interlinkages between targets and existing policy [73,74]. The integration of environmental objectives into non-environmental policy-sectors is a critical precept for sustainable development [75]. Acknowledging that the SDGs represent a continuum across economies, societies and the biosphere [28] emphasises the connectivity, synergies and trade-offs across SDGs and between environmental policy objectives with those of other sectors (Figure 8).

The National Planning Framework of Ireland [22] and the SDG National Implementation Plan (NIP) with its links to national sustainable development and climate action frameworks [1] recognise that transforming socio-technical systems, which underpin production and consumption patterns for sectors such as agriculture, transport and energy is essential if human activities are to be brought back within ecological boundaries [76].

Ireland's Project Ireland 2040 National Development Plan [22,23] articulates a vision for economic, environmental and social progress in the context of a growing population through ten strategic outcomes (Figure 9). This plan recognises the value of biodiversity, includes a commitment to the UN Sustainable Development Goals, and objectives to support the transition to a competitive, low-carbon, climate-resilient and environmentally sustainable economy by 2050 [77,78]. Although not explicitly stated, Project Ireland 2040 is effectively an operational framework for Ireland's approach to

Figure 9.The National Strategic Outcomes outlined in Ireland's National Development Plan. Source [22]

sustainable development as set out in "Our Sustainable Future"[3,79], which also recognises the importance of biodiversity and climate action to social and economic resilience and achieving sustainable development. Biodiversity and ecosystems contribute significantly to climate change adaptation, mitigation, and Disaster Risk Reduction (DRR), while at the same time, climate change is a major and growing driver of biodiversity loss. Despite such recognition, through global to local scales, achieving sustainable development is compromised by natural resource degradation, scarcity, and climate change impacting human quality of life [80,81].

The 2030 Agenda, with the Paris Agreement, Sendai Framework and other related initiatives, provide a shared set of goals and targets for societies that should be adopted locally and nationally in order to achieve the wider global goals. Unsustainability emerges from resource exhaustion and/or environmental shocks arising within a context of poor practices and weak capacity to adapt to changing ecological and societal contexts. Development and implementation of coherent, integrated, and co-beneficial policies is required across the biodiversity, climate change, and sustainable development arenas. "*Our Sustainable Future Progress Report 2015*" [79] identifies that "implementation of the 2030 Agenda at national level will require a broad and integrated domestic policy response across the economic, social and environmental pillars of sustainable development, as well as the UN Development Group" and "will require close coordination across all Departments and a suitable mechanism is being actively considered to achieve this."

An overall outcome from an evaluation of the literature since the instigation of the 2030 Agenda is that seemingly each goal is somehow connected to every other goal such that deciphering a pathway for implementation of the SDGs at a national-level is an intimidating task [82]. This could lead policy makers to continue with business as usual approach hoping that existing policy actions will somehow deliver aspects of the SDGs and Targets [71,74]. However, this is likely to perpetuate existing institutional arrangements and further entrench existing policy siloes. With 169 Targets, the potential synergies and trade-offs are almost infinite and probably unmanageable as a whole – for instance see the JRC study for the European Union [10]. A number of studies have emphasised the importance of the underpinning role of the biosphere and a fundamental requirement to reduce degradation of natural resources if the goals of all dimensions of the 2030 Agenda are to be achieved everywhere, for everyone [28,82–88].

To further investigate the challenges of integrating across policy areas the SDGs4I project will focus on the implementation of environmental features of the SDGs and the underpinning SDGs relating to climate and biodiversity to explore how government policy interacts with the framework of the SDGs. The SDGs have not been formally classified as one of economic, social and environmental goals, but Goals 13, 14 and 15 with 6 have been commonly identified as forming an environmental goal cluster

representing the biosphere that underpins economy serving society so that it evolves within the safe operating space of the planet [25,28,67,89].

This section has outlined the wider policy context for SDG implementation in Ireland and introduced the underpinning foundation for societal and economic development provided by the biosphere represented by the four environment SDGs (and other environment-oriented targets and text across other SDGs).

3 The context of the environment and biodiversity to SDGs

This section outlines the specific importance of the environment, and the influence of climate change, to the wider ambitions of the SDGs, how the environment is pervasive throughout the 17 SDGs and why this is relevant in the context of national planning that may have a greater emphasis on social and economic goals.

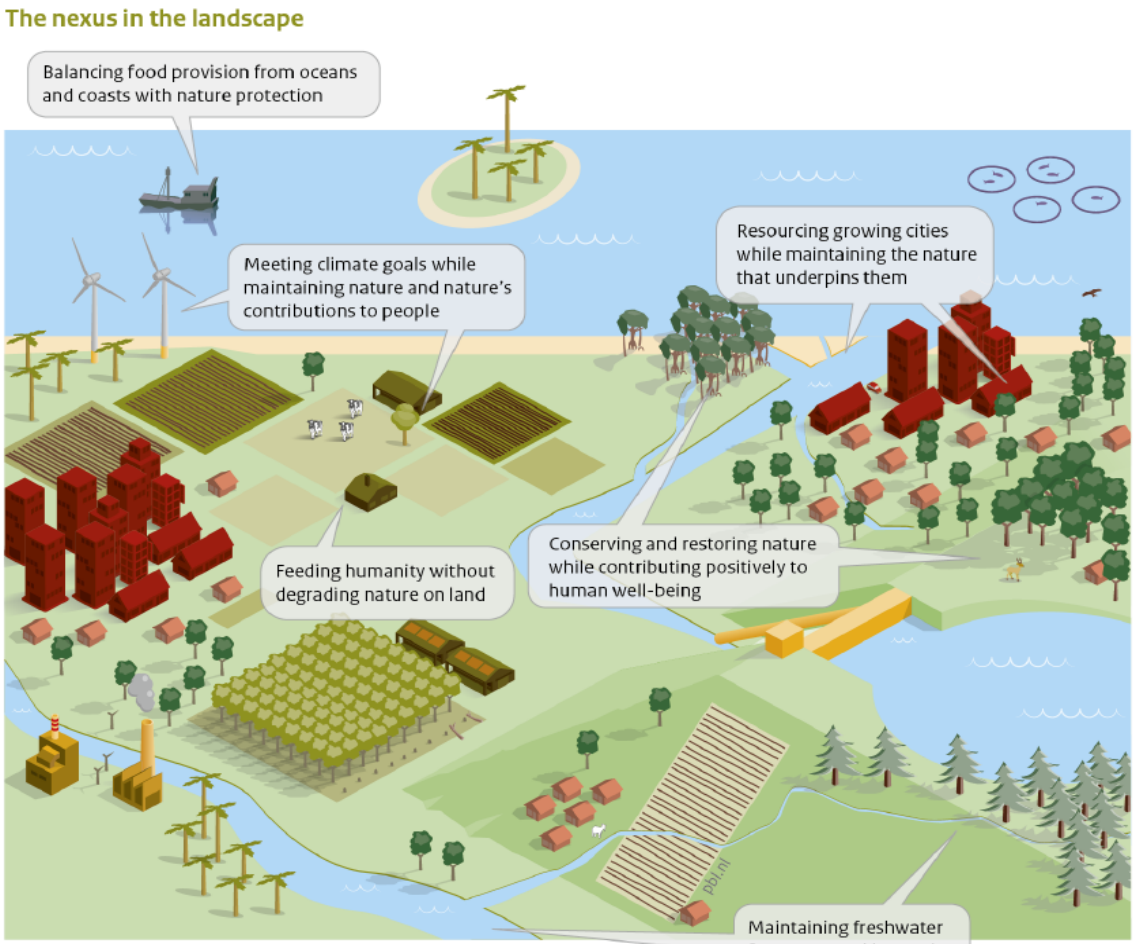

Figure 10. The complementary perspectives of the contribution of biodiversity and the environment to sustainability goals and targets (especially the UN's Sustainable Development Goals, SDGs, and the CBD's Aichi Targets). Source [109]

The environment plays a pivotal role in lifting people out of poverty, in ending hunger, in growing our economies, in building peaceful, just and inclusive societies, and in promoting the health of our people and this planet (Figure 10) [90]. Concurrently, there is overwhelming evidence that atmospheric,

geologic, hydrologic, biospheric and other earth system processes are now altered by humans to a greater extent than by 'natural' processes leading to the concept of the Anthropocene [81,91,92]. A key indicator that human pressures on Earth's life-supporting natural systems now exceed the planet's bio-geo-capacity is climate change [93–95] with complex causation and response relationships and feedback loops [96,97]. Review of progress on the sustainable development goals has highlighted a lack of progress among environment-related Goals such as climate action and biodiversity as significant barriers to the overall achievement of the 2030 Agenda [98]. This is illustrated by the reported synergistic and trade-off connections between the environmental (biosphere) SDGs with other SDGs, as well as between the environmental SDGs themselves (Figure 11).

Modern societies have increasing patterns of consumption, and waste, that lead to interactions with the biophysical environment that are unsustainable [99]. Current research tends to focus on assessing the status of the environment and the implications of current and projected patterns of impact of humanities exploitation of the environment [100]. The consequence is that policy responses have tend to be reactive, in an attempt to limit access to space and resources, and not also allowed for the design of proactive that would lead to societal transformation that benefit both society and the environment [101]. Rather, policy makers need to integrate environmental dimensions of the SDGs into policies, plans, programs, budgets, and investments, which requires all parts of government to consider the environment in their own policy planning and implementation [102].

It is widely recognised that sustainable development has become an inescapable reality at all levels of economic integration, which makes strong action in environmental matters all the more necessary and legitimate [2,25,90,102–106]. Research has shown that biodiversity underpins human well-being and livelihoods whilst often pursuing social goals can lead to higher environmental impacts [107,108], which emphasises the need for integrative policy response to sustainability to achieve the SDGs [107]. This conclusion has been emphasised in the Global Assessment of the State of Biodiversity and Ecosystem Services that calls for immediate action to transform the relationships between humans and nature to prevent severe consequences and safeguard our ability to achieve the SDGs [109]. Going far beyond the scope of SDG 14 and 15, that respectively address life below water and life on land, biodiversity and healthy ecosystems provide the essential resources and ecosystem services that directly support a range of societal sectors and economic activities, such as agriculture, forestry, fisheries, and tourism [110]. Current negative trends in biodiversity and ecosystems will, for instance, undermine progress towards 80% of the assessed targets of SDGs related to poverty (SDG1), hunger (SDG 2), health (SDG 3), water (SDG 6), work and economic growth (SDG8), industry and infrastructure (SDG 9), cities (SDG 11), sustainable consumption (SDG12), climate (SDG 13), oceans (SDG 14), land (SDG 15), and peace and justice (SDG16) [27]. Such considerations have led to a re- drawing of the SDGs to more strongly imply that economies and societies are embedded parts of the biosphere [28].

