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Interrelating the Sustainable Development Goals

A geographic assessment of correlations, synergies and trade-offs
across the 2030 Agenda

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Abstract

The Sustainable Development Goals were adopted by the UN General Assembly in 2015 along with the claim that these goals are integrated and indivisible. The objective of this master's thesis is to assess correlations, synergies and trade-offs across the 2030 Agenda from a geographic perspective. Based on the SDG Index 2020, the correlation analysis is conducted on the global and national levels as well as by different country groupings based on national income, geographic location and other indices. The analysis shows a significant correlation pattern with three distinct groups on different levels: SDGs 1 to 11 and 16 have a positive correlation with each other, whereas the correlation with SDGs 12 and 13 is negative. No significant correlation patterns can be observed for SDGs 14, 15 and 17. Subsequently, these correlation patterns and notable deviations are further analysed to identify causal relationships across the 2030 Agenda in form of effective synergies or trade-offs. Overall, the correlation analysis demonstrates that synergies are more numerous than trade-offs, although the latter subsist and need to be addressed accordingly. Therefore, while many aspects of the 2030 Agenda are mutually beneficial, the SDGs are neither fully integrated nor indivisible.

Die Ziele für nachhaltige Entwicklung wurden von der UN-Generalversammlung im Jahr 2015 mit dem Anspruch auf Ganzheit und Unteilbarkeit verabschiedet. Ziel dieser Masterarbeit ist es, Korrelationen, Synergien und Zielkonflikte innerhalb der Agenda 2030 aus geographischer Perspektive zu erfassen. Auf der Grundlage des SDG-Index 2020 wird die Korrelationsanalyse auf globaler und nationaler Ebene sowie für verschiedene Ländergruppen nach nationalem Einkommen, geographischer Lage und anderen Indizes durchgeführt. Die Analyse offenbart ein charakteristisches Korrelationsmuster mit drei trennscharfen Gruppen: Die Ziele 1 bis 11 und 16 haben eine positive Korrelation zueinander, wohingegen die Korrelation zu den Zielen 12 und 13 negativ ist. Für die Ziele 14, 15 und 17 können keine aussagekräftigen Korrelationsmuster festgestellt werden. Diese Korrelationsmuster und auffällige Abweichungen werden anschließend näher untersucht, um kausale Zusammenhänge innerhalb der Agenda 2030 in Form von tatsächlichen Synergien und Zielkonflikten zu identifizieren. Insgesamt zeigt die Korrelationsanalyse auf, dass Synergien häufiger auftreten als Zielkonflikte, wobei letztere weiterhin bestehen und dementsprechend thematisiert werden müssen. Auch wenn viele Aspekte der Agenda 2030 sich gegenseitig bedingen, sind erfüllen die Ziele für nachhaltige Entwicklung damit weder den Anspruch auf Ganzheit und Klarheit nicht vollumfänglich.

The Sustainable Development Goals

Goal 1: End poverty in all its forms everywhere

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

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

Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

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

Goal 6: Ensure availability and sustainable management of water and sanitation for all

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

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

Goal 10: Reduce inequality within and among countries

Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12: Ensure sustainable consumption and production patterns

Goal 13: Take urgent action to combat climate change and its impacts

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

Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Goal 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

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List of Abbreviations

EU	European Union
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GNI	Gross National Income
HDI	Human Development Index
HDR	Human Development Report
HIC(s)	High-income countries
HLPF	High-level Political Forum on Sustainable Development
ILO	International Labour Organization
IMF	International Monetary Fund
LAC	Latin America and the Caribbean
LIC(s)	Low-income countries
LMIC(s)	Lower-middle-income countries
MDG(s)	Millennium Development Goal(s)
MENA	Middle East and North Africa
MIC(s)	Middle-income countries
MOI	Means of implementation
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
SDG(s)	Sustainable Development Goal(s)
SDR	Sustainable Development Report
SDSN	Sustainable Development Solutions Network
SWB	Subjective Well-being
UMIC(s)	Upper-middle-income countries
UN	United Nations
UNCSD	United Nations Conference on Sustainable Development
UNDESA	United Nations Department of Economic and Social Affairs
UNDG	United Nations Development Group
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Science and Cultural Organisation
UNODC	United Nations Office on Drugs and Crime
WHO	World Health Organization
WHR	World Happiness Report

1. Introduction

The 2030 Agenda for Sustainable Development was adopted by the United Nations General Assembly on 25 September 2015 as the United Nations official global development agenda. It is composed of seventeen goals, referred to as the Sustainable Development Goals (SDGs), and succeeded the Millennium Development Goals (MDGs), which had been adopted 15 years earlier. In contrast to its predecessor, the scope of the new agenda was broadened and included new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice (UNDP 2017), and also became applicable to all UN member states.

The UN General Assembly resolution which adopted the 2030 Agenda underlines that “the 17 Sustainable Development Goals and 169 targets (...) are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and cultural” (UN General Assembly 2015). It has therefore been a common claim that the SDGs are indivisible and mutually reinforcing, even though empirical data and analyses only confirm these claims to a certain extent. Previous studies have shown that some goals are mutually reinforcing, while other goals are mutually exclusive and contradict each other. Understanding interrelations among the 2030 Agenda is therefore essential groundwork on the way to its implementation.

While most of these previous studies on interrelations across the 2030 Agenda have analysed correlations between the goals on a global level, empirical data suggests that such correlations differ notably between different countries and regions of the world. Interlinkages between the SDGs are based on factors that are very diverse on a global scale and may include aspects such as climate, culture, demographics, economy, human development, policies, and others. It is thus beneficial to take a closer look at such differences and examine the underlying causes and factors that are beneficial or obstructive for synergies across the 2030 Agenda.

The general idea and epistemological interest of this thesis is hence to complement previous research and literature on correlation patterns and to analyse correlations across the 2030 Agenda from a geographic perspective and to determine whether the SDGs are actually integrated and indivisible. The overall research goals are to examine correlations across the 2030 Agenda for Sustainable Development, to scrutinise varying correlations based on income and regional groupings, to analyse potential causes for such variations and to determine which factors result in synergies or trade-offs in achieving the agenda. This objective shall be reached by the analysis of previous research regarding correlations across the seventeen goals and the empirical analysis of national data regarding their associated targets and indicators.

At the outset, this MA thesis will illustrate an introduction to the 2030 Agenda for Sustainable Development and its major characteristics that are relevant for the analytical part, including cross-references among the seventeen goals and their implementation in different parts of the world. The following chapter will summarize previous research and literature on correlations within the 2030 Agenda on the global level, by country grouping and on the national level. The observations from previous literature will be used afterwards for the contextualisation and validation of the empirical analysis and consideration of causal explanations.

The analytical part will illustrate key results of a correlation analysis across the seventeen goals on both the regional and national level from a comparative viewpoint. The general idea is to identify distinct geographical differences in the relations between two or more goals. To determine such correlations, a regression analysis will be conducted based on empirical data on the national performance regarding the 2030 Agenda's associated targets and indicators. The data used in this thesis derives from the Sustainable Development Report 2020, published by the Bertelsmann Stiftung and the Sustainable Development Solutions Network (Sachs et al. 2020), and will be statistically analysed using the programming language "R".

The analytical results shall then further be examined to validate the conclusion from existing research on correlations within the 2030 Agenda that is discussed in chapter 3. While previous studies found notable differences among the seventeen goals regarding their compatibility on the global level, this chapter will demonstrate whether this is also the case on a national or regional level of analysis. In this regard, it shall be underlined that all these observations are merely correlations and do not yet imply any causal relations or effects.

This aspect shall be addressed in subsequent chapter 6, in which the observed correlation patterns and notable deviations will be further examined. The general objective in this regard is a comparative analysis of different countries and country groupings to identify differing parameters and their impact on SDG performance and correlations across the 2030 Agenda. This objective will be achieved by contextualising the empirical data with previous literature and indicator analysis. While these methods are not exhaustive for a comprehensive analysis of SDG correlations across all country groupings and individual countries worldwide, they are going to provide an overview of contributing factors to varying synergies and trade-offs.

In the end, the final chapter shall evaluate the consequences of such discrepancies on the 2030 Agenda as a whole. This includes beneficial or obstructive factors for synergies, the relevance of national and regional characteristics on the interrelations between the goals and whether the 2030 Agenda's universal aspiration can be justified in accordance with these observations.

2. The 2030 Agenda for Sustainable Development

2.1. Overview and development process

The 2030 Agenda for Sustainable Development, also referred to as the 2030 Agenda or the Sustainable Development Goals (SDGs), is a collection of seventeen goals designed as a “blue-print to achieve a better and more sustainable future for all” (UN General Assembly 2017). The agenda was officially adopted by the UN General Assembly in September 2015 to succeed the Millennium Development Goals (MDGs) as the UN’s global development agenda. According to the General Assembly, these goals are considered as “integrated and indivisible and balance the three dimensions of sustainable development – economic, social and environmental” (ibid.). While their predecessors were applicable to developing countries only, the SDGs follow a universal approach, which gave them another unofficial name: Global Goals.



Figure 2.1 – The Sustainable Development Goals – UNRIC Brussels 2021

The 2030 Agenda was first envisioned at the UN Conference on Sustainable Development (UNCSD), which took place in June 2012 in Rio de Janeiro. Its outcome document entitled “The Future We Want” underscores the usefulness of the MDGs as “a useful tool in focusing achievement of specific development gains as part of a broad development vision and framework for development activities of the United Nations, for national priority-setting and for mobilization of stakeholders and resources towards common goals” (UN General Assembly 2012: 63). It also recognizes “that the development of goals could also be useful for pursuing focused and coherent action on sustainable development”, further recognizing “the importance and utility of a set of sustainable development goals” (ibid.).

Subsequently, these “Sustainable Development Goals” were scrutinized by the new “UN Task Team on the Post-2015 UN Development Agenda”, which was established by UN Secretary-General Ban Ki-moon and involved 60 UN agencies as well as the World Bank and the IMF (UN 2012). The task team’s work was supplemented by a high-level panel of eminent persons advising the Secretary-General on the Post-2015 development agenda, as well as consultation processes with civil society and the private sector on the national, regional and global levels. The intergovernmental “Open Working Group”, which had been established at the UNCSD, collected this input for a draft proposal of the SDGs. This draft proposal, comprising seventeen goals and 169 targets, was presented in the group’s outcome document on 19 July 2014 and adopted by the UN General Assembly on 25 September 2015 (UN General Assembly 2015).

While the MDGs were designed in 2000 as a set of eight specific goals to be reached by 2015, the 2030 Agenda was intended as a universal development agenda with a global approach. In comparison with its predecessor, the new agenda includes new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice (UNDP 2017). As a result, the 2030 Agenda has a more significant meaning for the activities of the UN and other organizations around the world. In a 2015 article on the new 2030 Agenda, the British newspaper “The Guardian” pointed out seven aspects of added value: Global collaboration, role of the private sector, roots in human rights standards, inclusiveness, opportunities for civil society engagement, inspiration to the world and synergies with the Paris Agreement (The Guardian 2015). As a result, the SDGs can be described as “the most comprehensive international development agenda that has ever been conceptualised” (Hartwich 2019: 11).

Self-evidently, a global development agenda with such a universal approach is not untainted by criticism. Although the overall perception of the SDGs by academia, civil society and the media has been rather positive, certain aspects have been subject of controversial debate. An important aspect is “the large number of goals and targets, which are viewed as too complex to communicate to the public or drive policy, and too ambitious, universal and absolute to be successful” (Liverman 2018: 178). In this context, the goals’ indivisibility has been called into question, as “disparaging analysis suggests that there exists a potential inconsistency in the SDGs, particularly between the socio-economic development and the environmental sustainability goals” (Swain 2017: 3). In addition, “critiques also raise questions on if and whether the SDGs can be measured and monitored (...) with each country being expected to create their own national or regional plans” (ibid.). In view of this MA thesis, the inconsistent data quality and availability certainly poses a challenge to empirical research and the subsequent analysis, which shall nonetheless address the question of the goals’ compatibility on a regional level.

2.2. Composition and structure

2.2.1. Goals

As mentioned above, the 2030 Agenda for Sustainable Development is composed of seventeen goals that are considered “integrated and indivisible and balance the three dimensions of sustainable development – economic, social and environmental” (UN General Assembly 2017). These dimensions resemble the three pillars of sustainability and sustainable development, as defined by the World Commission on Environment and Development (WCED) in 1987.

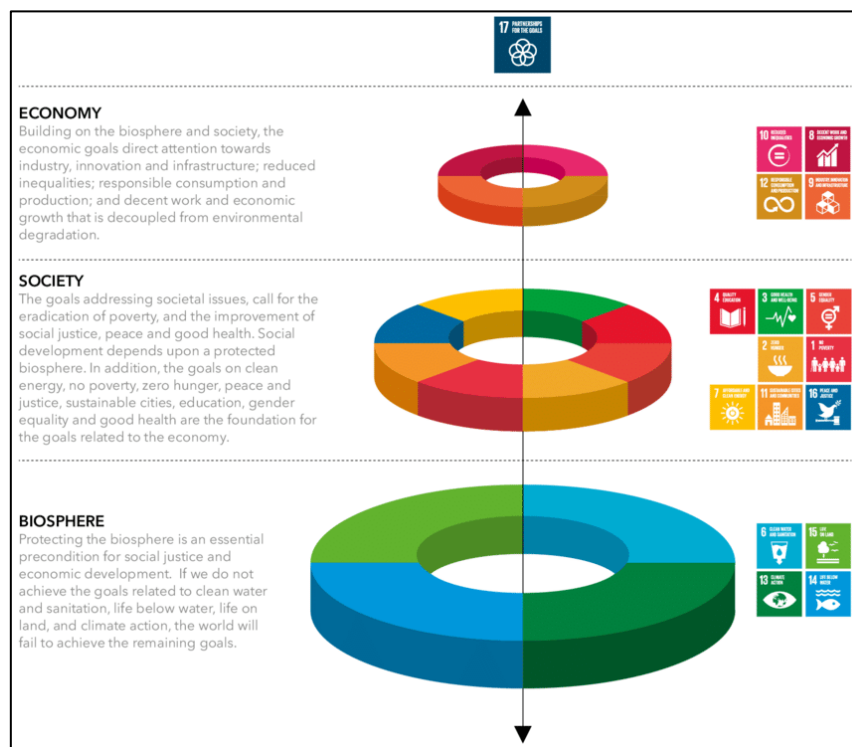


Figure 2.2 – The interconnected nature of the SDGs – Pretlove/Blasiak 2018: 8

Based on this perception, the SDGs themselves can be grouped into these three dimensions that build on each other. The model above considers the environmental dimension (labelled as biosphere) as the foundation, which is explained as follows: “The significance of the life-support systems and the biosphere as the foundation for the economy, society and the human dimension as a whole has been the basis of advancement of the planetary boundaries framework and in defining a safe operating space for humanity on Earth” (Folke et al. 2016: 44). The biosphere or environmental dimension is composed of four SDGs: goals 6, 13, 14 and 15. Building on this foundation, almost half of the SDGs (namely goals 1 to 5, 7, 11 and 16) fall into the social dimension and in turn are the foundation for the goals related to the economy. This dimension builds upon the biosphere and society and includes goals 4, 9, 10 and 12. Goal 17 is considered outside the three dimensions, as it promotes collaboration across the agenda.

2.2.2. Targets

Similarly to the MDGs, each SDG is associated with a group of typically eight to twelve targets, of which there are 169 in total. These targets can be categorized into two groups: “Outcome” targets describe the circumstances to be attained and are marked with numbers, while “means of implementation” (MOI) targets “were introduced late in the process of negotiation of the SDGs and provided a way to accommodate some of the concerns of Member States regarding how the SDGs were to be achieved” (Bartram et al. 2018: 1). These targets are often aimed at financial or political framework conditions and are marked with letters.

While the seventeen goals depict an overall vision of sustainable development, the targets formulated specific objectives that are aimed to be reached by 2030. As they were an integral part of the Open Working Group proposal, their purpose is described in clause 55 of the 2015 General Assembly resolution, in which the 2030 Agenda was officially adopted:

“The Sustainable Development Goals and targets are integrated and indivisible, global in nature and universally applicable, taking into account different national realities, capacities and levels of development and respecting national policies and priorities. Targets are defined as aspirational and global, with each Government setting its own national targets guided by the global level of ambition but taking into account national circumstances. Each Government will also decide how these aspirational and global targets should be incorporated into national planning processes, policies and strategies. It is important to recognize the link between sustainable development and other relevant ongoing processes in the economic, social and environmental fields.”

(UN General Assembly 2015: 13)

2.2.3. Indicators

Unlike the goals and targets, indicators are not an integral part of the 2030 Agenda. The indicator framework was developed by the Inter-Agency and Expert Group on SDG Indicators and agreed upon by the UN Statistical Commission in 2017. The framework is reviewed annually by the UN Statistical Commission which has replaced, revised and deleted several indicators. Since the last review in March 2020, the framework includes 231 unique indicators.

The Inter-Agency and Expert Group on SDG Indicators differentiates three tiers of indicators “based on their level of methodological development and the availability of data at the global level” (UN Statistics Division 2021). As of the last session of the UN Statistical Commission, the global framework indicators no longer include tier 3 indicators. This indicates that there are now an internationally established methodology and standards for all indicators across the 2030 Agenda. The key difference between tiers 1 and 2 is data availability, as data must be available for at least 50% of countries and the population in every relevant region for an indicator to be considered tier 1. The current tier classification contains 130 tier 1 indicators, 97 tier 2 indicators and 4 indicators that have multiple tiers (ibid.).

2.3. Monitoring and evaluation

2.3.1. Monitoring process

The lead management for monitoring the 2030 Agenda lies with the UN Statistics Division, which collects data and metadata on the indicators from the member states and publishes it online on the Global SDG Indicator Database. The data is used for annual progress reports, which are presented at the High-level Political Forum on Sustainable Development (HLPF).

The data collection itself is up to the individual member states and their national statistical systems. Consequently, “it is up to the countries themselves to decide on the level of detail of data and metadata they wish to share with the custodian agencies” (UN Water), which are the UN bodies responsible for compiling and verifying country data and metadata before submitting them to the UN Statistics Division. To ensure data coherence, several initiatives have provided guidance to national statistical offices on statistical methods for SDG monitoring.

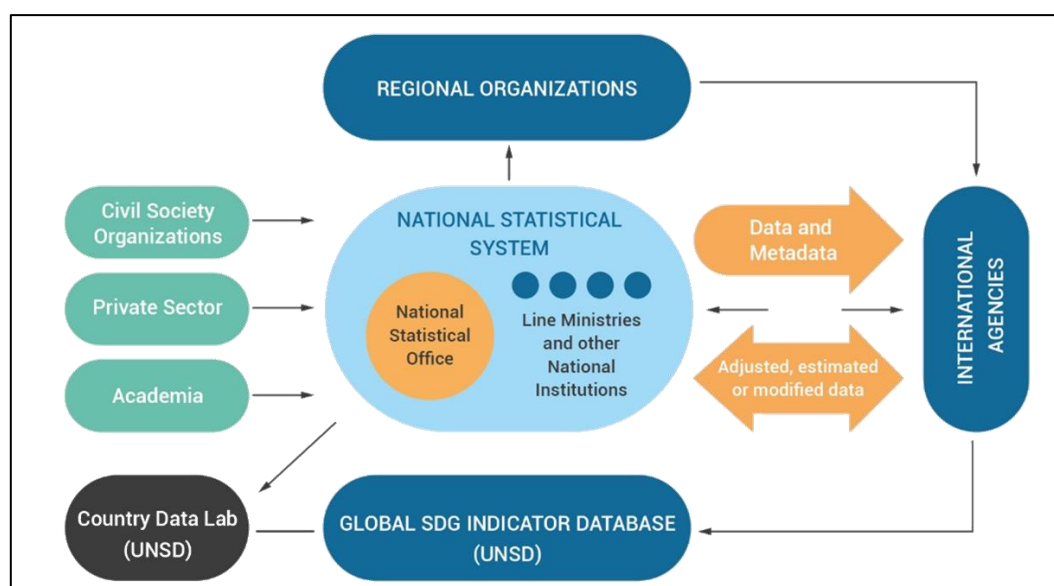


Figure 2.3 – Data flow in SDG monitoring and reporting – UN Water 2017

2.3.2. Voluntary National Reviews

As part of the 2030 Agenda’s follow-up and review mechanisms, the UN General Assembly encouraged member states “to conduct regular and inclusive reviews of progress at the national and subnational levels which are country-led and country-driven.” (UN General Assembly 2015: 33). In addition to regular SDG monitoring based on indicators, these Voluntary National Reviews showcase policy approaches for SDG implementation and are intended to share best practices (Fukuda-Parr 2018: 14). These reviews present an opportunity for member states to contextualise their current performance and to reconsider their national strategies.

2.3.3. SDG Index & Dashboards

The SDG Index & Dashboards were developed in 2015 by the Bertelsmann Stiftung and the Sustainable Development Solutions Network (SDSN) and were presented at the High-level Political Forum on Sustainable Development to UN Secretary-General Ban Ki-moon. The tool attempts to quantify SDG achievement based on their associated targets and indicators and is updated annually, as described in the most recent Sustainable Development Report:

“As in previous years, the Sustainable Development Report 2020 (SDR2020) presents and aggregates data on country performance towards the SDGs. It is not an official SDG monitoring tool, but instead complements efforts of national statistical offices and international organizations to collect data on and standardize SDG indicators. To this end, the SDR2020 presents the most up-to-date data from official sources (the United Nations, the World Bank, and others) as well as from non-official sources (research institutions and non-governmental organizations”).

(Sachs et al. 2020: 23)

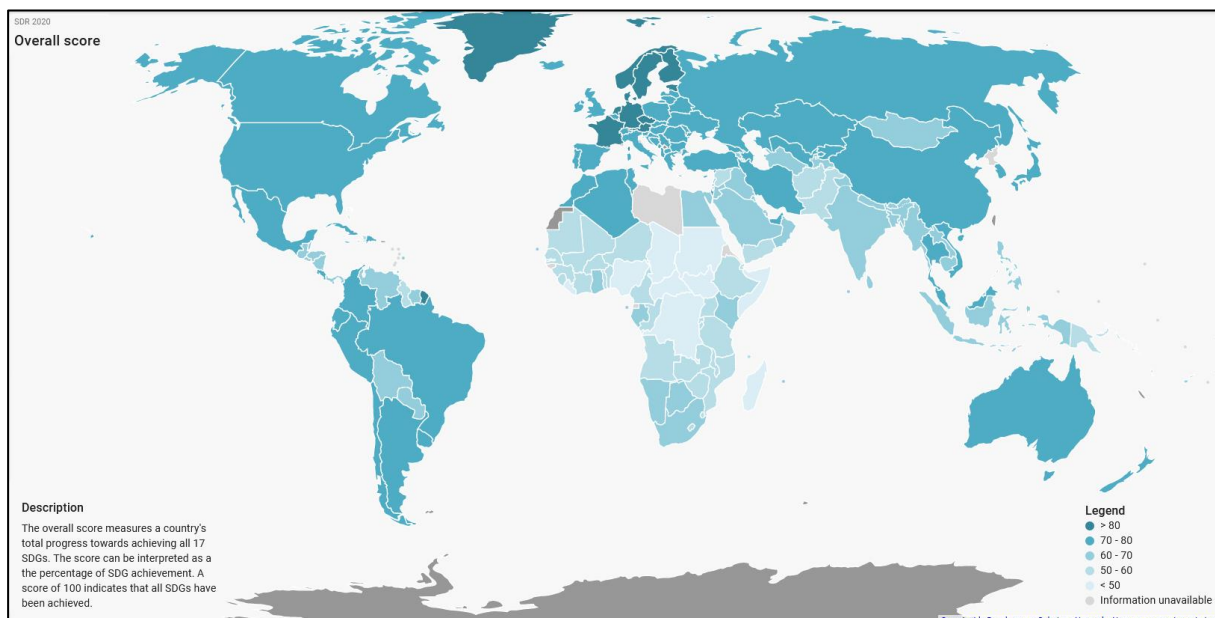


Figure 2.4 – SDG Index & Dashboards 2020 (Overall score) – SDSN/Bertelsmann Stiftung 2020

The most recent report includes data for 166 countries (ibid.) on “85 global indicators plus an additional 30 indicators for the OECD countries” (ibid.: 25) of a total 231 indicators associated with the SDGs. The national scores for each indicator have been normalized, assigning each a value between 0 and 100, and averaged to determine individual scores for each goal. The overall score, as visualised above, is calculated with equal weight given to all 17 goals. In the 2020 report, overall scores range from 84.7 (Sweden) to 38.5 (Central African Republic).

While the SDG Index & Dashboards are not an official monitoring tool of the 2030 Agenda, they are a comprehensive analysis of country performances towards the SDGs. Despite their weaknesses due to persistent data gaps and data time lags, they provide many opportunities for further in-depth analysis of SDG achievement and will be used as such in this MA thesis.

3. Literature review on SDG correlations, synergies and trade-offs

3.1. Overview

Correlations, synergies and trade-offs across the 2030 Agenda have become an increasingly popular field of research since the agenda's implementation in 2015. While the corresponding UN General Assembly resolution postulates an indivisible nature of the 2030 Agenda, many researchers disagree on this aspect: "The SDGs were conceived as an 'indivisible whole', but interactions between SDGs need to be better understood" (Scharlemann et al. 2020: 1573). In this context, several studies have analysed correlations across the agenda to identify potential synergies and trade-offs, which can be used to facilitate the agenda's realization.

In general, there is an empirical and an analytical approach to identify correlations across the 2030 Agenda. The empirical approach involves statistical methods and empirical data that is used to identify correlations of goals, targets and indicators. While this approach seems more objective and based on empirical evidence, it cannot identify causal relationships that would translate into synergies or trade-offs. This objective can be reached through a more analytical approach, which includes scientific literature, policy analyses and further observations to identify actual causal relationships between different goals, targets and indicators. A holistic approach to SDG interactions should therefore encompass a combination of both approaches.

According to a systematic review study by Bennich et al. (2020), "a relatively large number of studies focus primarily on the goals, targets, or indicators of the 2030 Agenda itself" (Bennich et al. 2020: 6). The review identifies seven types of interaction entities that typically occur in SDG interaction studies: (1) goal-goal interactions, (2) target-target interactions, (3) indicator-indicator interactions, (4) policy-policy interactions, (5) interactions across goals, targets, indicators and/or policy, (6) inclusion of external entities and (7) geographic location (ibid.).

A significant aspect of this observation is the global focus of a majority of such studies, while regional and national analyses of SDG interactions are much less common. Only about five percent of studies fall into the last category: "A small set of papers focuses on the geographic location of the interaction entities. These studies are concerned with how interactions connect countries or regions of different income levels, either adjacent or distant" (ibid.). While many studies differentiate between or focus on a selection of goals, targets and indicators, the geographic aspect of SDG correlations seems to have been neglected in previous research, although it matters significantly in assessments of SDG achievement (Moyer/Bohl 2019: 199).

3.2. Correlations, synergies and trade-offs on the global level

As mentioned above, most studies in the field of SDG correlations, synergies and trade-offs are limited to the global level or rather do not differentiate by regional or other geographical subdivisions. As a result, there is a wide range of recent literature in this field with different focuses regarding the selection and interrelations of goals, targets and indicators. Most studies either follow a quantitative or a qualitative approach, which means they either include all seventeen goals, limiting their analysis to the overall goals themselves, or they are limited to a small number of goals, focusing on interrelations of their associated targets and sometimes even indicators. The subsequent review is going to illustrate a representative sample of the research in this field that is most important and has the widest implications for this MA thesis. Overall, a review of previous literature and research “suggests that the understanding of the relationships between the SDGs remains limited. Correlations between SDGs mainly point towards synergies, but also indicate trade-offs” (Fonseca et al. 2020: 3)-

To that end, the most comprehensive study on the global level was conducted by Fonseca et al. in 2020. This study entitled “Mapping the Sustainable Development Goals Relationships” is based on the raw data from the 2019 Sustainable Development Report and features a rank correlation analysis of the SDG Index scores for the seventeen goals by applying Spearman’s rank correlation coefficient, also known as “Spearman’s ρ ” (ibid.: 5–7). Based on a Kolmogorov-Smirnov Test, the authors illustrate that most SDGs do not follow a normal distribution, which is why an analysis based on the Pearson correlation coefficient is not expedient in this case. The rank correlation measures the intensity of the interrelations between two goals and varies from $r_s=-1$ (strong negative correlation) to $r_s=1$ (strong positive correlation). A color-coded correlation matrix of their analytical results on the global level can be seen below.

Global	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Goal 1	1.000	0.609	0.734	0.670	0.338	0.357	0.661	0.578	0.686	0.424	0.466	-0.570	-0.177	-0.007	-0.164	0.599	-0.103
Goal 2	0.609	1.000	0.821	0.776	0.595	0.595	0.745	0.741	0.796	0.391	0.623	-0.675	-0.095	0.170	0.042	0.590	-0.028
Goal 3	0.734	0.821	1.000	0.857	0.612	0.501	0.840	0.784	0.892	0.372	0.711	-0.789	-0.179	0.180	-0.053	0.736	-0.032
Goal 4	0.670	0.776	0.857	1.000	0.655	0.542	0.773	0.731	0.811	0.341	0.712	-0.705	-0.164	0.215	0.030	0.646	-0.018
Goal 5	0.338	0.595	0.612	0.655	1.000	0.612	0.503	0.626	0.577	0.131	0.714	-0.485	-0.083	0.223	0.061	0.313	0.116
Goal 6	0.357	0.595	0.501	0.542	0.612	1.000	0.480	0.494	0.417	0.053	0.629	-0.416	0.033	0.120	0.031	0.140	0.149
Goal 7	0.661	0.745	0.840	0.773	0.503	0.480	1.000	0.611	0.785	0.291	0.655	-0.673	-0.034	0.175	-0.061	0.572	0.050
Goal 8	0.578	0.741	0.784	0.731	0.626	0.494	0.611	1.000	0.752	0.290	0.620	-0.653	-0.164	0.193	-0.033	0.610	-0.159
Goal 9	0.686	0.796	0.892	0.811	0.577	0.417	0.785	0.752	1.000	0.332	0.665	-0.775	-0.208	0.240	0.002	0.741	-0.090
Goal 10	0.424	0.391	0.372	0.341	0.131	0.053	0.291	0.290	0.332	1.000	0.125	-0.243	-0.070	-0.011	0.105	0.452	-0.065
Goal 11	0.466	0.623	0.711	0.712	0.714	0.629	0.655	0.620	0.665	0.250	1.000	-0.608	-0.079	0.263	-0.026	0.450	0.097
Goal 12	-0.570	-0.675	-0.789	-0.705	-0.485	-0.416	-0.673	-0.653	-0.775	-0.243	-0.608	1.000	0.324	-0.196	0.069	-0.570	0.029
Goal 13	-0.177	-0.095	-0.179	-0.164	-0.083	0.033	-0.034	-0.164	-0.208	-0.070	-0.079	0.324	1.000	-0.012	0.179	-0.240	-0.018
Goal 14	-0.007	0.170	0.180	0.215	0.223	0.120	0.175	0.193	0.240	-0.011	0.263	-0.196	-0.012	1.000	0.152	0.110	0.059
Goal 15	-0.164	0.042	-0.053	0.030	0.061	0.031	-0.061	-0.033	0.002	0.105	-0.026	0.069	0.179	0.152	1.000	-0.014	-0.047
Goal 16	0.599	0.590	0.736	0.646	0.313	0.140	0.572	0.610	0.741	0.452	0.450	-0.570	-0.240	0.110	-0.014	1.000	-0.101
Goal 17	-0.103	-0.028	-0.032	-0.018	0.116	0.149	0.050	-0.159	-0.090	-0.065	0.097	0.029	-0.018	0.059	-0.047	-0.101	1.000

Figure 3.1 – SDG correlation analysis (as of 2020) – Fonseca et al. 2020: 8 (modified illustration)

The chart above illustrates the correlations between all seventeen goals at one glance. It is the most similar approach to the methodology used in this MA thesis and thus very useful for a direct comparison. The key findings from this analysis are summarized as follows:

“The results of the correlation confirm that Poverty elimination (SDG1) and Good health and well-being (SDG3) have synergetic relationships with most of the other goals. SDG7 (Affordable and clean energy) has significant relationships with other SDGs (e.g., SDG1 (No poverty), SDG2 (Zero hunger), SDG3 (Good health and well-being), SDG8 (Decent work and economic growth), SDG13 (Climate action)). However, there is a moderate negative correlation with SDG12 (Responsible consumption and production), which emphasizes the need to improve energy efficiency, increase the share of clean and renewable energies and improve sustainable consumption patterns worldwide. There is also confirmation that SDG12 (Responsible consumption and production) is the goal strongly associated with trade-offs. To sum up, this research suggests that change towards achieving the Sustainable Development Goals offers many opportunities for reinforcing rather than inhibiting itself. However, some SDGs show no significant correlation with other SDGs (e.g., SDG13 (Climate action) and SDG17 (Partnerships for the goals)).” (Fonseca et al. 2020: 1)

Another correlation analysis, which applied Spearman’s ρ to the data from the SDG Index and Dashboards, was conducted in 2018 by Kroll et al. The authors added a temporal dimension by including globally available data at country level on 111 SDG indicators from 2010 to 2018. At first, they analysed interactions within SDGs and found that “the majority of goals show synergies between their component sub-indicators that are relatively stable over time (...) with an increased share of synergies and decreased share of trade-offs” (Kroll et al. 2019: 3). Regarding interactions between SDGs, they found a decrease in share of synergies and an increase in the share of trade-offs between 2010 and 2018 (ibid.: 4). Based on their data and findings, the authors project that SDGs 1, 3, 7, 8 and 9 will have significant synergies with the other goals, while trade-offs remain particularly for SDGs 11, 14, 16 and 17 (ibid.: 6–7).

A similar study was conducted by Pradhan et al. in 2017, who analysed country-disaggregated data from the UN Statistics Division for 56 indicators. Like the 2020 study by Fonseca et al., they conducted a rank correlation analysis by applying Spearman’s ρ to examine synergies and trade-offs across the 2030 Agenda. They found that SDG 1 has synergetic relations with most of the other goals, while SDG 12 is the goal with the most trade-offs (Pradhan et al. 2017: 1169). In a list featuring the top 10 pairs for both synergies and trade-offs, SDG 1 is included five times on the synergy side, followed by SDG 3, which is represented four times. On the other hand, SDG 12 is included seven times on the trade-off side, followed by SDG 15 with three times (ibid.: 1174). However, the authors identified examples of synergies between SDGs 3 and 12, which in their view “highlights that particular lock-in effects between goals can, and have been, broken by past and current policies. The evidence calls for a deeper investigation of the development paradigm in targeted countries” (ibid.: 1175–1177). They also made key observations for individual countries that will be addressed in the following subchapters.

In addition to these comprehensive studies of SDG interactions, numerous studies focus on interactions between several goals and their associated targets and indicators. As the goals can be grouped into different categories, some authors have scrutinized interrelations among SDGs that have a specific focus. For example, a study by Liu et al. claims that “SDG goals are interconnected and linked with the sectors of a particular nexus. For example, the food–energy–water nexus is directly linked with SDGs 2 (zero hunger), 6 (clean water and sanitation) and 7 (affordable and clean energy). This nexus also directly or indirectly affects all other SDGs” (Liu et al. 2018: 471). Like other studies of this kind, the authors not only conduct a correlation analysis but also elaborate on potential causal relations between these goals.

