

Understanding and mapping important interactions among SDGs

Background paper for

Expert meeting in preparation for HLPF 2017

Readying institutions and policies for integrated approaches to implementation of the 2030 Agenda

Vienna, 14 to 16 December 2016

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6 December 2016

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Executive summary

The 2030 Agenda emphasizes interlinkages and interactions among the SDGs, and the importance of implementing it as an “indivisible whole”. At the same time, development analysts, policy makers and practitioners know that there might be trade-offs as well as mutually reinforcing relationships among the goals and targets formulated in the Agenda. The purpose of this paper is to contribute to establishing a baseline understanding of important interactions that need to be taken into account, and to launch a discussion among experts and officials on implications for readying institutions for integrated approaches to implementation of the 2030 Agenda at the national and local levels.

The paper identifies some of the most important interactions among targets of Goals 1, 2, 3, 5, 9 and 14, which will be in focus at the 2017 High-Level Political Forum, and targets within other SDGs. It discusses the state of the knowledge base, and identifies some institutional implications and challenges.

Where poverty eradication is concerned, the paper notes that access to rights and economic resources are known with some certainty to be indivisible from other SDGs. Poverty eradication needs to be understood as aiming for the well-being, welfare and freedom of each individual. Development strategies such as export-driven manufacturing, value addition activities in the food sector or natural resource extraction only contribute to poverty eradication when there are adequate and effective institutional frameworks that enable equitable access by all to the opportunities and benefits from development. At the same time, such frameworks need to be able to accommodate shocks that can come from a variety of sources, and can threaten gains made in poverty eradication.

Achievement of food security is fundamentally dependent on increasing production, improving quality and ensuring access and utilisation to all over the life-cycle. At the same time, agricultural production is a major source of environmental impact including climate change. There are strong linkages between nutritious and healthy diets and health outcomes. Ending malnutrition in children is clearly connected to ending preventable child deaths and improving cognitive and physical development. At the national level, positive interactions can be leveraged by coordinating action on agriculture, health, gender and water and sanitation. Improving utilization of food is enhanced by improvements in education and health policies, and measures to enhance income growth amongst the poor. Investments in sanitation and clean water will also improve nutritional outcomes, in strong interaction with health and gender goals. Institutional programmes at national level to integrate food security with gender and health priorities have shown great potential. The split of responsibilities between agencies governing agriculture, health, education and social programmes can lead to suboptimal development results, but can be overcome. One route is to work with high-quality diets through using public procurement for schools and hospitals.

With regard to health, healthy lives depend critically on other SDGs, including nutritious food, sanitation, clean water and air, and education. There is relatively strong scientific agreement on the multiple interactions between health targets and other targets in the 2030 Agenda. At the national level, however, environmental and health issues almost invariably fall under different ministries and agencies. Ministries of health are central players in governing these interactions. Technical core capacities can be strengthened across countries through international efforts. Institutional capacities should also be developed to coordinate health research processes, findings, and structures, and with the overarching goal of enhancing the health system’s ability to perform its functions. Achieving the SDGs will rely on the build-up of much stronger linkages between communities and agencies in those various interrelated areas to enable a more holistic approach to health governance, including in terms of strengthening the capacity to respond to emerging challenges.

In the area of gender equality, the overwhelmingly positive interactions to other goals suggests that actions for improved gender equality can be an important lever for the 2030 Agenda overall. Strengthening interactions with gender equality can be pursued through several different types of institutional arrangements. There are

many examples of programmes and policies at national levels that have been used to improve gender equality and reinforcing positive change in other goals at the same time. One may also need to ensure that interventions in other sectors are being designed so as to not inadvertently limit their utilization by girls and women. National parliaments have a particularly important role in relation to gender equality. Gender mainstreaming (applying a gender lens on all policy domains) can be institutionalised in policy and planning procedures such as in national development plans and strategies and through gender-responsive budgeting. Sex-disaggregated national statistics to measure development outcomes on for example health, nutrition, education, crime and income, is an important component of the institutional framework of mainstreaming.

With respect to infrastructure and industrialization, there is strong agreement that enhancing science, technology and innovation leads to productivity increases, albeit with many dependencies related to governance and scaling capacities that are the subject of complex areas of research. Development of infrastructure contributes to, and benefits from, ensuring access to economic resources and services. Promoting inclusive industrialization reinforces economic growth by improving economic productivity, itself a key source of income growth over the long-term. Infrastructure also has strong positive impacts on education and health. On the other hand, conventional patterns of industrialization and infrastructure are associated with well-known trade-offs with a range of environmental factors. Regarding institutional responses, the environmental governance of industrial activity and infrastructure investment is a strong institutionalized policy domain. An entire ecosystem of institutions for sustainable financing is now being built up or adapted at national and international levels to finance the deep structural changes that are needed in infrastructure and industrial production systems. There needs to be efforts from the public side to orient innovation towards environmentally sustainable products, processes and services.

Finally, oceans are related to virtually all other goals. There is increasing agreement and evidence, for example, that the regulation of harvesting and ending of overfishing are inseparable from achievement of sustainable and resilient food production, where traditional and local institutions for regulation can play an important role. The sustainable management of marine and coastal ecosystems builds resilience of the poor and vulnerable, while addressing ocean acidification goes hand-in-hand with climate mitigation. The governance of the ocean has not been high up on political agendas at either national or international levels, and is difficult to discern to what extent it is oriented towards interacting with institutions that cover other areas of the SDGs. To enable and ensure a productive and sustainable economic use of oceans, institutional strengthening is required at different levels. With effective and inclusive institutions, oceans can yield increasing economic benefits, not least for small island developing States (SIDS) through sustainable use of marine resources to reinforce economic growth, trade, and employment.

Coping with the interactions among these goals and targets is a formidable institutional challenge at both national and international levels. Most member states govern their public policy sectors, such as health, energy, agriculture and education, through sectoral ministries and agencies. There are very good reasons for this, such as the need to have specialization of competence and establishing clear accountability relationships. However, the trade-offs are well known – since the lack of joint agendas and coordination often leads to inefficient or even contradictory policy actions.. The 2030 Agenda, which puts great emphasis on policy coherence and even has its own target: 17.14, is a mirror of the aspirations that already exist at the national level to work across policy sectors and coordinate them better.

Working through cross-sectoral governance systems and linked knowledge fields requires advanced capacities within the government machinery. Policies in support of positive interactions may have longer payback times and require longer planning horizons than one-goal approaches, in support of which institutions such as futures commissions and secretariats for strategic foresight may be established. Integration in administrative practice also requires communication systems and consultations across sectors. This can take different forms. Building institutions to this end is important but it is a challenge to make them effective vehicles of collaboration and

delivery. Integration faces institutional barriers, including both formal and informal incentives in government bureaucracies and narrowly-framed policy objectives in agencies.

Finally, the paper discusses the need for an internationally coordinated effort to invest in an open knowledge base containing systematic and robust analysis of the SDGs and their interactions, and how they might play out in different contexts. To ensure that this knowledge base becomes cumulative and comparable across knowledge fields, it should build on a common conceptual framework, perhaps developed under the auspices of the United Nations.

1. Introduction

The adoption of the 2030 Agenda for Sustainable Development (UN General Assembly, 2015) marked a new paradigm for global development policy and cooperation, distinguished not only by the universality principle and the firm commitment to leave no one behind, but also by the strong articulation of the importance of linkages, interdependencies and interactions among development goals – across sectors and jurisdictions. The 2030 Agenda is often referred to as an integrated, “indivisible” whole. Thus, the 2030 Agenda clearly expresses a recognition that human development and prosperity is dependent on earth’s life support systems (IRP, 2015), and that humanity is bound together and co-dependent across country boundaries. Neither development nor environmental goals can be reached in isolation from other goals or from other countries.

Integration and coherence has for some time been at the forefront of concern for international and national agencies around the world. International organizations such as the OECD (2016), UNDESA and UNEP (2016) have all launched efforts and processes to better understand, manage and leverage interactions and linkages among development policy areas. Many institutes and *ad hoc* expert groups have also contributed (e.g. IRP, 2015; SDSN, 2015; Stakeholder Forum, 2016) as has the European Commission (2015). However, there is at present no structured evidence base or framework for unpacking interactions, and get a systems understanding of whether and when goals and targets are indeed “indivisible”, or actually are to be traded off against each other. At the same time as the integration discourse blossoms in official documents, real world policy making is often based on negotiations around competing goals and interests.

The purpose of the paper is to help establish a baseline understanding of important interactions and launch a discussion among experts on implications for readying institutions for integrated approaches to implementation of the 2030 Agenda. The focus is on six SDGs selected for review at the 2017 High-Level Political Forum. These address ending poverty, ending hunger, healthy lives, gender equality, infrastructure and industrialization, and oceans (Goals 1, 2, 3, 5, 9 and 14). The paper presents a selection of salient targets for each of the six goals, and what stands out as some of the most important interactions with a selection of other targets, based on a reading of the mainstream literature.

It addresses the following overarching questions:

- What are the most important interactions among the targets of Goals 1, 2, 3, 5, 9 and 14 and other SDGs?
- What is the level of agreement around this knowledge?
- Where would joint action and international response likely bring clear net benefits?
- What are the institutional implications of addressing linkages among SDGs?

Section 2 discusses the six SDGs one by one. Targets within each of the six goals are analysed against targets in other goals. For each interaction, a score is applied, from +3 to -3 and the nature of the interaction is summarily introduced. The level of confidence and degree of consensus regarding the findings of the interactions is indicated with a brief comment, where possible. However, it must be noted that these comments are based on subjective judgment and a necessarily limited reading of the literature. In most cases it has not been possible to find information about robustness of level of consensus regarding the knowledge base. The state of knowledge is to some degree dependent on indicator systems and the quality of indicators which would enable statistical analysis with many countries.¹

¹ Data availability on each target indicator is not commented upon in this paper. On this topic the inter-agency and expert group on SDG indicators (IAEG-SDGs, 2016) has classified indicators into three tiers; Tier 1: conceptually clear, established methodology and standards, data regularly produced (81); Tier 2: as Tier 1 but data not regularly produced (57); and Tier 3: lacking established methodology and standards (88).