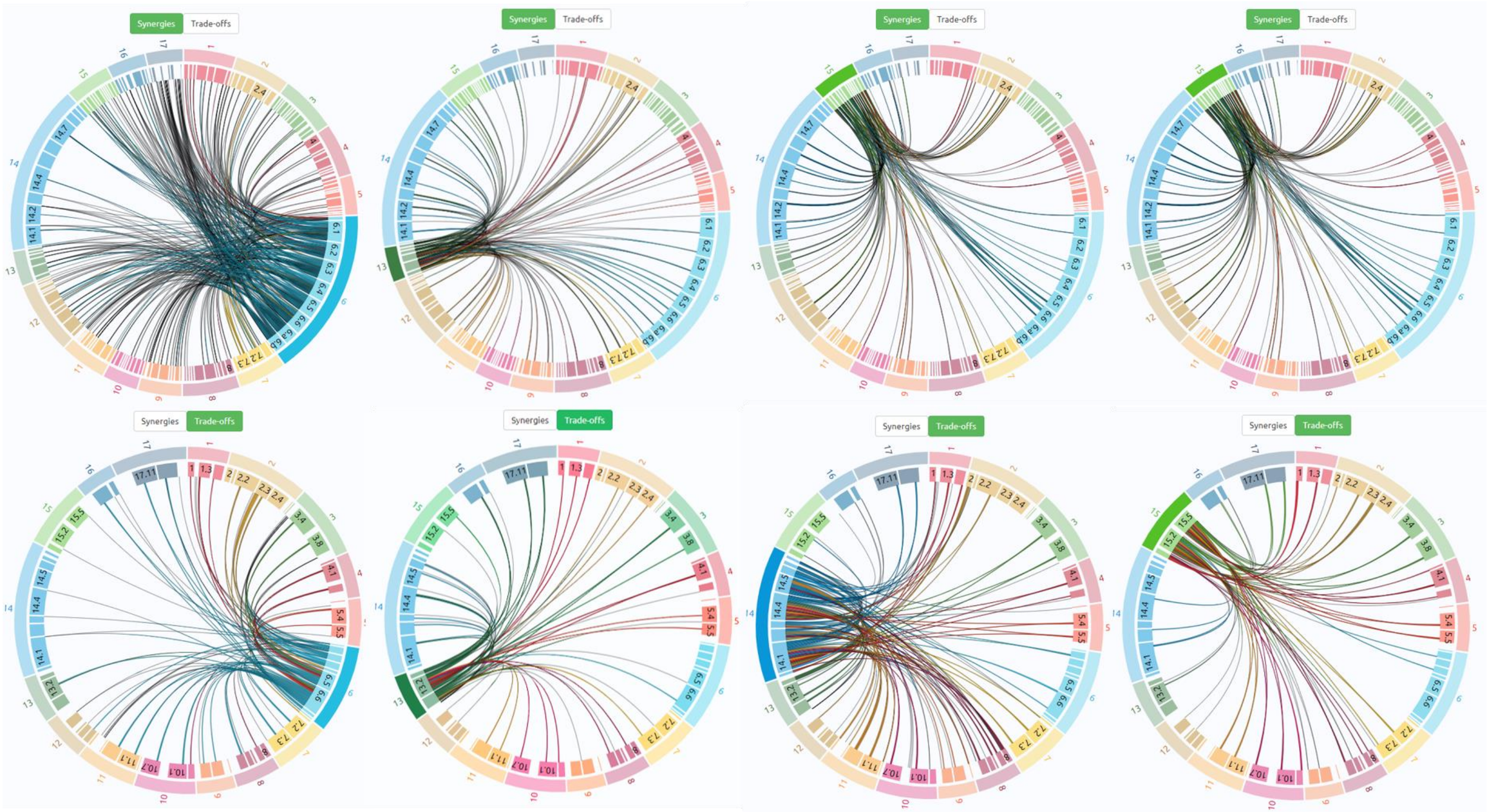

Figure 11. The synergistic and Trade-off linkages between environment (biosphere) SDGs with other SDGs based on a survey of literature. The SDGs provide a comprehensive, integrated development framework. There are potentially a large number of synergies and complementarities among the different SDGs and targets. Policies improving a specific dimension can generate impacts in other dimensions, with a large set of possible cascading positive or negative effects. Interlinkages can be context dependent or general, apply locally, nationally or globally and become effective in the short but also in the long-term. Source: EC, The KnowSDGs platform (http://knowsdgs.jrc.ec.europa.eu/).

This moves the paradigm for development from a sectoral approach, where social, economic, and ecological development are separate parts, to one where the economy serves society so that it evolves within the safe operating space of the planet [111].

Such an approach emphasises the importance of the environmental dimensions of sustainable development [112–114]. Biodiversity underpins the benefits provided by natural resources and ecosystem services that sustain the existence of humanity and are therefore fundamental to the contribution of the environment to sustainable development [115,116].

3.1 Policy challenges for the SDGs – environment nexus

There remains variation in the literature with respect to the designation of the environmental dimension of the SDGs (e.g. should it include only those indicators related to the state of the environment or should it also include indicators related to access to natural resources and/or interactions between environmental indicators and the attainment of other social and economic indicators?). The 3 pillars description of sustainable development instilled the environment alongside social and economy as equally important components of sustainability [117]. In practice, economic and social pillars became prioritised as Governments pursue growth strategies accepting trade-offs between environment and the economy.

Target No.	Content related to environment	Target No.	Content related to environment
1.5	Resilience to climate and environmental shocks and disasters	**7.b.**	**Infrastructure and technology**
2.4	**Sustainable food production systems**	**8.4**	**Resource efficiency & decoupling economic growth from environmental degradation**
2.5	Genetic diversity	**8.8**	Labor rights and safe working environment
3.3	Deaths and illness from pollution	**8.9**	**Sustainable tourism**
3.9	Water-borne diseases	**9.1**	**Sustainable and resilient infrastructure**
4.7	**Education for sustainable development**	**9.2**	**Sustainable industrialization**
5.a	**Women's equal rights to economic resources, property, natural resources**	**9.4**	**Sustainability upgrading and resource efficiency**
6.1	Access, safe water	**9.a**	**Financial, technical, & technological support for sustainable & resilient infrastructure**
6.2	**Sanitation**	**11.1**	Adequate, safe, affordable housing
6.3	**Water quality**	**11.2**	**Sustainable transport**
6.4	**Use-efficiency**, scarcity	**11.3**	**Inclusive and sustainable urbanization**
6.5	**Integrated water management**	**11.4**	Protect & safeguard cultural & natural heritage
6.6	Ecosystems	**11.6**	Environmental impact, air quality, **waste management**
6.a	**Capacity building**	**11.7**	Green and public spaces
6.b	**Local participation**	**11.a**	**National and regional development planning**
7.2	**Renewable energy**	**11.b**	**Integrated policies on inclusion, resource efficiency, climate mitigation & adaptation, resilience, disaster risk management**
7.3	**Energy efficiency**	**11.c**	**Support for sustainable & resilient buildings**
7.a	**Related investment**	**12-15: All**	**(Except 14. a)**

Gray box: environmental condition to be improved
Bold text: means to improve the environment
Gray box and bold text: the target combines the environmental condition to be improved with means to improve it
Normal text: ends which benefit from an improved environment

Figure 12. The environmental targets can be defined as ones which use specific words such as 'environment', 'sustainability' or 'pollution' or whose text can be interpreted as referring to them. This shows that 73 of the 169 targets are directly related to the environment representing 53% of the targets under SDGs 1–15. Conversely, only 37 of the 169 targets (about 22%) do not seem clearly related to the environment. Only SDGs 10, 16 and 17 do not directly or indirectly refer to the environment. Source:[107].

Within the SDGs many environment-related targets – including some of the most important ones – are found in Goals other than the 4 biosphere SDGs (SDGs 6, 13, 14 & 15) (Figure 12). Biodiversity is considered cross-cutting and relevant to all the SDGs [25,27] (Figure 13 & Box 1) and the integrity of the biosphere is a cross-cutting theme through many of the SDGs and Targets through its direct contributions to human wellbeing depicting societies and economies dependency on SDGs 6, 13, 14 and 15 [20] and, therefore, essential to ensuring the coherence and complementarity of the 2030 Agenda to existing national and international processes, frameworks, plans and strategies. There is variation in the precise connection between biodiversity and environmental dimensions to the SDGs and Targets; Elder and Olsen [117] identified 73 Targets across Goals 1-9 and 11-15 as 'Environmental' whereas UNEP [105] has identified 72 Targets across Goals 1-9 and 11-17, the Convention on Biological Diversity considers that 56 outcome Targets across all 17 SDGs have an environmental focus [27], and the OECD 22 Targets [14]. There is also some variation on which SDGs and what terminology is considered to represent the 'environment', for instance, the 'wedding-cake' depiction of the SDGs (Figure 8) identifies SDGs 6, 13, 14 and 15 as consituting the biosphere elements [28] whereas the recent Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) assessment has considered seven of the Sustainable Development Goals as nature-based (SDGs 2, 3, 6, 11, 13, 14 and 15) [109]. The analysis by Elder and Olsen [117] demonstrates that, in addition to SDGs that reflect the underpinning role of the biosphere to sustainability, the environment has a role in achieving 7 of the Society goals and 3 of the 4 Economic goals. Annex 1 provides a more detailed review of the interactions of biodiversity with the SDGs.

Figure 13. Biodiversity and ecosystem services are relevant for all SDGs. Source: [25]

Box 1: **Linkages between biodiversity and SDGs and the contributions of biodiversity to achieving the SDGs** contributing directly to human well-being and development priorities. Source: Adapted from [27].	
	GOAL 1 - END POVERTY IN ALL ITS FORMS EVERYWHERE: Biodiversity provides work, resources and income, particularly for the rural poor, the majority of whom directly depend on biodiversity and ecosystems. Ecotourism is a fast-growing sector that can generate significant employment and income for poor rural communities.
	GOAL 2 - END HUNGER, ACHIEVE FOOD SECURITY & IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE: Biodiversity is a key element of food security and nutrition underpinning ecosystem functions, such as pollination, soil fertility, and water quality, agricultural productivity. Agricultural practices can reduce vulnerability to climate change.
	GOAL 3 - ENSURE HEALTHY LIVES & PROMOTE WELL-BEING FOR ALL AT ALL AGES: Healthy ecosystems mitigate the spread and impact of certain types of air, water and soil pollution. Agricultural biodiversity contributes to human health through increased sustainable production, reducing the need for pesticides and other chemical inputs.
	GOAL 6 - ENSURE THE AVAILABILITY & SUSTAINABLE MANAGEMENT OF WATER & SANITATION FOR ALL: Ecosystems help maintain water supply and quality, and mitigate hazards and disasters. Managing ecosystems to maintain these types of services is generally more cost-effective than employing built technologies.
	GOAL 8 - PROMOTE SUSTAINED, INCLUSIVE & SUSTAINABLE ECONOMIC GROWTH, FULL & PRODUCTIVE EMPLOYMENT & DECENT WORK FOR ALL: Biodiversity and ecosystems underpin many economic activities. Conservation and sustainable use support higher productivity, efficient resource use, and long-term viability of resources.
	GOAL 9 - BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE & SUSTAINABLE INDUSTRIALIZATION & FOSTER INNOVATION: Biodiversity and healthy ecosystems can provide reliable and cost-effective natural infrastructure (e.g. coastal protection). Natural and green infrastructure in cities reduce run-off of pollution into water bodies and offer multiple benefits.
	GOAL 11 - MAKE CITIES & HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT & SUSTAINABLE: Ecosystems and biodiversity deliver the basic services and conditions that enable, support and protect human production, consumption and habitation. Biological resources provide many of the foods, building materials, energy, and medicines that are consumed in urban centres.
	GOAL 12 - ENSURE SUSTAINABLE CONSUMPTION & PRODUCTION PATTERNS: Consumption and production of goods and services require transformation of natural resources impacting biodiversity and provision of ecosystem services. Resource-efficient approaches to minimize wastes and pollutants lead to economic opportunities, wellbeing and benefit biodiversity.
	GOAL 13 - TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE & ITS IMPACTS: Ecosystems represent significant carbon stores that are critical to avoid changes to the Earth's atmospheric temperature and climate system. Protecting and restoring habitats offer cost-effective ways to mitigate and adapt to climate change and buffer against climate extremes and other disasters.
	GOAL 14 - CONSERVE & SUSTAINABLY USE THE OCEANS, SEAS & MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT: Conservation and sustainable use of biodiversity in marine and coastal ecosystems is a key aspect of sustainable development. Biodiversity underpins all fishing and aquaculture activities, as well as other species harvested for foods and medicines.
	GOAL 15 - PROTECT, RESTORE & PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION & HALT & REVERSE LAND DEGRADATION & HALT BIODIVERSITY LOSS: The conservation, restoration and sustainable use of terrestrial ecosystems is essential for sustainable development and for achieving other SDGs.
	GOAL 16 - PROMOTE PEACEFUL & INCLUSIVE SOCIETIES FOR SUSTAINABLE DEVELOPMENT, PROVIDE ACCESS TO JUSTICE FOR ALL & BUILD EFFECTIVE, ACCOUNTABLE AND INCLUSIVE INSTITUTIONS AT ALL LEVELS: Conflicts over natural resources, environmental degradation and contamination can be one of the factors leading to social insecurity and violence.
	GOAL 17: STRENGTHEN THE MEANS OF IMPLEMENTATION AND REVITALIZE THE GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT: National Biodiversity Strategies and Action Plans (NBSAPs) integrate biodiversity and ecosystems into national, subnational and sectoral development policies to help enhance policy coherence and implementation of the SDGs.