More studies in this context found significant synergies among goals that are interlinked in terms of their specific focus. Griggs et al. (2017) analysed relations between SDGs 2, 3 7 and 14, which they concluded “are mostly synergistic with the other SDGs. (...) The assessment identified 316 target-level interactions overall, of which 238 are positive, 66 are negative, and 12 are neutral” (Griggs et al. 2017: 8). In a study by Fader et al. (2018), a similar conclusion was reached for the interrelations between SDGs 2, 6 and 7. The paper “confirms the general belief that SDG 6 (water) has the highest number of potential synergies. (...) The SDG with the highest negative interaction count is SDG 2 (End hunger, achieve food security, and improved nutrition and promote sustainable agriculture) with 26 negative interactions” (Fader et al. 2018: 4). A third study by Nerini et al. (2017) identified “evidence of relationships between 143 targets (143 synergies, 65 trade-offs) and efforts to achieve SDG7” (Nerini et al. 2017: 10). It appears that synergies among the infrastructure-based goals are quite significant.

In addition to the correlation analyses across the 2030 Agenda, a few studies have examined interrelations with other aspects that might be related. For example, a correlation analysis of the SDG Index and the subjective well-being score in the World Happiness report found a strong correlation between SDG performance and well-being in most cases, but a negative correlation of well-being with SDGs 12 and 13 (de Neve et al. 2020: 1). In another evaluation of nine indicators across SDGs 1 to 7, Moyer and Bohl emphasize the role of spillovers through government intervention and financial investment to achieve the 2030 Agenda:

“Education completion (both primary and secondary) along with access to water, sanitation, and electricity are the most *trade-off vulnerable*. These indicators require government investment and targeted investments to improve achievement in other variables draws down resources without increasing economic growth enough to off-set these reductions. The SDG targets that are most *synergy receptive* are poverty, hunger, child undernutrition, and child mortality. Each of these SDG targets represent a lack of access to basic human inputs for the most vulnerable populations. In contrast to indicators that are more driven by government intervention, these indicators may be more responsive to spill-overs from other sectors through marginal improvement driven by investment elsewhere.”
(Moyer/Bohl 2019: 208)

3.3. Correlations, synergies and trade-offs by country grouping

3.3.1. Correlations, synergies and trade-offs by income grouping

In addition to SDG Index and Dashboards developments on the global and national levels, the Sustainable Development Report elaborates on developments for the four different income groups as defined by the World Bank. In general, “progress since 2015 has been faster in low- and middle-income countries compared with high-income countries” (Sachs et al. 2020: 25). A significant aspect is mentioned regarding international spillovers, as high-income countries generate the largest negative spillovers and thus undermine other countries’ efforts to achieve the SDGs. This is relevant for three areas with a high international interdependencies, namely the environment, development finance and security issues (ibid.: 33–34).

As the SDG Index and Dashboards specifically indicates scores for the four income groups across the 2030 Agenda, it provides a solid basis for a correlation analysis that differentiates between these groups. The most important previous study to that end is the aforementioned study by Kroll et al. (2018), which distinguishes high-income countries (HICs), middle-income countries (MICs) and low-income countries (LICs). Based on the subindicators within each SDGs, “it becomes evident that the overall picture is very similar across all income groups: Countries will face similar challenges with regard to intra-goal consistency regardless of their current stage of development” (Kroll et al. 2019: 7). The authors nevertheless mention some notable exceptions, such as increased synergies for MICs and especially LICs regarding SDG 6 compared to HICs, as well as weaker synergies for MICs and especially LICs regarding SDG 15 compared to HICs. In their projection for SDG trends until 2030, it becomes evident “that for certain goals the share of projected tradeoffs is lower compared to MICs and especially LICs. This is especially true for SDG 6 (...) and SDG 13” (ibid.).

A more recent study by Warchold et al. found that HICs have the lowest shares of synergies and trade-offs, while LICs have the highest shares of synergies and trade-offs, with UMICs and LMICs ranking in between. Consequently, “a high share of synergies reflects a good start to implement the 2030 Agenda in LIC” (Warchold et al. 2020: 7). Differences in correlation patterns were observed for SDGs 1, 4 and 9 with mostly weaker synergies for HIC.

While the amount of previous research regarding income groups is less extensive, it seems apparent that a distinction between these groups is beneficial to understanding SDG interactions: “The analysis according to income groups provides promising avenues for future research, and should in fact be complemented in the future by analyses that distinguish not just by income group but also by region or political system, for instance” (Kroll et al.: 10).

3.3.2. Correlations, synergies and trade-offs by regional grouping

Among the different country groupings examined in this MA thesis, income groupings are clearly the group that has received the most attention in scientific research. As mentioned above, several studies have emphasized the need for further analyses on the regional level, but not many studies have emerged in this field yet. There are however several studies on SDG interactions within individual countries that will be addressed in a separate subchapter.

The most significant study on regional correlations is the aforementioned study by Warchold et al. (2020). The authors of this study used the Global SDG Indicators Database, which was introduced by the UN Statistics Division in 2019 and provides data on 171 indicators for a total of 247 countries and areas worldwide between 1990 and 2019. The study applied several correlation methods “for a holistic quantification of SDG interactions” (Warchold et al. 2020: 2–3) with a population, regional and income disaggregation. In contrast to the regional groups in the Sustainable Development Report, they divided the world into four geographic regions: Latin America, Asia-Pacific, Africa and the Western World. Overall, they found that Latin America has the highest share of synergies, while Africa has the lowest share of both synergies and trade-offs, “but exhibits the highest shares of non-linear SDG interactions” (ibid.: 10).

Compared to the income groups, the authors found a larger number of similarities than differences in SDG interactions for the regional groups. Differences in synergistic SDG interactions are mainly attributed to SDG 1, such as the strong positive relation between different targets on poverty reduction and the support towards a peaceful and inclusive society with strong institutions (SDG 16). A suggestion by the authors is that “differences in the share of synergies can be due to variations in the stability among the regions” (ibid.). In addition, they attribute some varying trade-offs regarding SDG 1 to environmental externalities that are caused by varying accessibility to basic services, such as clean energy, safe water and health care systems. Subsequently, they demand that “these trade-offs should be tackled by transforming the current ways of natural resource use by energy, manufacturing and human systems to minimize the adverse environmental impacts” (ibid.).

Based on this previous research and the apparent lack of further analyses, it can be expected that differences on the regional level are not as significant as they are for the income groupings. Nevertheless, the research gaps in this regard complicate a contextualisation of the subsequent correlation analysis with previous research and literature. Consequently, the results from the correlation analysis will mostly be compared with results and previous literature that focuses on SDG interrelations on the global level.

3.3.3. Correlations, synergies and trade-offs with other indices

In addition to research on SDG correlations for groups of countries based on their geographic location and their national income, some studies have examined the relevance of other factors for correlation patterns across the 2030 Agenda. While a consideration of other factors cannot be exhaustive, a selection of other indices based on different factors will be included in the subsequent correlation analysis to broaden the geographic perspective on SDG interrelations.

A notable example for such an additional factor was examined by de Neve and Sachs (2020) in a study entitled “The SDGs and human well-being: a global analysis of synergies, trade-offs and regional differences”. While the study does not examine correlations between SDGs themselves, it adds the standard measure of well-being, in the form of Subjective Well-being as used in the World Happiness Report rankings between 2016 and 2018, as an additional category and analyses its correlations with the 2019 SDG Index and Dashboards by applying a standard univariate linear correlation analysis. They find that SWB correlates with the SDG index at a significant rate of 0.79 on the global level (de Neve/Sachs 2020: 2). Beyond the global perspective, the authors break down this analysis by individual SDGs and geographic regions.

“We find that at the global level most SDGs correlate strongly and positively with higher well-being. At the same time, we discover much heterogeneity in how some of the SDGs relate to well-being. In fact, we find SDGs 14 (Life below water), 15 (Life on land), and 17 (Partnerships for the goals) to be generally insignificant. Importantly, we find that SDGs 12 (Responsible consumption and production) and 13 (Climate action) are significantly negatively correlated with human well-being. When looking at the relationship between SDGs and well-being by region we detect further levels of heterogeneity in how individual SDGs relate to well-being in different contexts.”

(de Neve/Sachs 2020: 3)

Another aspect that has been considered in a recent study by Warchold et al. (2020) are SDG interactions among population groups. To that end, the Global SDG Indicators Database which disaggregates data on SDG indicators by gender, age and location (urban/rural). Out of the seventeen goals, such data that is usable for their analysis is available for eight goals, namely SDGs 1, 3, 4, 5, 6, 7, 8 and 16 (Warchold et al. 2020: 4). They observe “a high share of synergies (...) for female, younger and rural populations in comparison to male, elderly and urban populations” (ibid.: 7). Potential explanations include a chain of drawbacks in women’s life affecting health, employment and social security, poverty risks for the elderly due to unsustainable agriculture and better infrastructure in urban areas. While these results imply an advantage for female, young and rural populations for achieving the 2030 Agenda, the authors acknowledge that these population groups are often in disadvantaged positions in the first place. They conclude that “breaking away the current disadvantaged positions for these population groups (...) can fulfil the 2030 Agenda’s pledge to ‘leave no one behind’” (ibid.).

3.4. Correlations, synergies and trade-offs on the national level

In addition to the annual Sustainable Development Report, which attempts to quantify SDG achievement on a global level, the authors have published further reports for individual countries and regions, which often include further analyses of SDG achievement regarding developments within the last two decades or geographic differences on the subnational level. Within the last two years, such reports have been published (in chronological order) for the United States, Mediterranean countries, the Arab region, Latin America and the Caribbean, Italy, Bolivia, Africa, Spain, the European Union and Brazil. While the annual report itself already covers sufficient data to assess national deviations in terms of SDG performance and correlation patterns, such national and regional reports go into further detail and facilitate such analysis at the respective geographical level. It seems natural therefore that correlation patterns on the national level have been addressed in multiple studies for different countries.

An example for a comparative study at the country level was presented by Mainali et al. (2018) who evaluated synergies and trade-offs among SDGs 1, 2, 6, 7 with a focus on six developing countries in South Asia and Sub-Saharan Africa, namely Bangladesh, Nepal, Sri Lanka, Ghana, Ethiopia and Rwanda, by applying an analytical framework that uses qualitative and quantitative methods. While the analysis showed strong synergies among most targets related to these SDGs (along with similar results in previous studies on the global level), the authors found that “synergies differ from country to country and over time” (Mainali et al. 2018: 19):

“Ghana has relatively higher, and Rwanda lower potential synergy in the Sub-Saharan Africa, whereas Sri Lanka has relatively higher and Nepal has lower potential synergy in the South Asia among various targets associated with energy and other goals. Higher synergy values were evidenced where countries’ policy have recognized the importance of linkages among the cross-sectoral targets. (...) Based on the emphasis given by individual countries on specific targets, and the level of previous achievements, the synergy might differ over time. Sri-Lanka is already at the last mile when it comes to access to electricity and ending poverty, thus achieving higher potential synergy among the targets becomes more difficult at this stage.” (Mainali et al. 2018: 19)

The authors thus underline the relevance of national policies to take advantage of potential synergies across the four goals that were included in their study. In their analysis of pairwise interactions, the authors also address potential explanations for differences between the six countries. For example, synergies between SDGs 1 and 7 were attributed to micro-loans for access to water and sanitation, which had an average repayment rate of 99%. Synergies between SDGs 1 and 2 are attributed to changes in food prices, as shown in a study by the Asian Development Bank. In line with Conceição et al. (2016), the authors describe a “virtuous cycle of poverty reduction by increasing food security and generating farm employment opportunities while also avoiding the depletion of land and water resources” (ibid.).

Whereas SDG correlation studies on the global scale and comparisons across different groups of countries have become popular in recent years, such studies for individual countries are still quite rare. Despite the high number of studies that analyse SDG performance and strategies for SDG achievement in individual countries, there seems to be a shortage of studies that specifically focus on synergies and trade-offs across the 2030 Agenda. The following studies shall be understood as examples for such national studies, for which there is still a high need.

The most comprehensive study thus far which focuses on SDG interrelations within a single country was published by de Ramos/Laurenti (2020). Based on the most recent SDG Index and Dashboards, the authors conducted an analysis of synergies and trade-offs among SDGs and their associated targets in Spain between 2000 and 2019. While the overall correlation patterns are similar to those observed on the global level, the authors found some notable deviations. In their analysis of synergies between the seventeen goals, they applied Spearman's ρ and categorized interactions as synergy ($r_s \geq 0.6$), trade-off ($r_s \leq -0.6$) or unclassified ($0.6 > r_s > -0.6$). On average, "almost 80% of the significant interactions are classified as synergies or trade-offs concluding that the links are clearly defined as positive or negative, in the absence of 20% of remaining non-classified interactions" (de Ramos/Laurenti 2020: 7). Whereas SDG 13 was excluded due to the lack of analysable data, SDG 11 shows a full synergy share due to a unique synergy (targets 1.5 and 11.5) based on the significance analysis. Apart from that, the largest share (>60%) of positive interactions was observed for SDGs 4, 5 and 7 (ibid.: 10).

Another national study was published by Engström et al. (2019) who analysed interactions in Sweden between selected targets of SDGs 2, 6 and 15 with SDGs 7, 11 and 13. Their objective was to analyse "how local energy and climate actions can affect the use of water and land resources" (Engström et al. 2019: 1847). Based on different scenarios in terms of energy and climate actions, they found significant differences for the development of SDG performance. While all scenarios are positive towards the achievement of SDG 7, all fossil free scenarios benefit the achievement of SDGs 11 and 13. Varying effects can be observed for SDGs 2, 6 and 15 based on different decarbonization scenarios (ibid.: 1858). The authors conclude that "SDG interactions and their geographic distribution are highly path-dependent" (ibid.: 1860).

Both studies demonstrate that a detailed analysis at the target level may lead to heterogeneous results for an individual goal. While a broader correlation analysis, such as the one conducted in this MA thesis, cannot take all targets into account, it is important to note that combined values for SDG scores, as they are presented in the SDG Index and Dashboards, cannot reflect the diversity of each goal's targets, although developments for them might differ significantly.

3.5. Summary and research gaps

The literature review has demonstrated that SDG correlations, synergies and trade-offs are a research field with increasing popularity, particularly due to the increasing number of publications in this area. While the oldest studies mentioned above were published in 2017, a majority was published very recently, mostly in 2020. A common method to determine SDG interrelations is a correlation analysis by applying Spearman's rank correlation coefficient ρ and comparing the correlation coefficients for different SDG pairs or country constellations. The most common data source are the SDG Index and Dashboards, which are published annually by the Bertelsmann Stiftung and the SDSN. Another source is the Global SDG Indicators Database, which was initiated in 2019 and has been used more often in recent studies.

According to the most recent global correlation analysis by Fonseca et al. (2020), most SDGs have a significant positive correlation towards each other. The respective correlation matrix shows synergies for SDGs 1 to 11 and 16, whereas SDG 12 is the only goal with significant trade-offs with those goals. Beyond these two very distinct groups, SDGs 13 to 15 and 17 do not have significant correlations with any other goals. These observations are mostly reflected by other researchers, although studies based on older sources show some deviations regarding trade-offs among SDGs 11, 12, 14, 16 and 17. In all cases, the observation that SDGs 1 to 10 have strong synergies amongst each other seems to be a very consistent result in all studies.

While there are numerous studies on SDG correlations on the global level that are comparable to each other, this is not the case for longitudinal studies that focus on individual countries or groups of countries. Their findings mostly reflect the observations of other studies on the global level, although significant deviations can be observed for different regional groups and, to a smaller extent, for different income groups. Based on previous literature, it is not possible to summarize correlation patterns for individual countries that are comparable amongst each other, although the Spanish case hints at insightful observations from such kinds of research.

Although most studies have a global focus and do not elaborate in detail on SDG correlations for individual countries or groups of countries, the helpfulness of further analysis based on income groups, regions and political systems has been emphasized (Kroll et al.: 10). Beyond these aspects, previous studies have suggested human well-being and population groups as additional factors that might have a significant impact on SDG correlations. All in all, despite increasing popularity and demand in this field, a geographic perspective on SDG correlations seems beneficial to closing such research gaps and to providing a useful analysis to take advantage of synergies for SDG achievement based on national and regional parameters.

4. Correlation analysis of the 2030 Agenda

4.1. Empirical data from the SDG Index and Dashboards

4.1.1. Data composition and structure

The data source for the subsequent analysis is the raw data from the Sustainable Development Report 2020, which has been published online under the Creative Commons Attribution-Non-Commercial 4.0 International License (Sachs et al. 2020). As mentioned above, the 2020 SDG Index aggregates data for 166 countries on 85 global indicators plus an additional 30 indicators for the OECD countries from official and non-official sources across all seventeen goals. This data is normalized to determine a country's performance on these indicators on a scale from worst (0) to best (100) as well as summarized scores for each goal and the entire 2030 Agenda.

In addition to the national scores, the raw data includes aggregated values for the seven sub-regions and four income groups as defined by the World Bank, which are going to serve as an analytical foundation for the correlation analysis in this MA thesis. The income grouping classifies countries based on their GNI per capita. The most recent classification encompasses 29 low-income countries (1,035 USD or less), 50 lower-middle income countries (4,046 USD to 12,535 USD), 56 upper-middle-income countries (1,036 USD to 4,045 USD) and 83 high-income countries (12,536 USD or more) for the 2021 fiscal year (World Bank 2021). The regional grouping classifies countries based on their geographic location which seems to be based on the World Bank regional grouping, although they are not entirely congruent.

The chart below visualizes the connection between income and regional groups. It shows that income is clustered geographically, which is an important aspect for the correlation analysis.

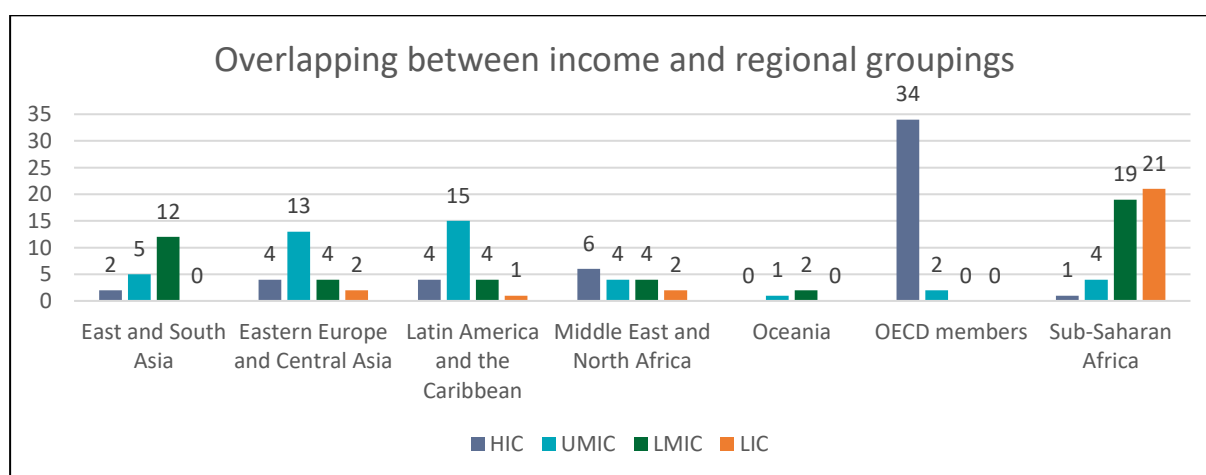


Figure 4.1 – Overlapping between income and regional groupings

4.1.2. Empirical evidence and findings

4.1.2.1. Findings on the global level

The 2020 SDG Index includes a total of 166 countries with an overall score from 84.7 (Sweden) to 38.5 (Central African Republic). Due to insufficient data availability, 27 UN member states were not included in the analysis, which represent about 0.56% of the global population. The largest of these countries are North Korea, Libya and Eritrea, while the others are mostly Small Island Developing Nations and microstates in the Caribbean, Europe and Oceania.

On average, the non-population-weighted overall score is between 66.77 (mean value) and 68.73 (median), with an interquartile range between 59.56 and 74.42. A more detailed analysis reveals significant differences among the different goals and indicators, suggesting that the outlook for SDG achievement is quite heterogenous across the agenda. The mean values range from 35.04 (SDG 9) to 90.62 (SDG 2). The interquartile ranges, which indicate the standard deviations, range from 13.27 (SDG 14) to 47.31 (SDG 2). In addition to this, a comparison of median and mean values suggests that individual scores do not follow a normal distribution. This aspect was examined in detail for the 2019 SDG Index by Fonseca et al. (2020: 6–7).

4.1.2.2. Findings by income grouping

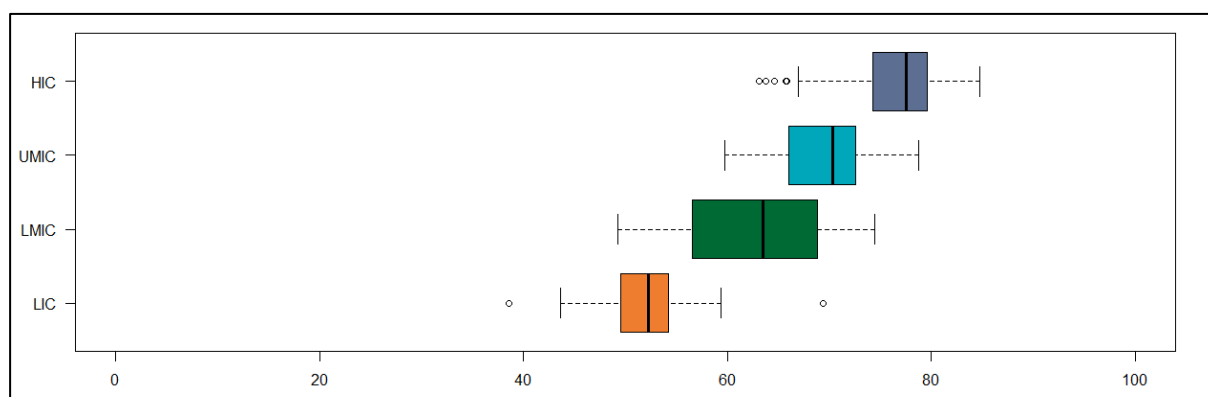


Figure 4.2 – Overall scores by income grouping

Even though the SDR itself does not further elaborate on data aggregated by income grouping, the data speaks for itself to a certain extent. As shown in the figure above, the overall scores unambiguously correlate with a country's income. A deeper look into the data reveals that this is also the case for most individual SDG scores, although not all of them. These include most notably goals 12, 13 and 14, whose scores seem to correlate negatively with national income. The distribution for goals 10, 15 and 17 is somewhat ambiguous and does not show a clear pattern. These first observations clearly require a more detailed analysis hereafter.

4.1.2.3. Findings by regional grouping

Based on the SDG Index itself, the SDG dashboards include population-weighted averages for the income and regional groups, highlighting “the strengths and weaknesses of each country in relation to each of the 17 SDGs” (Sachs et al. 2020: 37). In contrast to the income groups, the key findings for the seven regional groups are summarized in the report. According to this analysis, no region or country is currently on track to full SDG achievement by 2030.

The best-performing region is formed by the OECD countries, who “perform better on goals related to socioeconomic outcomes and basic access to infrastructure” (ibid.), namely goals 1 to 9. Despite significant improvements, these goals represent significant challenges for Sub-Saharan African countries. However, the opposite is true for goals related to climate change mitigation and biodiversity protection, which present significant challenges for most regions. This is particularly the case for OECD countries, whereas Sub-Saharan African countries have a somewhat better performance on these goals. The region that has progressed most in the SDG Index is East and South Asia, while Sub-Saharan Africa has also made significant improvements since 2015. The SDG performance of MENA countries varies greatly between conflict and non-conflict areas, while Oceania distinguishes itself due to a lack of data.

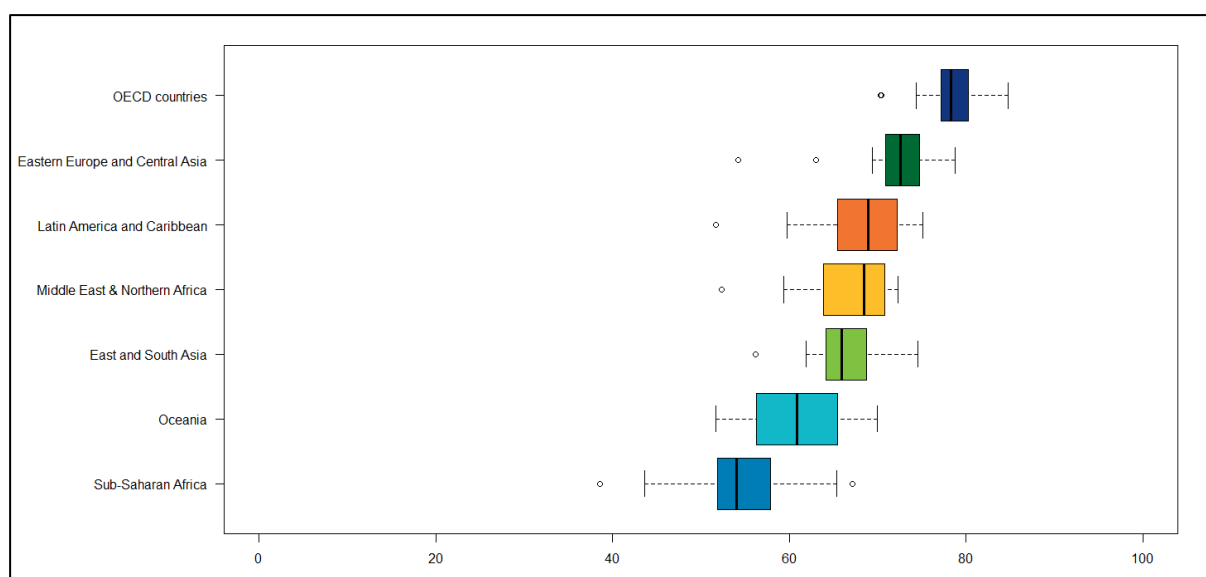


Figure 4.3 – Overall scores by regional grouping

In contrast to the income grouping, correlations between regional groupings across individual SDG scores are much less obvious from the data. A hypothesis based on this observation is that SDG performance is closer linked to national income than geographic location. The most significant aspect here is that OECD countries perform best on ten SDGs (goals 1 to 9 and 11), while Sub-Saharan Africa performs worst on seven SDGs (goals 1, 3, 4, 8, 11, 16 and 17).

4.1.3. Quality and implications of the data

A common criticism regarding the 2030 Agenda is the lack of sufficient data for the evaluation of all indicators. This is also reflected by the SDG Index, as only a third to a quarter of these indicators are considered for the index calculation. On top of that, even for those indicators, the data availability is not always sufficient. 27 countries have been excluded from the analysis due to a lack of sufficient data, as described in the SDR: “To minimize biases from missing data, the SDG Index only includes countries that have data for at least 80% of the variables included in the global SDG Index” (Sachs et al. 2020: 67). The regional group with the most data gaps by far is Oceania, which is already the smallest group in terms of country number. Only three countries in Oceania have a sufficient data base to be included in the SDG Index, which makes it unreasonable to perform an SDG correlation analysis for this regional group.

In addition to the overall availability of data, the authors of the SDG Index and Dashboards have found comparability and timeliness of available data somewhat challenging. As a result, they decided to only use data from internationally comparable sources, which sometimes bypasses more recent data from national sources. While this method ensures a considerably high level of comparability among countries, it does not reflect the effects of more recent developments (ibid.: 66). For example, the 2020 SDG Index and Dashboards do not yet reflect the presumably significant effects of the Covid-19 pandemic on SDG achievement. This is very important, as correlations between several SDGs might also change in the aftermath of the pandemic and have long-term effects on sustainable development in the years to come.

Even though the SDG Index and Dashboards are updated annually, the authors emphasize that “due to changes in the indicators as well as some refinements in the methodology, SDG Index rankings and scores cannot be compared with those of previous editions” (ibid.: 63). Based on this statement, the correlation analysis of this MA thesis cannot be compared to last year’s analysis by Fonseca et al. (2020) in the sense of a temporal development over time. Such an analysis would be possible using the historical data, which is also included in the SDR raw data, but this would exceed the scope of this MA thesis. The data and results from the subsequent correlation analysis are therefore not comparable to similar analyses from other years.

In summary, the SDG Index and Dashboards face numerous challenges that demonstrate which difficulties the UN Statistics Division will face when it comes to SDG evaluation. The most significant challenge remains the availability of correct and sufficient data that is both timely and comparable at an international level. The SDG Index attempts to aggregate the best available data to that end, although its findings should be taken with a grain of salt.

4.2. Methodological approach

Based on previous research regarding correlations, synergies and trade-offs across the 2030 Agenda, as described in chapter 3, the epistemological interest of this MA thesis is to examine these from a geographic perspective and to identify causal relationships. To that end, a correlation analysis of the 2020 SDG Index and Dashboards has been conducted and analysed. All steps of the analysis have been thoroughly documented and are described in the following.

The foundation for the correlation analysis was laid by a detailed examination of the raw data used for the 2020 SDG Index and Dashboards. Due to limited data availability for numerous indicators and the limited scope of this MA thesis, it was decided that the correlation analysis shall be limited to overall and individual SDG scores. This leaves a total of eighteen values for 166 countries as well as aggregated values for both the income and regional groupings. Based on the 2020 SDG Index raw data, a corresponding spreadsheet was drafted in Microsoft Excel.

The first analytical step was a visual exploration of SDG correlations on the global scale with the use of scatterplots for each SDG pairing. A total of 136 scatterplots was compiled with the usage of R, marking the regional groups with different colours. These scatterplots present a general overview of SDG correlations and their relation. At first glance, about 55% of the SDG pairings show a linear relation, about 20% show an exponential relation and about 25% do not show an apparent relation towards each other. In all cases, as has been analysed by Fonseca et al. (2020: 6–7), the individual and overall SDG scores do not follow a normal distribution.

Since the Pearson correlation coefficient (“Pearson’s r ”) requires a somewhat normal data distribution, it cannot be applied for a correlation analysis of the data at hand. Instead, Spearman’s rank correlation coefficient (“Spearman’s ρ ”) was chosen for the subsequent analysis. Even though both methods produce similar results at first glance, this choice bears significant implications for the interpretation of the data. While Pearson’s r denotes the significance of a linear relation, Spearman’s ρ denotes the significance a monotonous relation. For example, a high correlation coefficient using Pearson’s r denotes a strong linear correlation, while a high correlation coefficient using Spearman’s ρ denotes a strong correlation regardless of the kind of relation. This kind of relation has been observed in the scatterplots which are therefore a useful tool in addition to the correlation analysis itself, as they visualize distortions in the distribution of SDG scores and their relation. Due to the linear relation in numerous cases, Pearson’s r could have been applied to analyse the significance of linear relations in these cases. Despite this option for enhancing data validity, this method would prevent comparability of correlation coefficients across the entire 2030 Agenda and across different groups.

The correlation analysis was performed with R, which had already been used to compile the scatterplots. With the intention to compare different correlation coefficients for different SDG pairs, a matrix was compiled with the seventeen goals represented on both the X and Y axis. In addition to the matrix on the global level, the same operation was conducted for all four income groups and six regional groups from the SDR (excluding Oceania, as described above). These correlation matrices and their implications will be described in further detail hereafter.

Spearman's rank correlation coefficient is denoted as r_s or ρ , which falls into a range between -1 and 1. A correlation coefficient $r_s=1$ indicates a perfect positive correlation, a correlation coefficient $r_s=-1$ a perfect negative correlation of two values. The correlation is less significant the more r_s tends towards 0, which suggests that both values are independent from each other. Naturally, the correlation of any value with itself produces a correlation coefficient $r_s=1$. To facilitate the interpretation of Spearman's ρ , these results can be grouped into six categories: Strong positive correlation ($r_s \geq 0.800$), significant positive correlation ($0.800 > r_s \geq 0.500$), weak positive correlation ($0.500 > r_s > 0$), weak negative correlation ($0 > r_s > -0.500$), significant negative correlation ($-0.500 \geq r_s > -0.800$) and strong negative correlation ($r_s \leq -0.800$). In addition to these numerical values, the correlation's strength between two SDGs is also colour-coded as green (positive), white (insignificant) and red (negative) in the correlation matrices.

In addition to the SDG correlation matrices themselves, a corresponding set of matrices was compiled for all income and regional groups that indicate the deviations in comparison with the global values for each SDG pair. Beyond the general analysis of SDG correlations, this visualization facilitates the detection of significant deviations based on income and region. The most significant findings to that end will be further described in the discussion part.

Subsequent to the correlation analysis on the global level, by income and regional grouping, the analytical part will also consider correlations with other indices and significant deviations for individual countries. The indices that were selected for the correlation analysis include the Gini coefficient, the Human Development Index (HDI) and the World Happiness Report (WHR) ranking. The methodology for the correlation analysis on the national level differs from the methods described here and will be described corresponding chapter.

Based on the correlation analysis, the findings will be contextualised with previous research and literature in chapter 5. Subsequently, the intention of chapter 6 is to identify causal relations across the 2030 Agenda in the form of effective synergies or trade-offs. This part will also consider additional factors and parameters that might have an impact on SDG performance and interrelations, including cultural, economic, geographic and political aspects.

4.3. Findings and discussion

4.3.1. Correlations on the global level

Global (n=166)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.874	0.768	0.901	0.853	0.670	0.875	0.825	0.740	0.869	0.521	0.697	-0.657	-0.736	-0.083	0.230	0.797	0.163
Goal 1	1.000	0.636	0.850	0.774	0.498	0.770	0.765	0.647	0.832	0.524	0.620	-0.684	-0.776	-0.309	0.074	0.731	0.103
Goal 2	0.636	1.000	0.712	0.643	0.520	0.666	0.610	0.597	0.724	0.433	0.497	-0.487	-0.571	-0.045	0.153	0.626	-0.025
Goal 3	0.850	0.712	1.000	0.865	0.620	0.807	0.854	0.700	0.892	0.435	0.684	-0.796	-0.845	-0.202	0.088	0.822	0.118
Goal 4	0.774	0.643	0.865	1.000	0.612	0.759	0.758	0.668	0.819	0.378	0.633	-0.705	-0.784	-0.204	0.090	0.761	0.098
Goal 5	0.498	0.520	0.620	0.612	1.000	0.655	0.536	0.574	0.586	0.180	0.618	-0.518	-0.559	0.000	0.158	0.489	0.160
Goal 6	0.770	0.666	0.807	0.759	0.655	1.000	0.747	0.682	0.760	0.302	0.691	-0.619	-0.671	-0.068	0.192	0.655	0.123
Goal 7	0.765	0.610	0.854	0.758	0.536	0.747	1.000	0.564	0.799	0.344	0.611	-0.704	-0.778	-0.218	0.049	0.702	0.191
Goal 8	0.647	0.597	0.700	0.668	0.574	0.682	0.564	1.000	0.683	0.346	0.523	-0.485	-0.563	-0.034	0.160	0.590	-0.107
Goal 9	0.832	0.724	0.892	0.819	0.586	0.760	0.799	0.683	1.000	0.403	0.589	-0.726	-0.819	-0.174	0.101	0.779	0.051
Goal 10	0.524	0.433	0.435	0.378	0.180	0.302	0.344	0.346	0.403	1.000	0.188	-0.336	-0.344	-0.232	0.294	0.476	-0.043
Goal 11	0.620	0.497	0.684	0.633	0.618	0.691	0.611	0.523	0.589	0.188	1.000	-0.615	-0.604	-0.092	0.030	0.619	0.163
Goal 12	-0.684	-0.487	-0.796	-0.705	-0.518	-0.619	-0.704	-0.485	-0.726	-0.336	-0.615	1.000	0.860	0.261	-0.156	-0.708	-0.199
Goal 13	-0.776	-0.571	-0.845	-0.784	-0.559	-0.671	-0.778	-0.563	-0.819	-0.344	-0.604	0.860	1.000	0.205	-0.121	-0.736	-0.180
Goal 14	-0.309	-0.045	-0.202	-0.204	0.000	-0.068	-0.218	-0.034	-0.174	-0.232	-0.092	0.261	0.205	1.000	0.211	-0.228	-0.101
Goal 15	0.074	0.153	0.088	0.090	0.158	0.192	0.049	0.160	0.101	0.294	0.030	-0.156	-0.121	0.211	1.000	0.142	-0.017
Goal 16	0.731	0.626	0.822	0.761	0.489	0.655	0.702	0.590	0.779	0.476	0.619	-0.708	-0.736	-0.228	0.142	1.000	0.079
Goal 17	0.103	-0.025	0.118	0.098	0.160	0.123	0.191	-0.107	0.051	-0.043	0.163	-0.199	-0.180	-0.101	-0.017	0.079	1.000

Figure 4.4 – SDG correlation analysis (Global)

The table above illustrates the results of a global SDG correlation analysis, which is going to serve as a foundation for further analyses based on the income and regional groupings. At the global level, correlations among the seventeen goals are predominantly positive, although this does not apply universally. Based on the goal's correlation with the overall score, twelve goals (SDGs 1 to 11 and 16) have a significant or strong correlation, three goals (SDGs 14, 15 and 17) have a weak positive or negative correlation and two goals (SDGs 12 and 13) have a significant negative correlation. According to the scatterplots for the latter two goals, their correlation coefficient decreases exponentially with an increasing overall score.

