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TOOLS FOR IDENTIFYING SDGS INTERACTIONS FOR DOMESTIC POLICY INTEGRATION

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ABSTRACT

The concept of sustainable development is characterised by integrating the social, economic and environmental dimensions. In addressing its implementation, literature on governing for sustainable development have demonstrated little success in policy integration. The advent of the Sustainable Development Goals (SDGs) was hailed as the turning point towards better integration with the outcome document emphasising that it must be seen as an integrated package with the goals and targets indivisible from each other. Nonetheless, as an outcome of a political process, it has been criticised from a scientific perspective of achieving a low level of integration. This paper attempts to assess the promise of SDGs of moving towards integration by assessing two levels of linkages. Firstly, tools for identifying functional linkages across SDG targets are assessed. Secondly, the political linkages, and more specifically, the institutional arrangements of the identified issue linkages are then identified to determine whether there is a correlation or mismatch between the two types of linkages. A case study to identify and implement the issue linkages of the drivers and benefit of forest cover (SDG 15.1) in Malaysia was undertaken for this purpose. The results demonstrated that by using a combination of existing approaches such as scoring of interaction of the SDGs and issue mapping through network analysis clusters of strongly inter-linked issues such as the Forest-Climate-Resilience nexus can be identified. The causalities between the issue linkages are, however, difficult to infer due to unreliable data, resulting in higher uncertainties in more complex systems and requiring tools such as integrated modelling. In conclusion, the findings suggest that the SDGs, supplemented with existing tools, can be a starting point to identify issue linkages of strongly linked clusters. This lends itself to a piece-meal approach of addressing issue linkages rather than integration as a whole, which may prove to be more pragmatic in the shorter term.

KEYWORDS: *SDGs, Interlinkages, Policy Integration, Biodiversity, Sustainable Development*

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1. INTRODUCTION

The Sustainable Development Goals (SDGs) implementation is required to be taken as an integrated package with the goals and targets indivisible from each other (United Nations, 2015). This requires the understanding of scientific synergies and trade-offs along with the social issue linkages between them. The multi-level and multi-scale complexity (Cash et al., 2003) has seen various approaches from multiple disciplines, including interdisciplinary and trans-disciplinary approaches that are holistic, multi-sectoral and multidimensional, to identify synergistic linkages between institutions, issue-areas, resources, policy domains, stakeholders and so on. However, the fact that the SDGs constitute of individual 17 goals and 169 targets, how to achieve integration is unclear.

Addressing interlinkages is also mired in confusion.

In understanding approaches to define, identify and implement key synergistic issue linkages, this paper undertook a brief review of the current studies related to addressing interactions in the context of the SDGs. As the next sections will demonstrate, issue linkages, by its nature in addressing a complex landscape, can be approached in multiple ways from various disciplines as well as viewpoints. This paper is not an exhaustive review of issue linkages but focused only on those in relation to SDGs. In organizing the paper, the first section reviews the current approaches to address or identify the natural issue linkages from a scientific perspective. These are studies to identify the linkages in biophysical or socioeconomic terms or what Oran Young calls 'functional linkages' (Young, 2002). The second section looks at the institutional dimensions, also known as the political linkages where actors deliberately seek linkages towards achieving a certain goal. The third section provides a case study of policy coherence efforts in mainstreaming the conservation of biodiversity in Malaysia. This would provide practical lessons for efforts in implementation of policy integration.

1. Tools for synergistic Natural Issue linkages across SDGs

Natural issue linkages, or functional linkages are the linkages across issues in biophysical or socioeconomic terms (Young, 2002). Science, by its nature, often derives causal linkages and correlations between different sets of variables. The SDGs being a political process, it was criticised for having a lack of scientific basis in addressing interlinkages across by the International Council of Science (ICSU) and International Social Science Council (ISSC). In its review of the goals and ICSU & ISSC raised concerns that the goals are presented in a silo approach (ICSU & ISSC, 2015). It is also made clear in the report that there needs to be caution in assessing the interactions between goals and targets as the interactions are more dense when assessed scientifically compared to when analysing it semantically or through language.