The biosphere SDGs (6,13,14 and 15) represent both the opportunity that the environment offers societies and economies (SDGs 6, 14 & 15) and humanity as a major force impacting and dictating

current and future opportunity (SDG 13). The juxtaposition between sustainable development and the environment's connection with societies and economies features prominently in the 2030 Agenda [38]. The "*Identifying Interactions for SDG Implementation in Ireland*" project will focus on the synergies and trade-offs of Means of Implementation (MoI) targets of the biosphere SDGs with other SDGs to explore SDG implementation in the context of domestic priorities and global obligations; namely, Climate Action aligned to the 2015 Paris Agreement within the framework of the United Nations Framework Convention on Climate Change (UNFCCC) and Biodiversity assessment aligned to the Convention on Biological Diversity (CBD) and IPBES.

Recent SDG status reports indicate that implementation of SDGs with a stronger environmental focus shows limited progress [102]. There is a need to better comprehend the impact of policies on the environment, the contribution the environment can make to other sector policies and the importance of delivering the SDGs as an integrated whole. For instance, meaningful action to achieve SDG 12 on Responsible Consumption and Production requires action on environmental goals and targets—such as, 14 on Life below Water and 15 on Life on Land—and significant strengthening of national responses to meet them. Taking a whole-of-government approach is a key mechanism to avoid trade-offs between environment and socioeconomic priorities and ensure that the environment plays a pivotal role in lifting people out of poverty, in ending hunger, in growing economies, in building peaceful, just and inclusive societies, and in promoting the health of our people and this planet [90,118].

3.2 Characterising biodiversity in the SDGs

Biodiversity is essential for sustainable development and human well-being [116,119]. It underpins the provision of food, fibre and water; it mitigates and provides resilience to climate change; it supports human health, and provides jobs in agriculture, fisheries, forestry and many other sectors. Without effective measures to conserve biodiversity and use its components in a sustainable manner, the 2030 Agenda for Sustainable Development will not be achievable. Inculcating biodiversity into planning for SDG implementation faces challenges in four key areas: (i) mainstreaming biodiversity at the national level; (ii) mainstreaming biodiversity in the agriculture, forestry and fisheries sectors; (iii) biodiversity mainstreaming in development co-operation; and (iv) monitoring and evaluating biodiversity mainstreaming [120]. Mainstreaming biodiversity and the value of natural ecosystems into economic growth and development objectives is a crucial element of this, as reflected by Sustainable Development Goals 14 and 15 on Life under Water and Life on Land, among others.

The Strategic Plan for Biodiversity 2011-2020 adopted under the Convention on Biological Diversity has linked all 20 of its Aichi Biodiversity Targets against all 17 SDGs [27]. There is, however, no clear designation of the environmental dimension of the SDGs (e.g. should it include only those indicators related to the state of the environment or should it also include indicators related to access to natural

resources and/or interactions between environmental indicators and the attainment of other social and economic indicators?).

Strategic Goal A of the 2011-2020 Aichi Biodiversity Targets under the Convention on Biological Diversity is to address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society [27]. Meeting the Aichi Biodiversity Targets would contribute significantly to broader global priorities addressed by the post-2015 development agenda; namely, reducing hunger and poverty, improving human health; and ensuring a sustainable supply of energy, food and clean water. The SDGs reaffirm the importance of biodiversity for human well-being and apply equally to developed countries, such as Ireland, and undeveloped countries. At the national level, including for Ireland [31], National Biodiversity Strategies and Action Plans (NBSAPs) there is a recognition of the linkages between biodiversity and development and include targets for mainstreaming (Box 2). Similarly, National Development Plans (NDPs), National Sustainable Development Plans, and green growth strategies of some countries include consideration of biodiversity.

Box 2. Ireland's commitment to protecting and mainstreaming biodiversity

Ireland has signed and ratified international conventions, treaties, protocols and other agreements to contribute to a global response and approach to protecting biodiversity and ecosystem services including: the CBD, the UN Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Bonn Convention (on conservation of migratory species of wild animals) (CMS), the Global Strategy for Plant Conservation (GSPC), OSPAR Convention (North-East Atlantic), International Convention for the Regulation of Whaling, and the Ramsar Convention (on wetlands).

Ireland is also a member of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), a Party to the UN Framework Convention on Climate Change and has adopted the Sustainable Development Goals (SDG). Ireland is implementing the Lima Action Plan for UNESCO's Man and the Biosphere Programme and its World Network of Biosphere Reserves (2016-2025).

In Ireland, the Wildlife Act, 1976, amended by the Wildlife (Amendment) Act, 2000, is the principal national legislation providing for the protection of wildlife and habitats with the European Communities (Birds and natural habitats) Regulations 2011 providing compliance with The EU Habitats Directive (Directive 92/43/EEC)17 and the Birds Directive (Directive 79/409/EC). Other EU legislative instruments relevant for mainstreaming biodiversity that Ireland must comply with are the Marine Strategy Framework Directive (2008/56/EC); the Water Framework Directive (2000/60/EC); the Nitrates Directive (91/676/ EEC); the Environmental Impact Assessment Directive (2011/92/EU amended by 2014/52/EU); the Strategic Environmental Assessment Directive (2001/42/EC); and the Environmental Liability Directive (2004/35/CE).

Environmental jurisprudence has evolved rapidly over the past four decades but in a largely piecemeal and reactive manner such that it is fragmented and is poorly integrated, if at all, with other sectoral regulatory frameworks at national, regional or international levels [121,122]. For instance, responsibility for biodiversity is now vested in the Minister for Culture, Heritage and the Gaeltacht but other areas relevant to the environment and biodiversity rest with the Department of Housing, Planning and Local Government (planning and development, water quality and marine environment)and the Department of Communications, Climate Action and Environment (renewable energy, and climate change), the Department of Agriculture, Food and the Marine (policies and funding programmes in the areas of agriculture, food, fisheries, forestry, and rural environment), An

Garda Síochána and Customs (enforcement of certain key legislation in the area of illegal trade and importation); and other State bodies such as the Environmental Protection Agency, Marine Institute, Inland Fisheries Ireland, Teagasc, the Heritage Council, Waterways Ireland, Coillte and the Office of Public Works.

3.3 The linkages between climate change to biodiversity and the SDGs

Biodiversity and the ecosystems they underpin have a complex circular relationship to climate change; they provide natural solutions that build resilience to the impacts of climate change as well as contributing to the wider objectives of the SDGs [123,124], whilst climate change is recognised to have a significant impact on biodiversity change from local to global scales [119,125].

Climate change is a threat multiplier that exacerbates change across many of the SDGs, as well as compromising the contribution that environmental factors make towards them [126,127]. Climate change is a direct driver of changes in nature and its contributions to people that will increase in coming decades [107]. Scenarios show that meeting the SDGs and the 2050 Vision for Biodiversity depends on taking into account climate change impacts in the definition of future goals and objectives. To meet the SDGs, and achieve the 2050 Vision for Biodiversity [128,129], addressing Targets is likely to be more effective, and could be enhanced, if the impacts of climate change are factored into actions addressing their implementation [130–132]. The 2030 Agenda complements the Paris Agreement by linking climate mitigation and adaptation with other sustainable development challenges across its 17 goals [133–136]. As well as SDG 13, many of the SDGs include text and Targets that are relevant to addressing climate change such that the SDGs and their Targets can be regarded as enablers for policy integration because they address cross-sectoral and policy linkages that can bring shared benefits [137–142] (Figure 14). The IPCC report on 1.5°C pathways indicate robust synergies, particularly for the SDGs 3 (health), 7 (energy), 12 (responsible consumption and production) and 14 (oceans). For

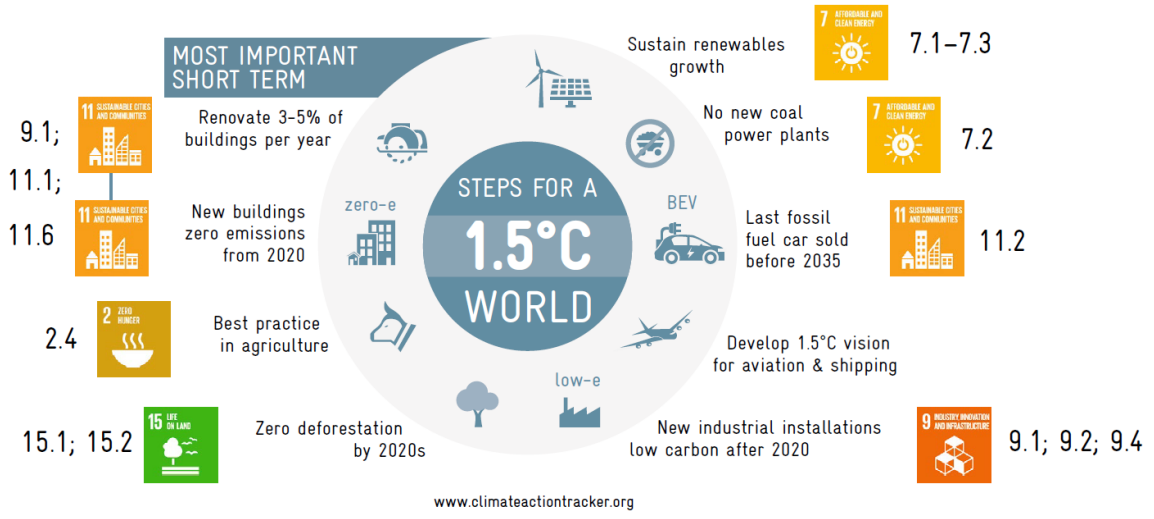

Figure 14. Short term connections between possible climate mitigation and adaption options with SDG implementation. Source: https://www.wri.org/publication/connectingthedots-ndc-sdg.

SDGs 1 (poverty), 2 (hunger), 6 (water) and 7 (energy), there is a risk of trade-offs or negative side effects from stringent mitigation actions compatible with 1.5°C of warming [143].

The deep socio-technological transformation implied by strong climate action (SDG 13) could slow economic growth, negatively change industrialization and exacerbate inequality and poverty [72]. International climate change policy, as exemplified by the Paris Agreement, and the 2030 Agenda are fundamentally pursuing the same objective — a better, healthier and more resilient life for present and future generations. SDG 13 (Climate Action) and other SDGs, have interactions and interlinkages with many Targets of other SDGs (Figure 11), as well as alignment to features of the Paris Agreement and the Sendai Framework [137]. The link between SDGs and climate change reflects that many global goals, from poverty eradication and ending hunger to conserving biodiversity and protecting our oceans, will be unattainable if climate change mitigation, adaptation and resilience building fail [138]. These interdependencies present a challenge to reconcile policy agendas aimed at achieving and sustaining high standards of well-being with the need to move swiftly and decisively to decarbonize economies and take other measures to protect the health of the planet in the interest of future generations. In most cases, progress towards specific socio-economic goals and targets reinforces progress towards climate goals, and vice versa, but in some cases there may be difficult trade-offs to be addressed (e.g., providing universal, affordable energy access while transitioning rapidly away from carbon-based energy; expanding transportation infrastructure without increasing greenhouse gas emissions apace). An example of how climate change is inculcated in the structuring of the SDGs is provided by Target 8.1, that emphasises strong economic growth performance, which, if pursued without regard for other targets under SDG 8, would most likely drive increased carbon emissions. SDG Target 8.4, on the other hand, calls for decoupling growth from environmental degradation, which would moderate if not neutralize emissions growth. This underlines how issues around agriculture, energy and water are key for combating climate change as well as for sustainable development. The same is true for SDG 11, which reflects the importance of urbanization both for achieving the 2030 Agenda and for the success of the Paris Agreement, with over 70% of all greenhouse gas emissions generated by towns and cities [133,134].

This section has addressed the context of the environment as an underpinning foundation to the SDGs and the success of national planning, and how the influence of climate change will impact the environmental foundation to sustainable development.

4 Ireland's policy and implementation for the SDGs and the environment

This section provides an analysis of the connection of Ireland's policy and implementing setting to the SDGs, and a more in-depth examination of the policy environment in the context of a suite of SDG Targets that have been specifically chosen as having specific relevancy to the impact of the

environment on the successful implementation of the SDGs, and Targets that have a specific influence on the quality of Ireland's environment.