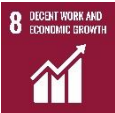
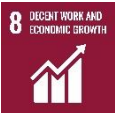
Strong positive correlation ($r_s \geq 0.800$)		Significant positive correlation ($0.800 > r_s \geq 0.500$)		Weak positive/ negative correlation ($0.500 > r_s > -0.500$)		Significant negative correlation ($-0.500 \geq r_s > -0.800$)	
	0.901		0.869		0.790		0.230
	0.875		0.853		0.768		-0.083
	0.874		0.825		0.670		-0.657
					0.740		-0.736
					0.521		
							0.163

Figure 4.5 – Correlation of SDG scores with the 2030 Agenda overall score

Beyond the correlation analysis of individual goals with the 2030 Agenda overall score, the table above shows the correlation coefficients for a total of 136 unique combinations of SDGs. These 136 pairs can also be grouped into six categories of different correlation intensity. At the global level, this examination outlines 9 pairs with a strong positive correlation, 45 with a significant positive correlation, 37 with a weak positive correlation, 25 with a weak negative correlation, 18 with a significant weak correlation and 2 with a strong negative correlation.

The strongest correlations can be observed for those SDGs which already have the strongest correlation with the 2030 Agenda overall score. On the positive end, four of the five strongest correlations involve goal 3, which has the strongest positive correlation with the overall score. On the negative end, four of the five strongest correlations involve goal 13, which has the strongest negative correlation with the overall score. Looking at these extreme examples, two aspects are remarkable: First, even though goals 12 and 13 have the most negative correlation with the 2030 Agenda overall score, their correlation with each other is strongly positive and the third most correlating SDG pair across the agenda. Second, while goal 3 has the strongest positive correlation with the 2030 Agenda overall score, its correlation with goals 12 and 13 is significantly low. In fact, goals 3 and 13 have the most negative correlation of all SDG pairs.

A comparison at the SDG level also indicates significant differences for the range of correlation coefficients across the 2030 Agenda. Out of the seventeen goals, the majority has a wide range that exceeds a difference of 0.8 between the most positive and most negative SDG pairing. Based on the pattern of their correlation, these goals can be put into two groups: SDGs 1 to 11 and 16 are positively correlated, at a significant rate in most cases. In turn, these goals have a negative correlation with SDGs 12 and 13, also at a significant rate in most cases. The color-coding in figure 4.4 underlines this divide between these two groups of SDGs. These differences reflect the correlations with the 2030 Agenda overall score, as mentioned above.

Beyond these two groups with significant or strong correlations, four goals are characterized by a narrow range of correlation coefficients around 0, namely SDG 17 (-0.199 to 0.191), SDG 15 (-0.156 to 0.294) and SDG 14 (-0.309 to 0.261). These less significant correlations can also be seen in the scatterplots, as no visual correlation or kind of relation can be observed for most pairs which include these goals. Therefore, SDGs 14, 15 and 17 supposedly have considerably lower synergies with both the rest of the 2030 Agenda as a whole and other goals, as these less significant correlations can be observed with all other goals across the three groups.

To facilitate further analysis, these groups (which can be recognized in figure 4.5) will be signified as A (SDGs 1 to 11 and 16), B (SDGs 12 and 13) and C (SDGs 14, 15 and 17) hereafter.

4.3.2. Correlations by country grouping

4.3.2.1. Correlations by income grouping

4.3.2.1.1. High-income countries

HIC (n=51)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.406	0.523	0.588	0.566	0.722	0.704	0.433	0.685	0.661	0.677	0.385	-0.145	0.043	0.033	0.507	0.621	0.176
Goal 1	1.000	0.114	0.361	0.227	0.430	0.173	0.213	0.441	0.320	0.488	0.306	-0.429	-0.348	0.003	0.113	0.482	0.135
Goal 2	0.114	1.000	0.343	0.335	0.152	0.379	0.138	0.349	0.475	0.315	0.168	-0.055	0.068	-0.098	0.198	0.367	-0.054
Goal 3	0.361	0.343	1.000	0.666	0.667	0.410	0.554	0.332	0.836	0.555	0.408	-0.571	-0.354	-0.300	0.036	0.673	0.179
Goal 4	0.227	0.335	0.666	1.000	0.576	0.456	0.471	0.513	0.634	0.347	0.339	-0.483	-0.233	-0.246	0.237	0.557	0.037
Goal 5	0.430	0.152	0.667	0.576	1.000	0.551	0.622	0.359	0.645	0.503	0.512	-0.494	-0.165	-0.097	0.195	0.610	0.266
Goal 6	0.173	0.379	0.410	0.456	0.551	1.000	0.245	0.556	0.404	0.150	0.341	-0.082	0.184	0.142	0.486	0.474	-0.010
Goal 7	0.213	0.138	0.554	0.471	0.622	0.245	1.000	0.238	0.463	0.457	0.261	-0.460	-0.033	-0.364	-0.116	0.308	0.226
Goal 8	0.441	0.349	0.332	0.513	0.359	0.556	0.238	1.000	0.424	0.390	0.145	0.026	0.087	-0.131	0.452	0.498	-0.094
Goal 9	0.320	0.475	0.836	0.634	0.645	0.404	0.463	0.424	1.000	0.535	0.386	-0.450	-0.350	-0.240	0.001	0.614	0.169
Goal 10	0.488	0.315	0.555	0.347	0.503	0.150	0.457	0.390	0.535	1.000	0.198	-0.551	-0.604	-0.231	0.249	0.605	0.193
Goal 11	0.306	0.168	0.408	0.339	0.512	0.341	0.261	0.145	0.386	0.198	1.000	-0.423	-0.165	-0.102	0.098	0.305	0.003
Goal 12	-0.429	-0.055	-0.571	-0.483	-0.494	-0.082	-0.460	0.026	-0.450	-0.551	-0.423	1.000	0.640	0.326	0.109	-0.474	-0.172
Goal 13	-0.348	0.068	-0.354	-0.233	-0.165	0.184	-0.033	0.087	-0.350	-0.604	-0.165	0.640	1.000	0.051	0.202	-0.339	-0.116
Goal 14	0.003	-0.098	-0.300	-0.246	-0.097	0.142	-0.364	-0.131	-0.240	-0.231	-0.102	0.326	0.051	1.000	0.193	-0.198	0.046
Goal 15	0.113	0.198	0.036	0.237	0.195	0.486	-0.116	0.452	0.001	0.249	0.098	0.109	0.202	0.193	1.000	0.227	-0.256
Goal 16	0.482	0.367	0.673	0.557	0.610	0.474	0.308	0.498	0.614	0.605	0.305	-0.474	-0.339	-0.198	0.227	1.000	0.067
Goal 17	0.135	-0.054	0.179	0.037	0.266	-0.010	0.226	-0.094	0.169	0.193	0.003	-0.172	-0.116	0.046	-0.256	0.067	1.000

Figure 4.6 – SDG correlation analysis (High-income countries)

The chart above shows that the general correlation pattern with three distinct groups, which was observed on the global level, applies to high-income countries as well. However, a closer look at the correlation coefficients reveals that most of these correlations are much less significant in this case. The most remarkable difference for correlations with the overall score is that of Group B, which demonstrates remarkably weak correlations with the 2030 Agenda overall score. In addition, SDGs 10 and 15 also show increased correlations with the overall score, which now can be categorized as significantly positive. SDG 10 even shows the fourth strongest correlation with the overall score and significant correlations with several goals, which indicates a remarkable deviation from the global level. On the other hand, most goals in Group A show weaker correlations compared to the global analysis, especially SDG 1.

Regarding correlations between individual goals, it is remarkable that the differences between groups A and B are much less significant than at the global level and even slightly positive in some cases. The most extreme difference is the correlation coefficient of SDGs 6 and 13, which changes from -0.671 on the global level to 0.184 for high-income countries. Notable changes of more than 0.5 can also be observed for the correlation of SDG 13 with SDGs 2, 4, 7 and 8 as well as the correlation of SDG 12 with SDGs 6 and 8, which partially become weak positive.

Within groups A and B, it can be observed that correlations between any two goals are mostly less significant than they are on the global level, although they remain positive in all cases. As will be seen in the following, this unambiguity is only the case for high-income countries.

4.3.2.1.2. Upper-middle-income countries

UMIC (n=44)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.650	0.534	0.690	0.416	0.280	0.474	0.273	0.434	0.540	0.525	0.229	0.091	0.052	0.328	0.171	0.277	0.072
Goal 1	1.000	0.277	0.569	0.329	-0.114	0.115	0.152	0.309	0.515	0.694	0.125	-0.127	-0.122	-0.243	0.050	0.293	-0.146
Goal 2	0.277	1.000	0.356	0.066	0.207	0.245	0.057	0.167	0.258	0.280	-0.037	0.023	0.049	0.276	0.072	-0.038	-0.053
Goal 3	0.569	0.356	1.000	0.510	0.075	0.444	0.312	0.338	0.432	0.294	0.107	-0.016	0.027	0.072	-0.114	0.198	0.087
Goal 4	0.329	0.066	0.510	1.000	0.058	0.313	-0.082	0.223	0.253	0.030	0.102	0.059	0.056	0.003	-0.145	0.265	0.059
Goal 5	-0.114	0.207	0.075	0.058	1.000	0.260	-0.044	0.364	0.143	-0.327	0.281	-0.023	-0.148	0.428	0.119	-0.202	0.132
Goal 6	0.115	0.245	0.444	0.313	0.260	1.000	0.306	0.355	0.148	-0.155	0.325	-0.082	0.124	0.291	-0.148	-0.020	0.098
Goal 7	0.152	0.057	0.312	-0.082	-0.044	0.306	1.000	0.075	0.135	0.019	0.157	0.025	0.140	0.147	-0.087	-0.034	0.188
Goal 8	0.309	0.167	0.338	0.223	0.364	0.355	0.075	1.000	0.280	-0.026	0.260	0.057	-0.021	0.252	-0.118	-0.042	-0.216
Goal 9	0.515	0.258	0.432	0.253	0.143	0.148	0.135	0.280	1.000	0.216	0.108	0.003	-0.116	0.005	-0.095	0.102	-0.227
Goal 10	0.694	0.280	0.294	0.030	-0.327	-0.155	0.019	-0.026	0.216	1.000	-0.275	0.046	-0.061	-0.342	0.303	0.405	-0.058
Goal 11	0.125	-0.037	0.107	0.102	0.281	0.325	0.157	0.260	0.108	-0.275	1.000	-0.174	-0.064	0.198	-0.153	0.083	-0.055
Goal 12	-0.127	0.023	-0.016	0.059	-0.023	-0.082	0.025	0.057	0.003	0.046	-0.174	1.000	0.564	0.269	-0.141	-0.049	-0.374
Goal 13	-0.122	0.049	0.027	0.056	-0.148	0.124	0.140	-0.021	-0.116	-0.061	-0.064	0.564	1.000	0.064	-0.266	-0.100	-0.240
Goal 14	-0.243	0.276	0.072	0.003	0.428	0.291	0.147	0.252	0.005	-0.342	0.198	0.269	0.064	1.000	0.241	-0.154	-0.063
Goal 15	0.050	0.072	-0.114	-0.145	0.119	-0.148	-0.087	-0.118	-0.095	0.303	-0.153	-0.141	-0.266	0.241	1.000	0.026	0.050
Goal 16	0.293	-0.038	0.198	0.265	-0.202	-0.020	-0.034	-0.042	0.102	0.405	0.083	-0.049	-0.100	-0.154	0.026	1.000	0.078
Goal 17	-0.146	-0.053	0.087	0.059	0.132	0.098	0.188	-0.216	-0.227	-0.058	-0.055	-0.374	-0.240	-0.063	0.050	0.078	1.000

Figure 4.7 – SDG correlation analysis (Upper-middle-income countries)

Whereas the correlation patterns for high-income countries generally follow the three groups observed globally, this applies to upper-middle-income countries to a much lesser extent. With regards to correlations with the 2030 Agenda overall score, it is the only income group that shows positive correlation coefficients for all seventeen goals. Within that framework, the goals with the least significant correlation include those of group B and group C, which all demonstrate a weak positive correlation with the overall score. The most significant differences to the global level can be observed for SDGs 13 (+0.788), 12 (+0.748) and 14 (+0.411). Within group A, most SDGs demonstrate a weak positive and thus less significant correlation than on the global level, with notable weaker correlations for SDGs 16 (-0.520) and 7 (-0.552).

A more detailed analysis of correlations between different goals signifies several SDG pairs within group A that have a negative correlation coefficient such as SDGs 5 and 10 (-0.327) or SDGs 5 and 16 (-0.202). On the other hand, positive correlation coefficients can be observed between groups A and B in numerous cases, although these correlations remain very weak. This is a notable observation regardless, since all other income groups show distinct negative correlations between these two groups. In comparison with global correlations, the respective coefficients increase by 0.283 (SDGs 10 and 13) up to a remarkable 0.918 (SDGs 7 and 13). The difference to other income groups is so exceptional that a differentiation between these two groups is neither visible from the correlation matrix nor does it make sense in this case.

As for group C, differences to the global level and the high-income countries are very small. While correlations with SDG 14 are somewhat higher than at the global level, they are a bit lower for SDGs 15 and 17. These differences are so minor however, that no SDG pair involving each of these three goals surpasses a correlation coefficient that is considered significant.

4.3.2.1.3. Lower-middle-income countries

LMIC (n=45)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.844	0.570	0.863	0.813	0.358	0.739	0.856	0.341	0.642	0.593	0.433	-0.301	-0.467	-0.083	-0.111	0.597	0.355
Goal 1	1.000	0.342	0.748	0.685	0.124	0.620	0.742	0.234	0.640	0.692	0.204	-0.331	-0.458	-0.315	-0.200	0.517	0.256
Goal 2	0.342	1.000	0.326	0.486	0.195	0.453	0.396	0.203	0.421	0.329	0.191	0.245	0.089	0.097	-0.100	0.310	-0.085
Goal 3	0.748	0.326	1.000	0.702	0.240	0.646	0.764	0.318	0.464	0.405	0.568	-0.465	-0.488	-0.207	-0.207	0.634	0.376
Goal 4	0.685	0.486	0.702	1.000	0.395	0.527	0.696	0.401	0.589	0.429	0.282	-0.281	-0.513	-0.039	-0.123	0.511	0.245
Goal 5	0.124	0.195	0.240	0.395	1.000	0.370	0.233	0.155	-0.061	-0.006	0.337	-0.018	-0.176	0.008	-0.047	-0.072	0.210
Goal 6	0.620	0.453	0.646	0.527	0.370	1.000	0.629	0.193	0.384	0.343	0.380	-0.176	-0.310	-0.110	-0.134	0.289	0.235
Goal 7	0.742	0.396	0.764	0.696	0.233	0.629	1.000	0.165	0.582	0.386	0.300	-0.266	-0.493	-0.088	-0.038	0.476	0.295
Goal 8	0.234	0.203	0.318	0.401	0.155	0.193	0.165	1.000	0.342	0.192	0.068	-0.009	0.026	0.120	-0.198	0.181	-0.166
Goal 9	0.640	0.421	0.464	0.589	-0.061	0.384	0.582	0.342	1.000	0.366	-0.012	-0.127	-0.308	-0.069	-0.158	0.515	0.077
Goal 10	0.692	0.329	0.405	0.429	-0.006	0.343	0.386	0.192	0.366	1.000	0.005	-0.128	-0.117	-0.211	-0.126	0.288	0.114
Goal 11	0.204	0.191	0.568	0.282	0.337	0.380	0.300	0.068	-0.012	0.005	1.000	-0.540	-0.432	-0.233	-0.395	0.422	0.404
Goal 12	-0.331	0.245	-0.465	-0.281	-0.018	-0.176	-0.266	-0.009	-0.127	-0.128	-0.540	1.000	0.685	0.189	0.124	-0.441	-0.597
Goal 13	-0.458	0.089	-0.488	-0.513	-0.176	-0.310	-0.493	0.026	-0.308	-0.117	-0.432	0.685	1.000	0.210	-0.072	-0.379	-0.666
Goal 14	-0.315	0.097	-0.207	-0.039	0.008	-0.110	-0.088	0.120	-0.069	-0.211	-0.233	0.189	0.210	1.000	0.380	-0.298	-0.306
Goal 15	-0.200	-0.100	-0.207	-0.123	-0.047	-0.134	-0.038	-0.198	-0.158	-0.126	-0.395	0.124	-0.072	0.380	1.000	-0.239	0.216
Goal 16	0.517	0.310	0.634	0.511	-0.072	0.289	0.476	0.181	0.515	0.288	0.422	-0.441	-0.379	-0.298	-0.239	1.000	0.264
Goal 17	0.256	-0.085	0.376	0.245	0.210	0.235	0.295	-0.166	0.077	0.114	0.404	-0.597	-0.666	-0.306	0.216	0.264	1.000

Figure 4.8 – SDG correlation analysis (Lower-middle-income countries)

In contrast to the upper-middle-income countries, the three groups of similar correlation patterns can be clearly observed for lower-middle-income countries. The correlation matrix is very similar to that at the global level, even though most correlations are less significant. In terms of correlations with the overall score, the four tiers are almost evenly split: four goals (SDGs 1, 3, 4 and 7) have a strong positive correlation, five goals have a significant positive correlation (SDGs 2, 6, 9, 10 and 16), four goals have a weak positive correlation (SDGs 5, 8, 11 and 17) and four goals have a weak negative correlation (SDGs 12 to 15). This pattern results in lower correlation coefficients within both groups A and B and higher correlation coefficients between these two groups. The most important differences can be observed for SDGs 2, 8 and 9, although correlation coefficients remain close to 0 and are thus insignificant. In general, correlations between groups A and B only reach a significant level in a few cases.

Within group A, SDGs 5, 8 and 11 only have a weak correlation coefficient with the 2030 Agenda overall score. The most notable deviations from the global level are the correlations between SDGs 5 and 9 (-0.061), 5 and 16 (-0.072) as well as 9 and 11 (-0.012). These three pairs, which show a significant or almost significant correlation at the global level, are observable exceptions from the overall positive correlation pattern across the group. Other than that, most SDG pairs in group A show a significant or almost significant positive correlation.

As for group C, it is worthwhile to mention that SDG 17 displays a higher overall correlation coefficient than SDG 8, as it has mostly positive correlations with goals from groups A and B. The most remarkable difference however is the goal's significant negative correlation with SDGs 12 and 13, which are the two most negative correlations across the entire matrix. All other income groups show a weak positive or weak negative correlation for these two pairs.

4.3.2.1.4. Low-income countries

LIC (n=26)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.501	0.587	0.656	0.488	0.250	0.439	0.404	0.534	0.575	0.266	0.432	0.068	-0.664	-0.038	0.052	0.621	0.031
Goal 1	1.000	0.223	0.337	0.200	-0.244	0.252	0.404	0.496	0.546	0.581	0.121	0.167	-0.501	0.214	-0.167	0.343	-0.315
Goal 2	0.223	1.000	0.371	0.355	0.482	0.356	-0.164	0.679	0.400	0.284	0.448	0.260	-0.172	0.115	0.318	0.409	-0.107
Goal 3	0.337	0.371	1.000	0.531	0.408	0.262	0.256	0.245	0.684	0.103	0.314	-0.197	-0.433	-0.297	-0.198	0.541	0.028
Goal 4	0.200	0.355	0.531	1.000	0.414	0.319	0.126	0.171	0.423	-0.131	0.255	-0.044	-0.521	-0.706	-0.313	0.294	0.029
Goal 5	-0.244	0.482	0.408	0.414	1.000	0.142	-0.262	0.409	0.234	-0.170	0.309	0.134	-0.034	0.159	-0.094	0.478	0.044
Goal 6	0.252	0.356	0.262	0.319	0.142	1.000	-0.024	0.272	0.200	0.037	0.282	0.011	-0.316	-0.077	0.044	0.368	0.006
Goal 7	0.404	-0.164	0.256	0.126	-0.262	-0.024	1.000	-0.028	0.262	0.110	0.041	-0.023	-0.585	-0.330	-0.250	0.105	0.087
Goal 8	0.496	0.679	0.245	0.171	0.409	0.272	-0.028	1.000	0.538	0.343	0.427	0.378	-0.265	0.258	0.211	0.521	-0.262
Goal 9	0.546	0.400	0.684	0.423	0.234	0.200	0.262	0.538	1.000	0.057	0.184	-0.048	-0.493	-0.500	-0.119	0.432	-0.095
Goal 10	0.581	0.284	0.103	-0.131	-0.170	0.037	0.110	0.343	0.057	1.000	0.198	0.183	0.132	0.224	0.187	0.330	-0.216
Goal 11	0.121	0.448	0.314	0.255	0.309	0.282	0.041	0.427	0.184	0.198	1.000	0.212	-0.156	0.187	0.035	0.470	-0.021
Goal 12	0.167	0.260	-0.197	-0.044	0.134	0.011	-0.023	0.378	-0.048	0.183	0.212	1.000	-0.181	0.615	-0.248	0.015	-0.082
Goal 13	-0.501	-0.172	-0.433	-0.521	-0.034	-0.316	-0.585	-0.265	-0.493	0.132	-0.156	-0.181	1.000	0.044	0.245	-0.324	-0.116
Goal 14	0.214	0.115	-0.297	-0.706	0.159	-0.077	-0.330	0.258	-0.500	0.224	0.187	0.615	0.044	1.000	0.115	0.093	-0.220
Goal 15	-0.167	0.318	-0.198	-0.313	-0.094	0.044	-0.250	0.211	-0.119	0.187	0.035	-0.248	0.245	0.115	1.000	0.147	0.138
Goal 16	0.343	0.409	0.541	0.294	0.478	0.368	0.105	0.521	0.432	0.330	0.470	0.015	-0.324	0.093	0.147	1.000	-0.078
Goal 17	-0.315	-0.107	0.028	0.029	0.044	0.006	0.087	-0.262	-0.095	-0.216	-0.021	-0.082	-0.116	-0.220	0.138	-0.078	1.000

Figure 4.9 – SDG correlation analysis (Low-income countries)

The correlation matrix for low-income countries reflects the general structure that has been observed for the three other income groupings, with one major difference: While SDG 13 has a negative correlation with almost all twelve goals in group A, this is not the case for SDG 12. Compared to the global level, the correlation coefficients of SDG 12 with the goals in group A have increased by 0.519 (SDG 10) to 0.863 (SDG 8). While its correlation coefficient with the 2030 Agenda overall score is close to 0, it has a remarkable positive correlation with SDG 14 at a correlation coefficient of 0.615. This value is not only one of the most significant correlations across the entire matrix for low-income countries, but also a big difference to the weak correlation of these two goals both on the global level and for other income groups.

The different correlation patterns of SDGs 12 and 13 result in a remarkable constellation between these two goals, whose correlation coefficients with each other has remained among the highest across all income groups. Compared to the global level, the correlation coefficient for this pair diminishes by 1.041 points, which is the highest rate across all income groups. As a result, this usually very strong correlation becomes a weak negative correlation here.

Apart from the remarkable observations within group B, the correlation patterns within groups A and C are very similar to those in the other income groups. The overall correlations within group A are much weaker than on the global level and even negative in some cases like SDGs 1 and 5 (-0.244) and SDGs 5 and 7 (-0.262). Similarly, most correlation coefficients in group C are lower than at the global level and insignificant. The two exceptions in this regard are the correlations of SDGs 4 and 14 (-0.706) as well as SDGs 12 and 14 (0.615), which are both insignificant for all other income groups. All in all, while the general correlation pattern for low-income countries is not very different, there are a few remarkable deviations.

4.3.2.2. Correlations by regional grouping

4.3.2.2.1. East and South Asia

E_S_Asia (n=19)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.742	0.409	0.761	0.484	0.402	0.788	0.704	0.261	0.695	0.061	0.621	-0.467	-0.600	0.000	0.023	0.556	0.372
Goal 1	1.000	0.191	0.814	0.507	0.265	0.523	0.598	0.276	0.699	0.049	0.577	-0.725	-0.831	-0.385	-0.067	0.587	0.247
Goal 2	0.191	1.000	0.130	0.104	0.735	0.395	0.030	-0.032	0.256	0.392	0.216	0.296	0.118	-0.389	-0.365	0.151	-0.379
Goal 3	0.814	0.130	1.000	0.726	0.235	0.611	0.756	0.198	0.761	-0.098	0.711	-0.777	-0.851	-0.129	-0.054	0.546	0.326
Goal 4	0.507	0.104	0.726	1.000	0.396	0.349	0.475	0.382	0.595	-0.150	0.246	-0.611	-0.656	-0.021	-0.019	0.375	0.239
Goal 5	0.265	0.735	0.235	0.396	1.000	0.412	0.044	0.019	0.358	0.270	0.160	-0.044	-0.242	-0.179	-0.051	0.154	-0.116
Goal 6	0.523	0.395	0.611	0.349	0.412	1.000	0.747	0.068	0.546	-0.005	0.691	-0.414	-0.530	0.050	-0.167	0.474	0.314
Goal 7	0.598	0.030	0.756	0.475	0.044	0.747	1.000	0.139	0.782	-0.338	0.670	-0.709	-0.728	0.082	-0.232	0.542	0.349
Goal 8	0.276	-0.032	0.198	0.382	0.019	0.068	0.139	1.000	0.379	-0.213	-0.158	-0.119	-0.191	0.175	0.025	0.135	-0.046
Goal 9	0.699	0.256	0.761	0.595	0.358	0.546	0.782	0.379	1.000	-0.176	0.493	-0.649	-0.770	-0.125	-0.253	0.489	0.102
Goal 10	0.049	0.392	-0.098	-0.150	0.270	-0.005	-0.338	-0.213	-0.176	1.000	-0.314	0.392	0.248	-0.390	0.294	-0.233	0.047
Goal 11	0.577	0.216	0.711	0.246	0.160	0.691	0.670	-0.158	0.493	-0.314	1.000	-0.516	-0.556	-0.093	-0.277	0.546	0.204
Goal 12	-0.725	0.296	-0.777	-0.611	-0.044	-0.414	-0.709	-0.119	-0.649	0.392	-0.516	1.000	0.949	0.007	-0.100	-0.551	-0.414
Goal 13	-0.831	0.118	-0.851	-0.656	-0.242	-0.530	-0.728	-0.191	-0.770	0.248	-0.556	0.949	1.000	-0.025	-0.051	-0.577	-0.393
Goal 14	-0.385	-0.389	-0.129	-0.021	-0.179	0.050	0.082	0.175	-0.125	-0.390	-0.093	0.007	-0.025	1.000	0.461	-0.371	0.361
Goal 15	-0.067	-0.365	-0.054	-0.019	-0.051	-0.167	-0.232	0.025	-0.253	0.294	-0.277	-0.100	-0.051	0.461	1.000	-0.332	0.386
Goal 16	0.587	0.151	0.546	0.375	0.154	0.474	0.542	0.135	0.489	-0.233	0.546	-0.551	-0.577	-0.371	-0.332	1.000	0.016
Goal 17	0.247	-0.379	0.326	0.239	-0.116	0.314	0.349	-0.046	0.102	0.047	0.204	-0.414	-0.393	0.361	0.386	0.016	1.000

Figure 4.10 – SDG correlation analysis (East and South Asia)

In general, the correlation patterns for the six regional groups resemble the overall structure that has been observed on the global level and the different income groups by arranging the seventeen goals into three groups. While deviations from this classification can be observed in numerous incidents, its overall structure remains visible for all regional groups.

In East and South Asia, SDGs 12 and 13 are the goals with the most negative correlations across the agenda. The correlation between these two goals however is strongly positive with a correlation coefficient of 0.949, the highest value of any SDG pair across the income and regional groupings. In contrast to the global correlation pattern, overall correlations of these goals with those in group A is much lower than at the global level, although their correlation with SDGs 1, 3, 4, 6, 7, 11 and 16 can still be classified as significant or strong negative. On the other hand, both goals even have weak positive correlations with SDGs 2 and 10.

Within group A, SDGs 8 and 10 are notable exceptions to the overall correlation patterns, as the corresponding values are significantly lower than on the global level, with the exception of correlations with SDGs 12 and 13. While a general trend of less significant and sometimes negative correlations within group A has been observed for all income groups compared to the global level, the same can be said for all regional groups, including East and South Asia.

Despite notable deviations of correlation coefficients from the global level in group C, there are no changes regarding the significance of such interrelations involving these goals. It is worth noting however that increased correlations can be observed within this group at values of 0.461 (SDGs 14 and 15), 0.386 (SDGs 15 and 17) and 0.361 (SDGs 14 and 17).

4.3.2.2.2. Eastern Europe and Central Asia

E_Euro (n=23)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.395	0.668	0.699	0.055	0.469	0.672	0.310	0.762	0.675	0.551	0.135	-0.465	-0.319	0.727	0.560	0.155	0.274
Goal 1	1.000	-0.064	0.314	0.037	0.227	0.309	0.169	0.297	0.551	0.324	-0.005	-0.407	-0.290	-0.492	-0.039	-0.114	0.215
Goal 2	-0.064	1.000	0.594	-0.272	0.103	0.367	0.108	0.427	0.378	0.144	0.030	-0.288	-0.178	0.818	0.486	0.251	0.272
Goal 3	0.314	0.594	1.000	0.202	0.281	0.618	0.085	0.555	0.751	0.125	-0.043	-0.675	-0.443	0.445	0.529	0.378	0.053
Goal 4	0.037	-0.272	0.202	1.000	0.143	0.187	0.266	0.126	0.238	0.148	0.233	-0.129	-0.246	-0.409	0.034	0.378	-0.081
Goal 5	0.227	0.103	0.281	0.143	1.000	0.216	0.292	0.636	0.386	0.236	0.302	-0.184	-0.271	0.245	-0.011	0.042	0.114
Goal 6	0.309	0.367	0.618	0.187	0.216	1.000	0.037	0.568	0.643	0.105	0.042	-0.572	-0.449	0.564	0.433	0.247	0.036
Goal 7	0.169	0.108	0.085	0.266	0.292	0.037	1.000	0.380	0.326	0.203	0.265	-0.001	-0.004	0.236	0.312	0.233	-0.241
Goal 8	0.297	0.427	0.555	0.126	0.636	0.568	0.380	1.000	0.739	0.226	0.307	-0.591	-0.526	0.655	0.443	0.217	-0.104
Goal 9	0.551	0.378	0.751	0.238	0.386	0.643	0.326	0.739	1.000	-0.015	0.065	-0.771	-0.687	0.364	0.418	0.357	-0.044
Goal 10	0.324	0.144	0.125	0.148	0.236	0.105	0.203	0.226	-0.015	1.000	-0.041	-0.118	-0.034	-0.118	0.133	-0.327	0.376
Goal 11	-0.005	0.030	-0.043	0.233	0.302	0.042	0.265	0.307	0.065	-0.041	1.000	0.098	-0.105	0.318	0.206	0.191	-0.221
Goal 12	-0.407	-0.288	-0.675	-0.129	-0.184	-0.572	-0.001	-0.591	-0.771	-0.118	0.098	1.000	0.741	-0.164	-0.402	-0.173	0.010
Goal 13	-0.290	-0.178	-0.443	-0.246	-0.271	-0.449	-0.004	-0.526	-0.687	-0.034	-0.105	0.741	1.000	-0.227	-0.216	-0.248	0.100
Goal 14	-0.492	0.818	0.445	-0.409	0.245	0.564	0.236	0.655	0.364	-0.118	0.318	-0.164	-0.227	1.000	0.445	0.418	-0.318
Goal 15	-0.039	0.486	0.529	0.034	-0.011	0.433	0.312	0.443	0.418	0.133	0.206	-0.402	-0.216	0.445	1.000	0.006	-0.134
Goal 16	-0.114	0.251	0.378	0.378	0.042	0.247	0.233	0.217	0.357	-0.327	0.191	-0.173	-0.248	0.418	0.006	1.000	-0.283
Goal 17	0.215	0.272	0.053	-0.081	0.114	0.036	-0.241	-0.104	-0.044	0.376	-0.221	0.010	0.100	-0.318	-0.134	-0.283	1.000

Figure 4.11 – SDG correlation analysis (Eastern Europe and Central Asia)

Similarly to the case of East and South Asia, an SDG correlation analysis of Eastern Europe and Central Asia shows that a few goals in group A have significant lower correlation rates than they have on the global level or in other world regions. In Eastern Europe and Central Asia, this is particularly the case for SDGs 1, 4, 7, 11 and 16, which all have a weak correlation with the 2030 Agenda overall score (compared with a significant or strong correlation globally). In addition, some SDG pairs involving these goals are signified with a negative correlation coefficient, which remains at a weak level in all such cases. The most significant examples are the correlations of SDGs 2 and 4 (-0.272 compared to 0.774 globally), SDGs 1 and 16 (-0.114 compared to 0.731 globally) as well as SDGs 10 and 16 (-0.327 compared to 0.476 globally).

The correlation coefficients for goals in group B also follow the previously observed trend of less significant negative correlations compared to those on the global level. Nevertheless, all interrelations but one between groups A and B remain on the negative spectrum, although at a weak rate in most cases. The only significant negative correlations that remain are those of SDG 12 with SDGs 3, 6, 8 and 9 as well as those of SDG 13 with SDGs 8 and 9. The most notable difference can be observed for the interrelations of both goals with SDGs 7 and 11, which result in an almost non-existent correlation between these goals.

The most interesting SDG group for Eastern Europe and Central Asia is group C, which has the least significant correlations on the global level, most income and regional groups. In this case however, SDGs 14 and 15 have one of the highest overall correlation coefficients as well as positive correlations with several other goals. With an overall correlation coefficient of 0.727 (the second highest after SDG 8), SDG 14 has significant or strong positive correlations with SDGs 2, 6 and 8, while SDG 15 has a significant positive correlation with SDG 3.