Section 3 includes a discussion regarding the results and their dependencies, and some remarks on institutional issues. Section 4 presents conclusions and suggested priorities and ways forward in developing the knowledge base about integrated approaches. The conceptual approach is described in Annex 1 and put in the context of existing literatures and efforts to analyse interactions. Annex 2 contains a compilation of studies and references on interactions.

2. Mapping important interactions across SDG targets

Goal 1. End poverty in all its forms everywhere

Goal 1 on poverty eradication implies a focus on not just income. Over the last decades, poverty has evolved to become a multi-cause and multidimensional concept, as articulated in the targets under Goal 1, which refers to, for example, “all dimensions” (1.2), social protection (1.3), rights, access to resources and control (1.4) and resilience building. It can thus be argued that poverty is in many ways indivisible from other goals. Such an argument is underpinned by the works of development economists and philosophers such as Sen (1993) and Dasgupta (2001) and was embodied in the Millennium Development Goals (MDGs). These theories of poverty and development typically elaborate a set of basic dimensions (freedoms, capabilities, entitlements), including basic access to health services, education, shelter, nutrition, water, energy and sanitation as well as to human rights and liberties, empowerment, social inclusion, human security, dignified livelihoods, and opportunities to participate in trade and production activities.

To take just one example, health progress is indivisible from poverty reduction insofar as at low levels of income, rising incomes lead inevitably to health gains, as basic needs (including nutrition, health care, shelter and others) are fulfilled. At higher levels of income, the interaction becomes more ambiguous in some dimensions of e.g. nutrition and non-communicable disease (see Goal 3 on health).

Observing the principle of leaving no one behind, it is important to keep in mind that interactions with poverty cannot be understood as simply interactions with the goal of aggregate economic well-being. Contrary to the economic utilitarian view and resulting “trickle down” assumptions in development policy, the end objective is instead the wellbeing, welfare and freedom of each individual (Gewirth, 1978). This distinction is important and the implication may change the character of some of the interactions. For example, development strategies such as export-driven manufacturing, industrialization, value addition activities in the food sector, or natural resources extraction invariably reinforce aggregate economic well-being but only contribute to poverty alleviation when there are adequate and effective institutional frameworks that enable access of the poor to the opportunities and benefits from development.

At the international level, political unrest related to perception of the domestic impacts of international trade and “job competition” from lower income countries may be putting a strain on the opportunities for these countries to pursue export-led development strategies for poverty reduction in the future. The poverty reduction impacts of pursuing international trade are highly dependent on which sectors are being developed. Furthermore, trade agreements tend to go both ways and the last decades have shown that many domestic infant businesses and industries in e.g. Africa have often been out-competed by more efficient large-scale suppliers from emerging economies (Zafar, 2007).

 1 NO POVERTY		Important interaction	Key dependencies (geography, technology, governance)	State of knowledge (agreement, evidence base)
EXAMPLES OF POSITIVE INTERACTIONS				
+3	Access to rights and economic resources (1.4)	< Indivisible from developing infrastructure (9.1)	Infrastructures for basic access, but also for connectivity (GSDR, 2016)	Strong agreement and knowledge base
+3	Building resilience of the poor (1.5)	< Indivisible from sustainably manage marine and coastal ecosystems (14.3)	Generally applicable in coastal areas where communities depend on marine resources for livelihoods	Scientific gaps in knowledge about functioning of marine ecosystems.
+2	Access to rights and economic resources (1.4)	< Indivisible from ending discrimination against women (5.1)	Generally applicable	As targets are formulated, they are indivisible per definition
+2	Reduction of poverty (1.2) and building of resilience of the poor (1.5)	< Reinforced by agricultural productivity and small farm income (2.3)	Keeping rural livelihood opportunities rather than pursuing productivity improvements through reducing labor input onto large farm units	Increasing agreement
+2	Reduction of poverty	Reinforced by inclusive industrialization (9.2)	Focusing on sectors where poor communities can engage and get employment and training	Increasing agreement
+2	Reduction of poverty (1.2) and building of resilience of the poor (1.5)	< Reinforced by access to modern energy services (7.1)	Generally applicable but lack of access to energy is predominantly in rural areas in Sub-Saharan Africa and South Asia	Strong agreement and clear knowledge base but knowledge needs remain regarding viable scaling models for energy
+2	Building resilience of the poor (1.5)	Reinforced by reducing deaths and illness from chemicals and pollution (3.4)	In urban polluted areas and regions where cooking is carried out with dirty cookstoves	Strong agreement and scientific evidence base
+1	Building resilience of the poor (1.5)	Enabled by adaptive capacity to climate-related hazards and natural disaster (13.1)	Generally applicable	Strong agreement

Poverty alleviation is the perhaps strongest SDG in terms of institutionalization, being the key objective and *raison d'être* of most multilateral development organizations, bilateral development cooperation agencies and front and centre of all national development strategies in lower-income countries. Institutions to combat poverty at both national and international levels have been built up and become strong as part of the entire post-World War II international political order.

In this institutional structure, interlinking poverty strategies with international trade and inclusion in the global market place remains a strong discourse. At the same time, given current international political developments, poverty-oriented development efforts may think about nurturing both domestic and intra-region market institutions, in addition to engaging with the export market for higher value addition products and services.²

Domestic and intra-regional-oriented poverty reduction strategies, including domestic market institutions, have gained interest in recent years. For examples, the African Union has established an Action Plan for boosting intra-African trade where the economic transformation is driven from within the region itself. This involves creating a more cohesive institutional trade system among countries as well as improving infrastructures (Valensisi and Karingi, 2016).

² The reliance on markets for poverty reduction has been criticized also on political grounds as it tends to orient attention to solely the income dimension of poverty. In quantitative measurements of poverty, the income dimension is also strongly institutionalized.

Another important institutional area lies in national efforts such as conditional cash transfer programmes (see Example), which offer opportunities to leverage the positive interactions with health care, education, and gender equality. Such institutional programmes oriented to expanding entitlements and capabilities will go hand in hand with poverty reduction. Given the universal aspiration of poverty eradication, ensuring the rule of law and equal access to justice for all, promoting effective, accountable and transparent institutions, and ensuring inclusive, participatory and representative decision making at all levels will be important elements of the institutional setting.

EXAMPLE: Institutionalizing multidimensional poverty eradication – conditional and connected cash transfers

Conditional cash transfers have received growing attention around the world, across many Latin American, Sub-Saharan African and Southeast Asian countries, and in both lower- and middle-income contexts. Assistance to poor households are made in cash but linked to things like school attendance (Goal 4) or postnatal health care visits (Goal 3), such as in the Brazilian Bolsa Familia. Gender equality dimensions (Goal 5) can be strengthened by directing assistance to the female household head, such as in the Mexican Oportunidades programme. Programmes can also be linked to investments in public works and infrastructure (Goal 9). These programmes thus leverage directly on interactions among development goals at the household level. Evaluations of them have yielded mainly positive results. (UN, 2016 – Annex 1).

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

The achievement of Goal 2 is dependent on major production and productivity increases. For example, FAO estimates that food production must increase by 70% until 2050. But more efforts are also needed on the demand and distribution side. For example, coping with food waste (which has its own target under Goal 12) is today estimated at between 30-50% of all food produced at different stages of the supply chain (World Resources Institute, 2014). Herein lies an immense opportunity in economic, social and environmental terms alike but also a challenge due to the multi-actor complexity of global supply chains.

Productivity increases have so far been able to keep up and have made food cheaper and more abundant than ever at a general level. This has generated, and has the potential to continue to generate, great benefits in terms of food security and providing adequate nutrition for all. However, the benefits of this progress have often been distributed unevenly. In the process of exploiting productivity gains, global commodity chains have become a strong feature of the sector. As a consequence, small-scale farming systems, including such that are traditionally dominant in many lower income countries, have become less viable on many markets. Import-competing producers in domestic markets are struggling today, in both developing and higher-income countries. Since many low-income countries depend on the agricultural sector, this is a particularly critical concern.

Agricultural production is a major source of environmental impact, including climate change, but also terrestrial ecosystems, and coastal pollution (Foley et al. 2011). However, it also provides landscapes and cultural environments that are deeply valued. On the social side, Goal 2 embodies social, economic and environmental dimensions of sustainable development in a balanced way: ending hunger and improving nutrition (social dimension) are addressed through targets 2.1 and 2.2, productivity improvement and revenue increase (economic dimension) are addressed through target 2.3 and sustainability of agriculture (environment dimension) is addressed through targets 2.4 and 2.5 (Mollier, et al., 2017).

Nutritious and healthy diets are embodied in target 2.1 and 2.2, and are intimately linked to health outcomes. Today, the number one risk factor behind the global burden of disease is diet. This has several important

connotations at all levels of national income. This in turn leads to economic losses. It has been estimated that undernutrition in Africa and Asia has an economic cost equal to 11% of GDP. (Global Panel on Agriculture and Food Systems for Nutrition, 2016) (see also Goal 3 below).

At the national level, positive interactions can be leveraged by coordinating action on agriculture, health, gender and water and sanitation. Improving utilization of food is enhanced by improvements in education and health policies, and measures to enhance income growth amongst the poor. Investments in sanitation and clean water will also improve nutritional outcomes, in strong interaction with health and gender goals.