A recent study found that EU Member States are integrating SDGs into national strategies [144]. While Member States have taken steps to enhance horizontal policy coordination, there is a continuing need to better mainstream sustainability into national planning processes in a way that enhances collaboration across Government and addresses governance principles of the 2030 Agenda that demand:

> **Interconnectedness and indivisibility** so the 17 SDGs are implemented in their entirety supported by policy integration, coherence, and coordination.
>
> **Universality** to consider the interconnectedness of internal and external policies that are aligned with implementing the SDGs and Agenda 2030.

As to how this is achieved by individual nation states, the 2030 Agenda stipulates that "Each Government will also decide how these aspirational and global targets should be incorporated into national planning processes, policies and strategies. It is important to recognize the link between sustainable development and other relevant ongoing processes in the economic, social and environmental fields" (para.55 [38]). An EU-wide study [144] noted that, while Ireland's NIP was characterised by a 'whole-of-Government' approach and the SDGs were to be directly incorporated into a new foreign policy strategy (launched in 2018 [145]), the National Planning Framework to 2040 [22] and the strategy for public capital investment in the National Development Plan 2018-2027 [23] do not explicitly include a focus on the SDGs.

4.1 Ireland's organisation for SDG implementation

The Department of the Taoiseach, with support from the National Sustainable Development Unit, chairs a Senior Officials Group (SOG), made up of Assistant Secretaries from all Government Departments, to provide strategic coordination and to report to Cabinet. The SOG is assisted by an SDG Interdepartmental Working Group [IDWG], comprised of representatives from all Government Departments. The IDWG, chaired by DCCAE, is responsible for developing national policy in relation to SDG implementation.

The NIP recognises that there is an outstanding need for integrated, mutually supportive policies across economic, social and environmental dimensions of sustainable development in Ireland [1]. Each SDG target has been assigned a lead Department and other relevant Departments have been identified as stakeholders (Annex 1 [1]) (Figure 16 & Figure 21).

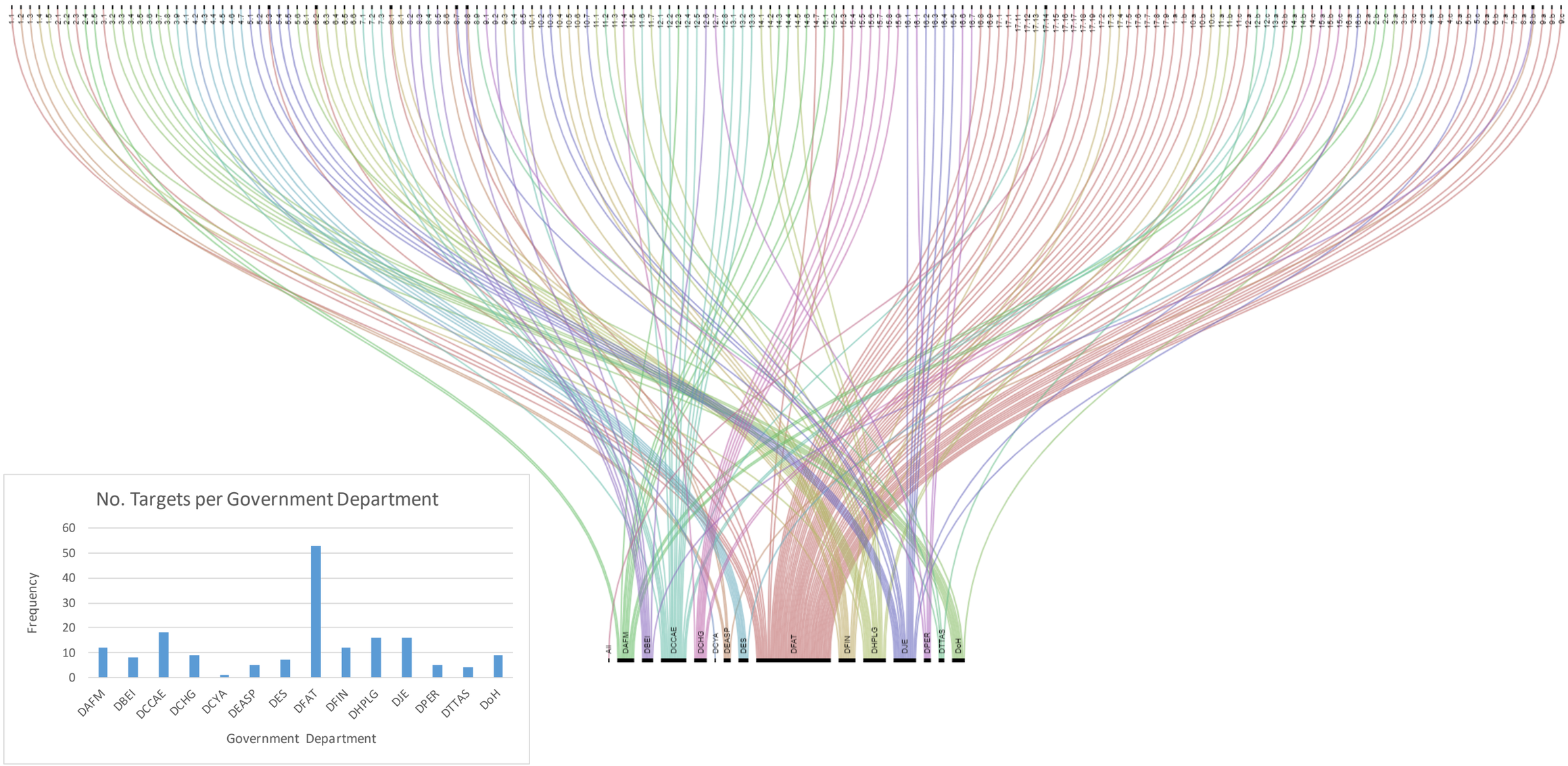

Figure 15. Alignment of Lead Government of Ireland Departments with the SDG Targets. All refers to all Govt. Depts and Revenue is strictly not a Govt. Dept but an Office of Commissioners. 3 Depts are not identified as a lead Dept. – Defence, Rural and Community Development and the Taoiseach, the latter as it has oversight across all SDGs and their Targets. Inserts: A graphical representation of the data showing the number of Targets aligned to each Government Department. The data shows that there is an uneven distribution of Department allocations across the SDG Targets. Source: Authors elaboration based on [1].

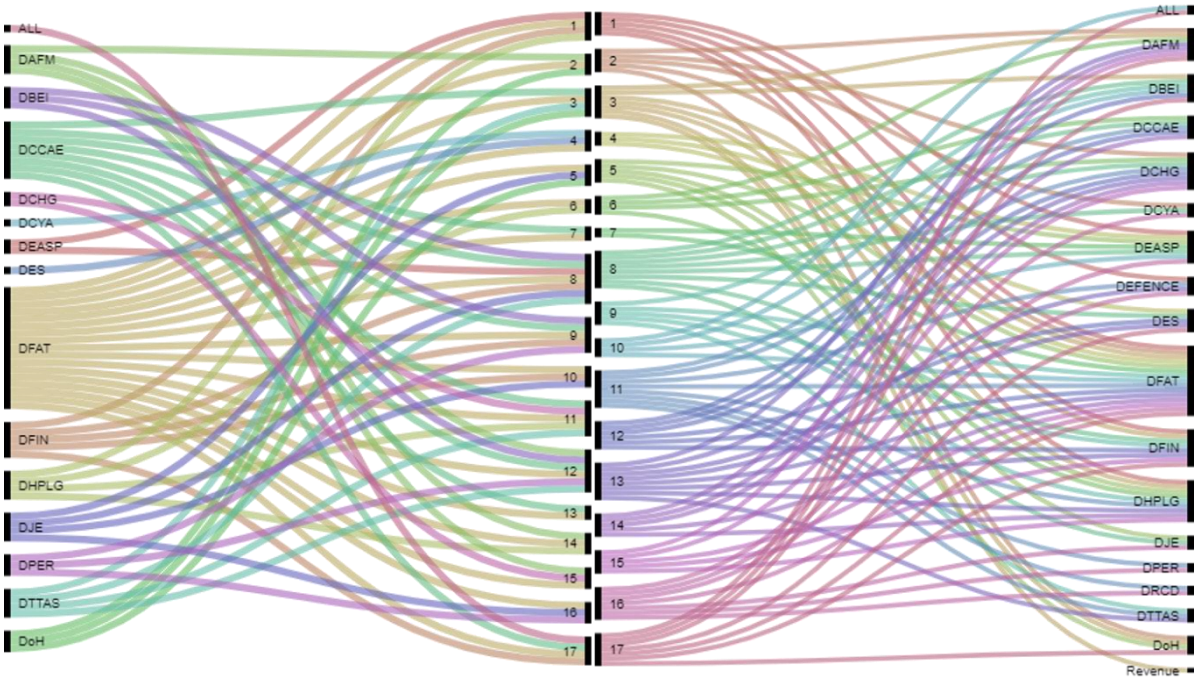

Figure 16. Distribution of Lead Government Depts (left) to the 17 SDGs (middle) and distribution of Stakeholder Government Depts (right) to the 17 SDGs. 14 out of 16 Government Depts are in the Lead Group (Department of Rural and Community Development and DEFENCE are not a Lead Dept. for any SDG). All 16 Government Depts are represented in the Stakeholder group. The Department of the Taoiseach is not included in this analysis as it has overarching responsibility across all 17 SDGs. Note that 1 SDG (SDG 17) under a 'Lead' heading and 2 SDGs under 'Stakeholder' (SDG 10 & 17) have 'All' Depts. allocated to them for at least 1 of their Targets. Source: Authors elaboration based on [1].

From a review of Annexes 1 and 2 from the NIP a number of observations can be made:

- There is an uneven spread of allocation as Lead Department across Government to the SDGs and Targets:

Dept	All	DAFM	DBEI	DCCAE	DCHG	DCYA	DEASP	DES	DFAT	DFIN	DHPLG	DJE	DPER	DTTAS	DoH
Lead	1	12	8	18	9	1	5	7	53	12	16	16	5	4	9

- 50 of the 169 Targets only have a Lead Department allocated to them with no Stakeholder Departments identified (Annex 1 of [1]).
- In conjunction with the alignment of Departments to SDGs and Targets, some 118 policy documents (including all plans, programmes, strategies and legislation) from 16 (of the 17) Government Departments and some EU legislation (Directives) and regional and international obligations (e.g. OSPAR and CDB respectively) have been identified as containing objectives that intersect with the ambition outlined by SDG Targets (Annex 2 of [1]).
- The alignment/allocation of policy documents and number of Departments at Target level is variable (Figure 17) with variances found in relation to (1) the number of policy documents aligned to any given Target; (2) the number of Departments aligned to any given Target; and (3) the number of Departments aligned to any given target with and without policy documents.