4.3.2.2.3. Latin America and the Caribbean

LAC (n=24)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.523	0.508	0.738	0.567	0.761	0.593	0.492	0.209	0.716	0.220	0.427	-0.017	-0.047	0.473	-0.018	0.456	0.236
Goal 1	1.000	0.357	0.552	0.639	0.421	0.264	0.411	0.219	0.520	0.195	0.303	-0.494	-0.494	0.009	-0.057	0.441	-0.024
Goal 2	0.357	1.000	0.308	0.316	0.170	0.536	0.301	-0.039	0.453	0.059	0.077	-0.372	-0.183	0.260	-0.233	0.241	0.162
Goal 3	0.552	0.308	1.000	0.561	0.643	0.506	0.501	0.157	0.677	0.063	0.357	-0.173	-0.298	0.164	-0.119	0.698	0.266
Goal 4	0.639	0.316	0.561	1.000	0.532	0.206	0.455	0.246	0.563	0.209	-0.146	-0.306	-0.382	0.147	0.038	0.368	0.289
Goal 5	0.421	0.170	0.643	0.532	1.000	0.155	0.410	0.244	0.503	0.265	0.207	-0.042	-0.187	0.325	0.296	0.551	0.341
Goal 6	0.264	0.536	0.506	0.206	0.155	1.000	0.563	0.032	0.665	-0.401	0.256	-0.069	-0.089	0.413	-0.232	0.110	0.072
Goal 7	0.411	0.301	0.501	0.455	0.410	0.563	1.000	0.033	0.769	-0.216	0.207	-0.577	-0.513	0.039	0.153	0.476	0.438
Goal 8	0.219	-0.039	0.157	0.246	0.244	0.032	0.033	1.000	0.237	-0.205	-0.035	-0.055	-0.293	0.244	0.249	-0.003	0.015
Goal 9	0.520	0.453	0.677	0.563	0.503	0.665	0.769	0.237	1.000	-0.185	0.321	-0.371	-0.363	0.202	-0.022	0.431	0.167
Goal 10	0.195	0.059	0.063	0.209	0.265	-0.401	-0.216	-0.205	-0.185	1.000	-0.003	0.015	0.168	-0.238	-0.029	0.179	0.251
Goal 11	0.303	0.077	0.357	-0.146	0.207	0.256	0.207	-0.035	0.321	-0.003	1.000	-0.087	-0.048	0.053	0.039	0.415	0.034
Goal 12	-0.494	-0.372	-0.173	-0.306	-0.042	-0.069	-0.577	-0.055	-0.371	0.015	-0.087	1.000	0.803	0.363	-0.171	-0.526	-0.383
Goal 13	-0.494	-0.183	-0.298	-0.382	-0.187	-0.089	-0.513	-0.293	-0.363	0.168	-0.048	0.803	1.000	0.168	-0.264	-0.575	-0.421
Goal 14	0.009	0.260	0.164	0.147	0.325	0.413	0.039	0.244	0.202	-0.238	0.053	0.363	0.168	1.000	0.185	-0.097	-0.172
Goal 15	-0.057	-0.233	-0.119	0.038	0.296	-0.232	0.153	0.249	-0.022	-0.029	0.039	-0.171	-0.264	0.185	1.000	0.024	0.017
Goal 16	0.441	0.241	0.698	0.368	0.551	0.110	0.476	-0.003	0.431	0.179	0.415	-0.526	-0.575	-0.097	0.024	1.000	0.461
Goal 17	-0.024	0.162	0.266	0.289	0.341	0.072	0.438	0.015	0.167	0.251	0.034	-0.383	-0.421	-0.172	0.017	0.461	1.000

Figure 4.12 – SDG correlation analysis (Latin America and the Caribbean)

Similarly to the previous regional analyses, the correlation matrix for Latin America and the Caribbean mostly follows the general structure of three categories. There are nevertheless some major differences in all three groups, which results in an intermingling of these groups.

The correlations within group A resemble the observations made for East and South Asia, as SDGs 8 and 10 have particularly less significant correlation coefficients with the overall score and negative correlation coefficients with some goals. The correlation between SDGs 6 and 10 ranks at a remarkable -0.401, which almost puts it in the “significant negative” category. Correlation coefficients related to SDG 8 have decreased the most compared to the global level with an average difference of -0.518 and the lowest overall correlation within group A.

As for group B, the correlations of SDGs 12 and 13 with the 2030 Agenda overall score are significantly lower than on the global level and most other regional groups. Their relations with other goals are quite diverse, ranging from -0.577 to 0.168 in group A and -0.421 to 0.363 in group C, respectively. This observation indicates that trade-offs between these groups are less prevalent than in other regional groups, while the correlation coefficient between SDGs 12 and 13 ranks at a high value of 0.803, which is the highest value across the entire matrix.

The goals included in group C also show a remarkable correlation pattern, as the values for SDGs 14 and 17 seem to align with the goals in group A. While SDG 17 only shows minor differences from the values observed on the global level, such differences are larger for SDG 14, as its overall correlation coefficient of 0.473 is close to the “significant positive” category.

All in all, Latin America and the Caribbean is the region with the highest average correlation coefficient at 0.402 across all seventeen goals (compared to 0.489 globally).

4.3.2.2.4. Middle East and North Africa

MENA (n=16)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.452	0.428	0.231	0.571	0.414	0.137	-0.026	0.422	0.165	0.582	0.717	0.029	0.060	0.315	0.703	0.281	0.096
Goal 1	1.000	-0.048	0.690	0.429	0.548	-0.333	-0.595	0.619	0.262	0.833	0.262	-0.143	-0.310	-0.214	0.071	-0.357	0.071
Goal 2	-0.048	1.000	0.741	0.600	0.829	-0.026	0.512	0.503	0.615	0.345	0.226	-0.591	-0.550	0.403	0.403	0.635	-0.506
Goal 3	0.690	0.741	1.000	0.682	0.653	-0.259	0.288	0.771	0.818	0.736	0.097	-0.850	-0.879	0.215	0.024	0.547	-0.515
Goal 4	0.429	0.600	0.682	1.000	0.497	-0.203	0.147	0.747	0.565	0.509	0.135	-0.574	-0.526	0.415	0.235	0.329	-0.021
Goal 5	0.548	0.829	0.653	0.497	1.000	-0.021	0.494	0.362	0.624	0.600	0.106	-0.553	-0.526	0.129	0.388	0.532	-0.459
Goal 6	-0.333	-0.026	-0.259	-0.203	-0.021	1.000	0.285	0.000	-0.459	-0.273	-0.015	0.285	0.329	-0.394	0.359	-0.276	-0.135
Goal 7	-0.595	0.512	0.288	0.147	0.494	0.285	1.000	0.012	0.365	-0.227	-0.115	-0.476	-0.297	0.018	-0.047	0.256	-0.374
Goal 8	0.619	0.503	0.771	0.747	0.362	0.000	0.012	1.000	0.553	0.600	0.100	-0.482	-0.568	0.291	0.285	0.324	-0.438
Goal 9	0.262	0.615	0.818	0.565	0.624	-0.459	0.365	0.553	1.000	0.418	0.138	-0.844	-0.859	0.253	-0.071	0.594	-0.468
Goal 10	0.833	0.345	0.736	0.509	0.600	-0.273	-0.227	0.600	0.418	1.000	0.627	-0.373	-0.455	-0.173	0.164	0.391	-0.027
Goal 11	0.262	0.226	0.097	0.135	0.106	-0.015	-0.115	0.100	0.138	0.627	1.000	0.029	0.076	0.297	0.347	0.338	0.112
Goal 12	-0.143	-0.591	-0.850	-0.574	-0.553	0.285	-0.476	-0.482	-0.844	-0.373	0.029	1.000	0.926	-0.100	0.274	-0.444	0.353
Goal 13	-0.310	-0.550	-0.879	-0.526	-0.526	0.329	-0.297	-0.568	-0.859	-0.455	0.076	0.926	1.000	-0.047	0.291	-0.429	0.421
Goal 14	-0.214	0.403	0.215	0.415	0.129	-0.394	0.018	0.291	0.253	-0.173	0.297	-0.100	-0.047	1.000	0.238	0.182	-0.144
Goal 15	0.071	0.403	0.024	0.235	0.388	0.359	-0.047	0.285	-0.071	0.164	0.347	0.274	0.291	0.238	1.000	0.082	-0.229
Goal 16	-0.357	0.635	0.547	0.329	0.532	-0.276	0.256	0.324	0.594	0.391	0.338	-0.444	-0.429	0.182	0.082	1.000	-0.165
Goal 17	0.071	-0.506	-0.515	-0.021	-0.459	-0.135	-0.374	-0.438	-0.468	-0.027	0.112	0.353	0.421	-0.144	-0.229	-0.165	1.000

Figure 4.13 – SDG correlation analysis (Middle East and North Africa)

Among the six regional groupings that have been analysed, the correlation analysis for the Middle East and North Africa certainly produced the most remarkable results. A difference between the three groups is barely visible, as their corresponding correlation coefficients are similar. With the rare exception of SDG 7 (-0.026), they all fall into the positive half of the spectrum, including SDGs 12 (0.029 compared to -0.657 globally) and 13 (0.060 compared to -0.736 globally). However, the most notable differences can be seen within the three groups.

This is particularly the case with group A, which has almost consistently lower correlation coefficients than at the global level. This difference exceeds a value of 1 in numerous cases, such as the correlation between SDGs 1 and 7 (-0.595 compared to 0.765), which correlates significantly positive globally and significantly negative in this case. This is the lowest correlation coefficient for any two goals within group A that is evident for any regional group. In addition to SDG 7, SDGs 1 and 6 also have several negative correlations within group A.

Concerning the relations between groups A and B, the correlation coefficient remains weak or significant negative in most cases. Compared to the global level however, a remarkable difference can be observed for the correlations of SDGs 12 and 13 with SDGs 1, 6, 11 and 17, whose corresponding values rise by more than 0.5, resulting in a few positive correlations.

Another notable exception for this regional group is the high correlation coefficient for SDG 15 at 0.703, which is the second highest across the seventeen goals. This applies to a lesser degree for SDG 14 as well, which is also positively correlated. While all these examples are remarkable deviations from the global analysis and other regional groups, it is important to note that this group only includes 16 countries, which might cause a wider range of numbers.

4.3.2.2.5. OECD members

OECD (n=36)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.404	0.422	0.382	0.186	0.610	0.379	0.562	0.465	0.550	0.783	0.516	-0.350	-0.394	-0.006	0.364	0.518	0.182
Goal 1	1.000	0.146	0.370	0.102	0.352	0.109	0.208	0.347	0.307	0.475	0.480	-0.519	-0.486	-0.209	0.030	0.548	0.209
Goal 2	0.146	1.000	0.063	0.002	-0.104	0.101	0.068	0.212	0.327	0.368	0.162	-0.100	-0.103	-0.122	0.191	0.156	0.035
Goal 3	0.370	0.063	1.000	0.253	0.576	0.107	0.595	0.041	0.726	0.561	0.399	-0.737	-0.661	-0.291	-0.205	0.557	0.414
Goal 4	0.102	0.002	0.253	1.000	0.296	0.005	0.191	0.111	0.229	0.079	0.089	-0.330	-0.308	0.027	-0.126	0.194	0.273
Goal 5	0.352	-0.104	0.576	0.296	1.000	0.286	0.747	0.027	0.500	0.544	0.554	-0.640	-0.453	0.058	-0.055	0.514	0.391
Goal 6	0.109	0.101	0.107	0.005	0.286	1.000	0.159	0.236	0.097	0.174	0.248	-0.207	-0.112	0.266	0.295	0.315	-0.086
Goal 7	0.208	0.068	0.595	0.191	0.747	0.159	1.000	0.147	0.587	0.515	0.298	-0.457	-0.287	-0.204	-0.212	0.408	0.329
Goal 8	0.347	0.212	0.041	0.111	0.027	0.236	0.147	1.000	0.260	0.402	0.098	-0.077	-0.264	-0.152	0.298	0.450	-0.138
Goal 9	0.307	0.327	0.726	0.229	0.500	0.097	0.587	0.260	1.000	0.543	0.395	-0.572	-0.595	-0.208	-0.203	0.376	0.405
Goal 10	0.475	0.368	0.561	0.079	0.544	0.174	0.515	0.402	0.543	1.000	0.468	-0.548	-0.584	-0.271	0.279	0.653	0.196
Goal 11	0.480	0.162	0.399	0.089	0.554	0.248	0.298	0.098	0.395	0.468	1.000	-0.605	-0.599	0.146	0.200	0.384	0.051
Goal 12	-0.519	-0.100	-0.737	-0.330	-0.640	-0.207	-0.457	-0.077	-0.572	-0.548	-0.605	1.000	0.827	0.035	0.067	-0.663	-0.320
Goal 13	-0.486	-0.103	-0.661	-0.308	-0.453	-0.112	-0.287	-0.264	-0.595	-0.584	-0.599	0.827	1.000	0.021	0.033	-0.657	-0.257
Goal 14	-0.209	-0.122	-0.291	0.027	0.058	0.266	-0.204	-0.152	-0.208	-0.271	0.146	0.035	0.021	1.000	0.080	-0.102	-0.137
Goal 15	0.030	0.191	-0.205	-0.126	-0.055	0.295	-0.212	0.298	-0.203	0.279	0.200	0.067	0.033	0.080	1.000	0.152	-0.491
Goal 16	0.548	0.156	0.557	0.194	0.514	0.315	0.408	0.450	0.376	0.653	0.384	-0.663	-0.657	-0.102	0.152	1.000	0.227
Goal 17	0.209	0.035	0.414	0.273	0.391	-0.086	0.329	-0.138	0.405	0.196	0.051	-0.320	-0.257	-0.137	-0.491	0.227	1.000

Figure 4.14 – SDG correlation analysis (OECD members)

Because of the high concentration of high-income countries among OECD member states, the correlation patterns are very similar for these two groups. Nevertheless, it is remarkable that the variance of correlation coefficients across the matrix above is somewhat higher than it is in the case of high-income countries. This is particularly visible for the goals in group B: SDG 12 has a significant negative correlation with seven goals (compared to two for high-income countries), while SDG 13 has a significant negative correlation with five goals (compared to one for high-income countries). In this context, it is worthwhile to mention that this matrix includes fewer countries, which might result in a more extreme variance across the chart.

The most notable difference for OECD members in comparison with the global analysis and other regional groups is the low correlation coefficient for most SDG pairs within group A. While only one pair (SDGs 2 and 5) has a weak negative correlation, only a few surpass the mark of 0.5 which puts them into the “significant positive” category. The most notable case in that regard is SDG 4, whose overall correlation coefficient (0.186) is significantly lower than it is on the global level (0.670). The only exception to this is SDG 5, whose overall correlation and correlation coefficients across the agenda are similar to their global equivalents.

Regarding group B, correlation coefficients are less significant than at the global level, but more significant than they are for high-income countries and some other regional groups. A similar observation can be made for the goals in group C, whose correlation coefficients have a larger variance, even though they remain insignificant from an analytical point of view. As seen before, the strongest positive correlation is that of SDGs 12 and 13. With a correlation coefficient of 0.827, it is the only strong positive correlation for the group of OECD members.

4.3.2.2.6. Sub-Saharan Africa

Africa (n=45)	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
Overall	0.705	0.411	0.724	0.687	0.489	0.641	0.664	0.514	0.761	-0.129	0.550	-0.181	-0.708	-0.050	0.053	0.641	0.182
Goal 1	1.000	0.198	0.514	0.320	0.029	0.548	0.594	0.333	0.681	0.137	0.299	-0.183	-0.556	-0.173	-0.155	0.506	-0.054
Goal 2	0.198	1.000	0.281	0.249	0.147	0.291	0.110	0.494	0.338	0.083	0.104	0.254	-0.163	-0.038	-0.034	0.182	-0.149
Goal 3	0.514	0.281	1.000	0.565	0.428	0.483	0.481	0.301	0.632	-0.133	0.510	-0.365	-0.460	-0.327	-0.165	0.742	0.126
Goal 4	0.320	0.249	0.565	1.000	0.701	0.411	0.500	0.260	0.567	-0.457	0.562	-0.271	-0.653	-0.193	-0.129	0.457	0.224
Goal 5	0.029	0.147	0.428	0.701	1.000	0.273	0.277	0.227	0.411	-0.517	0.447	-0.144	-0.468	-0.043	-0.213	0.292	0.303
Goal 6	0.548	0.291	0.483	0.411	0.273	1.000	0.433	0.156	0.593	-0.297	0.446	-0.228	-0.648	-0.107	0.064	0.411	0.179
Goal 7	0.594	0.110	0.481	0.500	0.277	0.433	1.000	0.167	0.623	-0.311	0.372	-0.215	-0.719	-0.241	-0.081	0.408	0.130
Goal 8	0.333	0.494	0.301	0.260	0.227	0.156	0.167	1.000	0.395	0.124	0.190	0.343	-0.173	0.072	-0.083	0.385	-0.270
Goal 9	0.681	0.338	0.632	0.567	0.411	0.593	0.623	0.395	1.000	-0.308	0.405	-0.259	-0.710	-0.243	-0.091	0.459	0.093
Goal 10	0.137	0.083	-0.133	-0.457	-0.517	-0.297	-0.311	0.124	-0.308	1.000	-0.396	0.267	0.505	0.313	0.055	-0.110	-0.378
Goal 11	0.299	0.104	0.510	0.562	0.447	0.446	0.372	0.190	0.405	-0.396	1.000	-0.355	-0.482	-0.143	-0.308	0.563	0.313
Goal 12	-0.183	0.254	-0.365	-0.271	-0.144	-0.228	-0.215	0.343	-0.259	0.267	-0.355	1.000	0.218	0.346	0.031	-0.292	-0.245
Goal 13	-0.556	-0.163	-0.460	-0.653	-0.468	-0.648	-0.719	-0.173	-0.710	0.505	-0.482	0.218	1.000	0.153	-0.060	-0.367	-0.295
Goal 14	-0.173	-0.038	-0.327	-0.193	-0.043	-0.107	-0.241	0.072	-0.243	0.313	-0.143	0.346	0.153	1.000	0.234	-0.150	-0.170
Goal 15	-0.155	-0.034	-0.165	-0.129	-0.213	0.064	-0.081	-0.083	-0.091	0.055	-0.308	0.031	-0.060	0.234	1.000	-0.137	0.257
Goal 16	0.506	0.182	0.742	0.457	0.292	0.411	0.408	0.385	0.459	-0.110	0.563	-0.292	-0.367	-0.150	-0.137	1.000	0.217
Goal 17	-0.054	-0.149	0.126	0.224	0.303	0.179	0.130	-0.270	0.093	-0.378	0.313	-0.245	-0.295	-0.170	0.257	0.217	1.000

Figure 4.15 – SDG correlation analysis (Sub-Saharan Africa)

The analysis for SDG correlations in Sub-Saharan Africa shows two significant deviations from the global analysis as well as the observation for other regions: A negative correlation coefficient for SDG 10 and a negative, though much more insignificant correlation coefficient for SDG 12. While their difference amounts to 1.257 on the global level, it decreases significantly to a mere 0.052 in the case of Sub-Saharan Africa. Interestingly, the correlation between these goals themselves is not that different (0.267 and 0.188, respectively). Consequently, these two goals also show very similar correlation patterns across the agenda similar to those of group C, despite being allocated into groups A (SDG 10) and B (SDG 12).

These differences result in negative correlations of SDG 10 with several goals in group A. Most notably, the correlation coefficient with SDG 5 ranks at -0.517 (compared to 0.180 on the global level) and is thus one of only two cases of a significant negative correlation within group A in any regional group. Further negative correlations of SDG 10, despite only falling into the “weak category”, include SDGs 3, 4, 5, 6, 9, 11 and 16. In addition to SDG 10, Sub-Saharan Africa also demonstrates notably lower correlations in the case of SDG 2.

Regarding SDG 12, all correlations except those with SDGs 13 and 17 are more positive, with four cases surpassing the value of 0, namely SDGs 2, 8, 10 and 14. Its correlation with SDG 13 however is much less significant than for the other regional groups, as was the case for the low-income countries compared to the other income groups. Regarding SDG 13, a remarkable difference can be observed due to a significant positive correlation with SDG 10 (0.505).

In contrast to the first two groups, deviations from the global analysis are very insignificant for group C, since all of the corresponding values remain in the range between -0.5 and 0.5.

4.3.2.3. Correlations with other indices

4.3.2.3.1. Gini coefficient

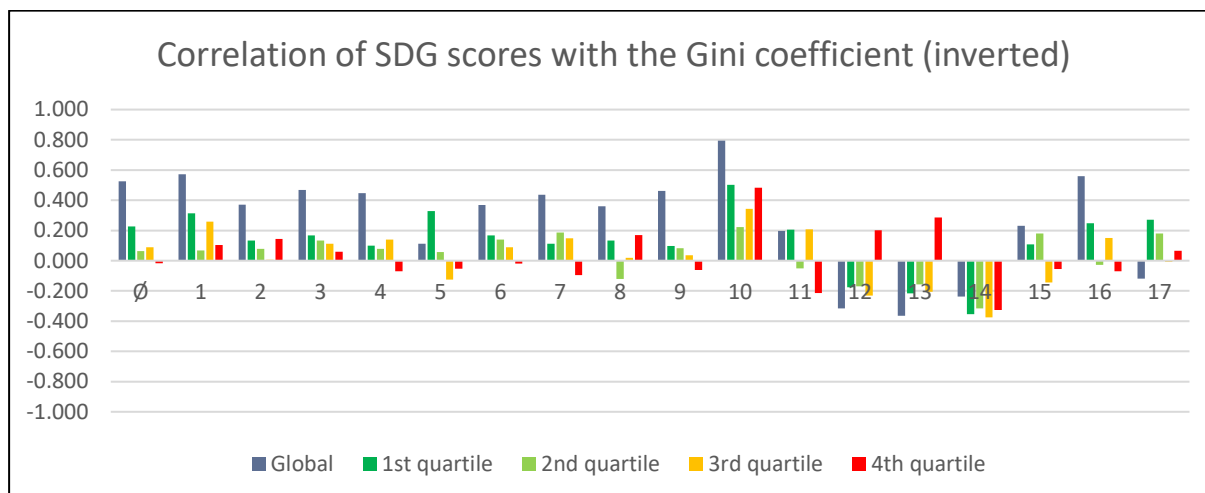


Figure 4.16 – SDG correlation analysis (Gini coefficient)

The Gini coefficient or Gini index is a measurement of income inequality that was developed by the Italian statistician and sociologist Corrado Gini. The coefficient ranks from a value of 0, indicating a completely equal distribution of income, to a value of 1, indicating the most unequal distribution of income (i.e., one person has all the income). The data used in this case is the most recent data which is published by the World Bank and includes 154 countries that were also included in the Sustainable Development Report. The correlation coefficients above are inverted to facilitate a comparison with the country groupings and the indices below. This means that a high correlation coefficient reflects a strong correlation with income equality.

In comparison with the previous analysis of correlations by income and regional groupings, the correlations of the SDG Index with the Gini coefficient seem to be much less significant. It should not surprise that the highest correlation coefficients can be observed for SDG 10, whose objectives reflect the Gini coefficient to a high extent. Other than that, the goals within group A mostly have positive correlations with income equality, with a correlation coefficient above 0.5 for SDGs 1 and 16 as well as the 2030 Agenda overall score. The most remarkable difference to the previous analyses, other than SDG 10, concerns the negative correlation of income equality with SDG 14, which is at a similar level to SDGs 12 and 13.

Another aspect that is evident from the chart above concerns the differences of correlation patterns across the four quartiles. The first quartile represents the countries with the highest income equality, whereas the fourth quartile represents the countries with the lowest income equality. Apart from SDGs 12 and 13, synergies between income equality and SDG achievement seem to be much more common in countries with a more equal income distribution.

4.3.2.3.2. Human Development Index

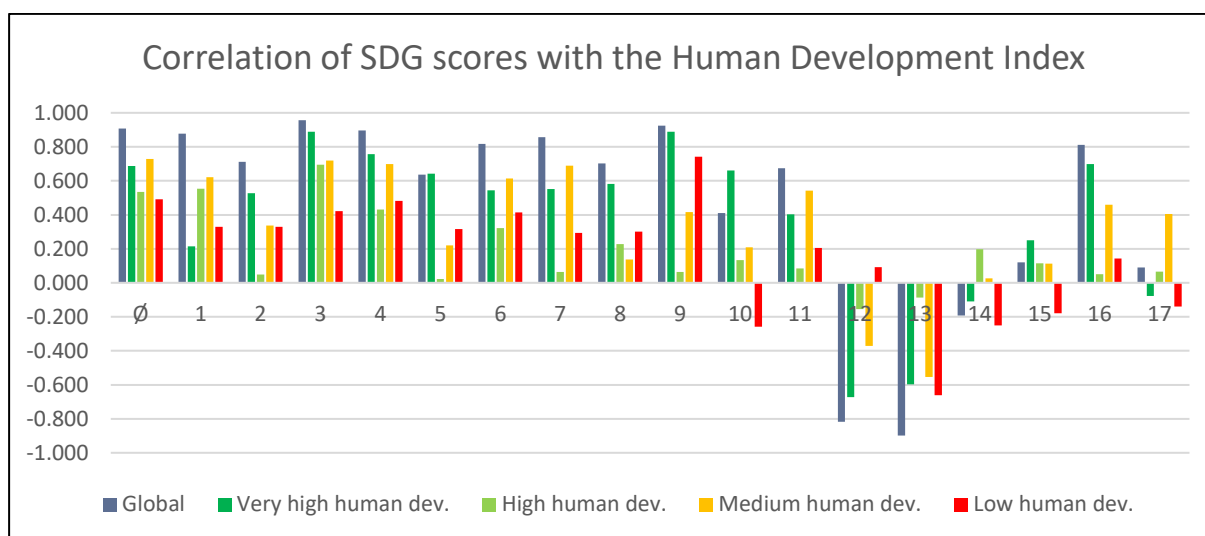


Figure 4.17 – SDG correlation analysis (Human Development Index)

The Human Development Index (HDI) is the most popular global measure of international and human development. It has been published annually by UNDP since 1990 along with its Human Development Report, which includes further analyses on equality and gender aspects. The standard index, which is used in this case, is composed of the life expectancy at birth, the education index (considering mean years and expected years of schooling) as well as the gross national income per capita. All included countries are attributed an index value for these three factors between 0 and 1, which are combined into an overall national index number of human development. Based on their index value, all countries are grouped into four categories, which are defined by predetermined values and thus different in size: very high ($HDI > 0.8$), high ($0.8 > HDI > 0.7$), medium ($0.7 > HDI > 0.55$) and low human development ($HDI < 0.55$).

Compared to the previous indices, the HDI has the strongest correlations with the SDG Index. On the global level, there are seven strong and four significant positive correlations, as well as two strong negative correlations (SDGs 12 and 13). A notable difference to the correlation patterns by income grouping regards the distribution of correlation patterns across the four groups, since they are not as coherent in this case: Whereas the countries with low human development are those with the lowest overall correlation, the group with the highest value is comprised of the countries with medium human development. While countries with very high human development are not far behind, this observation underlines that correlations between the HDI and the SDG Index are notably different. In terms of individual SDGs, the most significant differences between countries with very high and those with low human development (difference of more than 0.9) can be observed for SDGs 10 and 12. Once again, these differences are larger than those for the income groups or the other two indices above.

4.3.2.3.3. World Happiness Report ranking

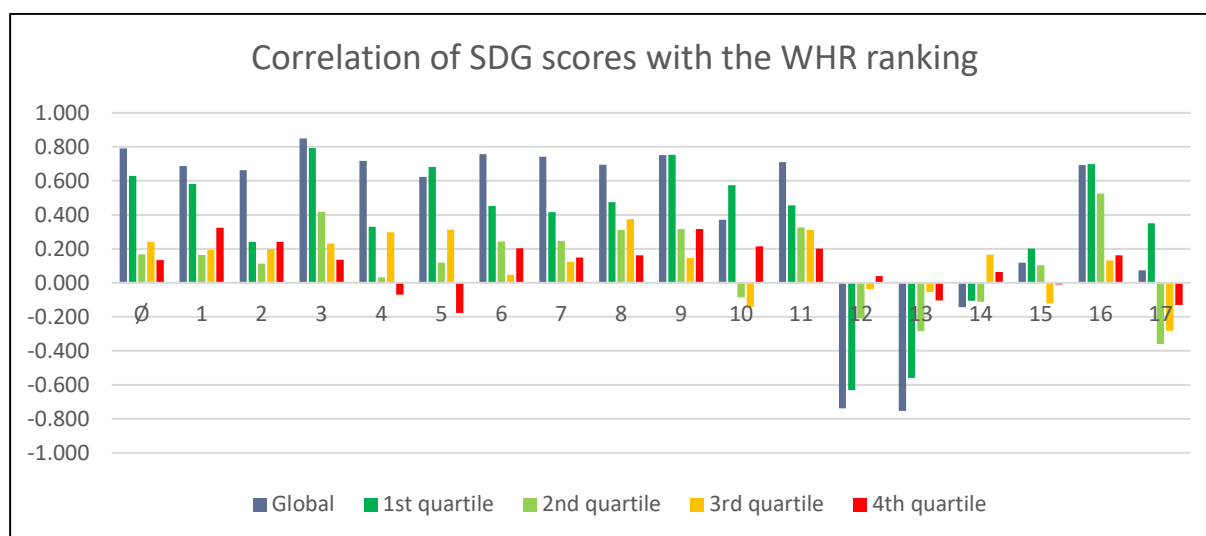


Figure 4.18 – SDG correlation analysis (World Happiness Report ranking)

The World Happiness Report (WHR) is published annually by the Sustainable Development Solutions Network (SDSN), co-author of the Sustainable Development Report. The ranking from the 2021 report is based on Gallup World Poll survey data from 2018 to 2020 and reflects subjective ratings of respondents regarding their quality of life and well-being on a scale from 0 (worst) to 10 (best). Subsequently, the authors divide these overall scores into six factors: income, health, someone to count on, freedom, generosity and trust (Helliwell et al. 2021: 50).

The correlation matrix shows a similar correlation pattern regarding the categorization of three distinct groups. However, there are major differences between the quartiles across all seventeen goals. Apart from SDG 14, countries that are among the 25% with the highest score have the most significant correlations with the SDG Index, regardless of whether these correlations are positive (SDGs 1 to 11 and 15 to 17) or negative (SDGs 12 to 14). The 2030 Agenda overall score correlates at a significant rate with the WHR ranking for these countries, whereas the correlation coefficients for the remaining three quartiles is much lower. Among these three quartiles, there is not a single correlation with any goal that can be considered significant, while for the first quartile this is the case for five goals (SDGs 3, 5, 9, 12 and 16).

The differences between the four quartiles, namely the first quartile and the other three, mark the largest disparities between country groupings for any aspect or grouping that has been considered in the correlation analysis. In consideration of the contributing factors of the index that have been identified by the authors of the World Happiness Report, the most notable aspect of this observation does not concern the high correlation coefficients within the first quartile, but rather the low correlation coefficients within the second and third quartiles.

4.3.3. Correlations on the national level

While the correlation patterns on the global level and the country groupings were calculated by applying Spearman's rank correlation coefficient, a correlation analysis on the national level cannot be executed with this method. As Spearman's ρ is based on a comparison of the country's ranks for the different goals, this method cannot be applied to an examination of individual countries. Therefore, a different method was applied to identify the case studies to be further analysed in terms of causal relations. A selection of case studies in the analytical chapter is inevitable on the national level because of the high amount of potential SDG pairs (22,576 in total, not accounting for data gaps), which cannot be portrayed here in detail.

To this end, it was decided to identify thirty case studies both for synergies and trade-offs on the national level based on a comparison of their national SDG scores with their respective income and regional groups. To identify the most significant synergies and trade-offs, a list with the deviations of individual goal scores from average scores for the income and regional groups was compiled for every country. As a result, the selection of case studies is very dependent on the categorization of countries into income and regional groups and individual country scores are mostly comparable within the respective group. The lists below shall thus not be understood as a ranking of the strongest synergies and trade-offs, but rather as a list of significant correlations as a basis for the subsequent selection of national case studies. The income and regional groups were selected as the comparison's foundation, as it seems most worthwhile to identify countries with significant deviations within their respective groups.

On the one hand, the most significant synergies for every country were identified based on the two goals with the highest scores compared to the country's income or regional grouping. These countries were then listed based on the second highest deviation to avoid a distortion that would be caused if only one goal had a significantly high score. Since this would be an insufficient observation for the identification of significant synergies, the list is not sorted by the combined deviation, although the order for both values is not very different.

On the other hand, the most significant trade-offs were identified based on the goal with the highest score and the goal with the lowest score compared to the country's income or regional grouping. These countries were then listed based on the second highest deviation as well regardless of whether this deviation is positive or negative. As seen in the table below, the order is determined by a comparison of the deviation for both goals that were analysed and not by the combined deviation that is illustrated in the last column. Similarly to the synergies, the order of both values is not fundamentally different, although slightly more in this case.

SYNERGIES BY INCOME GROUPING											
Rank	Country	Income group	Most deviating SDG score				2 nd most deviating SDG score				Combined deviation
			SDG	Nat.	Reg.	Dev.	SDG	Nat.	Reg.	Dev.	
1	Tajikistan	LIC	1	87.71	19.25	+68.46	7	91.23	37.34	+53.89	+122.35
2	Algeria	LMIC	10	88.67	51.63	+37.04	17	83.03	48.80	+34.22	+71.26
3	Ukraine	LMIC	10	98.69	51.63	+47.06	1	99.76	68.36	+31.41	+78.46
4	Moldova	LMIC	10	89.06	51.63	+37.43	1	99.65	68.36	+31.29	+68.72
5	Uzbekistan	LMIC	11	86.62	53.94	+32.68	5	73.89	42.95	+30.94	+63.62
6	Lesotho	LMIC	17	93.15	48.80	+44.34	5	73.46	42.95	+30.51	+74.85
7	Norway	HIC	10	100.00	67.51	+32.49	17	99.63	69.29	+30.34	+62.83
8	Kyrgyz Republic	LMIC	10	84.96	51.63	+33.34	11	83.84	53.94	+29.90	+63.24
9	Bosnia and Herzegovina	UMIC	17	98.23	62.42	+35.81	10	81.23	51.59	+29.69	+65.50
10	Tunisia	LMIC	17	80.63	48.80	+31.83	1	97.80	68.36	+29.44	+61.27
11	Vietnam	LMIC	5	72.05	42.95	+29.10	1	96.13	68.36	+27.77	+56.87
12	Eswatini	LMIC	11	83.39	53.94	+29.45	17	75.30	48.80	+26.50	+55.94
13	Bolivia	LMIC	11	81.60	53.94	+27.66	5	69.24	42.95	+26.28	+53.94
14	Cabo Verde	LMIC	5	72.43	42.95	+29.48	11	80.10	53.94	+26.16	+55.63
15	Lao PDR	LMIC	5	72.55	42.95	+29.60	11	80.00	53.94	+26.06	+55.66
SYNERGIES BY REGIONAL GROUPING											
Rank	Country	Regional group	Most deviating SDG score				2 nd most deviating SDG score				Combined deviation
			SDG	Nat.	Reg.	Dev.	SDG	Nat.	Reg.	Dev.	
1	Mauritius	Africa	1	98.79	22.33	+76.45	7	89.15	39.47	+49.68	+126.13
2	Gabon	Africa	1	86.30	22.33	+63.97	7	81.35	39.47	+41.88	+105.85
3	Mauritania	Africa	1	81.39	22.33	+59.05	10	85.61	44.43	+41.19	+100.24
4	South Africa	Africa	7	79.01	39.47	+39.54	9	57.57	20.72	+36.84	+76.38
5	Botswana	Africa	4	88.74	47.84	+40.89	1	58.53	22.33	+36.20	+77.09
6	Namibia	Africa	4	82.96	47.84	+35.11	5	86.04	51.71	+34.34	+69.45
7	Cabo Verde	Africa	7	81.33	39.47	+41.86	3	73.53	39.87	+33.66	+75.52
8	Sao Tome and Principe	Africa	4	82.90	47.84	+35.06	11	85.41	52.18	+33.23	+68.29
9	Gambia, The	Africa	1	67.29	22.33	+44.95	10	76.33	44.43	+31.90	+76.85
10	Norway	OECD	10	100.00	61.14	+38.86	17	99.63	67.84	+31.79	+70.65
11	Singapore	E_S_Asia	9	91.33	53.77	+37.56	11	94.37	62.82	+31.55	+69.11
12	United Arab Emirates	MENA	5	73.72	42.21	+31.51	9	73.57	43.81	+29.75	+61.26
13	Ghana	Africa	1	70.27	22.33	+47.94	4	76.52	47.84	+28.68	+76.61
14	Maldives	E_S_Asia	17	76.87	48.37	+28.50	7	96.74	68.94	+27.80	+56.31
15	Denmark	OECD	10	97.55	61.14	+36.41	15	92.94	65.23	+27.70	+64.11

Figure 4.19 – SDG correlation analysis (Synergies on the national level)

Based on the methodology outlined above, the identification of synergies on the national level reveals a notable pattern regarding the distribution of case studies across the different income and regional groups: Out of the fifteen countries listed in each section, twelve are considered lower-middle-income countries and ten are located in Sub-Saharan Africa. This distribution is primarily caused by the low regional scores for these groups, which gives countries in these groups a higher opportunity to exceed these scores by a significant amount. Both groupings show a different distribution of countries, although Cabo Verde and Norway are listed in both.