		Important interaction	Key dependencies (geography, technology, governance)	State of knowledge (agreement, evidence base)
EXAMPLES OF POSITIVE INTERACTIONS				
+3	Ensure sustainable food production (2.4)	< Indivisible from reducing marine pollution, in particular nutrient pollution (14.1) and overfishing (14.4)	Coastal zone and technology dependence, but see potential counteraction below	As targets are formulated, they are indivisible per definition
+3	End malnutrition in children (2.2)	>Indivisible from ending preventable child deaths (3.2)	Malnutrition leading to children dying is strongly associated with least developed and fragile states, areas of conflict, etc	Strong agreement and knowledge base, including how to manage it
+3	Access to food (2.1)	> Nutritious diets is indivisible from reduction in burden of non-communicable disease (3.4)	Generally applicable but in very different ways, undernutrition in some countries, obesity in most countries, and unhealthy diets almost everywhere	Strong agreement and increasing knowledge base, but much science needed on the mechanisms
+2	End malnutrition in children (2.2)	< Reinforced by universal access to sanitation and hygiene (6.2), diarrhea killing nearly a million children under five each year.	Burden of diarrhea strongly linked to developing countries. Prevented by clean water, improved sanitation, and hand hygiene	Strong agreement and knowledge base
+2	Double agricultural productivity and small farm income (2.3)	> Reinforces the reduction of poverty (1.2) and building of resilience of the poor (1.5)	Keeping rural livelihood opportunities rather than pursuing productivity improvements through reducing labor input onto large farm units	Increasing agreement
+2	Double agricultural productivity and small farm income (2.3)	< Reinforced by access of small scale enterprise to financial services (9.2) and by infrastructure developments (9.1)	Credit and market access critical barriers	Strong agreement and growing evidence base
+1	End malnutrition in children (2.2)	< Malnutrition is not only undernutrition. Mitigating obesity is enabled by quality and sustainable infrastructure (9.1) that enables healthier more active lifestyles	Obesity is a highly complex development problem as countries move from low to middle and high income. But also in low income countries, the issue is of growing concern	Not well researched or established relations and drivers of child obesity, or how to mitigate and prevent obesity
EXAMPLES OF NEGATIVE INTERACTIONS				
-1	Double agricultural productivity and small farm income (2.3)	>Constrains protection of terrestrial ecosystems (Goal 15)	Interaction significantly dependent on resource constraints. In some cases, productivity enhancements might counteract biodiversity if mono-culture technologies are prioritized.	A contradictory and complicated evidence base, highly contextual. Whether organic and eco-systems based approaches are more or less productive in the long term is not entirely clear
-2	Double agricultural productivity and small farm income (2.3)	>Counteracts in some cases the reduction of marine nutrient pollution due to the need to apply more fertilizer that can result in leakage (14.1).	This interaction depends strongly on geography (coastal zones) and vulnerability of ocean ecosystem but also technology (precision in applying agrochemicals)	Unclear knowledge base
-2	Access to	>May counteract climate	If dairy- and meat-based diets are	Strong agreement but

	food (2.1)	change mitigation (13.2)	pursued by an increasing global population, greenhouse gas emissions will rise significantly	controversial politically
-2	Access to food (2.1)	>May counteract sustainable water withdrawal (6.4) and reduction of chemicals releases (12.4)	If global consumption of cereals and sugars is replaced with a more healthy garden-vegetable rich diet, the use of inputs including agrochemicals may rise, but strongly dependent on regional context, governance and technology	Emerging knowledge

Institutionally, the integration between food and other SDGs is relatively well established at the international level, where the Food and Agricultural Organization (FAO) and the Consortium of International Agricultural Research Centers have had mandates connected to many other development areas, and to poverty. Significant work, including building institutions, is ongoing on closing the yield gap and enhancing productivity and these will continue to be critical areas of action. In this regard, there is great potential to strengthen the positive interactions from goal 2 through balancing agricultural and food policies so that policies geared to drive large-scale farming focusing on global crops is complemented with support to small-farmer applications and locally adapted crops.

Institutional programmes at national level to integrate food security with gender and health priorities have shown great potential. Land titling to women in Vietnam reinforced efforts to increase crop yields. And a programme in India that linked 30 million small-holders to dairy infrastructure and markets reinforced improvements in poverty reduction and nutrition in particular for children.

This quest connects the mandates of food and agricultural institutions with those for science, technology and innovation (in Goal 9). Innovation systems in the agricultural sector have been mostly funded by the private sector and often geared towards yields, agrochemical tolerance, and durability of produce in large-scale systems. The potential to develop e.g. crops and agro-processing that have better consumer amenities or environmental characteristics have been much less in focus. Innovation efforts need to tackle advancement of traits in crops for drought and heat resistance, for water and nitrogen uptake efficiency, for nutrient intensity, and for pest resistance. Several national and regional institutions across the developing world are now working increasingly on innovation in agriculture are now orienting themselves for applying the latest biotechnology to traditional crops that are applicable for small-scale farmers (Juma, 2011; Virgin and Morris, 2016).

Due to the global supply chain characteristic, food security is nowadays a multilevel institutional challenge and for commodities it requires internationally coordinated responses, as the collective impact of countries acting in a non-coordinated way can be detrimental to achieving food security. Experiences with national responses to food price fluctuations with interventions such as trade restrictions, price controls and buffer-stock policies have been seen to amplify market fluctuations. (Gouel, 2014)

The split of responsibilities between agencies governing agriculture, health, education and social programmes can lead to suboptimal development results at the national level, but can be overcome. One route is to work with high-quality diets through using public procurement for schools and hospitals. Such integrated approaches can leverage both education and health results from dietary improvements as well as shaping longer term popular norms about diets and lifestyle, and incentivizing food businesses to innovate (Global Panel on Agriculture and Food Systems for Nutrition, 2016).

EXAMPLE: Interactions between agricultural productivity, land degradation, poverty reduction and climate change

China undertook efforts at promoting agricultural productivity through curbing soil erosion in the Loess Plateau project (1994-2005). This proved to stimulate a whole range of positive interactions between development priorities. Halting activities leading to degradation, and improving agricultural structures such as terraces, increased yields and helped lift more than 2.5 million people out of poverty. In the process, climate change was curbed through enhanced storing of soil carbon and reinforced growth of trees and grassland. Average grain yields increased by 60% over 10 years. Additional interactions included mitigation of Yellow River silting and reducing air borne dust to Beijing. The example highlights the effective leverage of interactions that transitions a society away from a “nexus syndrome” of degraded ecosystems, low prospects of employment and livelihoods, and vulnerability to climate change (NCE, 2014).

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 3 embodies a deeply multifaceted concept. In 1948, WHO defined health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. Healthy lives depend critically on other SDGs, including nutritious food, clean water and sanitation, and education. It connects to economic aspects and employment as poor health directly impacts the economy – at both national and individual levels (with often disastrous consequences and tragedies at household levels for vulnerable groups) (Jamison et al 2013). There is relatively strong scientific agreement on the multiple interactions between health targets and other targets in the 2030 Agenda. However, national circumstances related for example to the degrees to which targets are being met are very different across countries.

Within social dimensions of development in particular the links between health and education appear to be strongly reinforcing each other. Education improves health and reduces fertility rates. And conversely, health and nutrition reinforce education³ (UNESCO, 2016). The link between non-communicable disease and food is ever-clearer, with problematic developments in low quality diets in both higher and lower-income countries, and in many places obesity and low quality diet-related disease is growing exponentially (Global Panel on Agriculture and Food Systems for Nutrition, 2016).

Interactions between environment and health are no less significant, with causality going in both directions, and often via intermediate factors. Temperature increases as a result of climate change results in vector-borne disease spreading (such as malaria, schistosomiasis and dengue). Air pollution from transport and from burning of fuels for energy services are estimated to be causing 7 million premature deaths per year (WHO, 2016). Natural disasters that occur as a result of climate change, deforestation lead to ill health and deaths for example through contamination of water (WHO and WMO, 2012).

Thus, health targets are highly dependent on other sectors. There are few examples of trade-offs between health targets and other SDGs. The interactions with economic growth depend on context. Inequities in the distribution of wealth can exclude groups from health services but also in themselves be a cause of mental health problems. At low levels of income, there is a clear reinforcement. At higher level, new health issues emerge. Affluent Western lifestyles (as Goal 8) can counteract the reduction of a range of non-communicable diseases (including some forms of allergies, cancer, cardio-vascular, obesity, and psychiatric conditions such as depression and dementia). As more and more countries, and groups within countries, reach higher levels of income, it is important to mitigate this welfare syndrome where trends are highly worrying (NCD-RisC, 2016).

³ In Nigeria, for example, it was shown that doing four more years of school reduced fertility rates by one birth per young girl. In India, female literacy rates were 5% higher for those with better access to water. And in Kenya, girls who received deworming treatment were 25% more likely to pass the primary school exam.

Adjacent efforts at national and international levels are crucial, whereby prevention and treatment through changing “affluence lifestyles” are promoted and implemented in the health sector.

A relatively recent literature connects health with cities and infrastructures. This is not only a question of pollution (see Example). Urban development and urban form are determinants of the health and well-being of residents, including through impacts on stress and anxiety. New research shows significant reinforcement of better designs of cities and neighborhoods on people’s health and wellbeing. As the city-related targets are formulated in Goal 11, they will not pose a constraint in this respect. However, urban development as often practiced today carries with it potential negative interactions with health and well-being.