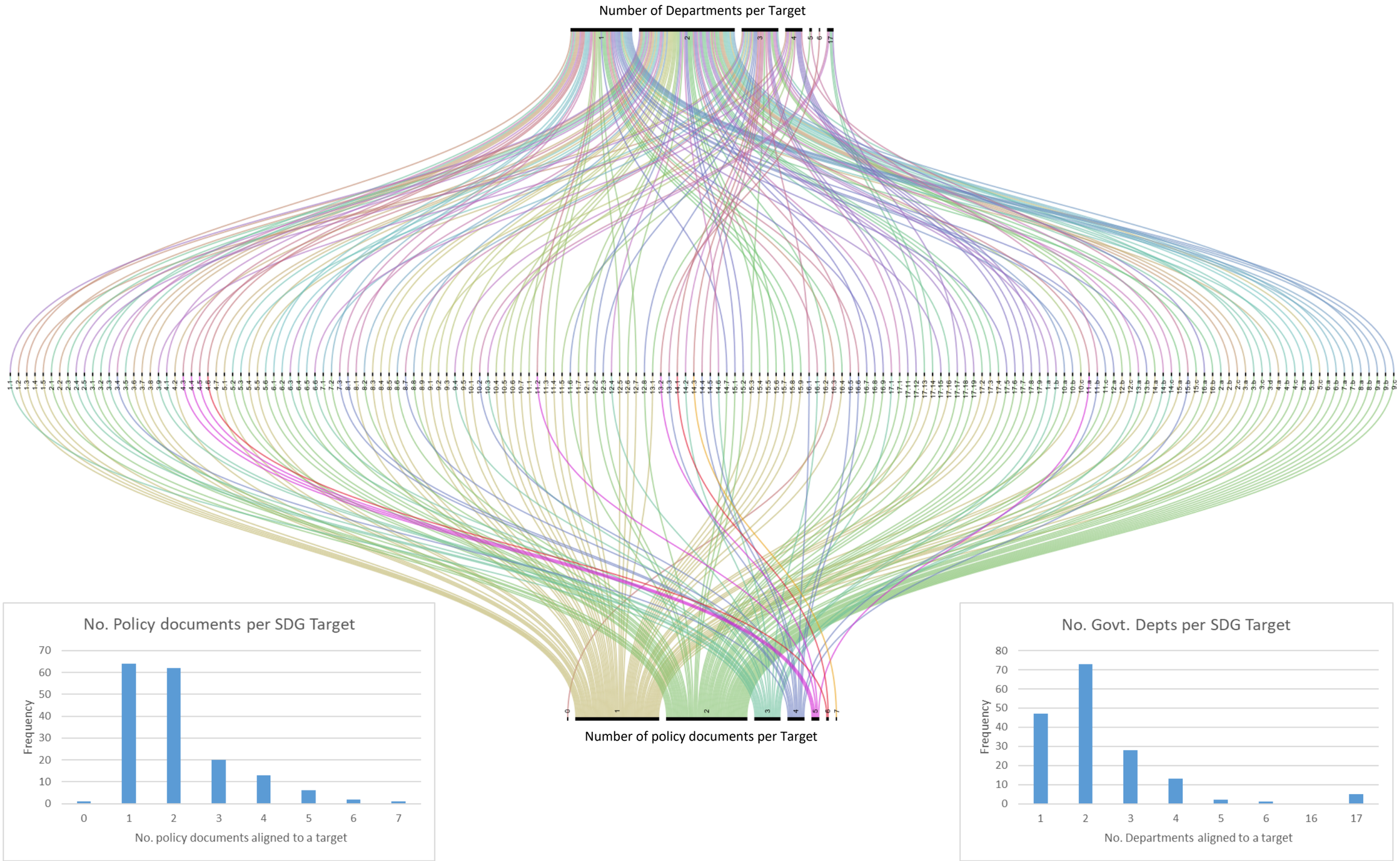

Figure 17. Illustration of the number of policy documents that are aligned to each SDG Target and the number of Government Departments that are aligned to each SDG Target. 1 instance of 0 (zero) policy documents aligned to Target 16.3 reflects that DJE is identified as a Lead Department but no policy document aligned to that Target. The inserts show graphically these 2 dimensions of alignment to SDG Targets to reflect that each target is aligned *mostly to 1 or 2 Departments and/or policy documents restricting the opportunities for integrated and coherent policy linkages. Source: Authors elaboration based on [1].*

Extending the analysis to look across both Lead and Stakeholder Departments and the alignment of policy documents towards SDG Targets reveals that most Targets are only aligned with one Department and its own policy document/s with few instances of Stakeholder Departments contributing policy documents to any given Target (Figure 18). This suggests that in most cases Stakeholder Departments have an interest in the 'outcome' of the implementation of any given SDG Target but this is not necessarily reflected in their Departmental responsibilities. It may also mean that there is little facility for a Lead Department to be able to assess the impact of how its policies impact upon other policy areas. This implies a weak, or absent, policy framework across Government Departments.

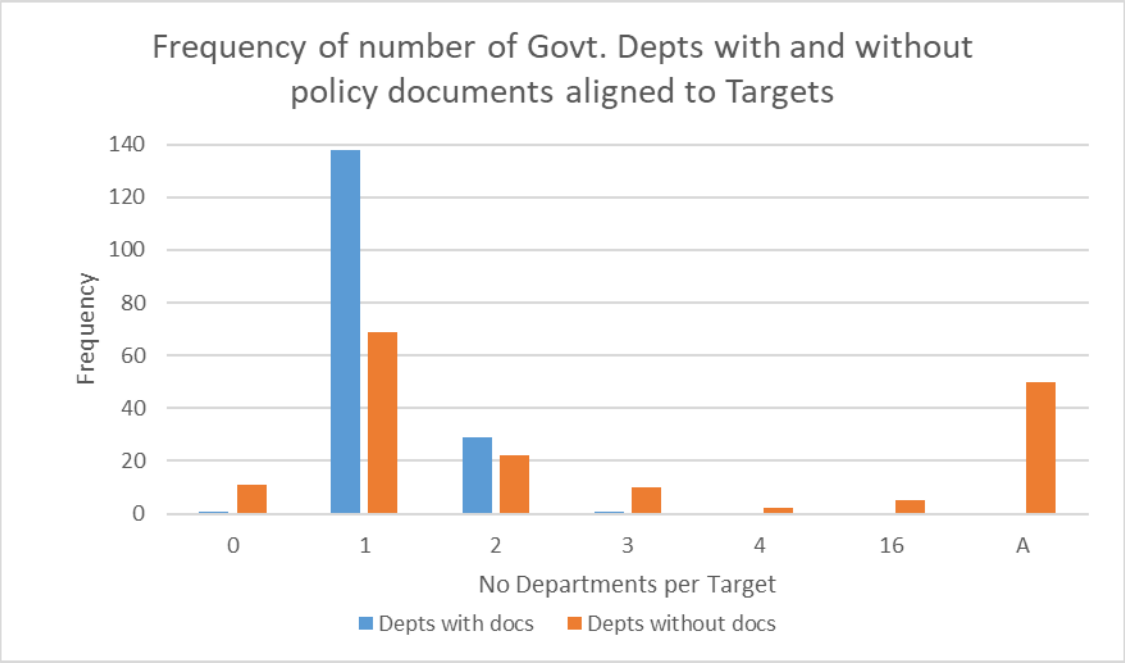

Figure 18. Alignment of policy documents to SDG Targets across both Lead and Stakeholder Departments. '0' (Blue) reflects that Target 16.3 has a Lead Department but no policy document identified, and (Orange) where both Lead and Stakeholder Departments have policy documents aligned to the Target. 'A' reflects the number of Targets where no Stakeholder Department is identified. Source: Authors elaboration based on [1]. '2' reflects that there are 29 instances where Stakeholder Departments have a policy document aligned to a Target in addition to the Lead Department. However, in 138 instances ('1') only the Lead Department has policy documents aligned to the Target. Source: Authors elaboration based on [1].

The analysis demonstrates that some Targets only have a single responsible Department, and whilst some individual policy documents have very specific alignment to a defined Target, others have alignment to multiple SDGs and Targets. Implicit to policy coherence is that any given objective should have oversight from more than one policy organisation and/or instrument otherwise there may be no check whether its action has either a synergistic or trade-off outcome on another objective. In effect, the implementation of any Goal is difficult if not impossible if it remains the responsibility of one Department. Comprehending how and to what extent policy documents align to more than 1 SDG and/or Target, and whether alignments lead to synergistic or incompatible (trade-off) outcomes, is important to determine in what way policy coherence can be gained. The nature of the alignment will

also shape whether outcomes are beneficial across environmental, social and economic pillars of sustainable development.

A further distinction in the allocation of Departments and policy documents to the SDG Targets is between their alignment to either 'Outcome' or 'Means of Implementation' (MoI) Targets. 107 of the 169 Targets are 'Outcome'-oriented i.e. circumstances to be attained with real change in people's lives, in the structure and functioning of society and in the health of the planet [14,39]. The remaining 62 Targets (all SDG 17 and 19 Targets designated by letters across the other 16 SDGs) are designated as MoI targets to facilitate outcomes. The UN defines MoI as the 'interdependent mix of financial resources, technology development and transfer, capacity-building, inclusive and equitable globalisation and trade, regional integration, as well as the creation of a national enabling environment required to implement the new sustainable development agenda' [40]. The distribution of Government Departments to either Outcome or MoI targets shows that whereas there is a strong focus and diversity of Government Departments to Outcome Targets, MoI Targets are predominantly aligned to DFAT and/or DFIN (Figure 19): This may reflect a legacy perspective of the Millennium Development Goals and a distinction between national-level development, that is often viewed as predominantly a 'technical' challenge whereas international aspects of development are the domain of DFAT, this in turn suggests an absence of a strong convergence in recognition of the transboundary impacts of development and the transboundary nature of the SDG framework [144].

4.2 Exploring the role of the environment in SDG implementation in Ireland

The implication from a review of the alignment of Ireland's portfolio of policy documents is that from this portfolio of policy documents across all SDGs 18 of Ireland's policy documents, 3 EU Directives, 1 Regional instrument and 4 International agendas administered by 9 (of 17) Government Departments (5 as both Lead and Stakeholder, and 4 others Stakeholder only) align with the environmental (biosphere) SDGs 6, 13, 14 and 15 (Figure 21 & Figure 20), and that:

- There is a relatively even spread of alignments across the 'environment' departments of DAFM, DCCAE, DCHG and DPLG,
- DFAT is predominantly aligned with MoI Targets.
- The National Biodiversity Action Plan 2017-2021 has the most connections (20) to SDG Targets. All others have less than 8 connections across the 35 Targets that comprise SDGs 6, 13, 14 and 15.
- 2 Stakeholder only Departments have policy documents aligned to the Biosphere Targets.
- Most policies are only connected to single Targets (9). Only 5 Policy documents from 3 Government Departments and the EU Common Fisheries Policy are aligned to both Outcome and MoI Targets.

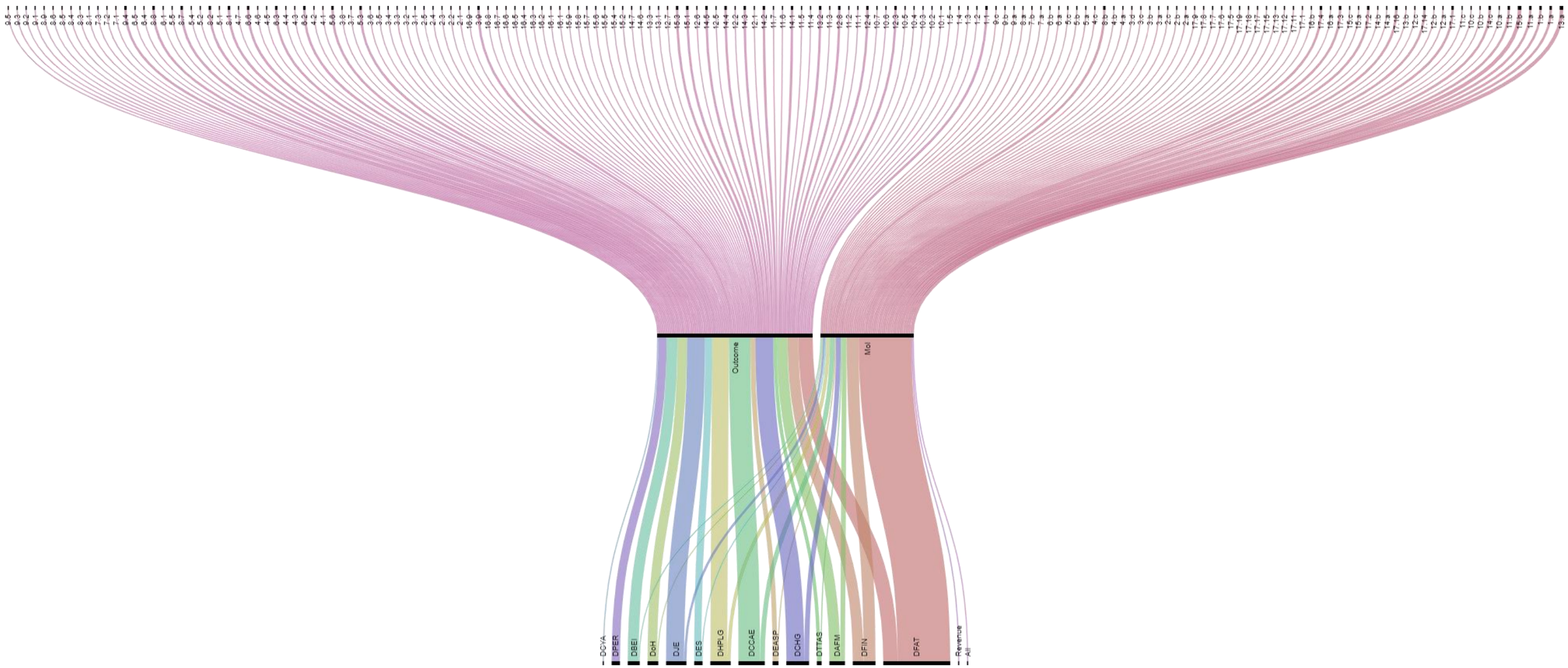

Figure 19. Allocation of Departments with policy documents to either 'Outcome' oriented SDG Targets or 'Means of Implementation' (MoI) Targets. The analysis shows that MoI Targets are primarily aligned with DFAT and DFIN with a more distributed alignment of other Departments across 'Outcome' Targets. Source: Authors elaboration based on [1].