An interesting observation regards the goals that are included in the table above, as only eight goals are represented. Among this selection, the goals which are listed most often are SDG 1 (eleven times), SDG 10 (ten times) and SDGs 5, 11 and 17 (eight times each). The SDG pairs of goals 1 and 10 as well as 5 and 11 are represented four times as the most deviating SDG pair from the group average. The combined deviation exceeds the value of 100 four times, which are represented on the first place for the income groups and the first three places for the regional groups. These countries have a considerably strong lead over the following countries, especially Tajikistan for the income groups with a leading margin of more than 40 points.

TRADE-OFFS BY INCOME GROUPING										
Rank	Country	Income group	Most deviating SDG score (+)				Most deviating SDG score (-)			
			SDG	Nat.	Reg.	Dev.	SDG	Nat.	Reg.	Dev.
1	South Sudan	LIC	17	100.00	49.13	+50.87	4	1.64	48.73	-47.09
2	Lesotho	LMIC	17	93.15	48.80	+44.34	1	14.01	68.36	-54.35
3	Cuba	UMIC	17	100.00	62.42	+37.58	9	23.11	64.73	-41.62
4	Congo, Rep.	LMIC	15	91.29	55.84	+35.45	1	3.85	68.36	-64.51
5	Mauritania	LMIC	10	85.61	51.63	+33.99	4	39.70	75.88	-36.18
6	Norway	HIC	10	100.00	67.51	+32.49	13	20.93	62.37	-41.44
7	Yemen, Rep.	LIC	7	69.25	37.34	+31.91	5	6.72	48.06	-41.35
8	Bosnia and Herzegovina	UMIC	17	98.23	62.42	+35.81	9	33.10	64.73	-31.63
9	Vanuatu	LMIC	11	85.22	53.94	+31.28	7	34.92	66.47	-31.55
10	Latvia	HIC	15	97.84	67.77	+30.06	17	36.14	69.29	-33.15
11	Sao Tome and Principe	LMIC	11	85.41	53.94	+31.47	1	38.40	68.36	-29.96
12	Eswatini	LMIC	11	83.39	53.94	+29.45	10	0.00	51.63	-51.63
13	Benin	LMIC	15	85.21	55.84	+29.37	7	13.97	66.47	-52.50
14	Tanzania	LMIC	5	71.08	42.95	+28.13	1	23.42	68.36	-44.94
15	Mongolia	LMIC	1	95.65	68.36	+27.30	13	66.21	96.62	-30.41
TRADE-OFFS BY REGIONAL GROUPING										
Rank	Country	Regional group	Most deviating SDG score (+)				Most deviating SDG score (-)			
			SDG	Nat.	Reg.	Dev.	SDG	Nat.	Reg.	Dev.
1	South Sudan	Africa	17	100.00	50.57	+49.43	4	1.64	47.84	-46.20
2	Lesotho	Africa	17	93.15	50.57	+42.58	10	0.14	44.43	-44.29
3	Mauritius	Africa	1	98.79	22.33	+76.45	15	25.25	66.92	-41.67
4	Botswana	Africa	4	88.74	47.84	+40.89	10	4.81	44.43	-39.62
5	South Africa	Africa	7	79.01	39.47	+39.54	10	0.00	44.43	-44.43
6	Norway	OECD	10	100.00	61.14	+38.86	13	20.93	67.74	-46.81
7	Singapore	E_S_Asia	9	91.33	53.77	+37.56	12	17.77	90.27	-72.50
8	Brunei Darussalam	E_S_Asia	11	100.00	62.82	+37.18	13	13.31	93.65	-80.33
9	Niger	Africa	10	80.95	44.43	+36.52	4	8.57	47.84	-39.28
10	Namibia	Africa	4	82.96	47.84	+35.11	10	0.00	44.43	-44.43
11	Iceland	OECD	10	93.79	61.14	+32.66	12	27.68	62.18	-34.50
12	Latvia	OECD	15	97.84	65.23	+32.60	17	36.14	67.84	-31.69
13	United Arab Emirates	MENA	5	73.72	42.21	+31.51	13	28.85	85.29	-56.44
14	Eswatini	Africa	11	83.39	52.18	+31.21	10	0.00	44.43	-44.43
15	Malta	E_Euro_Asia	10	94.05	63.72	+30.32	12	43.13	80.93	-37.80

Figure 4.20 – SDG correlation analysis (Trade-offs on the national level)

The identification of trade-offs on the national level reveals a similar pattern to the synergy identification in terms of group clustering, although to a much lower extent. Out of the fifteen countries in each section, nine are considered lower-middle-income countries and eight are located in Sub-Saharan Africa. The overlapping on the other hand is larger, as five countries are represented in both groups (Eswatini, Latvia, Lesotho, Norway and South Sudan). Norway is thus the only country to be listed in all four sections of this correlation analysis on the national level because of its high score for SDGs 10 and 17 and its low score for SDG 13. Eswatini and Lesotho are listed in all sections apart from the synergies by regional grouping.

The table above includes nine goals in total, with SDG 10 as the most frequent with twelve times – six times on each side of the spectrum. The other most frequently represented goals include SDG 17 (eight times) as well as SDGs 1 and 4 (six times each), which are represented on both sides of the spectrum. SDGs 11, 13 and 15 are listed five times each, although only on one side of the spectrum (SDGs 11 and 15 on the positive, SDG 13 on the negative deviations). Out of the seventeen goals, SDGs 2, 6, 8, 14 and 16 are not represented in either the top fifteen synergies or trade-offs on the national level by income or regional grouping.

5. Contextualisation with previous literature and research

5.1. Correlations on the global level

The correlation analysis on the global level reveals three distinct groups of SDGs based on their correlation coefficient with the 2030 Agenda overall score and their interrelations with the other goals across the agenda. These results can be compared to previous studies with a similar methodology that have been conducted in previous years. It is important to underline however that differences in correlation patterns are not necessarily caused by the year in which the data was collected, since the SDG Index and Dashboards methodology has been adjusted over recent years. Nevertheless, a contextualisation with previous literature and research is essential for comparing these findings and putting them into a broader perspective, before assessing potential reasons for deviating correlation patterns in the following chapter.

As previously mentioned, the study by Fonseca et al. (2020) applies a similar method to the data from the Sustainable Development Report 2019, which allows for a direct comparison of the corresponding correlation matrix with the results from this MA thesis. Since both analyses are just one year apart, one might expect very similar correlation patterns across the entire agenda. While this is mostly true, the latest analysis shows more significant correlations at both ends of the spectrum. This can be observed across the entire matrix, while the general correlation patterns seem to be rather constant. A remarkable exception to this consistency and the only major difference between both analyses is the correlation pattern of SDG 13. In the latest analysis, it has a significant negative correlation with the agenda's overall score and negative correlations with all other goals apart from SDGs 12 and 14. However, in the analysis by Fonseca et al. (2020), it is considered to have weak correlations with all other goals and a weak correlation with the 2030 Agenda overall score that is prone towards 0. Apart from this major difference, the categorization into three groups can also be observed in this analysis.

The different outcomes for SDG 13 might be caused by a different selection of indicators, given that the Sustainable Development Report 2020 modified the consideration of CO₂ emissions for this goal, as the pertaining data source was changed to increase timeliness and country coverage. In addition, carbon accounting is no longer technology adjusted and fuel exports are now capped at the country's level of production (Sachs et al. 2020: 64). A short comparison of national SDG 13 scores in the 2019 and 2020 SDG Index and Dashboards indicates that some countries, whose score values have slightly changed, have moved up or down the ranking significantly. This may be attributed to the change in methodology to a significant extent.

It is worthwhile to mention that the authors of the 2020 correlation analysis themselves underlined that “particularly in the case of SDG13 (Climate action), it is surprising no significant correlation with other SDGs was found” (Fonseca et al. 2020: 12). In line with Stafford-Smith et al. (2017), they attribute this observation to open issues regarding SDG performance measurements, operationalization and interlinkages. The logarithmic distribution of SDG 13 scores facilitates notable changes in rank correlation compared to previous years, demonstrating the shortcomings of applying Spearman’s ρ . To that end, it should be reiterated that Spearman’s rank correlation only indicates a correlation’s significance regardless of its linearity.

A comparison of the correlation analysis with the one by Kroll et al. (2018) also reveals many similarities between both studies. Based on data from the SDG Index and Dashboards 2018, they found SDGs 1, 3, 7, 8 and 9 to have significant synergies with the other goals, whereas strong positive correlations were found for SDGs 1, 3, 4, 6, 7 and 9 in the correlation analysis above. SDG 8 has a correlation coefficient of 0.740, which is considered as significant positive. On the other hand, Kroll et al. found trade-offs particularly for SDGs 11, 14, 16 and 17. In contrast to Fonseca et al., it is notable that major trade-offs were also found for SDG 13, while SDG 12 had insufficient data for the analysis. Based on these findings, it seems understandable that these two goals would have the most significant negative correlations according to 2020 data. On the other hand, the trade-offs for SDGs 11 and 16 seem to contradict the correlation analysis above at first glance. The key difference between both studies in this regard is the methodology used by Kroll et al., as it depicts the number of countries for which synergies and trade-offs were found. Consequently, it is suggested that the rank correlation coefficient for these two goals would be significant negative for many individual countries, which may be observed at the country groupings or national levels. Since both goals also have a notable share of synergies, the difference between both analyses is not as large as it might seem.

Another correlation analysis across the 2030 Agenda by Pradhan et al. (2017) reached conclusions that are in line with both this MA thesis and the two studies mentioned above. It found synergetic relations of SDG 1 with most of the other goals and major trade-offs for SDG 12 (Pradhan et al. 2017: 1169). While the ranking of SDG pairs for both synergies and trade-offs has changed over the years, the general correlation patterns are quite similar. Beyond these three previous correlation analyses, studies that focused on a specific selection of goals are replicable with the data from the 2020 SDG Index and Dashboards, specifically for SDGs that were attributed to group A. Regarding the global analysis, the main aspect in the following chapter will thus address potential reasons for the allocation of the goals into three groups based on their correlation patterns, in particular the trade-offs between groups A and B.

5.2. Correlations by country grouping

5.2.1. Correlations by income grouping

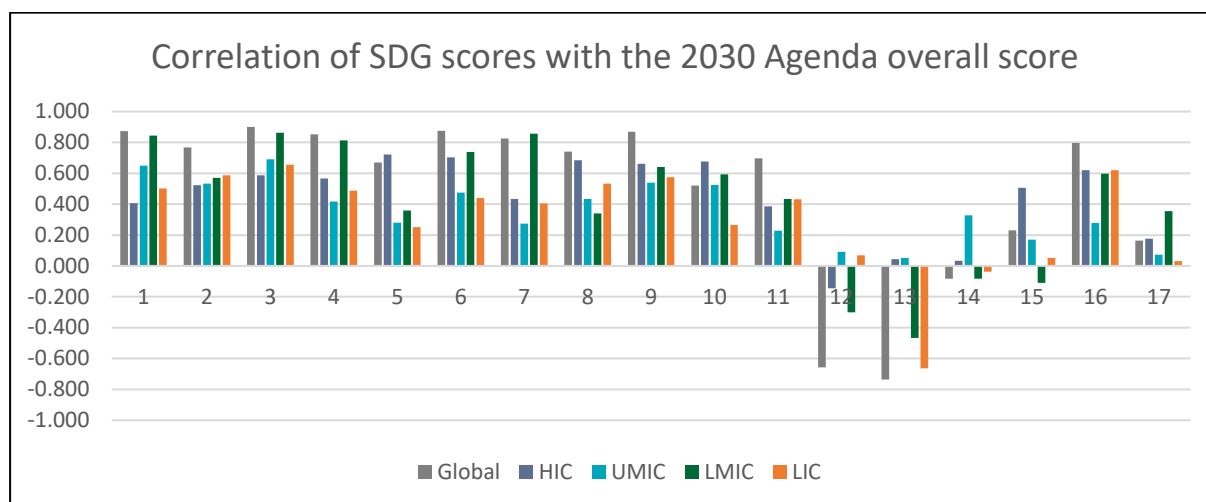


Figure 5.1 – Correlation of SDG scores with the overall score by income grouping

As visualised in the figure above, the correlation patterns for the four income groups are quite similar to those on the global level. At first glance, the most notable observation regards the significance of SDG interrelations, which is much higher on the global level than it is within any given income group. These differences are mostly caused by the number of countries that are included in each analysis and the distribution of SDG scores among the income groups. As these four groups are more homogenous in terms of their SDG performance, as can be seen in the raw data and the scatterplots, trends in SDG correlations are not as obvious as they are on the global level. In this context, it is important to keep in mind that the correlation coefficients above reflect the significance of the correlations, not their linear relation.

While the general correlation patterns across the 2030 Agenda seem very consistent for the four income groups, a more detailed analysis reveals some remarkable differences. Regarding interrelations with the overall score, LMIC have the most significant correlations on average. On the other hand, UMIC have the least significant correlations on average and deviate very significantly from the correlation patterns on the global level, as the correlation matrix with all SDG pairs hardly point out any significant correlation patterns. The opposite is true for the adjacent groups of HIC and LMIC whose correlation patterns are similar to the global one.

In terms of individual SDGs, those goals in group A show positive correlation patterns across all income groups. The most notable difference between the income groups regards goal 13 and its varying relations across the agenda, in particular with goal 12. Apart from that, the correlation patterns of SDGs 12, 14, 15 and 17 differ across the income groups, although at much less significant rates that are not sufficient for a detailed analysis on such differences.

The results from the correlation analysis reflect the observations by Kroll et al. (2019), who found “that the overall picture is very similar across all income groups” (Kroll et al. 2019: 7). The authors mention two significant differences across the income groups for goals 6 and 15, which are partially reflected in the illustration above: HICs have stronger synergies for goal 15 than the other income groups, even though the difference is not as significant as described by Kroll et al. Their study projected that goals 6 and 13 would have the highest share of trade-offs in HICs until 2030, which does not seem very likely from the results above.

Therefore, the subsequent chapter will analyse the following observations in further detail:

- Differences between high-income and low-income countries regarding SDG 13
- High significance of positive correlations in lower-middle-income countries
- Low significance of positive correlations in upper-middle-income countries

5.2.2. Correlations by regional grouping

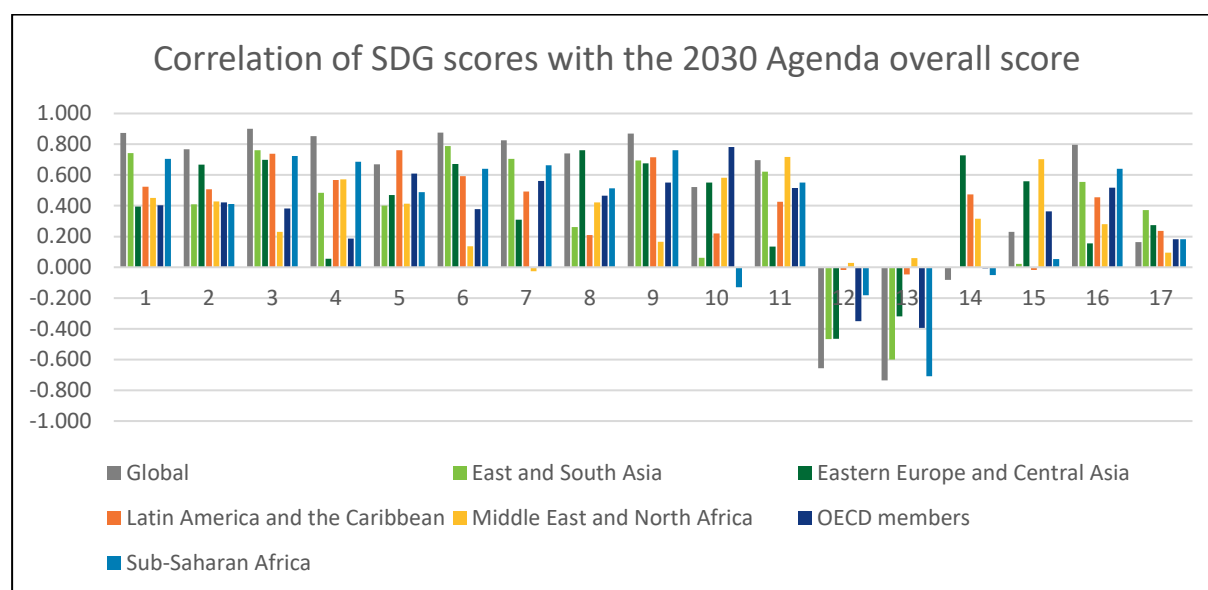


Figure 5.2 – Correlation of SDG scores with the overall score by regional grouping

In general, all regional groups in principle follow the global correlation pattern with three distinct groups with just a few exceptions. In comparison with the income groups though, correlation patterns across the six regional groups follow a much more diverse pattern, as correlation coefficients for some goals show a wide range of significance, which exceeds a value of 0.5 for twelve of the seventeen goals. Some of these deviations are significant enough to contrast the general pattern, as three negative correlations within group A and two positive correlations in group B with the overall score can be observed. However, these deviations are very close to a correlation coefficient of 0 and not significant enough for a detailed analysis.

Whereas the general correlation patterns are rather consistent across the six regional groups, their significance is not as coherent. Countries included in the MENA and OECD groups have the lowest correlation coefficients with an average of 0.328 across the entire 2030 Agenda. The group with the highest correlation coefficients is that of LAC countries with an average of 0.402. A contributing factor to this high score is a notable difference regarding goals 12 and 13, which do not correlate as negatively as they do in most of the other regional groups. This is also the case for the MENA countries, which in contrast have comparably insignificant correlation patterns for some SDGs within group A, notably goals 3, 6, 7, 9 and 16.

The findings from the correlation analysis on the regional level are partially congruent with those from the aforementioned study by Warchold et al. (2020). Both analyses found that Latin America has the highest share of synergies across the 2030 Agenda, but they are inconsistent regarding the region with the lowest synergies. Warchold et al. identified Africa to have the lowest share of synergies and trade-offs and the highest share of non-linear SDG interactions. While the group selection is slightly different in both studies, the correlation analysis and figure above depict Sub-Saharan Africa as third in terms of average correlation coefficient and attributes the most significant positive correlations for goals 4, 9 and 16 to this region.

Another difference in comparison to the study by Warchold et al. regards the coherence of correlation patterns across the different groups. The authors of the 2020 analysis found a larger number of similarities for the regional groups compared to the income groups, which implies that correlations across the 2030 Agenda would be more dependent on income rather than geographic location. This is not reflected in the correlation analysis above, as correlation coefficients vary more for the regional groups. As the difference is not very remarkable, both aspects appear to be of similar relevance for assessing the significance of SDG correlations.

All in all, the most significant deviations from the global correlation matrix can be observed for LAC and MENA countries. Although the average correlation coefficient for LAC countries is remarkably high, such differences are evenly distributed across the 2030 Agenda and cannot be attributed to a single goal, which makes it difficult to elaborate on potential reasons for this observation. In contrast, the case studies to be further examined shall be limited to those differences in correlation patterns that concern one region or a selection of a goals. Therefore, the subsequent chapter will analyse the following observations in further detail:

- Low significance of correlations in the MENA region regarding SDGs 3, 6, 7, 9 and 16
- Regional differences of correlation patterns regarding SDGs 12 and 13
- Regional differences of correlation patterns regarding SDGs 14 and 15

5.2.3. Correlations with other indices

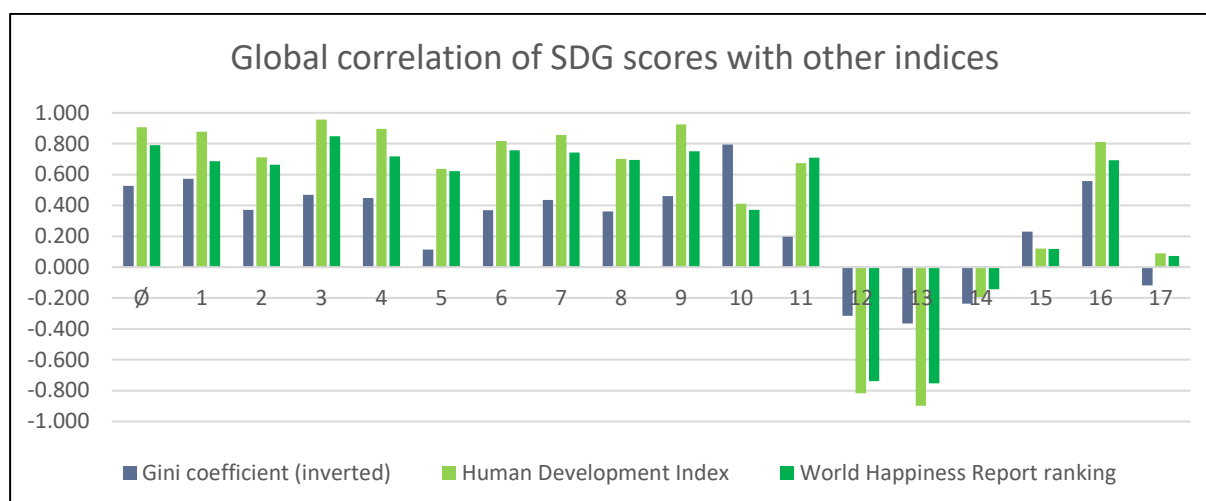


Figure 5.3 – Global correlation of SDG scores with other indices

A comparison of the three indices that were analysed above shows a coherent distribution in the significance of correlations patterns across the 2030 Agenda. While the WHR ranking and the Human Development Index have quite significant correlations with the SDG Index, which follow the previously observed pattern of three distinct groups, this is not the case for the Gini coefficient. Even though the same pattern is visible here as well, the significance of these correlations is very low and thus not sufficient for a detailed analysis of causal relations. The only exception to this is SDG 10, which by definition should have a strong synergy with the Gini coefficient, since both focus on measuring and overcoming income inequality.

Regarding the WHR ranking, the results above reflect the 2020 study by de Neve and Sachs, who analysed the respective rankings between 2016 and 2018. On this basis, the authors found strong positive correlations with most SDGs, insignificant correlations with SDGs 14, 15 and 17 as well as significant negative correlations with SDGs 12 and 13 (de Neve/Sachs 2020: 3). According to the data from the correlation analysis above, these findings from previous years are still effective and reflect the correlation patterns with other indices (as visible above).

In conclusion, all three indices have notable correlation patterns that are worthwhile to be analysed in terms of their causal relations. Due to the difference in terms of significance, these correlation patterns would need to be examined under different circumstances. Therefore, the subsequent chapter will analyse the following observations in further detail:

- Overall low significance of correlations with the Gini coefficient
- High significance of correlations with medium human development
- Unequal distribution of correlations with the WHR ranking

5.3. Correlations on the national level

A contextualisation of the correlation analysis on the national level with previous literature is quite difficult because of two major reasons: On the one hand, a comprehensive analysis of SDG pairs at the country level would need to analyse an enormous amount of data that no study has considered so far. On the other hand, there are not many country-level studies on SDG relations which could be used for a contextualisation of the correlation analysis. Since the case studies of significant correlation patterns are dependent on national framework conditions that are very different in these countries, the contributing factors that have been identified in previous literature will be described in the framework of these case studies.

The selection of case studies is not systematic and based on different considerations regarding their meaningfulness and transferability to other national frameworks. This excludes those countries which might not be representative for their income and regional groups, since their scores across the entire 2030 Agenda deviate significantly from the group average. This is the case for Mauritius (compared to the rest of Sub-Saharan Africa) and Tajikistan (compared to the rest of low-income countries), for example. While not all countries can be included in this selection, a certain level of representation across the income and regional groups is desirable.

The correlation analysis includes a total of twelve countries that were listed on both the most significant correlations and the most significant trade-offs on the national level (figures 4.19 and 4.20). Out of these twelve countries, Norway is the only one that is represented in all four subsections, while Eswatini and Lesotho are represented in three subsections. These countries were therefore identified as case studies to be analysed in further detail. In addition to these countries, three more countries that were listed in both tables were selected to cover a more representative sample, namely Bosnia and Herzegovina, Singapore and the United Arab Emirates. This selection of six countries therefore includes three income groups (with the exception of low-income countries) and five regional groups (with the exception of Latin America and the Caribbean). Based on their correlation patterns, these six countries will be analysed in the subsequent chapter regarding their performance on the following goals:

- Synergies and trade-offs between SDGs 9, 10 and 17 in Bosnia and Herzegovina
- Synergies and trade-offs between SDGs 10, 11 and 17 in Eswatini
- Synergies and trade-offs between SDGs 1, 5, 10 and 17 in Lesotho
- Synergies and trade-offs between SDGs 10, 13 and 17 in Norway
- Synergies and trade-offs between SDGs 9, 11 and 12 in Singapore
- Synergies and trade-offs between SDGs 5, 9 and 13 in the United Arab Emirates

6. Identification of synergies and trade-offs

6.1. Synergies and trade-offs on the global level

6.1.1. Group A (SDGs 1 to 11 and 16)

The correlation analysis on the global level shows many significant positive correlations between SDGs 1 to 11 and 16, which are considered as group A in the scope of this analysis. Based on the perception of three dimensions across the 2030 Agenda, these goals primarily represent the economic and social dimensions. SDG 6 is the only goal within this group that falls into the environmental dimension, while SDG 12 is the only goal in the first two groups that does not have a positive correlation pattern with the others. These observations therefore contradict the model regarding the interconnected nature of the SDGs (see figure 2.2).

The number of potential synergies is too large to be analysed in detail regarding their causal relations. The observation of synergies among these twelve goals however reflects previous studies which found synergies and mutual dependencies between some of these goals. For example, a study by Barbier and Burgess (2017) found that sufficient access to food, water and sanitation has a positive effect on reducing poverty. Based on the SDG Index 2020, significant correlations can be observed between the corresponding goals (SDGs 1, 2 and 6).

Such links can be found in previous literature for many SDG pairs and constellations, in which SDG 1 is often perceived as the most important goal to take advantage of synergies. In 2015, the International Council for Science stated that “when SDG 17 on ‘means of implementation’ (...) is excluded from the analysis, SDG 1 on poverty is the most central node for the system. In other words, in the view of scientists, (...) progress on poverty eradication is also central to all other goals” (International Council for Science 2015). Based on this assessment, several scientists have suggested to place SDG 1 as the keystone of SDG implementation, including Kroll et al. (2019), who found “positive developments with notable synergies in our projections, especially for SDGs 1, 3, 7, 8, and 9: Poverty alleviation and strengthening the economy, rooted in innovation, and modern infrastructure, therefore continue to be the basis upon which many of the other SDGs can be achieved” (Kroll et al. 2019: 1), concluding that “focusing on SDG 1 would therefore be the most promising strategy to ultimately start-off a virtuous cycle of SDG progress” (ibid.: 9). Many other studies have recognized the causal relations of SDG 1 with the other goals, particularly those within group A, which can go either way. In the scope of the SDG correlation analysis, the correlations with SDG 1 can therefore be widely considered as synergies and mutually dependent relationships.

After SDG 1, SDG 3 is probably the goal which has been covered the most in terms of its synergetic relationships across the 2030 Agenda. This is of particular interest for the SDG correlation analysis since SDG 3 is the goal with the highest positive correlation coefficient for the 2030 Agenda overall score and has the highest share of strong positive relationships with other SDGs. This seems rather obvious, considering that good health would be mutually beneficial with other aspects of the 2030 Agenda, including poverty eradication, overcoming malnutrition as well as clean water and sanitation, as shown by Barbier and Burgess (2017). It is however noted that “in the health area, interactions were highly dependent on geographical place and scale. As noted already, health targets can be supported by increasing agricultural productivity (SDG 2) as it increases people’s incomes” (Nilsson et al. 2018: 1493). This finding is reflected by the results from the correlation analysis, as correlations between SDGs 2 and 3 range from 0.063 (OECD members) to 0.741 (Middle East and North Africa).

According to Nilsson et al., relations between SDGs 3 and 5 are also highly dependent on geographic location, underlining the synergetic potential that can be achieved through gender equality: “Improving gender equality generally enables the achievement of better health, but the interaction will be stronger where women face greater inequalities. In contexts where inequalities are great, women’s health issues are often under-prioritized and under-funded” (ibid.: 1493). Even though the range of correlation coefficients (0.235 to 0.653) is not as large as it is in the case of SDGs 2 and 3, this statement seems plausible. This is also the case for SDG 6, which has been included in the same study: “For energy, geographical context influences how interactions play out. For example, the expansion of renewables in Sweden may include hydropower as an option, which interacts strongly with freshwater ecosystems (SDG 6). In Denmark, on the other hand, hydropower is not an option, but wind power (both on-shore and offshore) is, which interacts with terrestrial and ocean systems (SDGs 15 and 14)” (ibid.: 1493). It is apparent that relations between these goals and, by extension, the existence of synergies and trade-offs, are based on geographic factors and national policies.

All in all, even though a comprehensive analysis for all correlations within group A cannot be conducted in the scope of this chapter, previous research and literature have demonstrated that most goals within group A have a synergetic relationship that is based on mutually beneficial effects. This assessment also seems plausible based on an assessment of the targets and indicators associated with these twelve goals, which focus on aspects of development that can be determined as more traditional compared to those covered by SDGs 12 to 15 and 17. While such mutually beneficial relationships can be observed on the global level, relations between these goals are dependent on the geographical context and national policies.

6.1.2. Group B (SDGs 12 and 13)

The correlation analysis shows significant negative correlations between the goals included in group A (SDGs 1 to 11 and 16) and group B (SDGs 12 and 13). While trade-offs with SDG 12 have been observed in previous studies and literature, different analyses have not found negative correlations with SDG 13 thus far. Nevertheless, authors like Fonseca et al. (2020) anticipated significant trade-offs for SDG 13 with other goals which were not yet visible from empirical data at this point. The alterations in indicator selection for the SDG Index 2020 likely changed this discrepancy and proved this assumption to be correct, which makes SDG 13 the second goal along SDG 12 with significant negative correlations across the 2030 Agenda. Despite progress on the achievement of the 2030 Agenda in recent years, trade-offs like these achieving of the entire agenda very difficult, as underlined in an income-based variation study by Lusseau and Mancini (2019). Based on a sustainome analysis, they concluded that “limiting climate change, reducing inequalities and responsible consumption are key hurdles to achieving the 2030 goals across countries” (Lusseau/Mancini 2019: 242), stating that “we cannot infer directionality, given the analyses, but we observe that a conflict emerges between SDG13 (and SDG12 to a lesser extent) and the other goals” (ibid.: 245).

The SDG Index considers seven indicators for the calculation of the SDG 12 score. All these indicators are related to waste production or emissions, which tend to be significantly higher in developed countries, and cover municipal solid waste, electronic waste, production-based SO₂ emissions, SO₂ emissions in imports, production-based nitrogen emissions, nitrogen emissions embodied in imports, and non-recycled municipal solid waste (Sachs et al. 2020: 79). As a result, it is not surprising that SDGs 1 and 9 are among the goals with the highest negative correlation with SDGs 12, as increased levels of welfare and industrial growth historically correlate with environmental pollution and unsustainable resource management. In addition, similar thoughts can be applied to the negative impact of other goals on SDG 12. These considerations are shared by Pradhan et al. (2017), who found economic progress to be very harmful for the achievement of SDG 12 based on observed trade-offs with other goals.

While the impacts of different goals across the 2030 Agenda on SDG 12 are rather obvious, this is not the case for the impacts of low performance on SDG 12 on the achievement of the other goals. A certain effect can be assumed for environment-related goals (SDGs 13 to 15), although these effects seem to be minor considering the correlation coefficients observed. Despite the negative correlation with the goals in group A, it appears unlikely that a low score and a poor performance on SDG 12 would have a positive effect on the achievement of these goals. The negative correlation can thus be attributed to the effects of these goals on SDG 12.

The second goal to be considered in this group is SDG 13, whose correlation coefficients across the 2030 Agenda are even more negative than those of SDG 12. In the SDG Index 2020, the scores for SDG 13 are based on only four indicators: Energy-related CO₂ emissions, CO₂ emissions embodied in imports, CO₂ emissions embodied in fossil fuels exports and effective carbon rate (Sachs et al. 2020: 80). As mentioned above, the consideration of indicators was changed compared to the Sustainable Development Report from the previous year, as carbon accounting is no longer technology adjusted and fuel exports are now capped at the country's level of production (ibid.: 64). In consideration of results from previous studies, it seems that these two aspects had a significant impact on the scores of SDG 13 for many countries.

Similarly to the assumed effects of other goals on SDG 12, the aspects covered by the goals in group A historically have had a negative effect on climate change mitigation. Once again, this effect is particularly evident for the interrelation between SDGs 9 and 13, since increased industrial activity and production has often resulted in increased carbon gas emissions. While this correlation does not necessarily apply for modern technologies and increased awareness for climate change, this dependency is prevailing for the relations between both goals. A study by Kroll et al. (2019) found positive developments with diminishing trade-offs for a few sets of SDG pairs, of which SDGs 9 and 13 are a particularly strong example (Kroll et al. 2019: 8).

Contrary to the observations in the correlation analysis, several authors have anticipated positive effects of SDG 13 on other goals across the 2030 Agenda, including Jonathan Dawes: "Progress on Goal 13 (Climate) reinforces progress on Goal 6 (Water), which in turn reinforces progress on Goal 7 (Energy), which reinforces Goal 13 again" (Dawes 2019: 4). This hypothesis is supported by Nilsson et al. (2018), who refer to previous studies by UNICEF and the WHO in that regard. While such effects sound plausible, they are not apparent from the analysis. Regardless, the long-term effects of climate change might be apparent only in a few decades.

In addition to the correlation patterns between groups A and B, the correlation between both goals in group B is strongly positive and ranks among the strongest across the entire 2030 Agenda. While this observation could be attributed to the similar correlation patterns that both goals have with the other SDGs, there is some evidence for a causal relationship between SDGs 12 and 13. An example for that is the observation that most environment impacts "can be attributed both directly and indirectly (through supply chains) to the consumption by households" (Scherer et al. 2018: 65). The emphasis on SO₂ emissions among the indicators related to SDG 12 signifies a direct influence of SDG 12 on SDG 13, implying that unsustainable production and consumption would have a negative effect on climate change mitigation.

6.1.3. Group C (SDGs 14, 15 and 17)

In contrast to the goals in the first two groups, SDGs 14, 15 and 17 do not have any significant correlations with either the 2030 Agenda overall or any individual goals. Regardless, previous studies have found causal relations for these goals as well, which suggest at least a low level of dependency, particularly for SDGs 14 and 15, as SDG 17 has a comparably broad scope.