		Important interaction	Key dependencies (geography, technology, governance)	State of knowledge (agreement, evidence base)
EXAMPLES OF POSITIVE INTERACTIONS				
+3	Reduce maternal mortality (3.1) and access to sexual and reproductive health care services (3.7)	<> Indivisible from sexual and reproductive health rights (5.6)	Generally applicable, but implementation strategies must be culturally and politically aware of contextual factors	Strong agreement
+3	End epidemics (3.3) and preventable child deaths (3.2)	<Indivisible from access to safe water (6.1) and sanitation and hygiene (6.2)	Generally applicable	Strong agreement
+3	Reduce mortality from non-communicable disease, promote mental health (3.4)	<Indivisible from eating more nutritious foods (2.1; 2.2) with malnutrition the number one risk driving global burden of disease	Generally applicable, including issues of obesity, and low quality diets	Strong agreement and increasing political interest
+3	Reduce deaths and injuries from road traffic accidents (3.6)	<Indivisible from safe, affordable, accessible transport systems (11.2)	A global issue, but accident numbers (per 100,000) at their worst in Asian and African cities	Strong agreement
+2	Reduce death and illness from chemicals and pollution (3.4)	<Reinforced by modern energy access (7.1) and to renewable sources of energy (7.2) via reduction in indoor and outdoor air pollution. (WHO, 2016)	Strongest outdoor in urban areas of rapidly growing economies. Indoor in rural Sub-Saharan Africa and South Asia	Strong agreement and strong knowledge base with air pollution monitoring in real time
+2	Prevent deaths of newborns and under five children (3.2)	<Reinforced by dealing with malnutrition (2.3)	Generally applicable	Strong agreement
+2	End the epidemics of AIDS, TBC, etc (3.3)	>Reinforcing the reduction of poverty (1.2) and building resilience of the poor (1.5)	Generally applicable	Strong agreement
+2	Prevent substance abuse, drugs, alcohol (3.5)	> Reinforces resilience building of poor and vulnerable to shocks (1.5)	Relevant in all contexts	Strong agreement
+1	Access to maternal health (3.1) and sexual and reproductive health care services (3.7)	<>Enables and enabled by women’s full participation in economic and political life (5.5) and ending discrimination of women (5.1)	Generally applicable	Strong agreement
+1	Reduce deaths and injuries from road traffic accidents (3.6)	<Enabled by better infrastructure for transport (9.1)	Generally applicable	Strong agreement
EXAMPLES OF NEGATIVE INTERACTIONS				
-1	End epidemics	<Constrained by aspiration	Potential constraint in certain	Unclear knowledge base but

	(3.3)	to lifestyles in harmony with nature (12.8)	western communities that turn away from modernity including modern vaccines	probably relatively weak interaction
-2	Reduce mortality from non-communicable disease, promote mental health (3.4)	<Counteracted in many dimensions by increasing levels of welfare and economic growth (8.1) not least via food consumption (2.1)	A phenomenon that most rich countries are struggling with, but not necessarily inevitable. The relationship between food consumption and health is highly context-dependent and governance dependent	Unclear and complex relationships in an emerging research area

The institutional framework for health governance has been relatively strong for decades, with notable achievements by e.g. the World Health Organization (WHO) in mitigating and sometimes eradicating infectious diseases. While the global health governance has focused strongly on infectious diseases, WHO has also increasingly engaged with other “sectors” such as the World Meteorological Organization and the United Nations Environment Programme on issues in the nexus between health, climate change and air pollution.

At national levels, however, environmental and health issues almost invariably fall under different ministries and agencies. In addition, very few civil society organizations or academic institutions span both. Ministries of health are central players in governing these interactions at national levels. Technical core capacities can be strengthened across countries through international efforts, a long term but important investment. Institutional capacities should also be developed with respect to National Health Research Systems, to coordinate health research processes, findings, and structures, and with the overarching goal of enhancing the health system’s ability to perform its functions.

Achieving the SDGs will rely on the build-up of much stronger linkages between these communities and agencies to enable a more holistic approach to health governance. The worldwide One Health initiative for expanding interdisciplinary collaboration and communication is an interesting institution in this regard, that seeks to promote this perspective and the linkages between human, animal and ecosystem health and taking an integrated perspective. Initiatives at subnational levels are needed, in particular to raise awareness and to strengthen institutional capacity— at district levels—to enable the design and implementation of integrated health programs (covering, e.g., education, nutrition, local environmental management and health) that have the support of communities and local organizations.

EXAMPLE: Interactions between health, economy, urban transport and energy in India

New Delhi has sailed up to the top list of the world’s most polluted cities. In November this year, the Indian government declared an “emergency situation” for New Delhi due to air pollution leading to shut downs of schools, construction sites and power stations. Transport, burning of solid fuels and waste, and ambient dust contribute the most. This is interacting strongly with severe environmental health conditions including morbidity and mortality from respiratory and cardiovascular illness. (WHO, 2016) Globally, outdoor air pollution represents 3 million deaths per year. There is also a causal link established to prenatal morbidity. Costs to society include direct productivity losses from e.g. sick days and medical costs that have been estimated to 1% of total GDP globally. Counting also statistical values of life lost often moves the welfare cost to up towards 5-10% of GDP in polluted places. (OECD, 2016)

EXAMPLE: Interactions between health and climate change impacts in cities

Rising temperatures and resulting heat stress is a growing phenomenon, in particular in cities where an urban “heat island” effect is worsening the problem. Lack of vegetation, dense infrastructure, concrete that absorbs heat, buildings blocking wind, means that city temperatures are up to 3°C warmer in the day and up to 12°C in the night. This leads to rises in mortality and respiratory disease. This problem has proven deadly in significant numbers in both Europe and in India.

Beyond the direct consequences of temperature rise, the health impacts are also linked to the environment. For example, heat speeds up chemical reactions for the formation of ground-level ozone which leads to inflaming and damaging airways and aggravating lung diseases such as asthma, emphysema, and chronic bronchitis. It also increases populations of disease vectors such as mosquitos. (UNU-IIGH, 2016)

Goal 5. Achieve gender equality and empower all women and girls

Gender inequalities represent human rights and social problems in their own right but they also represent barriers to development and inefficiencies in the economy. For example, a major interaction is the expansion of labor supply that results from women entering the work force - a key source of productivity growth and by extension economic growth. Discrimination of women in the economy stifles economic activity and decent work opportunities.

Gender equality naturally cuts across all other SDGs and can contribute significantly to many of them (Leach, 2015). The World Economic Forum (2015) examines correlations across many dimensions of growth and demonstrates strong interactions with gender dimensions. Broadly speaking, closing the gender inequalities in many dimensions (earnings, health, control of income, bargaining power, access to land, etc.) is instrumental to achieving food security (ADB and FAO, 2013). Evidence suggests that more equal participation for women will unleash improved productivity in agriculture (Ward et al 2011).

The relationship between gender equality and the environment encompasses many dimensions. Taking a global resource perspective, it is noteworthy how access to sexual and reproductive health leads to lower fertility rates, smaller families and, on the aggregate, lower population growth and pressure on resources and the environment (in the simple $I=P*A*T$ identity: Environmental impact = population * affluence * technology). (Hartmann et al 2015)⁴

Overall the literature does not seem to point to significant negative interactions of the gender equality targets with other SDGs. The overwhelmingly positive interactions to other goals suggests that actions for improved gender equality can be an important lever for the 2030 Agenda overall. Getting to serious grips with gender matters in development interventions will enhance development outcomes across the economy and sectors of health, education, food, sanitation, and even possibly environmental protection.

		Important interaction	Key dependencies (geography, technology, governance)	State of knowledge (agreement, evidence base)
EXAMPLES OF POSITIVE INTERACTIONS				
+3	Ending discrimination against women (5.1)	<>Indivisible from ensuring empowerment and political inclusion (10.1) and equal opportunity (10.3)	Generically applicable but discrimination takes very different forms in different contexts. In some societies, it is in the law and in formal institutions, in others it takes informal expressions that can be difficult to detect	Strong agreement but unclear knowledge base
+3	Access to sexual and reproductive health and rights (5.6)	>Indivisible from reducing maternal mortality (3.3)	Generally applicable and strongest reinforcement where current access is lowest	Strong agreement
+2	Access to sexual	>Reinforces ending	Generally applicable and strongest	Strong agreement, e.g.

⁴ This stance, while factually clear and simple, is however politically complicated as it puts the spotlight on poor countries which typically have lower per capita and overall environmental impact than rich ones.

	and reproductive health and rights (5.6)	communicable diseases such as HIV / AIDS (3.3)	reinforcement where current access is lowest	http://www.who.int/reproductivehealth/topics/linkages/en/
+2	Women's full participation in economy and political life (5.5)	>Reinforces productivity increases in the economy (8.2) and decent job creation (8.3) (Ramos, 2014)	Generally applicable and strong effect across all types of economies	Strong agreement, inefficiency of not having women participating is clearly in line with mainstream economic thinking
+2	Ending discrimination against women (5.1)	>Discrimination prevents women from engaging in trade activities and from forming of small enterprises and providing decent work (8.3 and 8.5)	Generally applicable and strongest where discrimination is highest	Agreement but sketchy knowledge and likely difficult to find causality
+2	Ending discrimination against women (5.1)	>Discrimination prevents girls from education at all levels (4.1; 4.2;4.3; 4.4)	Actions work best when gender equality of educational opportunities are extended to secondary and tertiary education; and where the quality of education received by girls is sufficiently high (Ward et al 2011)	Strong agreement niy discrimination is a multifaceted problem where research knowledge seems only nascent
+2	Women's full participation in economy and political life (5.5)	>Reinforces agricultural productivity in small holder farms (2.3)	Strongest in agricultural dominant economies.	There is good evidence that achieving gender equality could increase agricultural profits and yields.
+2	Ending discrimination against women (5.1)	>Women's empowerment and control reinforces nutritional health of their children (2.1)	Applicable in food-insecure communities and countries	Strong agreement
+2	Women's full participation in economy and political life (5.5)	<Reinforced employment of women by industrialization (9.1) and trade liberalization (17.11; 17.12) as many industries hire women as they are perceived to be more productive than men.	This positive association is strongest in labor-abundant economies in transition, but risk of reversal when industries upgrade (Braunstien and Houston, 2015)	Sketchy research / likely difficult to find causality.
+1	Women's full participation in economy and political life (5.5)	<>Small but significant relationship between rising female political and workforce participation and lower levels of corruption (16.5; 16.6)	Generally applicable	New and not yet robust evidence base
+1	Women's full participation in economy and political life (5.5)	<Enabled by access to financial services of small scale enterprise (9.1)	Generally applicable	Generally agreed but sketchy evidence base
+1	Women's full participation in economy and political life (5.5)	>Greater political representation for women is associated with the provision of a different mix of infrastructure (9.1 and 9.4)	Depends significantly on geographical and cultural context.	Unclear knowledge base
+1	Women's full participation in economy and political life (5.5)	<Better maternal health (3.1) enables women who can participate in the labour force	Mostly a factor in low income countries, but generally applicable	Strong agreement
+1	Ending discrimination against women (5.1)	<>Enables better health for women through reduced exposure from indoor air pollution due to dirty cook stoves (3.9). Cleaner cooking can also empower women (Casillas and Kammen, 2010)	Women disproportionately impacted to this air pollution from cooking in particular in South Asia and Sub-Saharan Africa	Strong agreement

Strengthening interactions with gender equality can be pursued through several different types of institutional arrangements. There are many examples of programmes and policies at national levels that have been used to improve gender equality and reinforcing positive change in other goals at the same time. In Brazil, for example, the Bolsa Familia programme tied state financial aid to women in poor households conditioned on school attendance and vaccinations. Such integrated programmes have empowered women as decision makers in families while at the same time reinforcing educational and health goals.