Approaches to identify issue linkages have emerged in many forms including nexus between resources as well as policy domains, identification of thresholds (i.e. planetary boundaries), cross-sectoral impacts, valuation studies, integrated assessments and so on. What is clear is that these approaches vary widely from each other. Furthermore, there is often confusion on what exactly is the purpose of the research on interlinkages, whether it is problem identification, or problem-solving. Literature from sustainability science highlights the difference between descriptive-analytical with transformational mode of science (Lang et al., 2012; Wiek, Ness, Schweizer-Ries, Brand, & Farioli, 2012).

Three categories to organise tools to address interlinkages were identified based on research on trans-disciplinary science (Hadorn, Bradley, Pohl, Rist, & Wiesmann, 2006). These are systems knowledge, target knowledge and transformation knowledge. These are reviewed further below in the context of the SDGs to both further understanding in the definition of interlinkages as to identify the tools.

1.1 Systems Knowledge

Systems knowledge put simply, is understanding how the system works. It is largely based on empirical processes and evidence. In understanding interlinkages across issue-areas, it relies on systems thinking to understand interactions across multiple variables. Systems thinking is characterised by a few shifts in thinking from more conventional to modern, sometimes referred to Cartesian, science. These are from reductionist to holistic; from analysis to synthesis and from self assertive to integrative (Capra 2012). The emphasis is in focusing on the whole rather than its parts and on the patterns and relationships rather than on objects. Further contribution from complexity theory has allowed it to flourish with further shifting from focusing on certainty to approximate knowledge and from linear to non-linear including feedback loops.

In the context of SDGs, system knowledge would help problematize the interactions across certain goals and targets in highlighting the trade-offs and synergies across certain goals and targets. Some of the tools employed in relation to SDGs are highlighted below.

1.1.1 Nexus Approach

Recently, a nexus approach has gained currency, such as the water-energy-food nexus in linking different issue areas or policy domains, and in particular addressing nexus between resources(Andrews-Speed et al., 2012; Bazilian et al., 2011; UNESCAP, 2013). Even the World Economic Forum adopted the nexus approach in identifying the water-energy-food nexus as one of the global risks in 2011 (World Economic Forum, 2011). Establishing interconnection between different resources or issues, it identifies the requirement of one resource as an input to produce another or from the substitutability of two or more resources across space and time (Andres-Speed et al., 2012). It also identifies actions (i.e. government policy) that have consequences for other resources. In literature, the nexus approach often addresses interconnections across more than two resources (i.e. minimum three) and investigates their interconnections in both directions, including its feedbacks.

Directly related to the SDGs, the Global Sustainable Development Report (GSDR), established as the science-policy interface on sustainable development, emphasized strongly on interlinkages and utilised a nexus approach in its prototype report (United Nations, 2016). It utilises an integrated approach that looks at clusters of strongly interlinked issues rather than integrated assessments as a whole. This creates an assessment of assessments model that is adopted in the subsequent GSDR iterations. It identified a number of nexuses such as climate-land-energy and water; oceans and livelihoods; industrialization and sustainable consumption and production; and infrastructure, inequality and resilience; that are relevant to the implementation of the SDGs. The purpose is to identify interlinked emerging challenges for policy-relevant research.

1.1.2 Scoring of Interaction Across SDGs

To guide understanding of the interaction between SDGs, ICSU produced an assessment framework that identifies "the causal and functional relations underlying progress or achievement of the sustainable development goals or targets" (ICSU, 2017: pg 9). It employs a scoring framework with seven types of interactions with the most positive rated scoring of +3 and the most negative -3. This allows for not only highlighting the synergies and trade-offs but also the degree and strength of its interactions. In line with the idea of systems knowledge, the framework is not meant for priority setting but rather as a tool to inform potential interactions.