In terms of their indicators, SDGs 14 and 15 cover different aspects of marine and terrestrial life. Indicators for SDG 14 include protection in marine sites, clean water, intensity of fishing and marine biodiversity threats embodied in imports, while indicators for SDG 15 include protection in terrestrial and freshwater sites, protection of endangered species, permanent deforestation as well as terrestrial and freshwater biodiversity threats (Sachs et al. 2020: 80). As both goals are focused on the biosphere in different areas, their associated indicators therefore follow a similar pattern and allow for good comparability between these two goals in theory. A major difference however applies to the measurability of these two goals:

“For the ocean, the geographical context is highly decisive but also difficult to grasp. This is due, on the one hand, to most interactions playing out in specific places such as coastal settings, with spill-over effects for example through trading of marine resources and products or through marine pollution from land-based sources. On the other hand, processes, activities and impacts in the marine environment evade concrete geographical boundaries due to the transboundary nature of impacts, effects and the marine environment as such.” (Nilsson et al. 2018: 1493)

A definite evaluation of SDG 14 and its interrelations with other goals is therefore not realistic based on empirical data from the SDG Index 2020, which is collected on the national level – which might remain a problem for the evaluation of the 2030 Agenda after its envisaged date of full implementation. In addition to this observation, Nilsson et al. also claim that “on oceans, interactions between SDG targets are often dependent on policy design or governance regimes, and on the measures taken to achieve a specific target” (ibid.: 1492). In terms of SDG 15, a potential link has been drawn to SDG 13, suggesting that both goals might be mutually reinforcing (Dawes 2019: 4). Even though the correlations for SDGs 14 and 15 are slightly different, they are not significant enough to support any of these previous suggestions.

Whereas correlations and causal relations have been analysed among SDGs 1 to 16, most studies have spared SDG 17 from their analysis. A common reason for this is the notion that “this Goal provides mechanisms that are intended to enable each of the more specific Goals 1–16” (ibid.: 3), which are often linked to policies and government action. In conclusion, while SDG 17 should have a direct impact on the rest of the 2030 Agenda, this cannot be said vice versa. Such dependencies seem to be independent of other coherent factors, as shown in the correlation analysis, and are more relevant for an analysis on the national level.

6.2. Synergies and trade-offs by country grouping

6.2.1. Synergies and trade-offs by income grouping

6.2.1.1. Differences between HICs and LICs regarding SDG 13

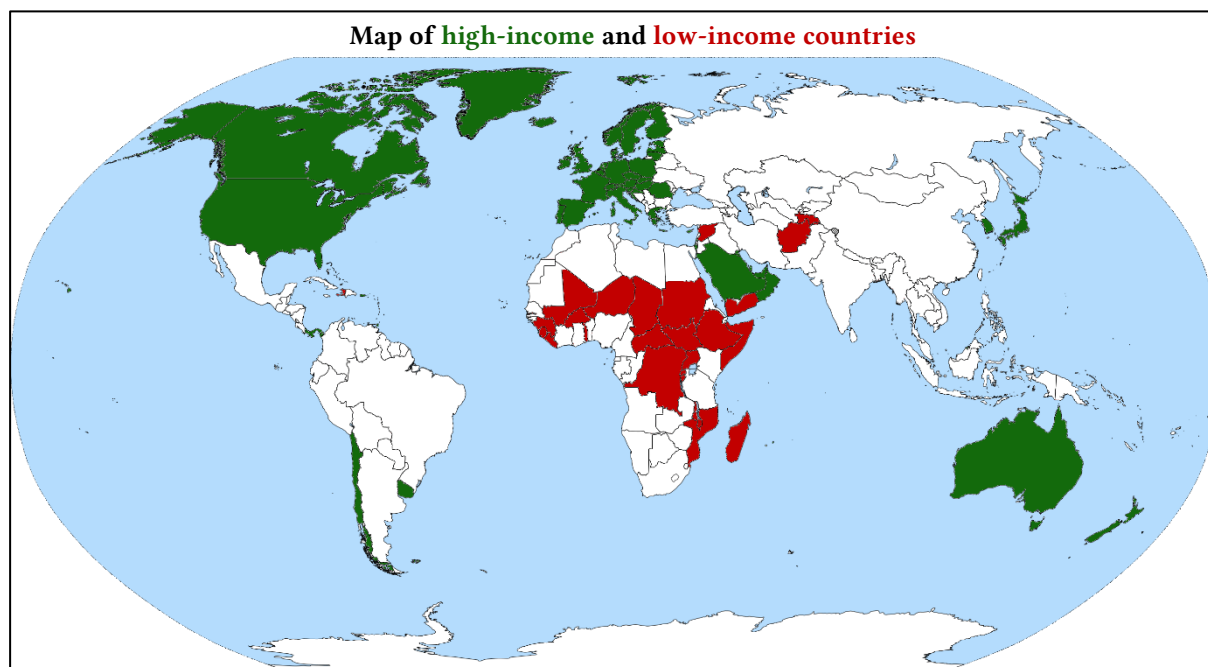


Figure 6.1 – Map of high-income and low-income countries

While the correlations of SDG 13 across the 2030 Agenda are primarily negative on the global level, this constellation differs significantly between the four income groups. In terms of the goal's overall correlation, the correlation coefficient ranks from 0.052 for UMICs and 0.043 for HICs to -0.664 for LICs, with the largest trade-offs observed for SDGs 1, 4, 7 and 9. Therefore, it seems natural that correlations with SDG 13 are dependent on a country's income level.

However, a more detailed observation from the correlation analysis is inconsistent in that regard. While trade-offs can be observed for the three income groups mentioned above, the correlation patterns for UMICs are fundamentally different. While this correlation pattern has been observed across the entire 2030 Agenda in this case, a coherent interrelation between SDG 13 and other goals could be called into question based on this anomaly. The aspect of diverging correlation patterns for UMICs and LMICs will be addressed below. In the case of SDG 13, the most reasonable way forward seems to be limiting the scope to HICs and LICs. As visualized in the map above, these income groups are clustered geographically: Most LICs are located in Sub-Saharan Africa, while HICs are more spread out across East Asia, Europe, North America, Oceania and the Arabian Peninsula. It should be noted that this geographic distribution might have a substantial impact on the correlation patterns, which are based on geographic parameters rather than national income, or a combination of both factors.

A potential reason for the different correlation patterns among the regional group lies in the distribution of SDG 13 scores. The correlation analysis shows a clear logarithmic correlation with the 2030 Agenda overall score and most other goals, particularly SDGs 1, 4 and 7. It is noticeable that these goals also have the most significant negative correlations with SDG 13, which suggests a strong connection between correlation coefficient and score distribution. The selected method of Spearman's rank correlation coefficient certainly plays a role in this regard, as a cluster of many countries within a slim score margin might result in a distorted ranking. This appears to be the case for the correlation of SDG 13 with the 2030 Agenda overall score, as the majority of LICs has an SDG 13 score just under the maximum score of 100.00. The average SDG 13 score for LICs at 99.09 is the highest score of an income group for any SDG and even slightly surpasses the SDG 1 score for HICs of 99.01. On the other hand, the average SDG 13 score for HICs at 62.37 is the third lowest for this income group.

Consequently, while the cluster of SDG 13 scores within LICs is a contributing factor to the difference of correlations between both groups, there must be additional factors that cannot be attributed to the methodology. It is apparent that the average scores for both groups are significantly different and contrary to the overall picture of the correlation analysis. It is thus worthwhile to take a closer look at the indicators that were assessed in the SDG Index 2020 for SDG 13, which include energy-related CO₂ emissions, CO₂ emissions embodied in imports, CO₂ emissions embodied in fossil fuels exports and effective carbon rate (Sachs et al. 2020: 80). It can therefore be concluded that higher emissions correlate with better performance on most of the other SDGs, although this correlation is less prevalent for countries with higher income. This implies that while progress on the 2030 Agenda usually leads to a worse performance on SDG 13, this development is dependent on national circumstances and might differ based on national income. While CO₂ emissions have been rising globally over the last decades, they have decreased in several HICs who have been altering their energy mixture in favour of renewable energies with low CO₂ emissions. The correlation of SDG 13 with other goals is thus dependent on national policies and strategies, particularly in HICs and UMICs.

In conclusion, similar to the findings from the global analysis, a causal relation can be drawn from most goals across the 2030 Agenda to the volume of CO₂ emissions and therefore the score of SDG 13. However, these effects are considerably influenced by national policies that affect carbon gas emissions, which do not seem to have a considerable impact on countries with a higher income. While an increase in emissions seems to accelerate development from an initial development stage, countries with more income have the potential to invest in more expensive yet more sustainable energy sources, which improve the SDG 13 score.

6.2.1.2. High significance of positive correlations in LMICs

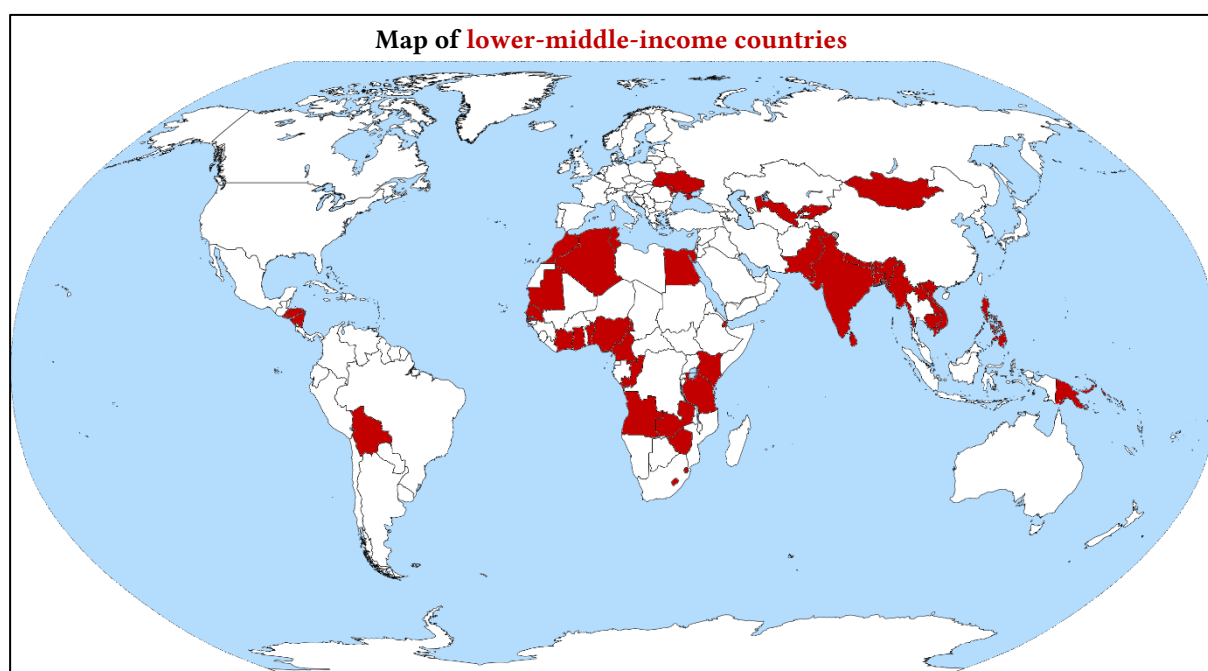


Figure 6.2 – Map of lower-middle-income countries

According to the correlation analysis by income grouping, synergies among the 2030 Agenda are the strongest for lower-middle-income countries. Compared to the other income groups, LMICs have the most significant correlation coefficients with the 2030 Agenda for a total of eight goals, which include seven goals with positive correlations (SDGs 1, 3, 4, 6, 7, 11, 17) and one goal with a negative correlation (SDG 12). On the other hand, LMICs have the least significant correlation for SDG 8 among the income groups. Based on the high share of significant positive correlations, it could be suggested that synergies across the 2030 Agenda are very strong in countries which are under-developed though not among the least developed. Another contributing factor is the large variation of scores for many SDGs among LMICs, which might cause a larger distinction between countries and a more significant correlation.

Based on positive correlations between the seven goals mentioned above, synergies can be attributed to different framework conditions, which in turn might benefit sustainable development in LMICs. Significant synergy can be observed between SDG 1 and some of the goals related to infrastructure, in particular SDGs 3, 4, 6, 7 and 9. Based on the suggestion that SDG 1 is a keystone of SDG implementation (Kroll et al. 2019), it can therefore be assumed that all these goals have a considerable positive effect on SDG 1 in these countries. From a policy perspective, it could be suggested that poverty eradication can be achieved through a multi-factor approach that specifically aims at the improvement of health care systems, access to education, clean water and energy as well as supporting industrial development.

Whereas strong synergies can be observed for these seven goals, synergies with SDG 8 are much less significant when compared to other income groups. Even though the correlations with SDG 8 still fall in the positive range, they are still considerably lower at an overall value of 0.341. The same can be said for correlations with SDG 5 with an overall value at 0.358. In this context, it should be noted that overall performance on SDG 8 among these countries is quite good and at an average value of 75.43, which can be attributed largely to the GDP growth indicator, which is included in the SDG 8 score. Gender equality remains a key issue with an average score of 42.95, which is particularly the case in Arabic and South Asian countries. Despite major differences, there is no clear evidence for a causal relation between these goals.

Another observation can be made for the correlation patterns of SDG 12 and 13, whose correlation with some goals is quite insignificant and even slightly positive in the case of SDG 2. Once again, these observations can be attributed to the high scores of LMICs regarding both goals, which distorts the rank correlation coefficient to be less significant. The correlation between SDGs 2 and 13 however could at least in part be attributed to accelerating climate change and reduced soil fertility, which affects several countries in this income group.

6.2.1.3. Low significance of positive correlations in UMICs

While the correlation patterns with three distinct groups can be observed on the global level as well as most country grouping, the correlation analysis shows a very different picture in the case of UMICs, which have a contrary correlation pattern to the LMICs as described above. This is the case as all seventeen goals have a positive correlation with the 2030 Agenda overall score, although most of the correlations are not significantly high. The correlation coefficients range from 0.052 (SDG 13) to 0.690 (SDG 3). In comparison to the other income groups, these correlations are much less significant, and the goals seem to be less interdependent. This might call the previously described synergetic effects across the 2030 Agenda into question.

Out of 136 individual SDG pairs, a significant correlation can only be observed for five pairs. The most significant correlations can be observed for SDGs 1 and 3, which is similar to the correlation patterns on the global level. The highest correlation coefficient can be observed between SDGs 1 and 10 at 0.694, which is higher than on the global level and almost equal to that for LMICs. In this context, it seems reasonable that a certain level of equality within a country of upper-middle income would be required to reduce poverty. It is worth mentioning that several countries in this group are known for their high level of inequality, such as Brazil, Mexico and South Africa. Strengthening equalities is thus very important to reduce poverty.

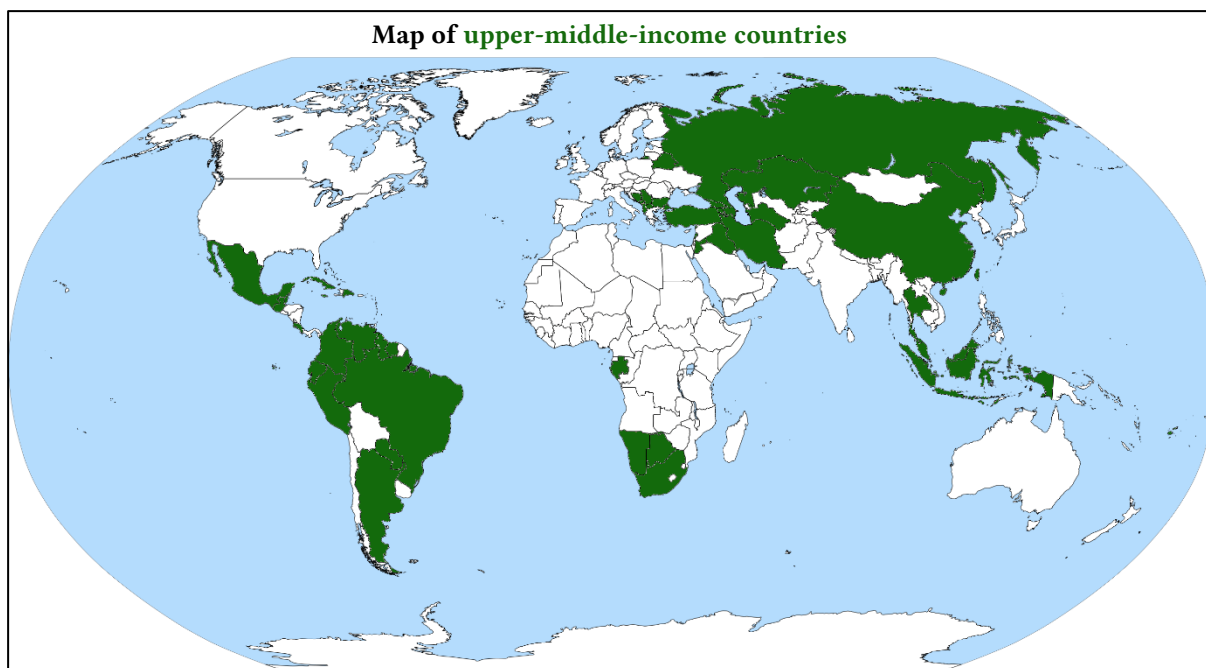


Figure 6.3 – Map of upper-middle-income countries

A closer look at the general geographical distribution of countries in this income group shows that they are primarily located in East and South Asia, Eastern Europe and Central Asia as well as Latin America and the Caribbean. All these regional groups have demonstrated clear patterns in the correlation analysis above, which seems contradictory to the results on the income group level. It could therefore be suggested that effects from the different regions that are represented here might cancel each other out and thus result in low correlation coefficients. Based on the observations described above, this option seems rather unlikely though.

In contrast, there are additional considerations that contradict the results from the correlation analysis: It seems counter-intuitive that performance on most SDGs is moderately increasing according to the Sustainable Development Report 2020 (Sachs et al. 2020: 40) despite the low significance of SDG correlations among UMICs. The only goal considered to be on track, SDG 13, has the lowest correlation coefficient with the 2030 Agenda overall score. Even if there are no considerable synergies, SDG performance actually seems to increase. The correlation analysis and the most recent developments regarding SDG performance therefore seem to diverge significantly, which calls the observed correlation patterns even more into question.

As the variations for most SDG scores are quite large across the 44 countries in this income group, a clustering effect of similar values should not play a central role, either. There is also no previous literature or research which includes such an analysis of UMICs. Ultimately, the reasons for the low significance of correlations in UMICs therefore remain unclear and are subject to a deeper analysis on SDG correlations across the individual countries in this group.

6.2.2. Synergies and trade-offs by regional grouping

6.2.2.1. Low significance of correlations in the MENA region

Whereas UMICs have the lowest significant correlations among the income groups, the same is true for the MENA region among the regional groups. However, while correlations for UMICs have a low significance across the entire 2030 Agenda, this pattern is limited to a few goals in the case of the MENA region, particularly to SDGs 3, 6, 7, 9 and 16. In this context, it is important to note that the number of overlapping countries between UMICs and the MENA region is not above average, as this applies to four countries: Iran, Iraq, Jordan and Lebanon. These four countries account for a quarter of the total 16 countries in the MENA region, which is the smallest regional group in terms of the number of countries included.

The correlation matrix for the MENA region shows the largest deviations from the global correlation analysis for any regional group. This is particularly the case for SDG 6, which despite its synergies in the other regional groups shows a negative correlation with several goals in the MENA region, as they have comparably low scores on this goal. In this context, it should be mentioned that the MENA region has the world's largest water deficit and needs to import large quantities of food, which makes it the least food self-sufficient region in the world (Lee et al. 2019: 557). Both factors are included in the indicators associated with SDG 6, which explains why performance on these indicators does not affect the overall SDG score. Due to this unsustainable management of water resources and food production in the region, "food security and sustainable agriculture (SDG 2) as well as sustainable water management (SDG 6) are high-priority challenges in most Arab countries" (Göll et al. 2019: 3).

The greatest deviation for the MENA countries, and thus the greatest deviation for all regional groups, can be observed for the correlation between SDGs 1 and 7. While both goals have a significantly positive correlation on the global level (0.765), the correlation in the MENA region is significant negative (-0.595). The MENA region is an extreme case in terms of both water and energy resources, as it accounts for 66% of the world's known crude oil reserves (ibid.: 570). The interlinkages between SDGs 2, 6 and 7 are increasingly problematic in the MENA region and particularly the Arab countries, as population growth leads to a higher demand in resources (Göll et al. 2019: 3). As more developed countries (hence countries with a higher overall SDG score) generally consume more water and energy resources, it seems that the negative correlation between SDGs 1 and 7 as well as the negative correlations with SDGs 6 and 7 across the 2030 Agenda are caused by unsustainable management of water and energy resources as well as their consumption patterns in more developed countries.

In addition to the low correlation coefficients for SDGs 6 and 7, a notable observation regards the correlation between SDGs 1 and 16 (0.731 on the global level, -0.357 for MENA countries). The MENA region is a particularly vulnerable region in terms of peace, as “ten of the twenty-two Arab countries are either under occupation or experiencing war or conflict, tens of millions of people are refugees or internally displaced, and many lack basic needs and rights at multiple levels” (ibid.: 6). While these circumstances are a serious threat to the fulfilment of SDG 16, they are not reflected by the indicators that were included in the SDG Index 2020, at least not explicitly. Regardless, conflict-affected countries rank the worst for SDG 13 scores, with Syria and Yemen at the ranking’s lower end. Most countries in the MENA region form a cluster in terms of the scatterplot corresponding to SDGs 1 and 16, which generally blends into the overall global picture. The negative correlation might thus be attributed to the low number of countries in the MENA region included in this analysis. Based on this data, there is no causal evidence for the numerical deviation from the global correlation matrix.

A similar conclusion can be drawn for the deviations regarding SDGs 3 and 9. The general correlation pattern is similar to that on the global level and in other regional groups, despite less significant correlation coefficients. The analysis shows particularly strong negative correlations between these two goals with SDGs 12 and 13, which will be further analysed below.

6.2.2.2. Regional differences of correlations with SDGs 12 and 13

As previously mentioned, the most deviating correlation patterns across the 2030 Agenda can be observed for SDGs 12 and 13, which have a significant negative correlation with the rest of the agenda on the global level. While the potential explanations for this observation have been described above, the correlation analysis also shows that correlations for these two goals vary among the six regional groups with correlation coefficients between -0.708 and 0.060. Correlations are very insignificant for LAC and MENA countries, but clearly notable for the other regional groups. The strongest negative correlations for SDG 12 can be observed for Eastern Europe and Central Asia as well as East and South Asia. The strongest negative correlations for SDG 13 can be observed for Sub-Saharan Africa as well as East and South Asia.

In addition to these correlations with the 2030 Agenda overall score, a notable pattern can be observed for interactions with individual goals. There are a few goals within group A that do not follow the general trend across all regional groups, including SDGs 2, 6, 7, 8, 9 and 10. Another notable observation is the high correlation between SDGs 12 and 13, which is one of the most significant across the 2030 Agenda with a maximum correlation coefficient of 0.949.

As previously mentioned, SDG 12 is based on indicators that are related to waste production and emissions, which tend to be significantly higher in developed countries. This assumption provides a reasonable explanation for the negative correlation of SDG 12 and most other goals across the 2030 Agenda on the global level. While this does not appear to be the case for LAC and MENA countries at first glance, a closer look at the corresponding correlation matrices shows major trade-offs with most other goals for these two regions as well. It is hence likely that progress on most individual goals would have a negative impact on waste production and emissions, and therefore the performance on SDG 12. The insignificant correlation with the 2030 Agenda overall score might be caused by the low number of countries in both groups, although a causal explanation for this correlation cannot be drawn from the analysed data.

Similar to SDG 12, the correlation analysis for SDG 13 also shows significant trade-offs with the rest of the 2030 Agenda, as lower developed countries tend to have a better performance on indicators related to climate change. The scatterplot for SDG 13 and the 2030 Agenda overall scores shows a logarithmic distribution of both scores with distinctive clusters for the six regional groups. All these clusters however follow the general trend of a negative logarithmic correlation between both values, which counterbalances the different correlation coefficients that were identified in the analysis as the general correlation patterns applies to all regions. In this context, the correlation coefficient is more significant in regional groups (notably Sub-Saharan Africa as well as East and South Asia) that have a high score for SDG 13 and a low overall score. It is thus apparent that more developed countries can compensate this negative correlation, as they may have more resources to invest in sustainable technology, for example. In this case, the difference would be more dependent on the income group than the regional context. This assumption is also reflected by the correlation analysis for the income groups.

Concerning the relation between SDGs 12 and 13, five regional groups have a significant or strong correlation which usually ranks among the most synergetic SDG pairs across the 2030 Agenda. The one noticeable exception is Sub-Saharan Africa, whose correlation coefficient for these two goals only amounts to 0.218. The most important difference to the other regional groups is the performance of Sub-Saharan African countries, which have the highest score for both goals (97.76 for SDG 13 and 91.58 for SDG 12). A less significant correlation between SDGs 12 and 13 can thus be explained by the small variation of their corresponding scores which form a larger cluster at the higher end of both scales. All in all, most observations from the analysis of SDGs 12 and 13 on the regional level can be attributed to shortcomings of the applied method or overlapping between income and regional groupings. The results from the correlation analysis do not allow for a comprehensive conclusion on causal relations.

6.2.2.3. Regional differences of correlations with SDGs 14 and 15

The correlation analysis on the regional level also shows that the correlation with SDGs 14 and 15 is very different between the six regional groups. The correlation coefficients for these goals with the 2030 Agenda overall score range from -0.050 to 0.727, with a similar range for both goals. While the objective of both goals is related to biosphere and the correlation analysis groups them into the same category, the regional distribution of their related correlation is very different. The highest values can be observed for Eastern Europe and Central Asia for SDG 14 and the MENA region for SDG 15, which will be further analysed in the following.

In the case of Eastern Europe and Central Asia, significant positive correlations with SDG 14 can be observed for SDGs 2 and 8, although correlation with SDG 1 is significantly negative. A closer look at the data however reveals that data for SDG 14 is only provided for eleven out of 23 countries in the region, which might distort the result to that end. Even though SDG 14 is the goal with the most data gaps in general, this is particularly a problem for this regional group. This observation supports the previous mention by Nilsson et al. that “for the ocean, the geographical context is highly decisive but also difficult to grasp” (Nilsson et al. 2018: 1493). A positive correlation with the goals mentioned above is prevailing regardless, which is an important indicator for a causal relation between these goals. It remains unclear however what kind of causal relation might exist between them and in which direction, so this aspect would need to be analysed in more detail for a profound statement on causal relations.

A different pattern can be observed for the MENA region regarding SDG 15: Whereas the correlation with the 2030 Agenda overall score is very positive, correlations with individual goals are not as strong, although mostly on the positive side. Regarding SDG performance, the average score of 57.12 in the MENA region is lower than the global average and the second lowest among the regional groups after East and South Asia with an average score of 54.80. As previously mentioned though, correlations for SDG 15 globally are not significant enough for any conclusion on causal relationship. Due to the lack of significant correlations with other goals, there are no apparent causal relations in the MENA region either. In contrast, it seems that a good performance of the 2030 Agenda in general is beneficial for the achievement of SDG 15 in the MENA region, although this should be perceived as a mere correlation.

In conclusion, it appears that while correlation patterns for SDGs 14 and 15 differ among the regional groups, it is very difficult to provide an explanation of causalities in this regard. Neither the empirical data nor the included indicators of the SDG Index 2020 can lead to any reliable suggestion on causal relation, which is why no presumptions can be made to that end.

6.2.3. Synergies and trade-offs with other indices

6.2.3.1. Overall low significance of correlations with the Gini coefficient

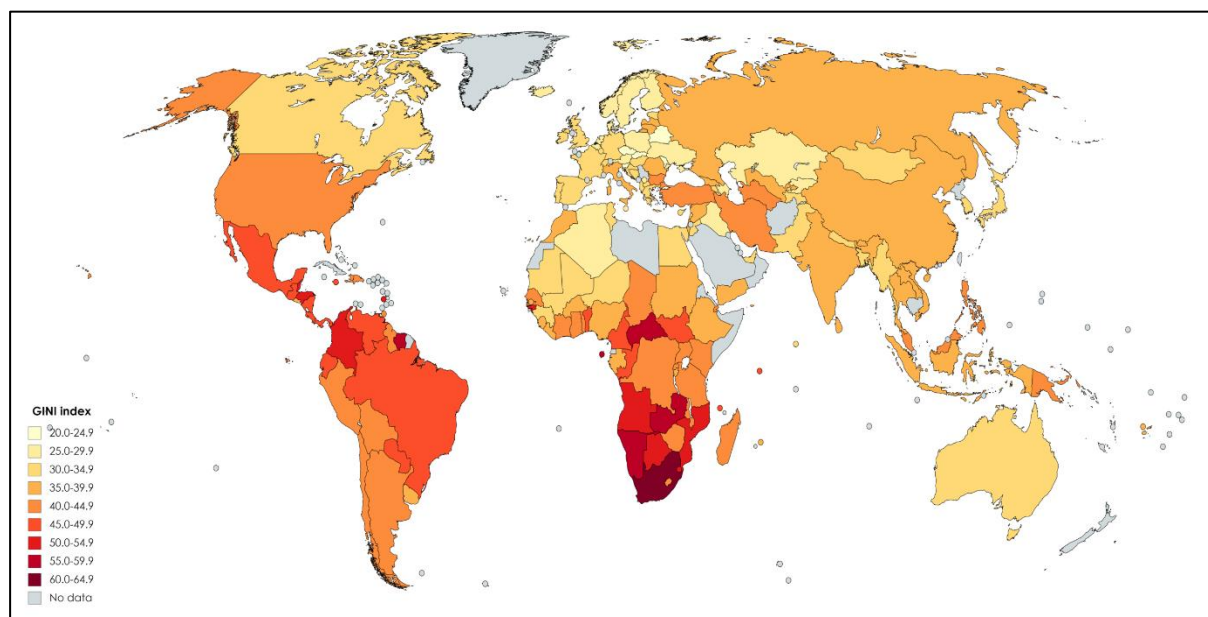


Figure 6.4 – Map of countries by Gini coefficient – Wikimedia Commons 2020a

Among the three indices that were covered in the correlation analysis, the Gini coefficient is by far the index with the lowest significant correlations with the SDG Index. The only notable, yet obvious exception is SDG 10, whose score is calculated with the Gini coefficient as one of three indicators. The other two indicators are only available for OECD countries, hence the correlation between the Gini coefficient and SDG 10 should be equal to 1.000 or 100%. This is not the case for the simple reason that the data used for the SDG Index 2020 and the correlation analysis with the Gini coefficient is based on different sources and reference years.

It seems surprising at first that correlations between the SDG Index and the Gini coefficient are so insignificant, as the correlation analysis by income groups has demonstrated that national income has a significant impact on a country's SDG scores. There is however no strong connection between national income and the national level of inequality, as can be seen on the map above. Nevertheless, the Gini coefficient tends to be a bit lower on average in countries with higher income, particularly in Europe, and a little higher in countries with lower income, particularly in Latin America and Sub-Saharan Africa. This is reflected in the correlation analysis, as the correlation coefficients with individual SDGs tend to be slightly higher in the countries with a low Gini coefficient. However, these findings still fall in the range of insignificant correlations, which is not sufficient to draw any causal conclusions. Therefore, it is difficult to find empirical evidence and to make a direct connection between inequality and development level on the national, regional or global level.

6.2.3.2. High significance of correlations with medium human development

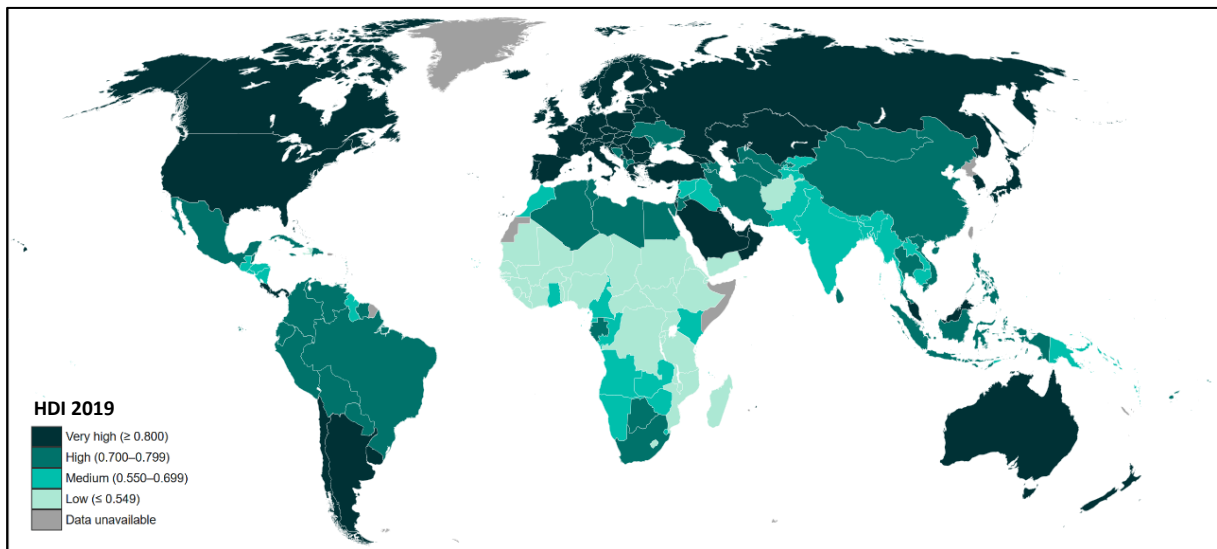


Figure 6.5 – Map of countries by Human Development Index – Wikimedia Commons 2020b

The Human Development Index (HDI) is a composite index of life expectancy, education and per capita income on the national level. As these factors correlate with other development indicators and are considered by the 2030 Agenda, it is not surprising that the overall correlation of the HDI with the SDG Index is very high and more significant than the correlation with the Gini coefficient and the WHR ranking. Based on the four categories of human development though, it is evident that the correlation is not constant throughout both indices.

According to the correlation analysis, countries with medium human development have a higher correlation between both indices than countries with high human development. An observation by the authors of the SDG Index is that “some countries, notably from the Middle-East and North Africa, perform well on meeting basic needs, as measured by the HDI, but fall short on the SDG Index. (...) This shows how a combination of the SDG Index and the SDG Dashboards provide a richer understanding of a country’s development challenges” (Schmidt-Traub et al. 2017: 549–550). The correlations between both indices therefore indicate the relation between sustainable development and development stage regarding basic needs. This assumption can be fully applied to the correlation analysis between both indices: While correlations are low for countries with low human development and high for countries with very high human development, the SDG Index values are more similar for countries with medium and high development in relative terms. The correlation analysis suggests that while countries with high human development perform better on basic needs than those with medium human development, their difference on SDG performance is not as large for some goals. Nevertheless, these differences are not evident or significant enough for causal explanations.