Gender laws and regulations can be enacted at different levels of government, such as law on gender equality passed or national strategies for advancement of women. National parliaments thus have a particularly important role in relation to gender equality. They can enact binding legislation against discrimination and they can set an example by promoting female politicians to achieve equal political representation. To this effect, gender quotas can be enacted at different levels of government and public affairs.⁵

Gender mainstreaming (applying a gender lens on all policy domains) can be institutionalised in policy and planning procedures such as in national development plans and strategies and through gender-responsive budgeting. Sex-disaggregated national statistics to measure development outcomes on for example health, nutrition, education, crime and income, is an important component of the institutional framework of mainstreaming (UNDP, 2014).

EXAMPLE: Interactions between women participating in political life and infrastructure investment

Women's empowerment and inclusion in economic and political decision making can influence public choice related to infrastructure investment. For example, in cases where a woman is head of a village council the type of public goods that are provided is distinctly different from case where a man is head. However, choices and preferences are locally determined. Studies have shown that, in West Bengal women are more concerned about, and spend more money on, drinking water and roads than on other public goods while in Rajasthan women are more concerned than men about drinking water but less about roads. (Ward et al 2012)

EXAMPLE: Public procurement to support women and food security

In India and Brazil (Fome Zero), a new policy approach has been used – public procurement that specifically targets small scale farmers (often women) that face barriers to reaching markets and obtaining fair prices. It reaches better quality food for schools and hospitals, and helps to diversify diets with fresh produce. In Brazil, sustained declines in hunger, especially in female-headed households, have been observed. This programme is now being replicated in several countries in Sub-Saharan Africa. (Fukuda-Parr, 2015)

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Much of the interactions of SDG 9 on the economic and social side are subjects of very substantial research literatures, including decades of economic research and experiences in both national and multilateral institutions such as development banks. There is broad agreement that industrialization, innovation and infrastructure investment are all important enablers of economic growth. Industrialization is critical to improve the productivity in the economy, and productivity is the key long term source of growth (Atkinson, 2013). However, when it comes to poverty reduction, Aggarwal and Kumar (2015) show in their study of India that this relation depends on the poor being capacitated to participate in and benefit from economic activity. Therefore,

⁵ See parliament shares on <http://www.ipu.org/wmn-e/classif.htm> and explore more general gender statistics on <http://reports.weforum.org/global-gender-gap-report-2016/>.

past decades of growth, while lifting many out of poverty, have still left significant populations behind - stuck in deep poverty. Studies suggest that manufacturing industry and value addition activities that generate employment for the poor have strong poverty returns (Hull, 2009). Also research and innovation driven productivity increases in the agricultural sector are understood to have strong poverty reduction returns (Thirtle et al., 2003). However, one should caution on political aspirations regarding “high-tech” industrialization strategies – as competing in such niches is difficult for low income countries and may not be inclusive of large groups in society.

When it comes to infrastructure, this encompasses a diverse set of assets. The Global Sustainable Development Report 2016 (UN, 2016, chapter 2) usefully identifies three mechanisms by which infrastructures affect development (and poverty alleviation in particular); providing basic access (electricity, water, sanitation, communications); enabling structural change (new types of job and industries); and providing connectivity between people and markets (transport infrastructure and ICT). Currently, bottlenecks exist in all these mechanisms and they are stifling economic activity and poverty alleviation in lower income economies. It has been suggested that, as a result of infrastructure deficits, economic growth is lowered by 2 percentage points per year and reducing firm’s productivity by as much as 40% in Africa (Ramachandran et al 2009). Establishing in particular regional transport will reinforce intra-regional trade and regional integration and cooperation. Increased access to infrastructure services generally improves the possibilities for the poor to be involved in economic activity.

Evaluations have shown that transport and communications infrastructure does reduce poverty in some areas, through enabling labour mobility, information flows, and non-farm economic activity in rural areas (Calderon and Serven, 2014). Furthermore, on the social side, infrastructure reinforces social dimensions of development, including having strong positive impacts on education and health. For example, transport infrastructure enables the establishment of schools and hospitals and reduces travel times to them (Brenneman, 2002). Energy infrastructure improves possibility to study at night, better equipment at schools, and reduces the need for labor for collecting traditional fuels.

Industrialization and infrastructure are associated with well-known trade-offs with a range of environmental factors, as articulated in decades of national and international environmental legislation and regulations. Conversely, these environmental objectives have traditionally been seen as constraints on industrialization. Science, technology and innovation is both a cause of environmental pressures and to large part the solution to them (European Commission, 2015). Deployment of improved technologies and innovation can help support a shift away from a negative to an actually positive interaction (NCE, 2015).

		Important interaction	Key dependencies (geography, technology, governance)	State of knowledge (agreement, evidence base)
EXAMPLES OF POSITIVE INTERACTIONS				
+3	Enhance science, technology, innovation (9.5)	>Indivisible from productivity increases (8.2) – as in the long term innovation is key source of productivity growth	Many dependencies related to technology and governance , in particular the interaction depending on scaling capacities	Strong agreement at a generic level but a very complex area of research
+3	Develop infrastructure (9.1)	<>Indivisible from ensuring access to economic resources, services etc (1.4)	Stronger relationship in areas where the most basic infrastructure is entirely lacking, as opposed to areas where access is missing	Strong agreement
+3	Promote inclusive industrialization (9.2)	>Reinforces economic growth (8.1) through improving productivity in the economy	Generally applicable	Strong agreement that productivity growth is the key source of income growth in the long term
+2	Develop infrastructure	>Better transport infrastructure reinforces	Mostly a concern in countries with infrastructure deficit	Strong agreement

	(9.1)	access to food (2.1) and farmers' access to markets (2.3)		
+2	Promote inclusive industrialization (9.2)	>Reinforces reduction of poverty (1.2)	Industrialization needs to occur in sectors where poor communities can contribute and get employment	Strong agreement
+2	Develop infrastructure (9.1)	>Reinforces education (4.1) through reducing travel time to schools, establishment of schools, possibility to study at night etc.	Robust interaction in particular for infrastructures in transport, electricity, telecommunications	Strong agreement
+2	Develop infrastructure (9.1)	>Reinforces access to health care services by reducing cost and time of travel (Brenneman and Kerf, 2002)	In particular infrastructures in transport and telecommunications	Strong and robust relationship
+1	Enhance science, technology, innovation (9.5)	<Enabled by quality technical, vocational and tertiary education (4.3)	The interaction is dependent on technology and innovation-oriented educational strategies	Weak agreement on relationship between university capacities and innovation capacities
+1	Boost industrialization and industry's share of GDP (9.2)	>Enables ocean and fisheries management (14.4 and 14.6) by reducing emphasis on primary resource extraction in the economy	Dependent on value addition activities as part of industrialization strategy. However, see also potential counteraction below	Unclear knowledge base
+1	Enhance science, technology, innovation (9.5)	>Enables agricultural productivity and incomes of small scale food producers (2.3)	Bioscience innovation policy and support in should be oriented towards small holder crops and agroprocessing (Virgin and Morris, 2016)	Increasing agreement based on growing experience base and literature
+1	Enhance science, technology, innovation (9.5)	>Enables the development of scientific management plans for oceans and marine resources (14.4)	Generally applicable interaction which depends on stronger science-based institutions in the governance system	Scientific agreement but political interest in maintaining fisheries / fleets often overrides science in the decision making.
+1	Develop infrastructure for transport (9.1)	>Public infrastructure enables participation of women in the work force and in political life (5.5) (GSDR, 2016)	Generally applicable	Unclear knowledge base
EXAMPLES OF NEGATIVE INTERACTIONS				
-1	Boost industrialization and industry's share of GDP (9.2)	<Industrial activities may be constrained by the prevention of marine pollution from land based activities (14.1) and conservation of coastal areas (14.5)	A concern universally where there are coastal areas in need of conservation. Zoning of industrial permits and implementing regulation of pollution	Unclear knowledge base as very complex systems and drivers within them
-1	Enhance science, technology, innovation (9.5)	>Technological progress may benefit mostly skilled workers and constrain inclusion of new groups into the formal economy such as women (5.5) (Andrews et al, 2015)	Programmes for training and education of women to enable enter skilled work force	Unclear knowledge base
-2	Boost industrialization and industry's share of GDP (9.2)	>Can counteract climate action measures (13.2) and sustainability of terrestrial ecosystems (15.1)	Industrial impacts on the environment are per definition very strongly dependent on which technologies are used, and whether proper environmental incentives and regulations are deployed	Strong agreement and evidence base also about cost-effective mitigation actions
-2	Boost industrialization and industry's share of GDP (9.2)	> Can counteract ocean and fisheries management (14.4 and 14.6) by "technologization" of fisheries which have led to overfishing historically	Counteraction occurs where strong institutions for managing stocks are missing, such as in international waters	Strong agreement evidence base

Regarding institutional responses, the environmental governance of industrial activity and infrastructure investment is a strong institutionalized policy domain since the 1960s and 1970s, and both regulation and institutions are well developed. Environmental protection agencies and environmental policy instruments, including taxes and regulations, are widespread and mainstream in most countries.