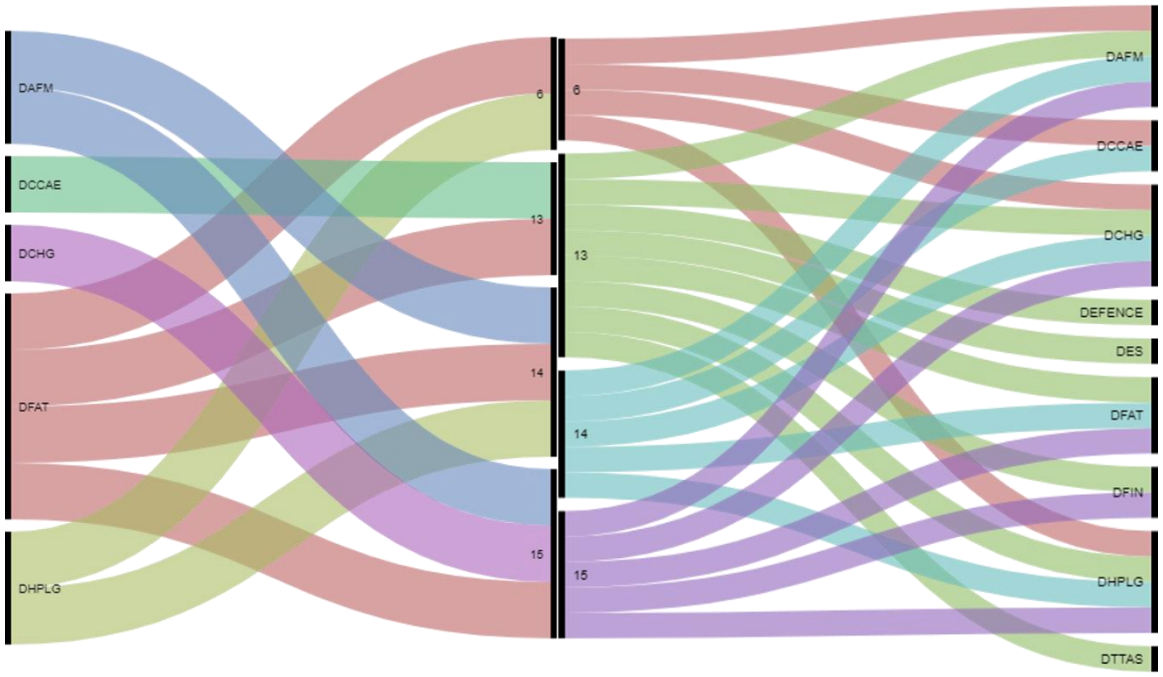

Figure 21. Distribution of the 5 Lead Depts to the 4 environmental (biosphere) SDGs (left) and the 9 Stakeholder Depts (right)). Source: Authors elaboration based on [1].

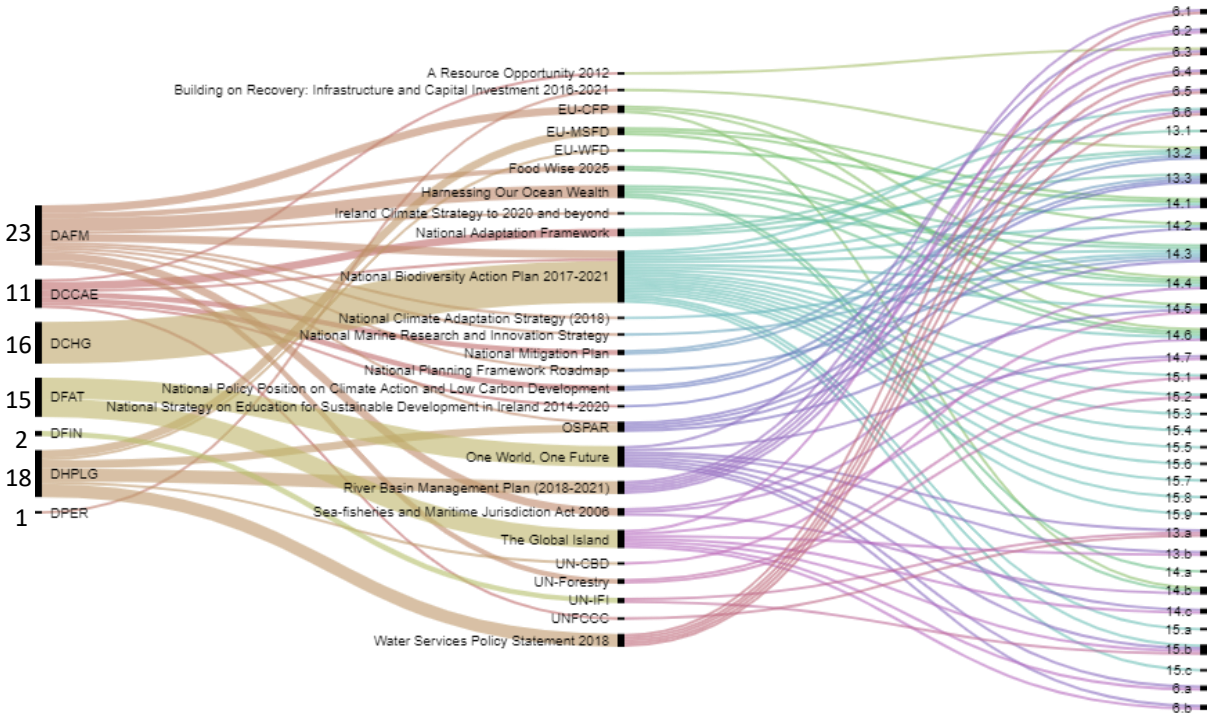

Figure 20. Alignment of Ireland Government policy documents and their 'owning' Department with the 4 biosphere SDGs. Numbers indicate number of Targets aligned to each Govt. Dept. Source: Authors elaboration based on [1].

As discussed in Section 3.1 and 3.2 the environment pervades not only the Biosphere SDGs and there is no strong consensus on the exact portfolio of environmental Targets, which is often determined by the sectoral focus and nature of the analysis being undertaken [146–148]. Using the analysis of Elder and Olsen [117], who identified 73 Targets as 'environmental', then 63 policies or policy instruments implemented by 12 Government Departments are aligned to the implementation of environmental dimensions of the SDGs (Figure 22 & Figure 24).

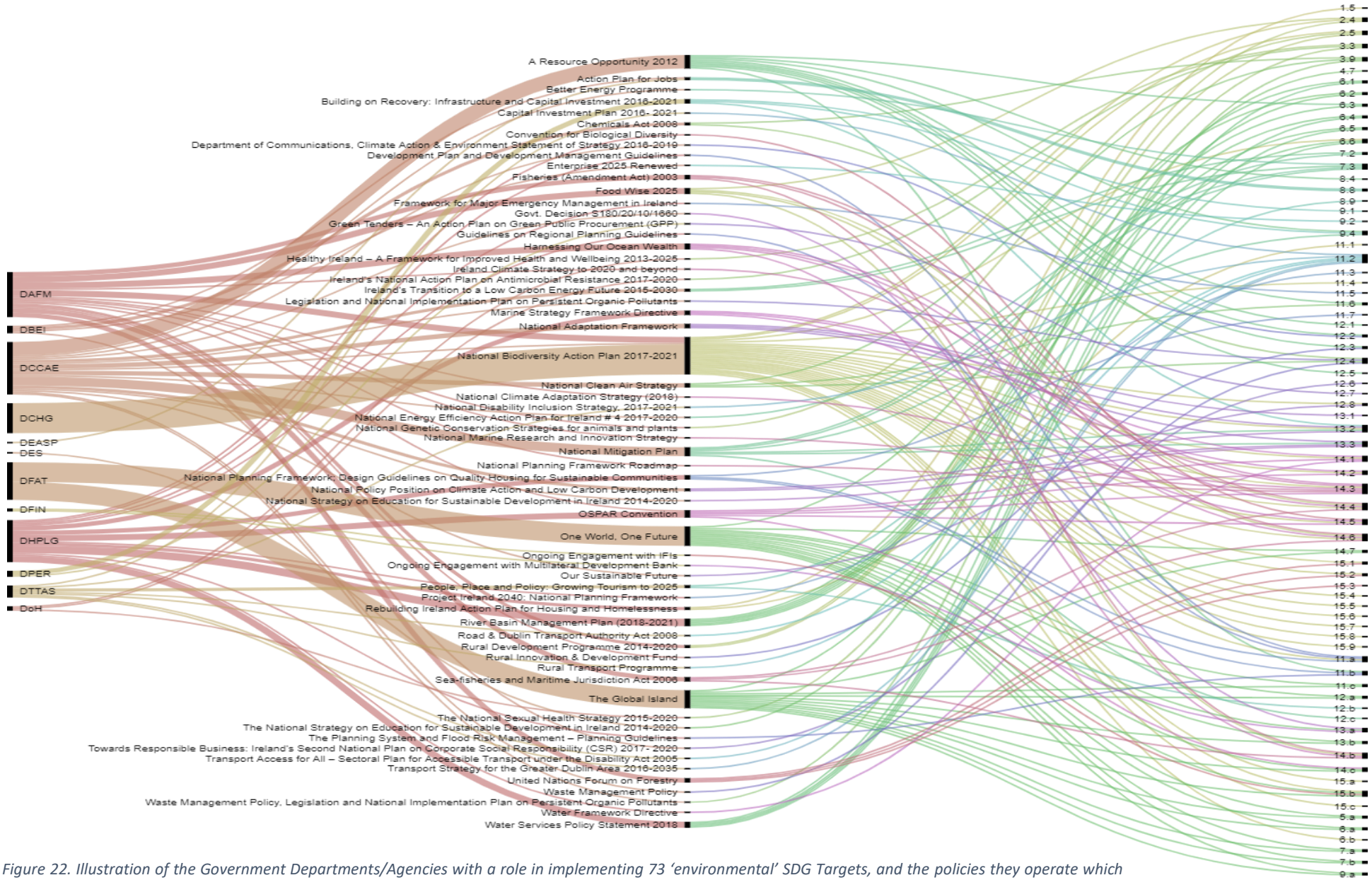

Figure 22. Illustration of the Government Departments/Agencies with a role in implementing 73 'environmental' SDG Targets, and the policies they operate which are mapped to those Targets (after the analysis of Elder & Olsen [117]). Source: Authors elaboration based on [1].