1.1.3 Linkages through Goal Setting Language

The interaction between SDGs can be assessed not only from a natural science perspective but also from the wording used as a goal setting strategy. Recent examples have demonstrated an approach which adopted analysed the wording used towards understanding how the goals and targets are linked(Kanie et al., 2015; Le Blanc, 2015). These are often mapped out through network analysis or other tools to demonstrate the relationship between the different goals and targets.

1.2 Target Knowledge

Where systems knowledge demonstrates what the problem is, target knowledge helps you understand where you want to go. It focuses on the purposive aspect of moving toward better practices. Beyond understanding the nature of the problem, the rationale is the need to understand the practices of actors in understanding how to get there. While this implies a focus on institutional dimensions (of which will be covered in the next section), it also focuses on the process of research and knowledge generation through participatory approaches (Hadorn et al., 2006; Lang et al., 2012). The need for dialogue beyond only researchers is argued to be necessary when dealing with complex interactions due to the high uncertainty. This post-normal mode of science (Funtowicz & Ravetz, 1993) requires processes to establish a common understanding on problem existence.

1.1.4 Expert Judgement

Due to the uncertainties described above, expert judgement is required towards achieving a high degree of consensus on problem existence. Although this may not necessarily include experts from beyond the research area, it may also include other knowledge systems including those working in practice as well as indigenous and local knowledge. For example, the ICSU scoring framework relies on both existing literature and expert judgement in its framework. To achieve a high degree of consensus a process to interface different sets of actors such as a science-policy interface (Koetz, Farrell, & Bridgewater, 2012; van den Hove, 2007; Watson, Soc, & Watson, 2005) platform. The GSDR is the platform that aims to interface scientist and decision-makers and receives input from experts in preparation for its report.

1.1.5 Co-Production of Knowledge

The term co-production of knowledge is both used in an analytical and practical sense. Science and Technology Studies (STS) analyses the relationship between science and society while as a tool, platforms, networks and bodies are applying the term in a more practical sense (van der Hel, 2016). Future Earth, in particular, institutionalizes co-production as a core principle in its function. This consists of co-design of the research agenda through sectoral integration with stakeholders and decision-makers, co-production of knowledge through scientific integration and finally co-dissemination of results among different societal groups (Mauser et al., 2013).

1.3 Transformation Knowledge

Transformative knowledge allows us to understand how you are going where you want to go. Taking account both target and systems knowledge, it highlights the possible transformative pathways.

1.1.6 Scenario Analysis

Integrated scenarios are "coherent and plausible stories, told in words and numbers, about the possible co-evolutionary pathways of combined human and environmental systems" (Swart, et al., 2004: pg 139). The objective is not to predict the future, but rather help understand uncertainties in a range of possible alternative futures (Moss et al., 2010). Previously, systems modelling using mathematical simulations have been applied to forecast the future (i.e. limits to growth). Perhaps more relevant to the SDGs due to its goal setting strategy, a backcasting approach by envisioning desirable futures have been undertaken to stimulate both simulations and discussions on how to get there (Swart et al., 2004).

In the context of sustainable development, earth systems science has made tremendous progress in understanding how the earth system works. This is in part due to the collaborative international research on global environmental change programmes such as the International Biosphere Geosphere Programme (IGBP) (Suni et al., 2015). In climate science, the use of scenarios analyses in the Intergovernmental Panel on Climate Change (IPCC) has been a central component of its work (Moss et al., 2010). Directly related to the SDGs and in attempt to even broader the integration of scenarios beyond the natural sciences, the International Institute for Applied Systems Analysis (IIASA) is undertaking an ambitious scientific initiative called the The World in 2050 to address the full spectrum of transformational challenges (IIASA, 2017). Another initiative as a policy coherence tool, the SDG model provides an integrated analysis through simulating the fundamental trends for SDGs until 2030 and beyond (Millennium Institute, 2016).