In the next stage of development towards the 2030 goals, deep structural change in infrastructure and industrial production systems will require significant investments from both private and public sectors. For example, environmental sustainability, in terms of e.g. mitigation of climate change and air pollution, is widely agreed to depend on a transition away from fossil fuel infrastructure. This will require massive investments and rebuilds of transport, electricity, and urban systems. This is not a separate set of infrastructures – it is the approximately 90 trillion USD of “conventional” infrastructure build up over the coming 15 years that needs reorienting to low-carbon types. For this, an entire ecosystem of institutions for sustainable financing is now being built up or adapted at national and international scales – including for example green state investment banks (NCE, 2016).

On the area of technology and innovation, far less has been done from the public side to orient innovation towards environmentally sustainable products, processes and services. In recent years, Science, Technology and Innovation (STI) agencies have been established in many member states. Complementing this, institutions for public investment are needed, beyond research, development and demonstration (RD&D). Beyond establishing institutions for risk assessment (such as for biotechnology) and creating an enabling environment for innovation, it has been suggested that “mission-oriented innovation” approaches can help direct innovation systems more towards 2030 Agenda outcomes. Such approaches focus on specific societal challenges and incentivize actors in different sectors to coordinate efforts to solve them – much like the SDGs. Such mission orientation frameworks require an active role of the state, not only to fix markets and system failures, but also for being forward-looking and creating and shaping new markets (Mazzucato, 2013).

EXAMPLE: Interactions between infrastructure development, urban life, climate change and social inclusion

The world is expected to invest around US\$90 trillion in infrastructure over the next 15 years, more than is in place in our entire current stock today. Urban infrastructure is the lion’s part of this massive undertaking. Investment decisions in cities alone taken over the next years can determine 30% of the global carbon budget. Furthermore, getting these investments right will shape the resilience and vulnerability to climate change of cities. At the same time, compact, connected and low carbon investments (including affordable public transport, bicycling and walking) have proved to promote social inclusion, more equal access to different parts of the city, and enabling employment for marginalized groups. (NCE, 2016)

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

More than other goals in focus in this paper, oceans are predominantly a truly international public good, and due to over-exploitation of e.g. fisheries, marine pollution, and climate change, the benefits, foods and services we derive from oceans are under serious stress. This threatens decent employment, poverty alleviation and livelihoods in coastal areas around the world. Oceans thus relate to virtually all other goals. Ocean-based economic activities are estimated to generate global income at around USD 3–5 trillion per annum (FAO 2014). While designating parts of marine and coastal areas for protection might constrain options for the formulation of growth and jobs policies in some cases, they will play a role in generating jobs and growth opportunities in others. Sustainable economic development for example of fisheries, aquaculture and tourism sectors can contribute to poverty alleviation especially in island states and coastal regions of less developed and developing

countries. For example, capture fisheries play often a major role in national economies of SIDS. (Schmidt et al 2017)

Since oceans are a public good, when examining interactions with other goals, and how to cope with them, it is crucial to keep in mind both time scales and different kinds of human enterprise and activity affecting them. The depletion of ocean resources has many different causes at different scales from the local to the global, and differentiated effects, often impacting poor and vulnerable groups the most.

		Important interaction	Key dependencies (geography, technology, governance)	State of knowledge (agreement, evidence base)
EXAMPLES OF POSITIVE INTERACTIONS				
+3	Regulate harvesting, end overfishing etc (14.4)	<>Indivisible from sustainable and resilient food production (2.4)	Traditional and local institutions for regulation play important role.	Increasing agreement, and evidence base on both fish stocks and on systems for managing local resources.
+3	Sustainable manage marine and coastal ecosystems (14.2)	>Indivisible from building resilience of poor and vulnerable (1.5)	Generally applicable	Agreement although uncertainty in knowledge about functioning of marine systems, including seabeds,
+3	Address ocean acidification (14.3)	<Indivisible from climate mitigation (13.2), as ocean acidification which poses major threat is a direct consequence of greenhouse gas concentrations in the atmosphere.	Generally applicable	Strong agreement in principle although uncertainty in knowledge about ocean to atmosphere interactions
+2	Regulate harvesting, end overfishing etc (14.4)	>Reinforces food security and access to food for vulnerable groups (2.1). Food security depends on status of stocks.	Short term trade-offs might occur in terms of local livelihoods, but absolutely critical positive interaction in the long term Depends on differentiated policies and in particular regulation of industrial scale fishing fleets on international waters	Agreement and scientific gaps on carrying capacities of different fish stocks
+2	Economic benefits from the sustainable use of marine resources (14.7)	>Reinforces the creation of decent jobs and small enterprises in e.g. tourism industry (8.5 and 8.9)	Generally applicable in coastal areas	Gaps in knowledge regarding marine ecosystems services and economic development. Lack of assessment of the economic potential of sustainable marine related growth strategies in most countries
+1	Sustainably manage and protect marine and coastal ecosystems (14.2)	>Enables the development of decent jobs and small enterprises in e.g. tourism industry (8.5 and 8.9)	Generally applicable in coastal areas	Agreement but there are gaps in the reverse interactions, eg in understanding sustainability impacts of aquaculture
EXAMPLES OF NEGATIVE INTERACTIONS				
-1	Prevent marine pollution (14.1), protection of coastal ecosystems (14.2) and	>Constrains the development and promotion of industrial activity, in particular in coastal areas (9.2)	Affects mostly coastal areas although upstream catchment areas must be considered. Zoning in permitting and planning that gives industry clear guidelines can minimize this constraint	Gaps in understanding of sources of marine pollution, including litter

	conservation (14.5)			
1-	Prevent marine pollution (14.1), protection of coastal ecosystems (14.2) and conservation (14.5)	>Constrain agricultural productivity (2.3) increases by enhanced fertilizer use	Depending on natural conditions, run off, etc (regional context) but mitigation opportunities also on application of fertilizer according to modern precision standards	Agreement but relatively weak evidence base in many geographical areas
-1	Regulate harvesting and end overfishing (14.4)	>Constrains the achievement of full and productive employment for all (8.5) in the short term (but enabling it in the long term!)	The significance of this constraint depends on the productive capacities of the ocean, which in turn depends on ecosystem health and effective governance structures	Scientific gaps in carrying capacities of different fish stocks. Even when science is relatively clear, it is not used in determining sustainable catch
-2	Protection of coastal ecosystems (14.2) and conservation (14.5)	>Can be counteracted or constrained by urbanization (Goal 11).	Coastal and waterfront housing are observed in many countries, leading to coastal sprawl, and placing pressures on the coastal systems (e.g. habitat degradation and destruction, pollution) but interaction depends very strongly on geographical context	Strong agreement

From an institutional perspective, oceans being to a large extent an international public good which is partly outside the jurisdiction of national governments, there is an institutional gap in how we address, value and maintain the services and functions that we derive from the oceans. The governance of the ocean has not been high up on political agendas at either national or international levels (Noone et al., 2011), and is difficult to discern to what extent it is oriented to interacting with institutions that cover other areas of the SDGs, although interactions are substantial with, e.g., the climate change convention and the World Trade Organization (Oberthür and Stokke, 2011). To enable and ensure a productive and sustainable economic use of oceans, institutional strengthening is required at different levels.

Due to the international public good character of the ocean SDG, joint actions internationally could have very strong benefits. For example, at the international level, institutions for stronger coordination and data sharing regarding ocean and marine resources, including fish stocks, could be pursued as a reinforced common basis for management strategies for the international waters. The UN technology facilitation mechanism could promote and disseminate innovations for resource efficient and sustainable marine practices, including fisheries and aquaculture.

At the national and regional levels, establishing institutions and processes for implementing ecosystem approaches, for example marine spatial planning, could be an effective action to establish zoning for development and for conservation. At the same time, local institutions need to be leveraged and strengthened for monitoring and implementation, taking into account local practices and traditions. With effective and inclusive institutions, oceans can yield increasing economic benefits, not least for small island developing States (SIDS) through sustainable use of marine resources to reinforce economic growth, trade, and employment.

EXAMPLE: Interactions between marine pollution, fisheries, food, and employment in the Baltic Sea

The Baltic Sea is a semi-enclosed sea surrounded by nine countries in Northern Europe. For centuries it has enabled crucial sea transport for international trade and for tourism and provided livelihoods and food security through fisheries. The

interaction between human activities such as in particular agriculture and waste water discharge has impacted the marine ecosystem health through nutrient pollution and resulting eutrophication. The ecosystem health is today strongly impaired. This has in turn impacted on the fish stock and its carrying capacity. Despite sustained reductions in nutrient pollution since the 1990s, the ocean ecosystem appears to have tipped into a eutrophied, oxygen-deprived state which is difficult or even impossible to reverse (Helcom 2010). As a result, employment and economic activity in the fishing and marine businesses are strongly constrained in coastal areas, as fish stocks are not recovering.

3. Discussion

3.1 State of knowledge and general agreement about interactions

Each goal area of the six in focus poses significant challenges in terms of synthesizing knowledge and assessing knowledge gaps. However, some patterns emerge when drilling in the knowledge base. The poverty and industrialization, innovation and infrastructure goals pose general analytical difficulties because they are highly multidimensional, but at the same time there are very rich established literatures in both academia and in international agencies regarding their interactions – with each other and with environmental aspects for example. However, a general research difficulty emerges regarding poverty. As understood today, poverty as a distinctly multidimensional concept (Alkire and Santos, 2014) is to some degree analytically inseparable from many other goals, such as health or education.

The food goal presents, relatively speaking, a clearer picture of interactions and with a strong experience base to draw from about how they can be governed (although this does not necessarily make it easier to actually govern them). The health goal presents a more mixed picture in terms of the state of knowledge, where the knowledge bases regarding maternal and child health and on infectious diseases is stronger than on non-communicable disease and mental health, at least at the level of international organizations. This field, and how it interacts with urban development, with diets, and with social inclusion, is rapidly evolving. The oceans goal has a strong scientific legacy but there still are significant gaps in terms of basic knowledge of the current state of the oceans, seas and marine resources and how they interact with other sectors. As a complex natural system, mostly hidden from direct view, there are also research challenges that are highly specific (e.g. seabed data). Finally, the gender equality goal's interactions with other areas represent a research area that is relatively more recent than the other six, although there is a long history of promoting gender equality. At the same time, the available knowledge suggests that gender-based action is a highly important, low hanging fruit in order to reinforce a whole range of in particular both social and economic SDGs, whereas negative interactions emanating from gender equality did not appear at all.