6.2.3.3. Unequal distribution of correlations with the WHR ranking

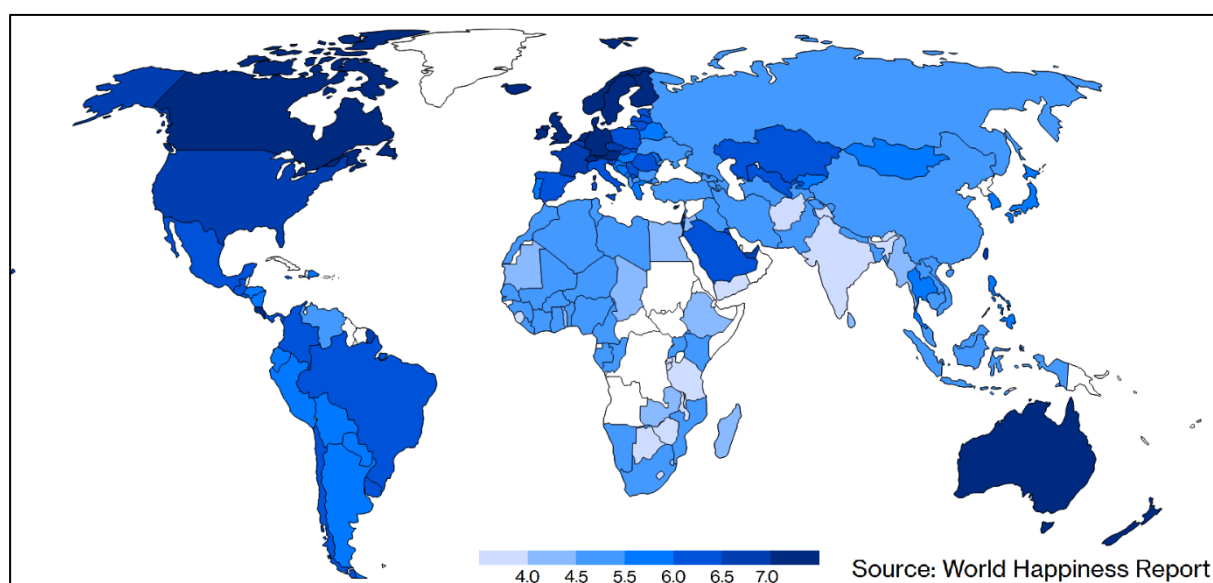


Figure 6.6 – Map of countries by World Happiness Report ranking – Pohjanpalo 2021

The correlation analysis of the SDG Index with the most recent World Happiness Report data shows that countries with a better performance on the 2030 Agenda are generally also ranked higher in the WHR ranking. The distribution of correlation coefficients across the quartiles (see figure 4.17) also shows that correlations of both indices are much more significant for the first quartile (and second quartile for some goals) than for the third and fourth quartiles. This constellation implies that synergies between both indices are stronger the higher a country performs on any of the two indices, which points towards a direct connection between them.

The World Happiness Report considers six factors to calculate the index: income, health, someone to count on, freedom, generosity and trust (Helliwell et al. 2021: 50). Even though these factors are determined through subjective polling data, some can be linked directly to individual goals of the 2030 Agenda, which is particularly the case for income (linked to SDGs 1 and 8), health (linked to SDG 3) and freedom (linked to SDG 16). This connection has been recognized in the World Happiness Report 2020, which states that “all SDGs are important—but some SDGs may be more relevant to well-being than others” (Helliwell et al. 2020: 114). The correlation pattern between both indices reflects the findings from the report, which the authors attribute to the shifting impact of economic growth on well-being:

“The best fitting model to describe the relationship between the SDG Index and SWB takes a quadratic form indicating that a higher SDG Index score correlates more strongly with higher SWB at higher levels of the SDG Index. This would indicate that economic growth is an important driver of well-being at early stages but becomes less significant later in the development cycle. Put differently, this result implies increasing marginal returns to sustainable development in terms of human well-being.”
(Helliwell et al. 2020: 114)

6.3. Synergies and trade-offs on the national level

6.3.1. Bosnia and Herzegovina

Based on the results from the correlation analysis on the global level, six case studies have been identified to further analyse correlations that deviate significantly from the respective income or regional group. The first identified case study is Bosnia and Herzegovina, which is an upper-middle-income country located in Eastern Europe. In comparison with the average scores for its income group, Bosnia and Herzegovina has high scores for SDG 10 (81.23; 51.59 for UMICs) and SDG 17 (98.23; 62.42 for UMICs) as well as a low score for SDG 9 (33.10; 64.73 for UMICs). With an overall score of 73.48, it ranks slightly above the UMIC average of 73.24.

A closer look at the associated indicators shows that Bosnia and Herzegovina performs very well on the Gini coefficient (SDG 10), government revenue and the corporate tax haven score (SDG 17). Its low performance on SDG 9 is based primarily on university rankings, the number of scientific and technical journal articles and the expenditure on research and development. In addition to these three goals, Bosnia and Herzegovina performs very well on SDG 1 (99.73) and has a rather weak performance on SDG 5 (40.10). The correlation pattern on the global level is significantly different, as the correlation analysis categorizes SDGs 9 and 10 in group A with a positive correlation, while SDG 17 has an insignificant correlation with both goals.

In the country's 2019 voluntary review on SDG implementation, it is acknowledged that investment in research and development is low in the country (0.2% of GDP compared to an EU average of 2.4%), stating that the country has a "low innovation capacity and modest level of investment in research and development" (UNDESA 2019: 58). Although no explanation is provided for this observation, it is notable that the share of imports in GDP is around 60%, while the share of export is only around 30%. This observation underlines that Bosnia and Herzegovina is economically dependent on other countries, in particular the Balkan countries and the European Union. Due to its peripheric location in these regional groups, it is reasonable to assume that most innovative activities would shift to the core countries.

While most countries in peripheric locations tend to have a high Gini coefficient, the value for Bosnia and Herzegovina is comparatively low among UMICs at 33.0. This value is however comparable to neighbouring countries Croatia (29.7) and Serbia (36.2). In conclusion, while Bosnia and Herzegovina has a comparatively low Gini coefficient among UMICs, it is similar to that of other countries in the region. The low performance on SDG 9 is a notable observation, although no causal relations with SDGs 10 and 17 seem plausible. The score on SDG 17 is mostly based on policy decisions, which do not seem worthwhile to discuss in this context.

6.3.2. Eswatini

The second identified case study is Eswatini, which is a lower-middle-income country located in Sub-Saharan Africa. In comparison with the average scores for its income and regional group, Eswatini has high scores for SDG 11 (83.39; 53.94 for LMICs) and SDG 17 (75.30; 48.80 for LMICs) as well as a low score for SDG 10 (0.00; 51.63 for LMICs; 44.43 for Sub-Saharan Africa). In terms of the associated indicators, Eswatini performs well on the concentration of fine particulate matter and access to improved water sources (SDG 11) as well as the corporate haven score and government spending for health and education (SDG 17). Its low score for SDG 10 is caused by its high Gini coefficient of 54.6, which is among the highest in the world. In addition to these three goals, Eswatini performs very well on SDG 13 (83.89) but performs very weakly on SDG 1 (22.95) and SDG 9 (14.07). This constellation generally reflects the three groups that were observed in the correlation analysis on different levels.

The most notable SDG score for Eswatini is certainly that of SDG 10 at 0.00, which is one of just a few cases in which a country scores the worst possible score for any goal of the 2030 Agenda. A look at the map of countries by Gini coefficient (see figure 6.4) demonstrates that inequality is particularly an issue in Southern Africa, which accounts for six of the ten countries with the highest Gini coefficient. The high level of inequality has led to a high level of poverty, which explains the country's poor performance on SDG 1. Based on the correlation analysis of the SDG Index and the Gini coefficient however, it can be suggested that the overall impact of a high level of inequality on the 2030 Agenda as a whole is not very significant.

In comparison with its regional group, the most significant deviations for Eswatini can be observed for SDGs 10, 11 and 17. As previously mentioned, the indicators related to SDG 17 that are included in the SDG Index 2020 are mostly based on policy decisions and government actions, which is usually not determined by other factors of sustainable development. A direct link between SDGs 10, 11 and 17 seems unlikely, as causal relations between these three goals do not seem plausible. In general, while the significance of synergies and trade-offs between these goals is much more significant than it is among LMICs and Sub-Saharan African countries, the general correlation pattern across the 2030 Agenda aligns well with the previous observations. The most important deviation from the average SDG performance regards the Gini coefficient and national inequality, which remains a major challenge in Eswatini. While this circumstance has a certain impact on the overall achievement of the 2030 Agenda, the correlation analysis suggests that this impact is not very significant. In summary it can be said that, although Eswatini ranks among the most significant synergies and trade-offs on the national level, the impact of these deviations on sustainable development are relatively minor.

6.3.3. Lesotho

The third identified case study is Lesotho, which is a lower-middle-income country located in Sub-Saharan Africa. In comparison with the average scores for its income and regional group, Lesotho has high scores for SDG 5 (73.46; 42.95 for LMICs) and SDG 17 (93.15; 48.80 for LMICs) as well as low scores for SDG 1 (14.01; 68.36 for LMICs) and SDG 10 (0.14; 44.43 for Sub-Saharan Africa). In terms of the associated indicators, Lesotho performs well on family planning, gender ratio for mean years of education and gender ratio of the labour force (SDG 5) as well as the corporate haven score and government spending for health and education (SDG 17). The low performance on SDGs 1 and 10 is attributed to the poverty headcount ratio at 3.20 USD per day and the Gini coefficient, which is similarly low to that of Eswatini. In addition to these four goals, Lesotho performs very well on SDG 12 (89.86) and SDG 13 (93.58) but has a weak performance for SDG 9 (14.07). Overall, the correlation pattern seems to be very similar to that of Eswatini, as both countries have a similar set of framework conditions and a similar overall SDG Index score (Eswatini: 53.40; Lesotho: 54.00). Nevertheless, there are some differences for correlations between several goals, including the ones mentioned above.

The most prominent aspect of Lesotho's performance on the SDG Index concerns the score values for SDGs 1 and 10. Even though these values have been improved significantly over the last fifteen years, they remain among the lowest worldwide. A 2019 World Bank study found "that the poverty rate in Lesotho fell from 56.6% to 49.7% between 2002 and 2017, driven by a reduction in inequality as a result of the expansion of the country's social protection programs and an increase in wages among the poor" (World Bank 2019b). This statement therefore suggests that reducing inequalities has had a significant impact on reducing poverty in Lesotho. The corresponding correlation coefficient by country grouping ranks at just 0.137 for Sub-Saharan Africa, while it has a significant value of 0.692 for LMICs. The correlation of both goals is evident in the case of Lesotho, as both goals appear to be mutually beneficial. As their performance remains very low, the further development of this correlation is to be seen.

Lesotho's high scores on SDGs 5 and 17 can primarily be attributed to national policies, as most associated indicators are based on political will. For example, the country adopted a new gender policy for the timeframe from 2018 to 2030 with the intention of aligning it "to the international and regional instruments including the Sustainable Development Goals" (Phamotse 2018: 20). The case study of Lesotho therefore proves that countries can perform very well on individual goals or indicators based on their national policies. The correlation patterns for SDG 10 are contradictory for the corresponding income and regional group, thus it does not seem reasonable to assume synergies or trade-offs that might evolve from that.

6.3.4. Norway

The fourth identified case study is Norway, which is a high-income country and a member state of the OECD. In comparison with the average scores for its income and regional group, Norway has high scores for SDG 10 (100.00; 67.51 for HICs; 61.14 for OECD members) and SDG 17 (99.63; 69.29 for HICs; 67.84 for OECD members) as well as a low score for SDG 13 (20.93; 62.37 for HICs; 67.74 for OECD members). Regarding the associated indicators, Norway performs very well on the Gini coefficient (SDG 10) as well as development assistance, the corporate haven score and government spending for health and education (SDG 17). The low performance on SDG 13 can be attributed to CO₂ emissions embodied in imports and fossil fuel exports. In addition to these four goals, Norway performs very well on SDG 1 (99.48), SDG 3 (97.08), SDG 4 (99.05) and SDG 7 (98.66) but comparatively low on SDG 12 (44.54). With an overall score of 80.67, Norway ranks sixth in regard to SDG achievement globally.

This constellation of SDG performance in Norway generally reflects the observations from the correlation analysis for both high-income countries and OECD member states, which are quite similar due to the high share of countries that are taken into consideration for both groups. In general, Norway has a high score for those goals that are included in group A, with the notable exception of SDG 2 (59.22). In this context, Norway has a poor performance on multiple associated indicators, including prevalence of obesity, human trophic level, nitrogen management and yield gap closure. While HICs generally perform slightly worse on SDG 2 than UMICs, this deviation suggests that countries on the top end of high income suffer from a poor performance on these indicators. A causal relation can be drawn between them and other goals, such as SDG 3 (related to obesity) and SDG 13 (related to CO₂ emissions).

Despite its high overall score, Norway ranks 163rd out of 166 for its performance on SDG 13. This observation underlines the general observation of a negative correlation between these two scores. Although the national level of CO₂ emissions is not fundamentally different from that of other HICs or OECD member states, Norway has a particular bad performance on CO₂ emissions embodied in imports. The addition of this indicator in the Sustainable Development Report therefore had a major impact on Norway's score, which dropped from 54.35 in 2019 to 20.93 in 2020. This case study demonstrates why studies from 2019 and before did not find significant negative correlations of SDG 13 across the 2030 Agenda. In this context, it would be worthwhile to further analyse the international trade-offs related to SDG 13, as it is presumably the goal with the most globalized effects. Based on this consideration, it is of utmost importance to address trade-offs related to SDG 13. If this is not the case, advancing development around the world might accelerate climate change, which could backfire eventually.

6.3.5. Singapore

The fifth identified case study is Singapore, which is a high-income country located in South and East Asia. In comparison with the average scores for its regional group, Singapore has high scores for SDG 9 (91.33; 53.77 for East and South Asia) and SDG 11 (94.37; 62.82 for East and South Asia) as well as a low score for SDG 12 (17.77; 90.27 for East and South Asia). In terms of the associated indicators, Singapore reaches perfect scores on population using the internet, mobile broadband subscriptions, university rankings and scientific and technical journal articles (SDG 9) and performs well on access to improved water sources and satisfaction with public transport (SDG 11). On the other hand, the low performance on SDG 12 is related to municipal solid waste, SO₂ emissions embodied in imports and nitrogen emissions embodied in imports. In addition to these three goals, Singapore performs very well on SDG 1 (98.36), SDG 3 (94.43), SDG 4 (99.72) and SDG 7 (94.57) but very poorly on SDG 14 (5.80).

The general correlation pattern for Singapore therefore resembles the correlation pattern on the global and regional levels with three distinct groups, similarly to the case of Norway. This is evident from the good performance on goals in group A, in particular SDGs 1, 3, 4, 9 and 11, and the poor performance on goals in group B, in particular SDG 12. The most notable deviation in the case of Singapore regards SDG 14, as it has the lowest score of all countries in the world by a significant margin (the second lowest is Montenegro with a score of 33.21). The SDG Index considers three indicators for Singapore in regard to this goal: mean area that is protected in marine sites important to biodiversity, clean water score and marine biodiversity threats embodied in imports. All these indicators have a normalized score which is lower than 15, while the average score for East and South Asia ranks at 57.75 (HICs: 59.55). There are multiple factors that might play a key role in this regard, including the singularities of a city state and its strategic location as a major port along one of the busiest shipping routes. This case demonstrates that while SDG 14 does not have a significant correlation pattern with other goals on the global and regional levels, correlations of the goals in group C (SDGs 14, 15 and 17) with other goals might be very significant depending on national circumstances.

Other than that, Singapore is another good example of high synergies across the twelve goals in group A, which is particularly the case in countries with a high 2030 Agenda overall score. While Singapore has a low performance on the goals in group C, namely SDGs 14, 15 and 17, previous case studies have demonstrated a different picture. In context with the correlation analysis on different levels, it can therefore be suggested that causal relations of these goals with the rest of the 2030 Agenda are relatively minor and differ based on the national context.

6.3.6. United Arab Emirates

The sixth identified case study are the United Arab Emirates, which is a high-income country located in the Middle East. In comparison with the average scores for its regional group, the United Arab Emirates have a high score for SDG 5 (73.72; 42.21 for the MENA region) and SDG 9 (73.57; 43.81 for the MENA region) as well as a low score for SDG 13 (28.85; 85.29 for the MENA region). In terms of the associated indicators, the United Arab Emirates perform particularly well on the gender ratio for mean years of education and the gender ratio in the national parliament (SDG 5) as well as the number of internet users, mobile broadband subscription, the Logistics Performance Index and university rankings (SDG 9). The low score for SDG 13 can be explained based on energy-related CO₂ emissions and CO₂ emissions embodied in imports. In addition to these three goals, the United Arab Emirates perform very well on SDG 3 (85.06), SDG 4 (88.63), SDG 7 (90.72) and SDG 10 (85.89). It is notable that the national scores on SDGs 5 and 9 are only the seventh and eighth best scores for the country, which indicates that the regional average of these goals is very low in comparison to the Emirates.

In terms of SDG 5, it should be noted that the MENA region has the lowest average score of the six regions at 42.21. This means that while the United Arab Emirates have a very high score on SDG 5 in comparison to other countries in the region, their score is very similar to the average score of OECD member states at 73.36. In comparison to other high-income countries, the Emirates have an even lower score than the income group average of 73.71. The correlation analysis by regional grouping has already demonstrated that correlations with SDG 5 are comparatively low in the MENA region, which can be attributed to cultural factors. The United Arab Emirates are an exception, since the government has made gender equality and women's economic empowerment a policy priority in recent years (Hamel/Dexter 2021). There is however no empirical evidence to describe any causal relations with other goals.

Similar to SDG 5, the correlation patterns of the United Arab Emirates and their difference to the other countries in the MENA region demonstrate that the country is at a very different stage of development. As a result, its SDG scores and correlations are very similar to the SDG index values and correlations across high-income countries and many OECD member states. In conclusion, the correlation pattern of the United Arab Emirates generally blends into the global trend and shows a similar distribution of synergies and trade-offs as other countries in the same income category. Based on this observation, it could be suggested that correlation patterns are primarily based on a country's income rather than geographic location. However, the United Arab Emirates clearly benefit from their prominent position in the MENA region, which is reflected on indicators like the Logistics Performance Index and university rankings.

7. Implications for the 2030 Agenda

The 2030 Agenda was adopted by the UN General Assembly in 2015 with a global and holistic approach to sustainable development. In this context, it was underlined that the 2030 Agenda and its seventeen goals would be “integrated and indivisible and balance the three dimensions of sustainable development – economic, social and environmental” (UN General Assembly 2017). Nevertheless, it has become evident that not all aspects of the 2030 Agenda are mutually beneficial, as trade-offs across the 2030 Agenda are a serious obstacle for its achievement.

According to the correlation analysis on the global level, there are three groups of SDGs based on their correlation pattern across the 2030 Agenda. The largest group, which is referred to as “group A”, comprises SDGs 1 to 11 and 16, which form a pattern of positive correlations amongst each other. The perception of an integrated and indivisible agenda could therefore be applied to these twelve goals, even though correlations between them vary depending on the individual constellations. It should be noted however that these goals primarily fall into the economic and social category, which leaves out the environmental dimension of sustainable development. This means that while positive correlations prevail among the social and economic goals, which could be considered as the traditional objectives of development, the interactions between these goals with the environmental dimension form a major trade-off.

The model of the interconnected nature of the SDGs (see figure 2.2) puts the environmental goals at the foundation of the 2030 Agenda, as their fulfilment is an important condition for attaining the social goals, which in turn are an important basis for the economic goals. While the latter two groups are closely interlinked and form a high number of synergies, the results from the correlation analysis indicate that correlations with the goals at the foundation of this model are mostly negative. Even though progress can be made on economic and social aspects of development, they might be unsustainable if they form a major trade-off with the environmental dimension. It is therefore important to identify these trade-offs, as has been demanded in previous studies, such as a very comprehensive 2019 study on synergies across the 2030 Agenda by Kroll et al.: “The alarming inability to overcome certain persistent trade-offs we have found, and indeed the deterioration for some SDGs, can seriously threaten the achievement of the Agenda 2030” (Kroll et al. 2019: 1). According to this perspective, overcoming trade-offs is the most important challenge that remains: “The achievement of the agenda crucially depends on whether we will be able to maximize such synergies and resolve the existing trade-offs” (ibid.: 2).

In addition to these general observations on SDG correlations, the analysis has provided a comprehensive insight into correlation patterns based on different factors. In this framework, it has been demonstrated that correlations across the 2030 Agenda differ significantly based on national income and geographic location. A consideration of these different factors is important to have a better understanding of SDG interrelations and to enable more successful policies on the way to SDG achievement. Consequently, it is important that geographical and economic factors are considered for SDG assessment and policy making. As demonstrated through the correlation analysis, this applies for the country groupings as well as national characteristics, which may lead to determinative deviations in correlation patterns. A policy approach to achieving the 2030 Agenda can take advantage of observed synergies, while it should be aware of potential trade-offs that need to be addressed. An SDG correlation analysis is thus a viable tool for governments to implement a policy strategy on SDG achievement.

Whereas correlations between individual goals are essential to be considered, this applies even more to the causal constellations behind these correlations. The correlation analysis in this MA thesis has provided a few suggestions based on the empirical data but cannot provide a comprehensive picture of causalities across the 2030 Agenda. While correlations between certain goals are rather obvious in terms of their causal relation, the latter remains quite speculative in many cases. Although the analysis of SDG interactions has become a popular field of research, there is a strong need for further research in terms of causal explanations for such correlations. Based on the different correlation patterns for different income and regional groups, it seems worthwhile to consider such aspects for an exploration of causalities as well.

In conclusion, the absent consideration of SDG interlinkages is a major shortcoming of the 2030 Agenda. A consideration of such interlinkages with an additional focus on national and regional characteristics would be beneficial for a better understanding of sustainable development processes and their implementation in different countries. A similar conclusion was reached by the International Council for Science, who expressed its serious concern on this shortcoming and raised the question of whether the 2030 Agenda is a reasonable tool without the consideration of interlinkages between the different goals:

“The goals are presented using a ‘silo approach’, that is, they are addressed as separate elements, mostly in isolation from each other. It is clear from systems science that goal areas overlap, that many targets might contribute to several goals, and that some goals may conflict. The goals are also addressed without reference to possible links with other goals. Since the SDG framework does not reflect interlinkages and cannot ensure that development takes place within sustainable levels of resource use at either the global or regional scale, it is possible that the framework as a whole might not be internally consistent – and as a result not be sustainable.”

(International Council for Science 2015: 9)

8. Conclusion

The objective of this MA thesis was to analyse correlations across the 2030 Agenda from a geographic perspective and to determine whether these correlations support the UN General Assembly's assumption that the SDGs are integrated and indivisible. Based on the SDG Index 2020, the correlation analysis has demonstrated that while most of the SDGs have a positive correlation pattern with each other, this statement cannot be applied to the 2030 Agenda as a whole. Based on the correlation coefficients across the agenda, three groups were identified. Two of these groups include goals which have a positive correlation amongst each other and a negative correlation to goals from the other group. These groups include SDGs 1 to 11 and 16 (group A) as well as SDGs 12 and 13 (group B). The remaining three goals, namely SDGs 14, 15 and 17 (group C), do not have any significant correlations amongst each other nor the goals in the other two groups. This correlation pattern is most prevalent on the global level but can also be observed at a less significant scale for most income and regional groups.

In addition to the global analysis, a correlation analysis was applied based on income groups, regional groups and other indices by applying Spearman's rank correlation coefficient. An application of Pearson's correlation coefficient is not reasonable due to the non-normal distribution of SDG Index values, as described in previous research (Fonseca et al. 2020: 5–7). While Spearman's rank correlation coefficient is more reliable for the detection of correlation significance, it is unable to indicate an interrelation's linearity or logarithmic kind of relation. Nevertheless, the correlation analyses on the global, grouping and national levels have shown remarkable differences in correlation patterns which need to be analysed in further detail.

Subsequently, the results from the correlation analysis were further analysed to identify any causal relationships across the 2030 Agenda in the form of effective synergies or trade-offs. Although it is difficult to provide empirical evidence for causal relationships, the assumptions and suggestions from this process underline the regional and local differences regarding SDG performance and correlations across the 2030 Agenda. These differences are a major factor regarding national policies and strategies on SDG achievement. It is therefore important to further investigate these correlations with special consideration of framework conditions in the according regional and national contexts. Overall, the correlation analysis has demonstrated that synergies across the 2030 Agenda are more numerous than trade-offs, although the latter subsist and need to be addressed accordingly. Therefore, while many aspects of the 2030 Agenda are mutually beneficial, the SDGs are neither fully integrated nor indivisible.

Appendix

Appendix 1: List of SDG targets and indicators

Goal 1: End poverty in all its forms everywhere	
1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day	1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)
1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Proportion of population living below the national poverty line, by sex and age 1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable
1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	1.4.1 Proportion of population living in households with access to basic services 1.4.2 Proportion of total adult population with secure tenure rights to land, (a) with legally recognized documentation, and (b) who perceive their rights to land as secure, by sex and type of tenure
1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	1.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population 1.5.2 Direct economic loss attributed to disasters in relation to global gross domestic product (GDP) 1.5.3 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 1.5.4 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions	1.a.1 Proportion of domestically generated resources allocated by the government directly to poverty reduction programmes 1.a.2 Proportion of total government spending on essential services (education, health and social protection) 1.a.3 Sum of total grants and non-debt-creating inflows directly allocated to poverty reduction programmes as a proportion of GDP
1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions	1.b.1 Proportion of government recurrent and capital spending to sectors that disproportionately benefit women, the poor and vulnerable groups

Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	
2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round	2.1.1 Prevalence of undernourishment 2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)
2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons	2.2.1 Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization (WHO) Child Growth Standards) among children under 5 years of age 2.2.2 Prevalence of malnutrition (weight for height >+2 or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight)

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size 2.3.2 Average income of small-scale food producers, by sex and indigenous status
2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	2.4.1 Proportion of agricultural area under productive and sustainable agriculture
2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	2.5.1 Number of plant and animal genetic resources for food and agriculture secured in either medium- or long-term conservation facilities 2.5.2 Proportion of local breeds classified as being at risk, not at risk or at unknown level of risk of extinction
2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries	2.a.1 The agriculture orientation index for government expenditures 2.a.2 Total official flows (official development assistance plus other official flows) to the agriculture sector
2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round	2.b.1 Agricultural export subsidies
2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility	2.c.1 Indicator of food price anomalies

Goal 3: Ensure healthy lives and promote well-being for all at all ages	
3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births	3.1.1 Maternal mortality ratio 3.1.2 Proportion of births attended by skilled health personnel
3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births	3.2.1 Under-5 mortality rate 3.2.2 Neonatal mortality rate
3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	3.3.1 Number of new HIV infections per 1,000 uninfected population, by sex, age and key populations 3.3.2 Tuberculosis incidence per 100,000 population 3.3.3 Malaria incidence per 1,000 population 3.3.4 Hepatitis B incidence per 100,000 population 3.3.5 Number of people requiring interventions against neglected tropical diseases
3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease 3.4.2 Suicide mortality rate

3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol	3.5.1 Coverage of treatment interventions (pharmacological, psychosocial and rehabilitation and aftercare services) for substance use disorders 3.5.2 Harmful use of alcohol, defined according to the national context as alcohol per capita consumption (aged 15 years and older) within a calendar year in litres of pure alcohol
3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents	3.6.1 Death rate due to road traffic injuries
3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes	3.7.1 Proportion of women of reproductive age (aged 15–49 years) who have their need for family planning satisfied with modern methods 3.7.2 Adolescent birth rate (aged 10–14 years; aged 15–19 years) per 1,000 women in that age group
3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all	3.8.1 Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population) 3.8.2 Proportion of population with large household expenditures on health as a share of total household expenditure or income
3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	3.9.1 Mortality rate attributed to household and ambient air pollution 3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services) 3.9.3 Mortality rate attributed to unintentional poisoning
3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate	3.a.1 Age-standardized prevalence of current tobacco use among persons aged 15 years and older
3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all	3.b.1 Proportion of the target population covered by all vaccines included in their national programme 3.b.2 Total net official development assistance to medical research and basic health sectors 3.b.3 Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a sustainable basis
3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in LDCs and small island developing States	3.c.1 Health worker density and distribution
3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks	3.d.1 International Health Regulations (IHR) capacity and health emergency preparedness

Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	
4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes	4.1.1 Proportion of children and young people (a) in grades 2/3; (b) at the end of primary; and (c) at the end of lower secondary achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex
4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education	4.2.1 Proportion of children under 5 years of age who are developmentally on track in health, learning and psychosocial well-being, by sex 4.2.2 Participation rate in organized learning (one year before the official primary entry age), by sex

4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university	4.3.1 Participation rate of youth and adults in formal and non-formal education and training in the previous 12 months, by sex
4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	4.4.1 Proportion of youth and adults with information and communications technology (ICT) skills, by type of skill
4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations	4.5.1 Parity indices (female/male, rural/urban, bottom/top wealth quintile and others such as disability status, indigenous peoples and conflict-affected, as data become available) for all education indicators on this list that can be disaggregated
4.6 By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy	4.6.1 Proportion of population in a given age group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills, by sex
4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	4.7.1 Extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment
4.a Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all	4.a.1 Proportion of schools with access to (a) electricity; (b) the Internet for pedagogical purposes; (c) computers for pedagogical purposes; (d) adapted infrastructure and materials for students with disabilities; (e) basic drinking water; (f) single-sex basic sanitation facilities; and (g) basic handwashing facilities (as per the WASH indicator definitions)
4.b By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries	4.b.1 Volume of official development assistance flows for scholarships by sector and type of study
4.c By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States	4.c.1 Proportion of teachers in: (a) pre-primary; (b) primary; (c) lower secondary; and (d) upper secondary education who have received at least the minimum organized teacher training (e.g. pedagogical training) pre-service or in-service required for teaching at the relevant level in a given country

Goal 5: Achieve gender equality and empower all women and girls	
5.1 End all forms of discrimination against all women and girls everywhere	5.1.1 Whether or not legal frameworks are in place to promote, enforce and monitor equality and non-discrimination on the basis of sex
5.2 Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation	5.2.1 Proportion of ever-partnered women and girls aged 15 years and older subjected to physical, sexual or psychological violence by a current or former intimate partner in the previous 12 months, by form of violence and by age 5.2.2 Proportion of women and girls aged 15 years and older subjected to sexual violence by persons other than an intimate partner in the previous 12 months, by age and place of occurrence
5.3 Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation	5.3.1 Proportion of women aged 20–24 years who were married or in a union before age 15 and before age 18 5.3.2 Proportion of girls and women aged 15–49 years who have undergone female genital mutilation/cutting, by age
5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate	5.4.1 Proportion of time spent on unpaid domestic and care work, by sex, age and location

5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	5.5.1 Proportion of seats held by women in (a) national parliaments and (b) local governments 5.5.2 Proportion of women in managerial positions
5.6 Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences	5.6.1 Proportion of women aged 15–49 years who make their own informed decisions regarding sexual relations, contraceptive use and reproductive health care 5.6.2 Number of countries with laws and regulations that guarantee full and equal access to women and men aged 15 years and older to sexual and reproductive health care, information and education
5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws	5.a.1 (a) Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure 5.a.2 Proportion of countries where the legal framework (including customary law) guarantees women's equal rights to land ownership and/or control
5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women	5.b.1 Proportion of individuals who own a mobile telephone, by sex
5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels	5.c.1 Proportion of countries with systems to track and make public allocations for gender equality and women's empowerment

Goal 6: Ensure availability and sustainable management of water and sanitation for all	
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Proportion of population using safely managed drinking water services
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated 6.3.2 Proportion of bodies of water with good ambient water quality
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	6.5.1 Degree of integrated water resources management implementation (0–100) 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1 Change in the extent of water-related ecosystems over time
6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan
6.b Support and strengthen the participation of local communities in improving water and sanitation management	6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all	
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 Proportion of population with access to electricity 7.1.2 Proportion of population with primary reliance on clean fuels and technology
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share in the total final energy consumption
7.3 By 2030, double the global rate of improvement in energy efficiency	7.3.1 Energy intensity measured in terms of primary energy and GDP
7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	7.a.1 International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems
7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support	7.b.1 Investments in energy efficiency as a proportion of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services

Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries	8.1.1 Annual growth rate of real GDP per capita
8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors	8.2.1 Annual growth rate of real GDP per employed person
8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	8.3.1 Proportion of informal employment in non-agriculture employment, by sex
8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead	8.4.1 Material footprint, material footprint per capita, and material footprint per GDP 8.4.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	8.5.1 Average hourly earnings of female and male employees, by occupation, age and persons with disabilities 8.5.2 Unemployment rate, by sex, age and persons with disabilities
8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	8.6.1 Proportion of youth (aged 15–24 years) not in education, employment or training
8.7 Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms	8.7.1 Proportion and number of children aged 5–17 years engaged in child labour, by sex and age
8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	8.8.1 Frequency rates of fatal and non-fatal occupational injuries, by sex and migrant status 8.8.2 Level of national compliance with labour rights (freedom of association and collective bargaining) based on ILO textual sources and national legislation, by sex and migrant status

8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	8.9.1 Tourism direct GDP as a proportion of total GDP and in growth rate 8.9.2 Proportion of jobs in sustainable tourism industries out of total tourism jobs
8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all	8.10.1 (a) Number of commercial bank branches per 100,000 adults and (b) number of automated teller machines (ATMs) per 100,000 adults 8.10.2 Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider
8.a Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-related Technical Assistance to Least Developed Countries	8.a.1 Aid for Trade commitments and disbursements
8.b By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization	8.b.1 Existence of a developed and operationalized national strategy for youth employment, as a distinct strategy or as part of a national employment strategy

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	9.1.1 Proportion of the rural population who live within 2 km of an all-season road 9.1.2 Passenger and freight volumes, by mode of transport
9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and GDP, in line with national circumstances, and double its share in LDCs	9.2.1 Manufacturing value added as a proportion of GDP and per capita 9.2.2 Manufacturing employment as a proportion of total employment
9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets	9.3.1 Proportion of small-scale industries in total industry value added 9.3.2 Proportion of small-scale industries with a loan or line of credit
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO ₂ emission per unit of value added
9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	9.5.1 Research and development expenditure as a proportion of GDP 9.5.2 Researchers (in full-time equivalent) per million inhabitants
9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, LDCs, landlocked developing countries and small island developing States	9.a.1 Total official international support (official development assistance plus other official flows) to infrastructure
9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities	9.b.1 Proportion of medium and high-tech industry value added in total value added
9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	9.c.1 Proportion of population covered by a mobile network, by technology

Goal 10: Reduce inequality within and among countries	
10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average	10.1.1 Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population
10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status	10.2.1 Proportion of people living below 50 per cent of median income, by sex, age and persons with disabilities
10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard	10.3.1 Proportion of population reporting having personally felt discriminated against or harassed in the previous 12 months on the basis of a ground of discrimination prohibited under international human rights law
10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	10.4.1 Labour share of GDP, comprising wages and social protection transfers
10.5 Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations	10.5.1 Financial Soundness Indicators
10.6 Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions	10.6.1 Proportion of members and voting rights of developing countries in international organizations
10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies	10.7.1 Recruitment cost borne by employee as a proportion of yearly income earned in country of destination 10.7.2 Number of countries that have implemented well-managed migration policies
10.a Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements	10.a.1 Proportion of tariff lines applied to imports from least developed countries and developing countries with zero-tariff
10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes	10.b.1 Total resource flows for development, by recipient and donor countries and type of flow (e.g. official development assistance, foreign direct investment and other flows)
10.c By 2030, reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent	10.c.1 Remittance costs as a proportion of the amount remitted

Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable	
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	11.3.1 Ratio of land consumption rate to population growth rate 11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically

11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	11.4.1 Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation), level of government (national, regional and local/municipal), type of expenditure (operating expenditure/investment) and type of private funding (donations in kind, private non-profit sector and sponsorship)
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population 11.5.2 Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities 11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities 11.7.2 Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months
11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	11.a.1 Proportion of population living in cities that implement urban and regional development plans integrating population projections and resource needs, by size of city
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels	11.b.1 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 11.b.2 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials	11.c.1 Proportion of financial support to the least developed countries that is allocated to the construction and retrofitting of sustainable, resilient and resource-efficient buildings utilizing local materials