The approaches above demonstrated a range of tools to address interlinkages. A few characteristics of interlinkages can be found in all the approaches. Adopting a systems thinking approach, it often goes beyond linking two issue-areas together and integrates multiple interconnected issues. With the focus on *inter*, it considers both directions of interactions as well as incorporate feedback loops. We can begin to define interlinkages in the context of SDGs, then, as a cluster of strongly interlinked goals or targets that interacts beyond a linear process. The implications are that interlinkages (as opposed to linkages) apply to those between two goals or targets only if the interactions are in both directions. In other cases, it is applied to interaction between three or more goals and targets.

2. THE INSTITUTIONAL DIMENSION OF ISSUE LINKAGES

Articulation of the interlinkages across goals and targets enables us to understand *why* we should address them in an integrated manner. Understanding *how* we address them requires inquiry into the institutional dimensions. Institutional analysis can be approached in multiple ways. While the SDGs is argued to be a 'governance-through-goals' model (Kanie and Biermann 2017), and in the absence of rules, not strictly speaking an international regime, there is much to be gained from literature on regime analysis. In particular, regime effectiveness(Krasner et al., 1982), and in this case, its ability to influence outcomes on interlinked areas is one possible area for further research. Literature on institutional interplay, in particular, has provided both theoretical and empirical understanding on institutional interactions (Gehring & Oberthür, 2004; Oberthür & Gehring, 2006; Young, 2002).

Architecture, which looks at the overarching system of institutions as proposed by Biermann and others in the Earth Systems Governance programme, could also provide key insights into issues of structure, design and effectiveness. It's focus on addressing the "interlocking web of principles, institutions and practices that shape decisions by stakeholders at all levels" (Biermann, 2007: pg 7) rather than analysis on single institutions lends itself as a useful framework to address institutional interlinkages. Research has recently been more focused on the global level, and in particular, strengthening the UN system (Biermann et al., 2012). Moving beyond conventional modes of governance, intermediaries also play a crucial role in implementation in the overall architecture. Research on the role of orchestration, which focuses on international organisations that enlists and supports intermediary actors as an indirect mode of governance (Abbott et al., 2015; Abbott et al., 2012) provides a promising approach in dealing with the complex landscape in governing interlinked clusters of areas and institutions.

Yet another approach is analysing the design of processes that encourage the understanding in relation to the policy objectives and its effectiveness and outcomes. The complexity inherent in research on interlinkages would naturally require relations between science and policy, known as the science-policy interface. Assessing interactions between science and decision-making, at the global level in particular, has seen a large interest in recent times with global science-policy panels such as the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Platform on

Biodiversity and Ecosystem Services (IPBES). While configurations or design for better science-policy interfaces are also proposed (Koetz et al., 2012), much of the research is centred on the design of processes of interactions between science and policy (van den Hove, 2007). Beyond the science-policy interface, the fields of knowledge governance focuses on the process of linkages between research-based knowledge and action (van Kerkhoff, 2013; van Kerkhoff & Lebel, 2006) as well as processes of social learning including co-production of knowledge (Clark et al., 2016).

The final approach reviewed is an empirical approach that looks into the dynamics of actor configuration. Methodologies such as social network analysis (SNA) has been adopted to study the social relationships and social structures of individuals, groups and organisations of which interact and form stable social structures or networks (Marín & Berkes, 2010). Research questions include network centrality, density along with more subjective traits such as trust and learning. This actor based focus research approach has demonstrated that no single actor exercises influence independent of others and untangling the actor configuration could provide important outcomes towards best governance practices (Kanie et al., 2013). In the context of assessing issue linkages, identifying the synergistic actor relations of difference fields as well as across science and policy and different sets of actors is an important task.

3. APPLYING TOOLS FOR POLICY INTEGRATION OF BIODIVERSITY CONSERVATION IN MALAYSIA

To understand the utility of the SDGs, a selection of the available tools are adopted in an attempt to understand how the SDGs can be utilised for addressing interlinkages at the policy making level. For the purpose of this paper, only tools that can be directly applied without requiring a stakeholder or expert process engagement are considered as the starting point is the SDGs itself, rather than a hypothetical institutional set up that was created due to the SDGs. With this in mind, ICSU's guide to SDGs interaction is selected as it provides a simple guideline that aims to provide a starting point for policymakers (ICSU, 2017).