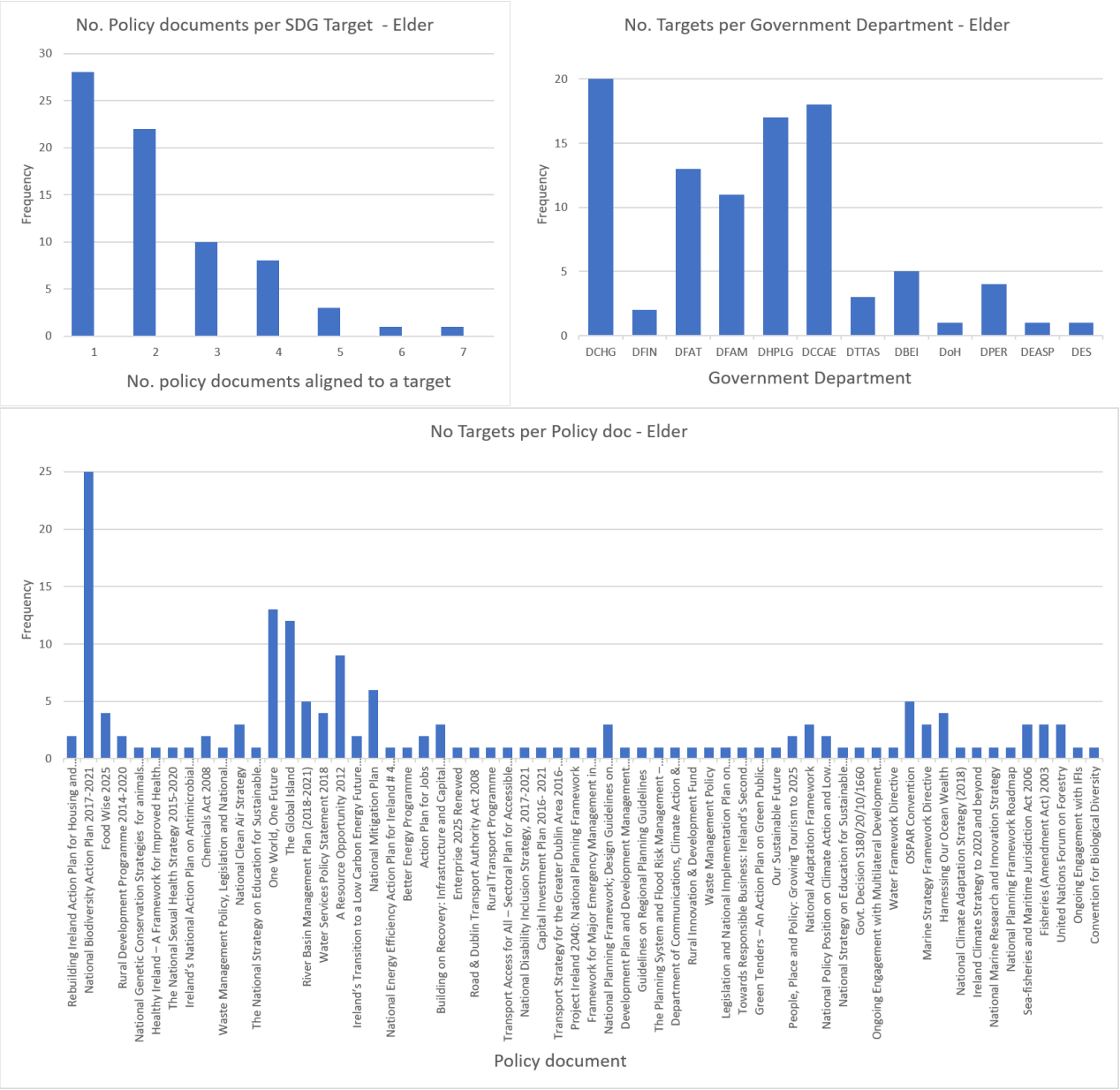

Figure 23. The number of policy documents aligned to each of the 'environmental' Targets; the number of targets aligned by each Government Department; and the frequency each policy document is aligned to Targets based on the analysis by Elder & Olsen [117]

The analysis shows that, in common with the Biosphere SDGs, the distribution of alignment of policy documents and Government Departments to Targets is uneven and with a predominance of one-to-one alignments.

Extending an analysis of SDGs and the environment across the full suite of SDGs is important to recognise how the environment supports social and economic objectives as well as how social and economic objectives can impact upon the environment [149]. Such bi-directional association requires an understanding of the interlinkages and interdependences across SDGs otherwise perverse outcomes may arise whereby human development may undermine the long-term viability of the planetary system to support humanity [op. cit]. The presence of 42 MoI Targets across 16 of the Goals and a 17th Goal entirely devoted to MoI recognises the need for systemic implementation. Mapping

associations and relationships between SDGs, targets, Policy documents and assigned Government Departments requires a deeper analysis to support more coherent and effective decision-making, and better facilitate follow-up and monitoring of progress [150]. Understanding possible trade-offs as well as synergistic relations between the different SDGs is crucial for achieving long-lasting sustainable development outcomes. Recent publications have also stressed the need to address the SDGs in the context of policy pathways at the national level and across multiple dimensions [106] to avoid tensions and trade-offs that hinder will the achievability of the SDGs [151].

4.3 Analysing the context of the environment for SDG implementation in Ireland.

The Department of Culture, Heritage and the Gaeltacht (pers. Comm) has identified a preliminary core set of SDG targets that are relevant to the environmental setting and context of Ireland (Figure 24 and Annex 2). The list includes Outcome Targets from Society SDGs (2, 7, 11) and Economic SDGs (8, 9) as well as the four Biosphere SDGs, but no MoI Targets, and is dominated from a policy context by two policy documents, namely the National Biodiversity Action Plan 2017-2021 and A Resource Opportunity 2012, as well as climate-action focused documents (Figure 25). These documents respectively reflect the support services that originate from biodiversity and the impact of socio-economic activity on maintenance of biodiversity services as well as the longer-term threats framed by climate change. It should be noted that since the publication of the NIP, a number of new policy documents have been published, especially in the area of Climate Action and International Development, and these will be included in subsequent analysis by the project. As part of the SDGs4I project it is the intention to focus on this portfolio of SDG Targets for future analysis with the addition

Figure 24. Departments and Policy documents aligned to SDG Targets identified as having relevancy for an environmental context in Ireland. Source: Authors elaboration based on [1].

of relevant MoI Targets that influence national implementation of SDGs, namely 2a; 6b; 9b; 11a; 14c; 15a. The absence of some MoI Targets directly connected to identified Outcome Targets reflects that there is often a weak connection between outcome Targets and MoI Targets [39] especially in relation to national-level implementation of SDGs and the connections between SDGs and targets [146]. The selection of this core set of SDG Targets also matches the significant literature that has explored the water-energy-food nexus with sustainable development [148,152,153].

The SDGs do not exist in a policy vacuum, and it is important that their implementation is cognisant of the national planning context as well as regional/international perspectives. The SDGs are relevant to the context of Project Ireland 2040 [23,154] where there are significant alignments in areas such as climate action, clean energy, sustainable cities and communities, economic growth, although a detailed mapping exercise has not currently been undertaken. In the context of sustainable development for Ireland [3] the NIP does map the SDGs at the goal level to sustainability objectives (Figure 3 & Table 1). Mapping the eight sustainability objectives to the SDGs and their organisation against Economic, Social and Biosphere labels demonstrates the potential utility of the SDGs to act as an integrator across Ireland's policy instruments where such mechanisms do not currently exist. Figure 26 demonstrates how the SDGs can integrate across sustainable development categories: For instance, respect for ecological integrity and biodiversity is linked through SDG 13 to Equity between generations and Economy. In the same vein, the Biosphere grouping of SDGs integrates across 5 sustainable development categories.

This section has outlined specifically a suite of SDG Targets that have can be linked to the National Planning Framework such that the SDGs can be viewed as policy enablers for Ireland's sustainable development.

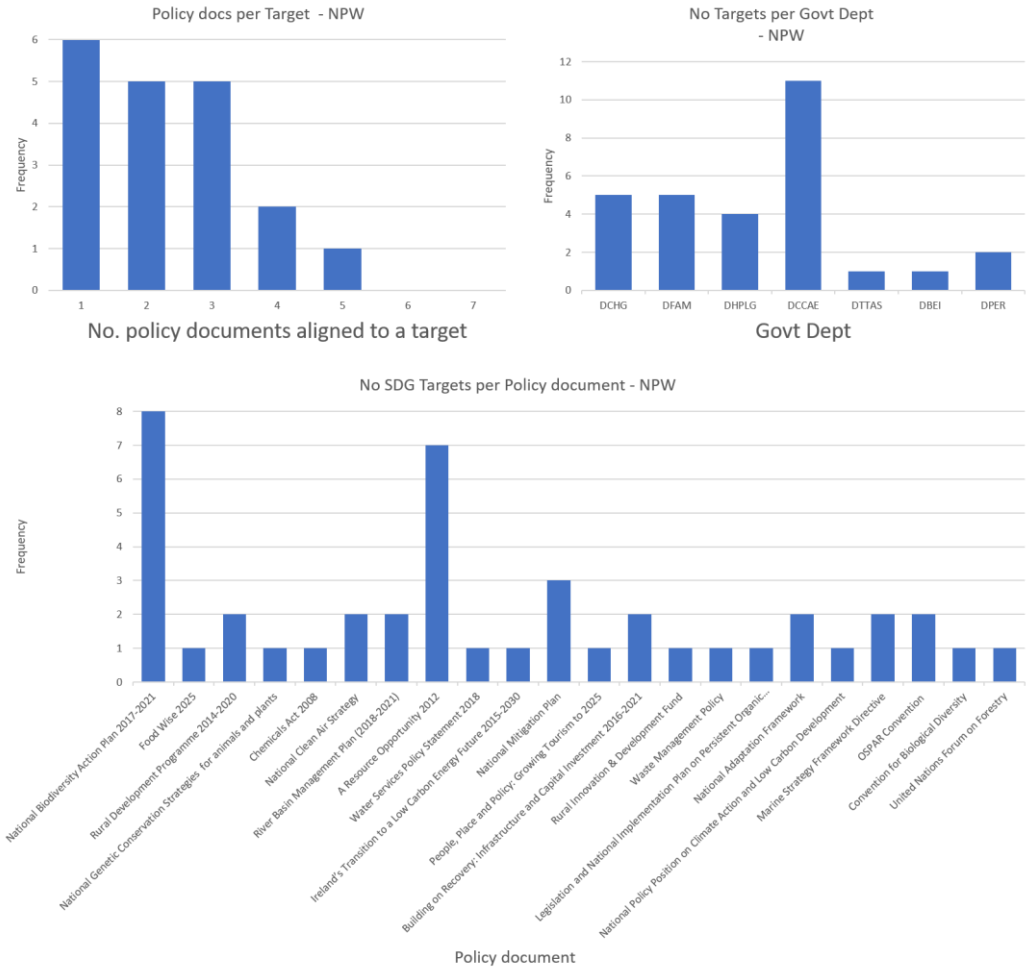

Figure 25. The number of policy documents aligned to 'environmental' Targets considered as most relevant to Ireland by DCHG-NPW; the number of targets aligned by each Government Department; and the frequency each policy document is aligned to Targets. Source: Authors elaboration based on [1].

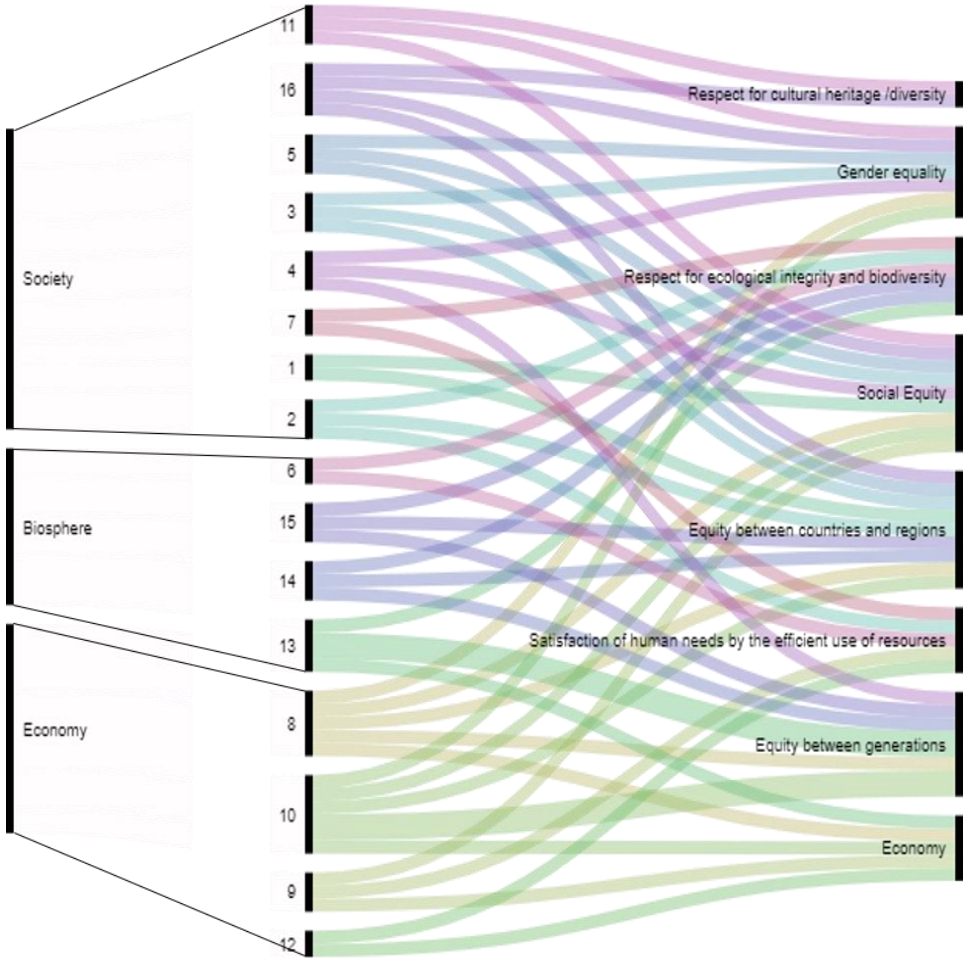

Figure 26. Association of SDG Wedding cake configuration into Economic, Society and Biosphere categories with SDGs and the categories of sustainable development identified in Sustainable development: A strategy for Ireland [3]. Source: Authors elaboration based on [1].