When going through targets within the six goals, and identifying potential interactions with targets in other goals, it was actually relatively rare to find negative interactions between the SDG targets. For Goal 5 on gender equality, no such interaction was detectable. In other areas, such as Goal 14 on oceans, negative interactions appear to be significant and addressing them will require adequate institutions and governance measures.

Examining the interactions from the perspective of other goals, which are not in focus at the 2017 HLPF, Goal 8 on growth and employment is intimately linked with industrialization and infrastructure. Interactions emanating from goals 10, 11, 12 and 16 on inequality, cities, sustainable consumption and production, and peace and justice, appear highly complex and likely difficult to untangle. Indeed, it has been difficult to assess interactions between the six goals in focus here and these four. Finally, many of the targets in goal 13 on climate and goal 15 on ecosystems on land, are relatively well-studied in terms of how they are affected by economic and social change, but we need to know more about how their achievement affects other goals.

3.2 Comments on context dependency

More often than not, the interactions observed in this paper are generally applicable. However, their significance depends on the degree to which targets are being met or approached in different contexts and this differs substantially between low-income and higher-income countries. The poverty-reduction agenda interacts substantially with most other goals, but these interactions become less significant when moving up the income ladder, although they do not disappear. Sometimes, the nature of the interaction shifts in interesting ways. For example, Goal 2, which is often summarized as “end hunger” is using such language predominantly a low-income country priority. However, the goal contains many aspects of strong relevance also for high income countries. “All forms of malnutrition” is not only lack of food (under-nutrition) but also bad food (leading to micro-nutrient deficiency) and also the growing obesity “epidemic” across the world. Dealing with obesity links strongly to education in one direction in high income countries (better education enables better nutrition habits), and under-nutrition links strongly to education in both directions in low income countries (where better nutrition enables school performance and, conversely, education enables better nutritional choices in household).

Goal area interactions where place-specific context and resources matter the most are predominantly linked to the natural resource and environment-related goals, such as the oceans and food goals in this sample, but also energy, water and sanitation, climate change and terrestrial ecosystems. Since, of these, only oceans and food are included in this paper, the geographical context has not played in as much as expected. The interaction between climate change and health in the context of urban areas is however highlighted as a geographically dependent interaction.

This paper has only to a limited degree been able to examine governance dependency related to the interactions, due to space constraints and the complexity that this entails. This is however a rich area of research and it can also be viewed as an interaction emanating from efforts at addressing several of the targets in Goal 16, such as 16.6 on effective and transparent institutions, 16.7, inclusive decision-making, and 16.10 on access to information and fundamental freedoms. What is beyond debate is that a multilevel (rather than purely international) institutional response is appropriate to govern interactions. In principle, governance must always be targeted at the appropriate scale of management.

3.3 Addressing interactions in government: institutional challenges for integrated policy making

Most member states govern their public policy sectors such as health, energy, agriculture and education through sectoral ministries and agencies. There are very good reasons for this, such as the need to have specialization of competence and establishing clear accountability relationships. However, the trade-offs are well known – since the lack of joint agendas and coordination often lead to inefficient or even contradictory policy actions. Therefore, many governments and international organizations take an interest in how to work across policy sectors and coordinate them better. In this respect the 2030 Agenda, which puts great emphasis on policy coherence (which even has its own target: 17.14) is a mirror of the aspirations that already exist at the national level.

As integrated decision making and policy coherence have been “holy grails” of public administration in the last two decades, there has also developed a significant experience base around barriers and enablers to governing the interlinkages among policy sectors (e.g., Jordan and Lenschow, 2008). Scholars of international political and policy research have also promoted the idea of governing interlinkages at the “earth system” (global) level (Biermann, et al. 2012). There is not space in the current paper to go in-depth into these literatures on institutional implications at national or international scales, but a few generic lessons can be highlighted.

Working through cross-sectoral governance systems and linked knowledge fields requires advanced capacities within the government machinery. Even if most analytics are not carried out internally within the ministries, resources are required for engaging expert competencies, through institutionalized (routine) engagement with universities, think tanks, and scientific advisory bodies. One institutional implication for integrated approaches

has to do with foresight mechanisms. The aspirations of the 2030 Agenda are far reaching, and many will only be achieved in the long term (possibly beyond 2030). And leveraging policies on positive interactions may have longer pay back times and require longer planning horizons than one-goal approaches. The systematic consideration of global trends and possible futures, including through scenario building and visioning exercises not only enables the long term view but also brings to the fore interactions among policies (GCPSE, 2014). A barrier is that much of today's governmental actions are coloured by short-termism. For example, this has been pointed to as a reason for the infrastructure deficit in both high and low income countries.)

Institutions such as futures commissions and secretariats for strategic foresight can be established. An interesting example comes from Finland, which has established a cross-departmental foresight institution. The Prime Minister's Office and Sitra, the Finnish Innovation Fund, coordinate the national foresight network and support foresight activities, and individual ministries present future reviews within that framework. The process in place for examining the future also allows the government to engage with stakeholders, research and business through a national foresight network, as well as the parliament. The Finnish foresight mechanism, including its flagship Foresight 2030 Report, is a reference point for assessing government performance. It traverses election cycles and includes mechanisms for cross-party collaboration.⁶

Integration in administrative practice requires communication systems and consultations across sectors. This can take different forms, including interdepartmental committees, inter-agency consultation mechanisms, top-down integration mechanisms (such as a sustainable development unit at the center of government) or councils, commissions or secretariats for sustainable development placed at the center of government (OECD, 2013; Jordan and Lenschow, 2008; UN; 2016, chapter 4). Building such institutions to enable integrated approaches to decision making is one thing, but making them effective is another. Integration faces institutional barriers, including both formal and informal incentives in government bureaucracies. Another common barrier is that in many jurisdictions narrowly-framed policy objectives in agencies create a disincentive to coordinate with others. Although the rhetoric often embraces integrated approaches, when it comes to actually evaluating performance, one public sector agency does not often get credit for taking into account or contributing to achievements of another.

4. Concluding remarks

The paper has shed light on how integrated approaches to SDG implementation can deliver much more effectively on the 2030 Agenda. For example, even if health and well-being were the only concern, priorities could be more effectively addressed if food diets and nutrition were included as parameters in the reference policy framework. This inclusion may be reinforced by working through schools or through women's groups. There are many opportunities awaiting governments that are able to create institutional frameworks that promote and enable such integrated approaches.

Pursuing these kinds of assessment to support policy making will be important investments in a crucial knowledge base for policy makers and planners wishing to move forward with effective implementation strategies. It can unveil sector agencies where indirect, so called "knock-on" effects can be expected – and where coalitions of the willing are most likely to emerge. And it can tell where and with whom trade-offs need to be negotiated. However, there will be political, institutional and cognitive limitations to how large complex problems can be addressed in policy making. Integration is not only a technical exercise but also a political one.

⁶ See <http://vnk.fi/en/foresight>.

And the cost of taking an integrated and comprehensive approach - that one risks overburdening and delaying urgent decisions - needs to be weighed against the benefits.

Thus, an integrated view and diagnostic of the interactions of the 2030 Agenda does not automatically mean that holistic, complex institutional arrangements are an effective response. In many cases, existing sectoral institutions offer the required competencies. What matters, first and foremost, is that the interactions with other institutions are taken into account in the problem understanding and design of action. Oftentimes, we are not there today.

The sample of interactions presented here is still relatively limited compared with all possible interactions. More comprehensive mapping depends on longer term, in-depth research work goal by goal, at national or possibly country-group level, also including establishment of trends in data and correlations over time. Work ahead is thus clearly carved out for the international sustainable development community, including the United Nations agencies, the scientific research community, research funding agencies, and national governments. Building up an international knowledge base about interactions in a robust way cannot be done only at the national level. This knowledge base needs to become institutionalized in order to be cumulative and comparable, so as to maximise learning over time and exchange of knowledge across countries.

However, even areas where scientific agreement and knowledge base appear relatively strong are often subject to fierce political disagreement. Even what scientists and analysts overwhelmingly agree are positive interactions between, say, renewable energy deployment (7.2) and climate change mitigation (13.2), are constantly challenged in national political debates. Shifts in political interest are of course entirely normal and also normally mitigated through strong institutions.

One such institution could be an openly accessible knowledge base containing systematic and robust analysis of the SDGs and their interactions, and how they might play out in different contexts. The framework for such an institutional knowledge base needs to be intuitive and accessible for non-experts, responding to policy makers and planners realities so that scientists, policymakers and practitioners can jointly explore how the SDG puzzle fits together and how it can be effectively implemented. At present, a number of semi-qualitative approaches are being piloted (e.g. UN, 2015 and 2016; ICSU, 2017). Quantitative integrated assessment modelling efforts adapted to the SDGs are also being piloted (eg van Vuuren et al 2015). The scoring applied here with the seven-point scale opens up for a third and complementary approach. In order to ensure that this knowledge base becomes cumulative and comparable across knowledge fields and enhance the science-policy interface for the SDGs, it may be worth institutionalizing these efforts further, perhaps under the auspices of the United Nations.

Acknowledgment

The work presented in this paper has drawn upon several months of useful discussions and insights from the on-going ICSU (International Council for Science) project which is working on applying the seven-point scale with expert teams around the world preparing in-depth interaction studies for oceans (GEOMAR and IASS), energy (IIASA), agriculture (IRD), and health (UNU-IIGH) and the coordinator Anne-Sophie Stevance (ICSU). Second, it has benefited profoundly from discussions with colleagues in Stockholm which have all worked hard thinking through SDG interactions in practice: Nina Weitz, Henrik Carlsen and Kristian Skånberg. Finally, I wish to recognize the guidance and input from colleagues at UNDESA: David Le Blanc, Patrick Spearing, and Ran Kim.