3.1 Natural Issue Linkages of Biodiversity in Malaysia

1.1.7 Linkages of Biodiversity Conservation through the ICSU's SDGs Guide for Interactions

The scoring framework is applied to target 15.1 (biodiversity conservation)[1] in Malaysia. Selection of a country as a case study provides context to the analysis. To further establish a causal relationship between the targets, the indicator, (15.1.1) forest area as a proportion of total land area, is used as a starting point. As such, all targets of the SDGs are analysed in both directions of interactions, including whether they are drivers or benefits of forest cover. In the absence of an expert judgement process, the identification and strength of the interaction is based on literature review ()[2]. The scoring framework allowed for the understanding of the linkages between one target (in this case forest cover) with other targets of the SDGs. It allows for identifying both synergistic linkages as well as trade-offs but more significantly, is the ability to identify the strength of those interactions. The results show that targets on agriculture, water and climate change, in

[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(United Nations, 2015)

[2] Neutral interactions are not included in the table.

particular, is inextricably linked with a high score inputted. These demonstrate that the strengths of the interlinkages are mainly those that are within the policy fields or existing linkages across issue-areas (i.e. food and forest). Additionally, the strength of trade-offs are also identified which are mainly contextual. For example, increasing the share of renewable energy may possibly exacerbate biodiversity loss where a shift towards biofuels based on oil palm will result in deforestation loss. Based on literature review, a major limitation is the lack of scientific evidence and data in establishing a high level of confidence in the scoring of the strength of interaction. The legitimacy of the results will improve through an expert judgement process.

1.1.8 Interlinkages of Forest Cover through Network Analysis

While operationalizing the ICSU framework on interactions allowed the identification of the strength of linkages, it doesn't allow understanding the centrality of the linkages, or in other words, the clusters of strongly interlinked targets. By applying another layer of interactions to expand the linkages not only with target 15.1, but also the linkages between each other, we begin to identify the clusters of strongly interlinked areas through a network analysis methodology (). Utilising a graph theory methodology (Barnes & Harary, 1983), the centrality of various targets can be computed. In particular, three types of interlinkages can be visualized and calculated based on their centrality. Firstly, betweenness centrality, calculates the shortest path of linking one node to another (Berkowitz, 1982). In the context here, it represents the most strongly interlinked (based on weighted strength of interaction) targets. The biodiversity-climate-resilience nexus is identified, primarily due to the high strength of linkages with goals on climate change and adaptive capacity. Secondly, is the degree centrality, or put simply, the number of links (or edges) connected to a node, regardless of its weightage. The governance targets related to goal 16 are the highest followed by education for sustainable development (target 4.7). This demonstrates a consistency with the notion that education and governance are the indirect and underlying drivers of biodiversity loss (Díaz, Fargione, Chapin, & Tilman, 2006). Thirdly, is the ability to highlight the negative interactions and their interlinkages with other targets along with the possibility to trace its negative impacts to other targets.

Similar to the previous section, the veracity and legitimacy from a scientific perspective is not guaranteed and a process of expert judgment would strengthen the ability to identify these interlinkages. However, as a policy coherence tool, it provides a useful approach to visualise and compute the clusters of strongly interlinked issues as an entry point for policy discourse.

3.2 Institutional Dimensions of Biodiversity in Malaysia

Following the identification of the biodiversity-climate-resilience nexus as a central concern, the institutional dimensions of these linkages are investigated. The institutional arrangement in Malaysia addressing the areas consist of various councils, ministries and agencies addressing specific issues related to the nexus.