5 Next Steps

Understanding the nature of the policy domain that frames the SDGs in Ireland, coupled with a preliminary selection of environmentally-oriented SDG Targets relevant to Ireland is a first step to piloting an approach that addresses (i) the critical nodes for SDG implementation in a given country as agreed by policy makers with their stakeholders including the scientific community, (ii) the goals and targets that will be most influential in aligning with and delivering on the country's priorities, (iii) the evidence-to-policy gaps and/or associated knowledge needs (where to focus the gathering of evidence and/or its translation into policy), and (iv) key intersections of policy domains and what needs to be measured to inform decision-making and monitor progress.

The portfolio of SDG Targets identified will be used as a basis for populating a tool developed by project partners to map, visualize and analyse how they influence each other using a cross-impact matrix to give direct visualization of highly catalysing targets and potential trade-offs, in addition to a comparison of interlinkages across different scales and contexts (Figure 27).

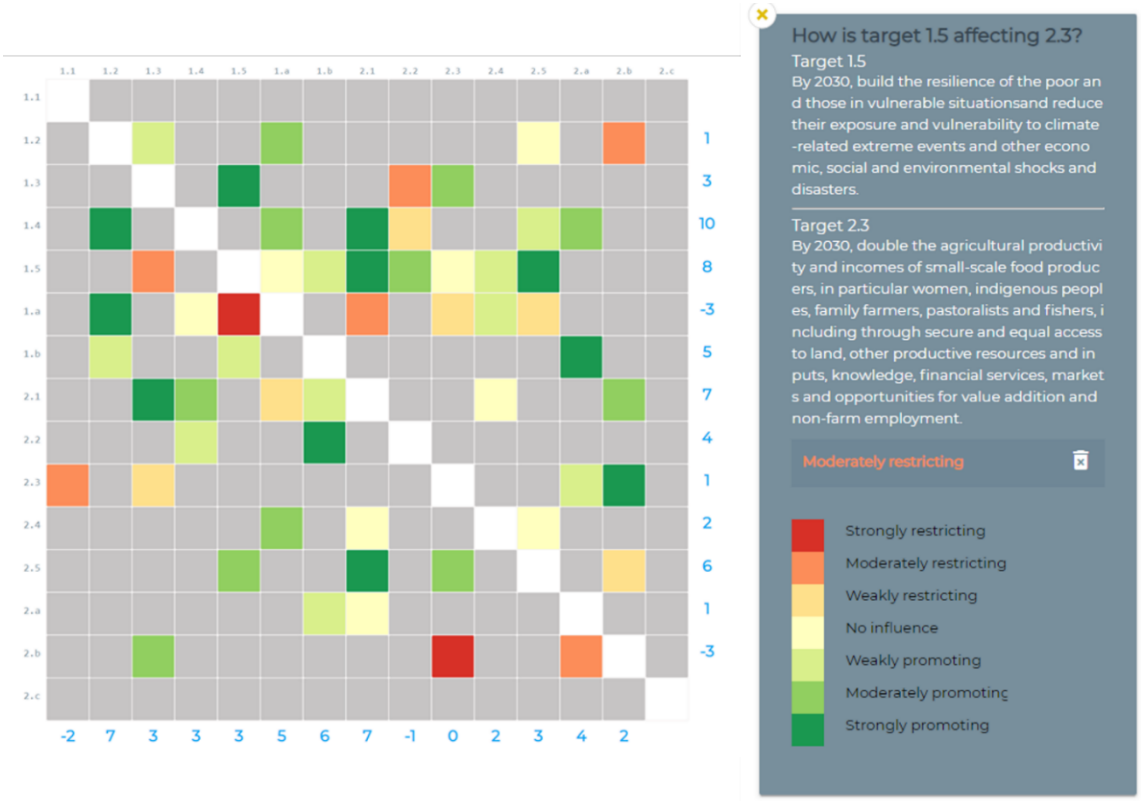

Figure 27. Example of Impact matrix to be used for the next steps of the SDGs4I project.

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Annex 1: Exploring biodiversity interactions with the SDGs

The Global Assessment on Biodiversity and Ecosystem Services (GA) [109] contributes to the evaluation of progress towards achieving the 2030 United Nations Sustainable Development Goals (SDG), particularly goals related to the natural environment and biodiversity. The assessment addresses the question "What pathways and policy intervention scenarios relating to nature, its contributions to people, and their impacts on quality of life can lead to sustainable futures?" In doing so, the assessment includes a nexus analysis of pathways toward six focal clusters of SDGs, including potential synergies and trade-offs, that relate SDGs falling under the 'Planet' of the "5Ps" of the 2030 Agenda (Figure 10). These six foci and principle outcomes are;

1. ***Feeding the world without degrading nature on land (SDG 15 with SDGs 2 & 12)***. Policies that encourage agro-ecological approaches and cross-sectoral integrated landscape and watershed management can both feed humanity and conserve biodiversity inclusively and equitably. Enabling practices include agricultural production approaches that reduce competition for land, uniformity and industrial scale of agricultural practices, distorting subsidies, and supply chain management.
2. ***Meeting climate goals while maintaining nature and its contributions to people (SDG 13 & 15 with SDGs 2 & 7)***. Land-based mitigation activities, such as nature restoration and improved land management, and demand-side climate mitigation measures (e.g., reduced food waste or demand for energy and livestock products), have large potential for climate mitigation with positive effects on nature and its contributions to a good quality of life, including, food and water security.
3. ***Conserving and restoring nature on land while contributing positively to human well-being (SDG 15 with SDG 3)***. Policies that promote expanding MPA networks so that they are ecologically effective, representative and well-connected whilst recognising land as a limited resource and innovations for the conservation-oriented economic use of biodiversity (e.g., new value chains for local agricultural and biodiversity products, biomimicry in pharmaceuticals, cosmetics, food) are important.
4. ***Maintaining freshwater for nature and humanity (SDG 6 & 12 with SDG 2)***. Integrated water resource management and landscape planning across scales; protecting wetland biodiversity areas; guiding and limiting the expansion of unsustainable agriculture and mining; slowing and reversing de-vegetation of catchments; and mainstreaming practices that reduce erosion, sedimentation and pollution run-off and that minimize the negative impact of dams
5. ***Securing food provisioning and nature protection in oceans and coasts (SDG 14 & 12 with SDG 2)***. Policies that promote measures that address synergies and trade-offs between biodiversity and food security goals to avoid near-term losses in access to living marine

resources coupled with the challenges of pollutant problems that affect marine ecosystems and undermine seafood safety and human health are important.

6. ***Resourcing growing cities while maintaining the nature that underpins them (SDG15 with SDG 11)***. Strengthening local- and landscape-level governance and enabling transdisciplinary planning to bridge sectors and departments, and to engage businesses and other organizations in protecting public goods to retain biodiversity and limit urban transformations are important policy considerations.

Sustaining nature's contributions to people—for current and future needs—implies integrating all six foci into planning and development with appropriate monitoring and enforcement systems that promote choices about consumption and production, accounting for poverty, inequality and cultural variability. This form of analysis is important because demonstrating that there are interactions and interlinkages between biodiversity with wellbeing and economic security provides persuasive arguments to policy, which often does not consider why legislation and enforcement of environmental policies at national and international levels have a wider benefit.

Identifying 'what' policy should be directed at is only an initial step, equally important is to identify leverage points to shape enabling and facilitating interventions [109]. IPBES (op.cit.) identifies eight leverage points, namely:

i. ***Diversifying notions of what constitutes a 'good life'***. Promoting stewardship and responsibility-taking, including addressing perverse subsidies and improving fairness in regulations and incentive programs at every scale.
ii. ***Reducing total consumption and waste***. In many countries, human quality of life can be enhanced with decreasing overconsumption and waste Policies to reduce
iii. ***Realising new social norms for sustainability***. Promote policies for social arrangements, regulations and incentives that talk to individually held values.
iv. ***Addressing inequalities, especially regarding income and gender***. Promote policies that address inclusive decision-making, fair and equitable sharing of benefits arising from the use of and adherence to human rights in conservation decisions.
v. ***Accounting for impacts of economies on nature deterioration***. Reconciling the issue that environmental policies and international trade often reduce negative impacts in a specific place, but can have unintended spill over effects elsewhere.
vi. ***Accounting for socioeconomic-environmental interactions over distances***. Ensuring that full costs of economic decision-making (via required payments for mitigating damages) are accounted for.

vii. ***Ensuing technological and social innovation and investment regimes all work for nature and sustainability***. Ensuring that innovation and investment have positive effects at the global scale, which is key to global sustainable economies and sustainable pathways and is not ambivalent in their impact on biodiversity.

viii. ***Promoting education, knowledge generation and maintenance of different knowledge systems***. Education generally only fosters changes in consumption, attitudes and relational values conducive to sustainability when it builds on existing understandings, enhances social learning, and embraces a "whole person" approach.

The analysis suggests that the outcome of the seven nature-based Sustainable Development Goals (SDGs 2, 3, 6, 11, 13, 14 and 15) should contribute to the following constituents of sustainability; (a) safeguarding remaining natural habitats on land and sea by strengthening, consolidating and expanding protected areas and their integration with surrounding land uses (well established), (b) undertaking large-scale restoration of degraded habitats (well established), and (c) integrating these activities with development through sustainable planning and management of landscapes and seascapes so that they contribute to meet human needs including food, fibre, water and energy security, while continually reducing pressure on natural habitats.

Annex 2: Table to Targets identified as of environmental relevance to Ireland by DCHG.

Table A2. SDG Outcome Targets identified by DCHG-NPW as relevant to the environmental context of Ireland with MoI Targets identified by the SDGs4I project.

Target No.	Description	Dept (**Lead** / Stakeholder)
2.4	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.	**DAFM** / DFAT & DCHG
2.5	By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	**DAFM** / DFAT & DCHG
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 substantially increasing recycling and safe reuse globally	**DHPLG** / DCCAE
6.6	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	**DHPLG** / DAFM & DCCAE & DCHG
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix	**DCCAE**
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	**DCCAE** / DFIN
8.9	By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	**DTTAS** / DCHG
9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	**DCCAE** / DFIN & DBEI
11.6	By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	**DCCAE** / DTTAS & DHPLG
12.2	By 2030, achieve the sustainable management and efficient use of natural resources	**DCCAE** / DCHG
12.3	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	**DAFM** / DCCAE & DFAT
12.4	By 2020, achieve the 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 in order to minimize their adverse impacts on human health and the environment	**DCCAE** / DBEI

12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	**DCCAE**
13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	**DCCAE** / DHPLG & DFAT & DEFENCE & DCHG
13.2	Integrate climate change measures into national policies, strategies and planning	**DCCAE** / DAFM & DTTAS & DHPLG & DCHG
14.2	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	**DHPLG** / DCHG & DAFM
14.5	By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	**DHPLG** / DCHG & DAFM
15.1	By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	**DAFM** / DCHG
15.9	By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	**DCHG**
2a	Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries	**DFAT** / DAFM
6b	Support and strengthen the participation of local communities in improving water and sanitation management	**DFAT** / DHPLG
9b	Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities	**DFAT**
11a	Support positive economic, social and environmental links between urban, periurban and rural areas by strengthening national and regional development planning	**DHPLG** / DCHG
14c	Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want	**DFAT** / DAFM & DHPLG
15a	Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	**DCHG** / DAFM
17.14	Enhance policy coherence for sustainable development	**DCCAE & DFAT** / All Depts