Annex 1: Approach taken to analyzing interactions

Several different approaches for analyzing interactions have been tested and published. One approach has been to simply identify them. Le Blanc (2015) used network analysis techniques to establish the existence of linkages. This paper based its findings on the linkages expressed in the wording of the SDGs. In further elaborations, Vladimorova and Le Blanc (2016) explore more linkages based on document review in the UN system, focusing on the case of education. An international policy and academic literature on the water-energy-food nexus has also highlighted the existence of linkages among in particular Goals 2, 6, and 7 (e.g. Hoff, et al, 2012).

For policy and planning support, simply identifying a link is insufficient. In the SDG policy debate, therefore much of the discourse has been around the existence of “trade-offs” and “synergies” (e.g. IRP, 2015; PBL, 2012), representing whether an interaction is broadly beneficial or adverse. Similarly, institutional interaction and policy coherence literatures have often applied such a “binary” view (with variations in terminology) (see e.g. Oberthür and Gehring, 2006).

Other attempts have been made to establish a more nuanced way of viewing interactions, in order to move the discourse beyond simply trade-offs and synergies. Weitz et al (2014) applied three forms of interactions in their analysis of the water-energy-food nexus in the SDGs: interdependence, imposing conditions or constraints, and reinforcing. Similarly, Stakeholder Forum (2016) applied an approach for interlinkages with three categories – supporting, enabling and relying, with subcategories. Also international agencies have published increasingly advanced takes on interactions in official reports (e.g. UNESCO, 2016; UN, 2016). As the conceptual basis for a science-based assessment of interactions, Nilsson et al. (2016) and ICSU (2016) presented a seven point typology of interactions, ranging from cancelling, counteracting, constraining on the negative side to enabling, reinforcing and indivisible on the positive side.

Policy assessments of interactions are thus progressing and becoming more complex. For the SDGs in particular, characterizing interactions among them is rendered more complex by the fact that the majority of interactions need to be assessed at the level of targets - not goals. The goals in themselves are highly multidimensional and contain different factors that will interact differentially with other areas. Due to the wide scope of the 2030 Agenda and its targets, the selection of interactions identified still has a degree of subjectivity. It is simply not possible to provide a robust, comprehensive assessment of all important interactions in one single policy paper. Firstly, there are simply too many of them. Selecting a sample of three salient targets from each of the six goals, and only look at interactions among them, would result in $3^6 = 729$ interactions. There can also be more than one interaction between two targets. Also looking at interactions with all targets within the remaining 11 SDGs, would imply assessing many thousands.

Secondly, every interaction, such as the impact of education on maternal health, is typically the subject of extensive literatures, in both academia and development policy and practice. They often represent an entire research area in and of themselves and characterizing each one fully requires substantial qualitative information, much of which will be context-specific. Furthermore, interactions are also the subject of political debate, often with a difference of views among experts and stakeholders as seen, for example, in the relationship between inequality and productivity growth. Thus, while there are many areas where there may be a common understanding of important interactions that are generically applicable, in order to guide action and responses at the national level with robust, salient and legitimate knowledge, context-specific and systematic interaction assessments are needed at the country level. This requires properly resourced policy-research projects as well as policy dialogues.

Interactions assessment

This paper cannot do justice to such an ambition but should be read more as a “proof of concept” for such assessments. The basis of the assessment is the typology of interactions presented by Nilsson et al. (2016) and ICSU (2016) to characterise interactions among the SDGs. (Figure 1). Interactions can be assessed and scored at the level of the targets themselves (Q: if we make some degree of progress on target A, how does this affect our ability to make progress on target B?). For example, getting more modern energy services to rural villages (7.1) will reinforce the reduction of deaths and illnesses from indoor air pollution (3.9). They can also be assessed at the level of interventions to reach the target (Q: if we implement policy X to make progress on / achieve target A, how does this policy affect our ability to make progress on target B? For example, implementing a tax on energy use to raise public revenues (17.1) will reinforce efforts to increase energy efficiency (7.3). In this paper, the focus is on the targets themselves although in some examples there are discussions about policy.

Important interactions were identified partly through the knowledge base assembled by ICSU, who in 2016 and 2017 are organizing a knowledge-building effort for some SDGs, and partly through literature studies of academic and grey literatures in the six goal areas, including library databases such as Science Direct. Strategic samples were then cross-checked with key official synthesis reports such as GSDR (2016) on infrastructure and UNESCO (2016) on gender equality to identify and fill any critical gaps.

Each SDG assessment table in the paper includes a summary column for comments about key dependencies, specifically:

Place-specific context: interactions may have different character depending on geographical location and what the national context and resource base looks like, not only in terms of natural resources but also levels of infrastructure, institutions, cultures, income levels and education levels. Indeed, the underlying interpretation of the target may also look very different depending on national circumstances (Weitz et al 2015).

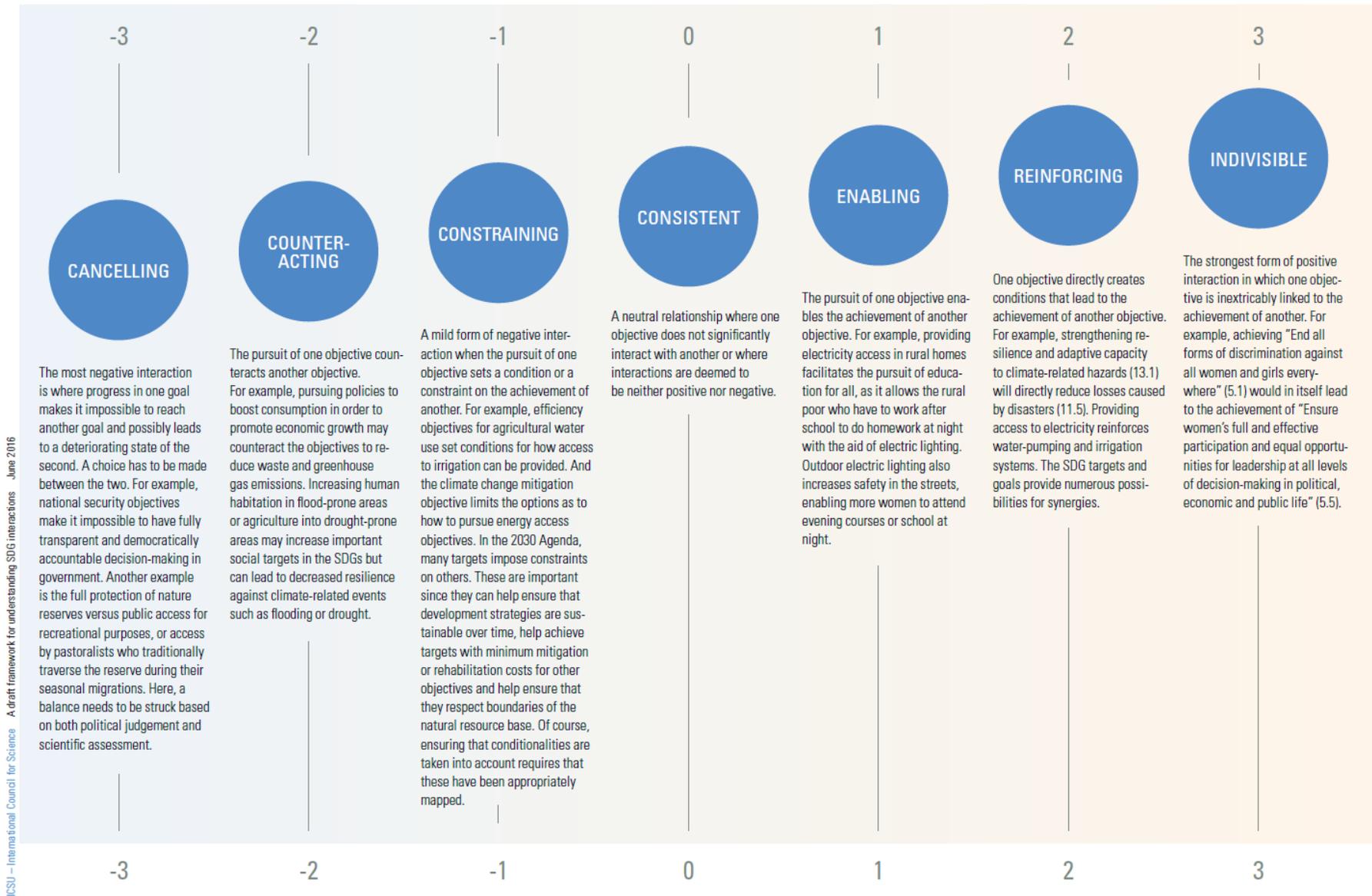
Technology: interactions may have different character depending on what technology is used, to produce food, energy or water for example. In those cases where the interaction is highly dependent on technology (e.g. for areas such as agricultural production, energy supply and transport in cities), there is also frequently an opportunity for action - as we can improve the interaction by deploying better technologies.

Governance: interactions may have different character depending on what policies and institutional measures are applied. For example, much of the sustainability debate regarding renewable energy (7.2) has concerned a negative interaction between biofuels expansion and local livelihoods or food security (Robledo-Abad, et al 2016). It has been observed, however, that this negative relationship can largely be attributed to aspects related to governance as opposed to biofuels production in itself.

Assessing the role of the place-specific resource base, technology and governance is useful not only to understand the underlying dynamics of the interaction, but also points towards potential implications regarding opportunities to change the interaction “up the scale” and even shift it from a negative one to a positive one.

There are various ways of presenting and visualizing results. This paper presents results goal-by-goal and then introduces interactions at target level from the most positive ones, represented by dark green in the table (and a +3 score) to the most negative ones, represented by dark red (and a -3 score). Directionality, i.e. whether the influence is bidirectional, or whether it goes in only one direction, is indicated in the table with a small arrow.

GOAL INTERACTION SCORING



ICSU – International Council for Science A draft framework for understanding SDG interactions June 2016

Figure 1: Goal interaction scoring on a seven-point scale (Source: ICSU, 2016)

Annex 2: Compilation of studies and references on interactions

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