At the coordinating level, biodiversity and climate change are placed under different ministries. Biodiversity is under the Ministry of Energy and Natural Resources and climate change is under the Ministry of Environment and Water. The National Biodiversity Council and the Malaysia Climate Action Council (MyCAC) coordinates their specific issue-areas while the National Security Council under the Prime Minister’s Department addresses natural hazards (i.e. floods). Disaster management on the other hand, is at the Prime Minister’s Department. At the agency level, various departments and institutes address, often specific issue-areas. The institutional arrangement of the biodiversity-climate-resilience nexus in Malaysia demonstrates a fragmented landscape. While coordination platforms exist, they also reside within different ministries.

As mentioned previously, as the SDGs is in its early phases of implementation, institutional analysis on certain aspects of SDGs require further conceptual refining and deserves a paper on its own. In particular, moving away from negative framing towards understanding interaction management can provide insights into how to increase interactions amongst institutions (Stokke, 2008). Understanding the relationship patterns and the regime complex (Raustiala & Victor, 2004) across certain goals and target will also be beneficial to map out the existing institutional linkages across the goals and targets.

3.3 Towards a toolbox approach for addressing SDG Interlinkages

In order for the approaches to be used effectively for the SDGs, the knowledge generated must be usable (W. C. Clark et al., 2016). This means that it must be accurate and politically tractable (Haas, 2004). To attain usable knowledge by addressing interlinkages across SDGs, a matrix is developed to understand the different types of approaches and begin to develop a toolbox to address them.

Lessons from literature on science-policy interface demonstrate that for knowledge to resonate with policymakers, it must credible, relevant (salient) and legitimate (Cash et al., 2006; Koetz et al., 2012; van den Hove, 2007). Credibility is assumed to be largely achieved in the scientific process. Relevance, referring to the ability to provide consensual, objective and valid rationales directly related to policy action, is also assumed to be addressed by undertaking the overall exercise an attempt to achieve policy relevance. Legitimacy, on the other hand, depends on the links between scientific and policy making communities (Koetz et al., 2012). Achieving a high degree of legitimacy would then require focus on inclusion of cross-disciplinary and extra-scientific actors in knowledge production (van der Hel, 2016). The approaches reviewed in this paper demonstrated that its legitimacy may vary significantly depending on the process undertaken in addressing the interlinkages. To categorise this further, a spectrum of high participation and low participation can be distinguished. Secondly, various approaches can be distinguished based on their level of complexity. A highly complex system is characterised by involving a variety of interconnected activities with often profound uncertainty, resulting in approximate knowledge (Underdal, 2010).

A matrix of the two spectrums allows us to identify specific approaches according their level of complexity and participation. Most importantly, participation relates to a higher degree of legitimacy and hence we begin to see the possibilities in providing usable knowledge for the complex interlinkages of the SDGs. Organising the information in this way demonstrates that few processes of highly complex system research having a high degree of legitimacy. The IPCC is an exception due to an established science-policy interface though its instrumentality still suffers, as its legitimacy at the decision-making levels (i.e. national and sub-nationals) is low. In the short term, there are proponents that argue for a piece-meal approach (Haas, 2014) due to the feasibility of its implementation. Particularly, a lower complexity with a high degree participation can provide a legitimate process to at least catalyse policy discourse on interlinkages. The case studies as well as the examples provided by ICSU demonstrate the importance of an expert judgement process to lend credibility and legitimacy to the results (ICSU, 2017). The challenge remains that many highly complex interlinkages and approaches, such as the various exercises undertaken by earth system science scholars may find difficulty in translating towards usable knowledge, and ultimately, its policy use if no participatory processes are conducted.

CONCLUSION

The paper set out to investigate the tools available to address interlinkages across goals and targets of the SDGs. By testing the tools at the national level, we see that context is extremely important, where results may differ than global level interactions. Although alternative pathways exist and may be implemented, the tools available allow us to highlight the potential trade-offs related to a specific situation. A participatory approach is also found to be essential. Not only will it provide a model for a co-production of knowledge in generating knowledge across scales, it will provide legitimacy to articulating complex interlinkages in the policy process, which will likely require a long term and iterative process of policy learning. In this context, a toolbox of approaches is proposed where tools dealing with less complex interactions can be legitimate if coupled with participation of extra scientific actors.

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APPENDICES

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Table 1: Linkages of the Drivers and Benefits of forest Cover with other SDG Targets

Goal	Target	Score	Rationale and Knowledge Gaps
Goa1 2 Agriculture	2.4 By 2030, ensure sustainable food production systems	3	Various practices such as in Cameron Highlands which is warned by scientists to be near ecological collapse due to soil contamination and illegal land clearing for agriculture (Barrow et al 2009).
Goa1 2 Agriculture	2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species	3	Malaysia is a mega-biodiverse country and maintaining the genetic diversity of seeds, cultivated plants and animals is inextricably linked to halting biodiversity loss and forests as their habitat (MNRE 2015)
Goal 4 Education	4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote **sustainable development**	3	Education for sustainable development inextricably linked to conservation of biodiversity
Goal 6 Water	6.3 By 2030, improve water quality by reducing pollution	3	Industrial pollution was found to reduce water quality in various rivers (See Compendium of Environmental Statistics and Environmental Performance index)
Goal 6 Water	6.5 By 2030, implement **integrated water resources management** at all levels, including through transboundary cooperation as appropriate	3	Malaysia's water basins are situated in biodiversity hotspots

Table 1 Contd.,

Goal 6 Water	6.6 By 2020, **protect and restore water-related ecosystems**, including mountains, forests, wetlands, rivers, aquifers and lakes	3	Malaysia's water basins are situated in biodiversity hotspots
Goal 11 Cities	11.4 Strengthen efforts to protect and safeguard the world's cultural and **natural heritage**	3	Natural heritage inextricably linked to biodiversity conservation
Goal 12 SCP	12.2 By 2030, achieve the sustainable management and efficient use of natural resources	3	Use of natural resources inextricably linked to biodiversity conservation with resource extraction still a big part of the economy (see Hezri and Alizan 2015)
Goal 13 Climate Change	13.2 Integrate climate change measures into national policies, strategies and planning	3	LULUCF a key component of climate change measures in Malaysia
Goal 14 Oceans	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	3	Mangrove forests is a biodiversity hotspot in coastal areas in Malaysia
Goal 1 Poverty	1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	2	Indications that annual floods are worsening due to climate change and illegal deforestation though further research required
Goal 3 Health	3.9 By 2030, substantially reduce the number of deaths and illnesses from **hazardous chemicals and air, water and soil pollution** and contamination	2	Health issues due to forest fires are an annual occurrence
Goal 6 Water	6.4 By 2030, substantially increase **water-use efficiency** across all sectors	2	Malaysia has an average non-revenue water rate of 36.6% (World Bank recommends less than 25%)
Goal 8 Decent work and economy	8.4 Improve progressively, through 2030, global **resource efficiency** in consumption and production	2	Sustainable timber production as well as oil palm consumption
Goal 8 Decent work and economy	8.9 By 2030, devise and implement policies to promote **sustainable tourism**	2	Sustainable tourism aids the conservation of biodiversity hotspots as opposed to land use for industrial and other purposes
Goal 11 Cities	11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by **disasters, including water-related disasters**,	2	Indications that annual floods are worsening due to climate change and illegal deforestation though further research required
Goal 11 Cities	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	2	Reducing environmental impacts will aid biodiversity conservation

Table 1 Contd.,

Goal 11 Cities	11.7 By 2030, provide universal access to safe, inclusive and accessible, **green and public spaces,** in particular for women and children, older persons and persons with disabilities	2	Natural green spaces will aid biodiversity conservation (i.e. see Kuala Lumpur Green Lungs)
Goal 12 SCP	12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	2	Raising public awareness reinforces the need to protect biodiversity
Goal 13 Climate Change	13.1 Strengthen resilience and **adaptive capacity** to climate-related hazards and natural disasters in all countries	2	Ecosystem based adaptation is researched in Malaysia though more evidence is required
Goal 16 Governance	16.3 Promote the **rule of law** at the national and international levels and ensure equal access to justice for all	2	Many policies exist in biodiversity conservation but enforcement is lacking (see SDGs report on Malaysia)
Goal 16 Governance	16.4 By 2030, significantly reduce **illicit financial and arms flows**, strengthen the recovery and return of stolen assets and combat all forms of organized crime	2	Many policies exist in biodiversity conservation but enforcement is lacking (see SDGs report on Malaysia)
Goal 16 Governance	16.5 Substantially reduce corruption and **bribery** in all their forms	2	Many policies exist in biodiversity conservation but enforcement is lacking (see SDGs report on Malaysia)
Goal 16 Governance	16.6 Develop effective, accountable and transparent institutions at all levels	2	Many policies exist in biodiversity conservation but enforcement is lacking (see SDGs report on Malaysia)
Goal 16 Governance	16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels	2	Access to justice is not guaranteed (See Alizan 2015 on human rights and Environment in Malaysia)
Goal 16 Governance	16.10 Ensure **public access to information** and protect fundamental freedoms, in accordance with national legislation and international agreements	2	Access to information is not guaranteed (See Alizan 2015 on human rights and Environment in Malaysia)
Goal 10 Inequality	10.2 By 2030, empower and promote the social, economic and **political inclusion** of all	1	Forest dwelling communities and land and environmental rights linked to many forest clearing areas in Malaysia
Goal 1 Poverty	1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have **equal rights to economic resources**	1	Forest dwelling communities rights to control over land
Goal 3 Health	3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, **water-borne diseases** and other communicable diseases	1	Bacterial disease leptospirosis is connected with irresponsible waste disposal around river areas

Table 1 Contd.,

Goal 9 Innovation and Infrastructure	9.5 Enhance **scientific research**, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries	1	Knowledge-based economy required to move away from resource-based economy
Goal 12 SCP	12.7 Promote **public procurement** practices that are sustainable	1	Government Green Procurement one of the key policy actions in Malaysia to create an enabling foundation for good practices
Goal 2 Agriculture	2.3 By 2030, double the **agricultural productivity** and incomes of small-scale food producers	-1	Doubling productivity and incomes would require land-use change and conversion from Permanent Forest Reserves to Agricultural land
Goal 7 Energy	7.2 By 2030, increase substantially the share of **renewable energy** in the global energy mix	-2	Bioenergy and biomass is one of the largest share and fastest growing sector towards renewable energy mix in Malaysia. Bioenergy is often from oil palm in Malaysia which may affect biodiversity conservation
Goal 9 Innovation and Infrastructure	9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries	-2	Various industrial land use change proposed, causing biodiversity loss (see National Physical Plan)

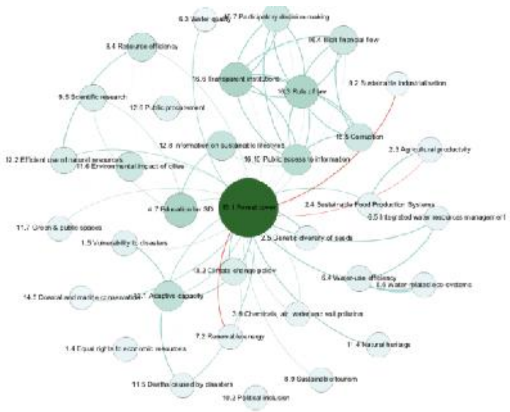

Figure 1: Interlinkages of Benefits and Drivers of Forest Cover with other SDG Targets

Table 2: Spectrum of usable Knowledge for SDG Interlinkages

	Lower Complexity	Higher Complexity
High participation (high legitimacy)	• ICSU framework through expert Judgement • GSDR report	• IPCC reports (scenario analysis)
Low participation (low legitimacy)	• ICSU framework based on literature review • Nexus approach	• Integrated assessments in earth system science