Goal 12: Ensure sustainable consumption and production patterns	
12.1 Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	12.1.1 Number of countries with sustainable consumption and production (SCP) national action plans or SCP mainstreamed as a priority or a target into national policies
12.2 By 2030, achieve the sustainable management and efficient use of natural resources	12.2.1 Material footprint, material footprint per capita, and material footprint per GDP 12.2.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	12.3.1 Global food loss index
12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	12.4.1 Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement 12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment

12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	12.5.1 National recycling rate, tons of material recycled
12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	12.6.1 Number of companies publishing sustainability reports
12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities	12.7.1 Number of countries implementing sustainable public procurement policies and action plans
12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	12.8.1 Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment
12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production	12.a.1 Amount of support to developing countries on research and development for sustainable consumption and production and environmentally sound technologies
12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	12.b.1 Number of sustainable tourism strategies or policies and implemented action plans with agreed monitoring and evaluation tools
12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities	12.c.1 Amount of fossil-fuel subsidies per unit of GDP (production and consumption) and as a proportion of total national expenditure on fossil fuels

Goal 13: Take urgent action to combat climate change and its impacts	
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	13.1.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population 13.1.2 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 13.1.3 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
13.2 Integrate climate change measures into national policies, strategies and planning	13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)
13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula 13.3.2 Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions
13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	13.a.1 Mobilized amount of United States dollars per year between 2020 and 2025 accountable towards the \$100 billion commitment

13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	13.b.1 Number of LDCs and small island developing States that are receiving specialized support, and amount of support, including finance, technology and capacity-building, for mechanisms for raising capacities for effective climate change-related planning and management, including focusing on women, youth and local and marginalized communities
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Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	14.1.1 Index of coastal eutrophication and floating plastic debris density
14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	14.2.1 Proportion of national exclusive economic zones managed using ecosystem-based approaches
14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations
14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	14.4.1 Proportion of fish stocks within biologically sustainable levels
14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	14.5.1 Coverage of protected areas in relation to marine areas
14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the WTO fisheries subsidies negotiation ³	14.6.1 Progress by countries in the degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing
14.7 By 2030, increase the economic benefits to small island developing States and LDCs from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	14.7.1 Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries
14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and LDCs	14.a.1 Proportion of total research budget allocated to research in the field of marine technology
14.b Provide access for small-scale artisanal fishers to marine resources and markets	14.b.1 Progress by countries in the degree of application of a legal/regulatory/policy/institutional framework which recognizes and protects access rights for small-scale fisheries
14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"	14.c.1 Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nations Convention on the Law of the Sea, for the conservation and sustainable use of the oceans and their resources

Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type
15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management
15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	15.3.1 Proportion of land that is degraded over total land area
15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	15.4.1 Coverage by protected areas of important sites for mountain biodiversity 15.4.2 Mountain Green Cover Index
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Red List Index
15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed	15.6.1 Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits
15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	15.7.1 Proportion of traded wildlife that was poached or illicitly trafficked
15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020
15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	15.a.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation	15.b.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	15.c.1 Proportion of traded wildlife that was poached or illicitly trafficked

Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
16.1 Significantly reduce all forms of violence and related death rates everywhere	16.1.1 Number of victims of intentional homicide per 100,000 population, by sex and age 16.1.2 Conflict-related deaths per 100,000 population, by sex, age and cause 16.1.3 Proportion of population subjected to (a) physical violence, (b) psychological violence and (c) sexual violence in the previous 12 months 16.1.4 Proportion of population that feel safe walking alone around the area they live
16.2 End abuse, exploitation, trafficking and all forms of violence against and torture of children	16.2.1 Proportion of children aged 1–17 years who experienced any physical punishment and/or psychological aggression by caregivers in the past month 16.2.2 Number of victims of human trafficking per 100,000 population, by sex, age and form of exploitation 16.2.3 Proportion of young women and men aged 18–29 years who experienced sexual violence by age 18
16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all	16.3.1 Proportion of victims of violence in the previous 12 months who reported their victimization to competent authorities or other officially recognized conflict resolution mechanisms 16.3.2 Unsentenced detainees as a proportion of overall prison population
16.4 By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime	16.4.1 Total value of inward and outward illicit financial flows (in current United States dollars) 16.4.2 Proportion of seized, found or surrendered arms whose illicit origin or context has been traced or established by a competent authority in line with international instruments
16.5 Substantially reduce corruption and bribery in all their forms	16.5.1 Proportion of persons who had at least one contact with a public official and who paid a bribe to a public official, or were asked for a bribe by those public officials, during the previous 12 months 16.5.2 Proportion of businesses that had at least one contact with a public official and that paid a bribe to a public official, or were asked for a bribe by those public officials during the previous 12 months
16.6 Develop effective, accountable and transparent institutions at all levels	16.6.1 Primary government expenditures as a proportion of original approved budget, by sector (or by budget codes or similar) 16.6.2 Proportion of population satisfied with their last experience of public services
16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels	16.7.1 Proportions of positions (by sex, age, persons with disabilities and population groups) in public institutions (national and local legislatures, public service, and judiciary) compared to national distributions 16.7.2 Proportion of population who believe decision-making is inclusive and responsive, by sex, age, disability and population group
16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance	16.8.1 Proportion of members and voting rights of developing countries in international organizations
16.9 By 2030, provide legal identity for all, including birth registration	16.9.1 Proportion of children under 5 years of age whose births have been registered with a civil authority, by age
16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements	16.10.1 Number of verified cases of killing, kidnapping, enforced disappearance, arbitrary detention and torture of journalists, associated media personnel, trade unionists and human rights advocates in the previous 12 months 16.10.2 Number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information
16.a Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime	16.a.1 Existence of independent national human rights institutions in compliance with the Paris Principles
16.b Promote and enforce non-discriminatory laws and policies for sustainable development	16.b.1 Proportion of population reporting having personally felt discriminated against or harassed in the previous 12 months on the basis of a ground of discrimination prohibited under international human rights law

Goal 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	
17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection	17.1.1 Total government revenue as a proportion of GDP, by source 17.1.2 Proportion of domestic budget funded by domestic taxes
17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries	17.2.1 Net official development assistance, total and to least developed countries, as a proportion of the Organization for Economic Cooperation and Development (OECD) Development Assistance Committee donors' gross national income (GNI)
17.3 Mobilize additional financial resources for developing countries from multiple sources	17.3.1 Foreign direct investment (FDI), official development assistance and South-South cooperation as a proportion of total domestic budget 17.3.2 Volume of remittances (in United States dollars) as a proportion of total GDP 17.4.1 Debt service as a proportion of exports of goods and services
17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress	
17.5 Adopt and implement investment promotion regimes for least developed countries	17.5.1 Number of countries that adopt and implement investment promotion regimes for least developed countries
17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	17.6.1 Number of science and/or technology cooperation agreements and programmes between countries, by type of cooperation 17.6.2 Fixed Internet broadband subscriptions per 100 inhabitants, by speed
17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	17.7.1 Total amount of approved funding for developing countries to promote the development, transfer, dissemination and diffusion of environmentally sound technologies
17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	17.8.1 Proportion of individuals using the Internet
17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation	17.9.1 Dollar value of financial and technical assistance (including through North-South, South-South and triangular cooperation) committed to developing countries
17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda	17.10.1 Worldwide weighted tariff-average
17.11 Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020	17.11.1 Developing countries' and least developed countries' share of global exports

17.12 Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access	17.12.1 Average tariffs faced by developing countries, least developed countries and small island developing States
17.13 Enhance global macroeconomic stability, including through policy coordination and policy coherence	17.13.1 Macroeconomic Dashboard
17.14 Enhance policy coherence for sustainable development	17.14.1 Number of countries with mechanisms in place to enhance policy coherence of sustainable development
17.15 Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development	17.15.1 Extent of use of country-owned results frameworks and planning tools by providers of development cooperation
17.16 Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries	17.16.1 Number of countries reporting progress in multi-stakeholder development effectiveness monitoring frameworks that support the achievement of the sustainable development goals
17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships	17.17.1 Amount of United States dollars committed to (a) public-private partnerships and (b) civil society partnerships
17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	17.18.1 Proportion of sustainable development indicators produced at the national level with full disaggregation when relevant to the target, in accordance with the Fundamental Principles of Official Statistics 17.18.2 Number of countries that have national statistical legislation that complies with the Fundamental Principles of Official Statistics 17.18.3 Number of countries with a national statistical plan that is fully funded and under implementation, by source of funding
17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries	17.19.1 Dollar value of all resources made available to strengthen statistical capacity in developing countries 17.19.2 Proportion of countries that (a) have conducted at least one population and housing census in the last 10 years; and (b) have achieved 100 per cent birth registration and 80 per cent death registration

(Source: UN Statistics Division 2017)

Appendix 2: SDG Index 2020 included indicators

SDG	Indicator	Ref. Year	Data Source	Coverage
1	Poverty headcount ratio at \$1.90/day (%)	2020	World Data Lab	Global
1	Poverty headcount ratio at \$3.20/day (%)	2020	World Data Lab	Global
1	Poverty rate after taxes and transfers (%)	2017	OECD	OECD only
2	Prevalence of undernourishment (%)	2017	FAO	Global
2	Prevalence of stunting in children under 5 years of age (%)	2016	UNICEF et al.	Global
2	Prevalence of wasting in children under 5 years of age (%)	2016	UNICEF et al.	Global
2	Prevalence of obesity, BMI ≥ 30 (% of adult population)	2016	WHO	Global
2	Human Trophic Level (best 2-3 worst)	2017	Bonhommeau et al.	Global
2	Cereal yield (tonnes per hectare of harvested land)	2017	FAO	Global
2	Sustainable Nitrogen Management Index (best 0-1.41 worst)	2015	Zhang and Davidson	Global
2	Yield gap closure (% of potential yield)	2015	Global Yield Gap Atlas	OECD only
3	Maternal mortality rate (per 100,000 live births)	2017	WHO et al.	Global
3	Neonatal mortality rate (per 1,000 live births)	2018	UNICEF et al.	Global
3	Mortality rate, under-5 (per 1,000 live births)	2018	UNICEF et al.	Global
3	Incidence of tuberculosis (per 100,000 population)	2018	WHO	Global
3	New HIV infections (per 1,000 uninfected population)	2018	UNAIDS	Global
3	Age-standardized death rate due to cardiovascular disease, cancer, diabetes, or chronic respiratory disease in adults aged 30–70 years (%)	2016	WHO	Global
3	Age-standardized death rate attributable to household air pollution and ambient air pollution (per 100,000 population)	2016	WHO	Global
3	Traffic deaths (per 100,000 population)	2016	WHO	Global
3	Life expectancy at birth (years)	2016	WHO	Global
3	Adolescent fertility rate (births per 1,000 adolescent females aged 15 to 19)	2017	UNDESA	Global
3	Births attended by skilled health personnel (%)	2016	UNICEF	Global
3	Percentage of surviving infants who received 2 WHO-recommended vaccines (%)	2018	WHO and UNICEF	Global
3	Universal health coverage (UHC) index of service coverage (worst 0-100 best)	2017	WHO	Global
3	Subjective well-being (average ladder score, worst 0-10 best)	2019	Gallup	Global
3	Gap in life expectancy at birth among regions (years)	2016	OECD	OECD only
3	Gap in self-reported health status by income (percentage points)	2018	OECD	OECD only
3	Daily smokers (% of population aged 15 and over)	2018	OECD	OECD only
4	Net primary enrollment rate (%)	2018	UNESCO	Global
4	Lower secondary completion rate (%)	2018	UNESCO	Global
4	Literacy rate (% of population aged 15 to 24)	2018	UNESCO	Global
4	Participation rate in pre-primary organized learning (% of children aged 4 to 6)	2018	UNESCO	OECD only
4	Tertiary educational attainment (% of population aged 25 to 34)	2018	OECD	OECD only
4	PISA score (worst 0-600 best)	2018	OECD	OECD only
4	Variation in science performance explained by socio-economic status (%)	2018	OECD	OECD only
4	Underachievers in science (% of 15-year-olds)	2018	OECD	OECD only
4	Resilient students in science (% of 15-year-olds)	2018	OECD	OECD only
5	Demand for family planning satisfied by modern methods (% of females aged 15 to 49 who are married or in unions)	2018	UNDESA	Global

SDG	Indicator	Ref. Year	Data Source	Coverage
5	Ratio of female-to-male mean years of education received (%)	2018	UNESCO	Global
5	Ratio of female-to-male labor force participation rate (%)	2019	ILO	Global
5	Seats held by women in national parliament (%)	2020	IPU	Global
5	Gender wage gap (% of male median wage)	2018	OECD	OECD only
5	Gender gap in time spent doing unpaid work (minutes/day)	2015	OECD	OECD only
6	Population using at least basic drinking water services (%)	2017	JMP	Global
6	Population using at least basic sanitation services (%)	2017	JMP	Global
6	Freshwater withdrawal (% of available freshwater resources)	2015	FAO	Global
6	Anthropogenic wastewater that receives treatment (%)	2018	EPI	Global
6	Scarce water consumption embodied in imports (m ³ /capita)	2013	Lenzen et al.	Global
6	Population using safely managed water services (%)	2017	JMP	OECD only
6	Population using safely managed sanitation services (%)	2017	JMP	OECD only
7	Population with access to electricity (%)	2017	SE4All	Global
7	Population with access to clean fuels and technology for cooking (%)	2016	SE4All	Global
7	CO ₂ emissions from fuel combustion for electricity and heating per total electricity output (MtCO ₂ /TWh)	2017	IEA	Global
7	Share of renewable energy in total primary energy supply (%)	2018	OECD	OECD only
8	Fatal work-related accidents embodied in imports (per 100,000 population)	2010	Alsamawi et al.	Global
8	Adjusted GDP growth (%)	2018	World Bank	Global
8	Victims of modern slavery (per 1,000 population)	2018	Walk Free Foundation	Global
8	Adults with an account at a bank or other financial institution or with a mobile-money-service provider (% of population aged 15 or over)	2017	Demirguc-Kunt et al.	Global
8	Unemployment rate (% of total labor force)	2019	ILO	Global
8	Employment-to-population ratio (%)	2019	OECD	OECD only
8	Youth not in employment, education or training (NEET) (% of population aged 15 to 29)	2018	OECD	OECD only
9	Population using the internet (%)	2018	ITU	Global
9	Mobile broadband subscriptions (per 100 population)	2018	ITU	Global
9	Logistics Performance Index: Quality of trade and transport-related infrastructure (worst 1-5 best)	2018	World Bank	Global
9	The Times Higher Education Universities Ranking: Average score of top 3 universities (worst 0-100 best)	2020	Times Higher Education	Global
9	Scientific and technical journal articles (per 1,000 population)	2018	National Science Foundation	Global
9	Expenditure on research and development (% of GDP)	2017	UNESCO	Global
9	Researchers (per 1,000 employed population)	2018	OECD	OECD only
9	Triadic patent families filed (per million population)	2017	OECD	OECD only
9	Gap in internet access by income (percentage points)	2019	OECD	OECD only
9	Women in science and engineering (% of tertiary graduates in science and engineering)	2015	OECD	OECD only
10	Gini coefficient adjusted for top income	2017	Chandy and Seidel	Global
10	Palma ratio	2017	OECD	OECD only
10	Elderly poverty rate (% of population aged 66 or over)	2017	OECD	OECD only
11	Annual mean concentration of particulate matter of less than 2.5 microns in diameter (PM2.5) (µg/m ³)	2017	IHME	Global
11	Access to improved water source, piped (% of urban population)	2017	WHO and UNICEF	Global
11	Satisfaction with public transport (%)	2019	Gallup	Global
11	Population with rent overburden (%)	2017	OECD	OECD only
12	Municipal solid waste (kg/capita/day)	2016	World Bank	Global

SDG	Indicator	Ref. Year	Data Source	Coverage
12	Electronic waste (kg/capita)	2016	UNU-IAS	Global
12	Production-based SO ₂ emissions (kg/capita)	2012	Lenzen et al.	Global
12	SO ₂ emissions embodied in imports (kg/capita)	2012	Lenzen et al.	Global
12	Production-based nitrogen emissions (kg/capita)	2010	Oita et al.	Global
12	Nitrogen emissions embodied in imports (kg/capita)	2010	Oita et al.	Global
12	Non-recycled municipal solid waste (kg/capita/day)	2018	OECD	OECD only
13	Energy-related CO ₂ emissions (tCO ₂ /capita)	2017	Gütschow et al.	Global
13	CO ₂ emissions embodied in imports (tCO ₂ /capita)	2015	Lenzen et al.	Global
13	CO ₂ emissions embodied in fossil fuel exports (kg/capita)	2019	UN Comtrade; EIA	Global
13	Effective carbon rate (EUR/tCO ₂)	2016	OECD	OECD only
14	Mean area that is protected in marine sites important to biodiversity (%)	2018	Birdlife International et al.	Global
14	Ocean Health Index: Clean Waters score (worst 0-100 best)	2019	Ocean Health Index	Global
14	Fish caught from overexploited or collapsed stocks (% of total catch)	2014	Sea around Us; EPI	Global
14	Fish caught by trawling (%)	2014	Sea Around Us	Global
14	Marine biodiversity threats embodied in imports (per million population)	2018	Lenzen et al.	Global
15	Mean area that is protected in terrestrial sites important to biodiversity (%)	2018	Birdlife International et al.	Global
15	Mean area that is protected in freshwater sites important to biodiversity (%)	2018	Birdlife International et al.	Global
15	Red List Index of species survival (worst 0-1 best)	2019	IUCN and Birdlife International	Global
15	Permanent deforestation (% of forest area, 5-year average)	2018	Curtis et al.	Global
15	Terrestrial and freshwater biodiversity threats embodied in imports (per million population)	2018	Lenzen et al.	Global
16	Exports of major conventional weapons (TIV constant million USD per 100,000 population)	2019	Stockholm Peace Research Institute	Global
16	Homicides (per 100,000 population)	2017	UNODC	Global
16	Unsentenced detainees (% of prison population)	2018	UNODC	Global
16	Percentage of population who feel safe walking alone at night in the city or area where they live (%)	2019	Gallup	Global
16	Property Rights (worst 1-7 best)	2019	World Economic Forum	Global
16	Birth registrations with civil authority (% of children under age 5)	2018	UNICEF	Global
16	Corruption Perception Index (worst 0-100 best)	2019	Transparency International	Global
16	Children involved in child labor (% of population aged 5 to 14)	2016	UNICEF	Global
16	Press Freedom Index (best 0-100 worst)	2019	Reporters sans frontières	Global
16	Persons held in prison (per 100,000 population)	2017	UNODC	OECD only
17	For high-income and all OECD DAC countries: International concessional public finance, including official development assistance (% of GNI)	2017	OECD	Global
17	Corporate Tax Haven Score (best 0-100 worst)	2019	Tax Justice Network	Global
17	Government spending on health and education (% of GDP)	2016	UNESCO; WHO	Global
17	Other countries: Government revenue excluding grants (% of GDP)	2018	IMF	Global
17	Financial Secrecy Score (best 0-100 worst)	2020	Tax Justice Network	OECD only
17	Shifted profits of multinationals (US\$ billion)	2016	Zucman et al.	OECD only

(Source: Sachs et al. 2020: 74–81)

Appendix 3: SDG Index 2020 data table

Country Code	Overall Score	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
AFG	54.22		45.25	36.64	54.60	32.81	46.31	64.27	40.56	6.48		39.40	90.84	99.03		52.18	46.58	46.32
AGO	52.59	43.91	47.22	37.22	38.20	50.53	53.96	51.48	57.92	8.38	50.49	47.03	92.83	96.75	56.71	64.23	45.37	51.78
ALB	70.82	95.54	48.88	78.14	94.16	54.55	75.91	86.85	64.44	29.07	60.05	75.01	79.86	93.26	50.30	85.66	66.62	65.59
ARE	70.30		63.40	85.06	88.63	73.72	56.11	90.72	68.98	73.57	85.89	77.51	52.16	28.85	67.09	58.21	79.58	51.39
ARG	73.17	96.72	64.52	80.90	94.97	79.22	79.06	91.97	69.47	45.21	45.99	86.08	77.76	86.49	51.94	59.87	65.14	68.55
ARM	69.86	93.18	58.97	77.39	90.49	58.07	67.49	94.98	64.89	33.43	43.76	67.22	89.49	93.68		61.08	77.61	56.98
AUS	74.87	99.03	56.18	95.59	99.75	80.00	94.95	91.11	82.66	89.70	73.45	82.30	42.79	15.09	57.48	62.70	86.09	63.91
AUT	80.70	99.19	71.62	92.05	98.22	81.97	89.60	94.12	83.29	93.39	87.42	88.40	46.71	56.46		73.02	93.72	63.35
AZE	72.61	100.00	61.76	73.49	88.28	54.15	65.56	90.90	66.03	34.64	68.60	85.41	84.77	90.40		66.70	74.04	70.70
BDI	53.46	0.00	50.95	47.23	60.24	63.49	54.90	0.11	43.21	5.02	68.72	59.41	82.77	99.83		82.93	53.86	71.65
BEL	79.96	99.54	69.37	92.73	98.37	85.23	71.73	93.69	82.41	89.04	94.77	83.87	55.77	62.82	46.59	84.32	84.86	64.14
BEN	53.31	18.49	57.28	45.08	52.22	40.24	50.22	13.97	71.27	13.22	35.29	52.19	96.13	98.78	57.51	85.21	53.26	65.96
BFA	55.22	27.15	53.02	47.57	36.04	38.45	44.66	12.54	70.25	16.67	78.08	61.06	89.87	99.34		86.03	57.40	56.17
BGD	63.51	66.95	55.29	59.51	84.20	49.65	67.33	61.19	78.27	24.75	68.50	54.72	95.44	98.58	64.60	57.80	54.91	37.92
BGR	74.77	97.17	63.58	78.30	67.60	70.70	70.86	90.45	81.75	51.61	62.17	74.44	74.97	80.91	73.81	94.49	70.20	68.01
BHR	68.83		66.39	89.22	95.13	53.93	71.34	93.87	79.52	46.43		52.01	67.56	62.84	65.15	61.35	69.61	39.31
BIH	73.48	99.73	61.88	78.59	90.58	40.14	77.33	79.50	69.34	33.10	81.28	72.35	79.30	86.41	58.40	70.32	72.67	98.23
BLR	78.76	99.91	61.33	83.08	95.37	80.84	79.72	89.98	75.39	43.69	85.37	80.41	87.67	90.66		78.79	73.20	74.58
BLZ	65.08	68.70	59.79	70.69	82.23	57.98	75.87	91.61	65.84	21.26		73.35	72.12	91.43	47.38	50.01	59.86	79.72
BOL	69.27	85.83	56.38	71.02	87.38	69.24	69.41	71.73	78.39	25.45	53.52	81.60	85.67	93.57		66.15	47.81	72.11
BRA	72.67	86.35	66.60	78.42	85.36	69.80	86.25	94.32	72.45	59.05	24.81	79.53	79.42	94.57	70.89	57.23	55.63	74.74
BRB	68.29	92.32	48.95	84.70	97.55	72.03	59.29	99.71	73.79	37.93		79.21	44.67	71.29	43.52	66.61	73.17	77.63
BRN	68.15		49.16	87.69	94.88	64.18	70.58	90.30	64.06	62.18		100.00	52.22	13.31	65.62	69.89	61.45	72.16
BTN	69.27	89.82	54.22	67.76	80.04	48.95	71.01	74.50	71.09	33.35	59.65	82.59	83.49	92.56		65.00	83.76	63.56
BWA	61.45	58.53	31.76	54.52	88.74	66.96	70.57	58.81	63.00	34.92	4.81	80.89	72.13	79.85		72.74	67.22	74.84
CAF	38.54	0.00	36.72	15.41	9.02	31.18	45.51	11.49	48.54	3.58	19.28	27.76	72.73	99.67		90.21	41.92	37.71
CAN	78.19	99.23	63.84	94.13	99.75	81.51	85.90	95.17	84.34	84.57	78.85	87.20	51.18	53.08	59.15	59.05	86.66	65.63
CHE	79.35	99.88	67.55	96.59	99.60	83.83	89.80	96.37	79.44	96.68	80.92	97.99	40.29	61.18		65.39	82.69	51.42
CHL	77.42	98.96	67.86	85.55	96.50	70.69	93.31	91.00	81.28	61.13	32.32	80.30	79.05	86.49	73.41	57.86	76.00	84.44
CHN	73.89	97.96	76.39	79.84	94.96	75.75	68.60	69.41	87.47	72.15	61.32	75.91	88.55	89.78	50.51	59.47	63.79	44.36
CIV	57.91	47.79	56.42	36.24	47.14	38.37	55.96	53.65	73.72	26.73	45.02	59.61	94.67	98.88	71.21	69.42	54.60	55.02
CMR	56.54	50.73	57.02	39.49	64.31	55.15	53.21	55.49	67.64	16.28	43.23	38.75	95.01	98.85	67.54	66.10	45.94	46.34
COD	49.71	0.00	47.65	39.60	58.23	37.77	43.42	36.36	55.89	9.31	58.94	48.29	92.65	99.47	57.41	71.57	29.90	58.64
COG	55.25	3.85	42.18	48.85	60.06	52.86	53.12	56.93	54.67	6.71	31.04	57.78	94.05	97.79	73.09	91.29	53.21	61.74
COL	70.91	86.64	59.44	79.19	84.33	70.65	81.16	91.26	69.60	40.21	21.92	84.16	86.16	90.04	79.04	57.18	58.43	65.97
COM	53.07	49.67	45.82	53.26	51.89	38.55	49.01	42.71	49.74	15.95	48.90	70.17	85.74	99.56	35.96	43.37	60.21	61.76
CPV	67.18	54.68	40.19	73.53	81.19	72.43	73.10	81.33	74.27	25.17	36.14	80.10	79.50	94.22	57.30	69.41	76.90	72.58
CRI	75.08	97.66	55.03	85.02	85.66	82.23	80.41	93.81	74.98	49.26	35.45	92.26	81.30	83.82	71.83	53.24	75.76	78.59
CUB	72.58		58.42	85.30	95.46	83.63	74.50	85.36	91.85	23.11		56.18	88.22	88.38	66.89	51.43	64.70	100.00
CYP	75.21	99.88	53.88	90.84	97.11	72.17	77.31	92.40	81.13	71.93	81.83	77.34	54.61	66.14	59.72	84.66	81.23	36.47
CZE	80.58	99.42	63.98	90.96	97.65	72.56	85.55	91.93	85.98	78.44	92.98	89.09	69.28	68.92		92.06	81.56	50.11
DEU	80.77	99.64	70.05	93.47	98.33	77.35	84.50	93.43	84.96	92.31	82.41	89.00	52.43	62.44	52.42	79.33	81.89	79.22
DJI	54.56	57.01	37.91	53.27	41.12	51.76	63.42	32.97	57.76	25.77	27.58	71.24	89.18	97.65	44.06	38.30	63.96	74.65
DNK	84.56	99.58	71.41	94.49	99.10	85.96	90.92	94.21	85.28	96.85	97.55	89.35	42.62	62.52	58.08	92.94	92.76	83.87
DOM	70.17	95.36	54.38	67.77	88.09	72.22	69.72	90.03	78.52	33.87	32.26	80.19	84.94	92.81	75.37	75.07	54.79	47.41
DZA	72.27	97.88	54.58	75.50	90.49	52.79	61.03	87.17	67.03	40.04	88.67	66.61	88.36	92.09	48.79	62.18	72.33	83.03
ECU	74.26	88.36	52.58	77.46	92.10	77.62	75.02	91.72	73.96	35.16	46.79	89.95	84.60	93.45	78.75	61.06	63.06	80.80
EGY	68.79	90.45	59.30	69.96	84.41	47.21	66.49	92.71	65.30	43.45	37.75	59.88	87.98	95.87	65.61	68.16	77.57	57.31
ESP	78.11	98.08	57.30	93.61	96.66	85.14	86.26	94.49	75.20	85.71	68.87	87.87	62.29	78.53	61.19	64.89	79.64	52.14
EST	80.06	99.70	61.51	87.10	96.72	76.33	88.50	90.22	88.01	74.35	79.23	91.26	59.38	57.70	82.59	96.24	88.66	43.52
ETH	55.23	32.55	53.22	43.11	43.66	53.35	35.75	41.39	72.71	11.81	78.95	58.86	96.21	99.58		57.02	50.23	46.14
FIN	83.77	99.84	61.11	94.90	98.08	91.23	94.44	96.32	85.67	93.88	96.75	85.37	54.68	61.10	62.78	85.05	94.46	68.48
FJI	69.95	93.37	51.29	70.77	97.51	58.28	76.74	66.96	83.45	39.70	29.74	95.59	81.16	92.17	59.21	42.82	85.59	64.74

Country Code	Overall Score	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
FRA	81.13	99.54	70.34	92.58	99.46	86.72	85.99	96.76	78.45	86.23	83.62	89.43	57.42	73.94	67.64	70.80	73.98	66.27
GAB	63.40	86.30	53.91	50.65	59.94	48.31	62.81	81.35	60.29	32.23	65.28	52.63	86.52	89.44	61.28	82.94	53.79	50.17
GBR	79.79	99.69	67.45	93.62	97.98	84.30	92.45	93.63	82.27	89.76	73.31	90.99	53.30	59.14	64.73	76.84	85.13	51.82
GEO	71.88	85.78	51.18	73.19	97.21	58.86	83.50	88.09	70.62	37.15	43.46	83.29	84.67	88.18	64.28	66.06	83.42	63.04
GHA	65.37	70.27	63.63	52.66	76.52	53.08	55.61	59.91	76.25	38.63	48.02	53.86	95.39	98.35	66.89	72.30	69.08	60.92
GIN	52.47	34.72	51.65	31.51	23.77	36.82	50.08	14.49	67.71	6.51	69.49	55.07	94.61	99.16	74.69	73.60	47.37	60.73
GMB	57.86	67.29	45.74	44.21	46.72	36.15	59.09	26.57	72.12	11.45	76.33	61.28	93.61	99.12	71.03	78.78	58.72	35.39
GRC	74.33	96.68	62.28	87.18	96.65	63.45	87.59	91.28	65.83	69.50	50.32	81.71	58.64	74.74	68.46	81.05	72.95	55.29
GTM	61.54	75.50	44.98	70.57	69.38	56.90	71.40	71.82	74.54	17.98	21.57	84.43	90.39	96.47	58.02	45.44	51.26	45.56
GUY	59.74	93.94	58.90	62.31	84.50	62.07	55.36	81.95	52.14	17.00		82.82	21.40	62.80	41.32	59.27	62.67	78.54
HND	64.44	58.78	48.15	75.23	61.47	64.10	74.49	73.15	72.51	16.97	30.10	86.90	89.51	95.88	70.32	60.49	48.47	69.04
HRV	78.40	98.47	68.84	86.05	88.39	61.87	86.79	89.47	81.05	62.59	74.42	76.04	70.41	79.58	79.29	84.24	73.75	71.57
HTI	51.69	36.96	41.15	42.90	74.14	39.37	53.76	27.50	57.86	12.65	60.45	39.82	92.48	99.24	51.83	41.46	46.32	60.92
HUN	77.34	98.97	68.04	84.46	94.25	63.64	88.72	91.71	83.16	62.99	76.56	85.10	72.96	81.74		88.94	75.37	38.78
IDN	65.30	75.94	56.40	62.78	91.05	62.44	66.42	73.54	75.62	40.38	35.28	66.08	88.04	93.09	59.97	44.35	72.36	46.41
IND	61.92	74.52	44.25	55.85	83.24	31.11	56.13	68.75	82.24	40.63	55.71	49.49	92.36	96.78	63.04	50.36	61.14	46.98
IRL	79.38	99.69	75.77	93.76	99.75	73.91	87.29	93.08	86.47	81.56	84.10	86.25	44.30	60.24	61.34	89.65	90.57	41.75
IRN	71.81	95.79	58.40	79.15	94.66	43.79	59.55	88.42	70.09	54.48	59.90	75.29	84.58	82.79	75.90	67.02	63.30	67.72
IRQ	63.14	85.18	43.86	62.30	69.87	36.19	71.55	89.58	56.94	31.52	59.74	58.26	86.53	91.13	47.51	38.45	67.58	77.13
ISL	77.52	99.71	62.06	95.24	98.60	85.62	74.64	99.35	83.06	86.50	93.79	89.54	27.68	55.65	48.70	51.40	94.65	71.60
ISR	74.60	99.23	57.78	94.69	96.32	73.92	72.78	94.33	84.91	93.30	55.76	79.79	61.46	74.36	47.71	52.18	72.40	57.23
ITA	77.01	97.31	66.93	93.69	97.27	71.03	82.11	93.53	80.90	83.04	68.09	68.73	62.61	78.52	49.76	80.26	77.23	58.18
JAM	68.66	86.05	49.75	78.03	76.90	71.29	70.64	87.12	77.73	36.30	37.70	89.10	78.19	89.95	39.78	57.70	66.30	74.76
JOR	68.05	90.80	52.79	75.66	69.14	42.36	57.52	92.31	63.33	51.37	61.81	74.85	87.27	91.08	57.90	50.68	73.77	64.27
JPN	79.17	98.99	74.12	94.14	99.75	58.76	84.87	93.51	86.83	90.41	76.94	76.67	69.09	68.59	52.37	64.84	90.43	65.52
KAZ	71.06	99.89	53.35	77.67	90.45	77.04	78.81	83.61	76.91	40.97	60.05	83.66	75.54	68.29		58.64	72.98	51.23
KEN	60.17	48.46	48.82	54.94	69.69	68.58	45.52	48.20	78.35	29.01	40.97	65.32	89.07	98.13	65.58	58.51	57.51	56.25
KGZ	73.01	84.33	60.49	72.66	90.54	62.18	65.15	90.33	69.48	28.43	84.96	83.84	86.75	93.25		71.08	64.38	74.42
KHM	64.39	87.93	58.10	62.88	71.33	54.80	63.62	58.94	62.11	24.99	77.61	79.17	93.58	97.95	47.19	44.50	58.51	51.35
KOR	78.34	99.02	80.24	91.71	96.79	65.49	75.23	92.48	85.77	98.76	86.50	80.72	71.59	65.30	58.01	54.45	75.14	54.58
KWT	63.14		62.85	82.97	84.59	56.48	48.62	92.62	56.52	56.18		54.31	36.55	33.83	50.95	54.97	76.89	68.62
LAO	62.06	58.72	63.01	49.96	75.89	72.55	68.22	48.33	70.96	17.54	45.77	80.00	96.03	98.96		49.87	56.91	46.17
LBN	66.68	99.93	49.13	79.66	70.62	42.60	65.43	88.02	69.65	50.68	75.58	59.95	78.41	87.71	47.36	62.13	66.72	39.94
LBR	47.12	22.99	44.39	39.83	16.86	43.93	52.53	6.81	63.11	5.17	67.23	29.63	95.91	99.52	77.20	49.29	45.18	41.46
LKA	66.88	92.09	53.47	78.86	97.14	48.81	56.63	65.39	82.20	33.79	32.60	80.44	86.63	95.32	63.54	54.75	66.87	48.38
LSO	54.00	14.01	50.51	27.23	65.65	73.46	56.29	30.70	53.80	17.35	0.14	70.31	89.86	93.58		74.02	43.49	93.15
LTU	74.95	98.51	61.48	83.80	99.91	73.53	81.99	80.17	81.97	59.89	53.07	76.50	62.08	74.87	70.11	94.96	76.48	44.84
LUX	74.31	99.86	67.12	95.84	95.65	76.56	79.13	66.67	69.98	86.19	79.51	95.90	20.17	45.38		67.04	90.21	68.72
LVA	77.73	98.75	63.94	83.29	98.05	77.22	92.46	93.28	85.81	59.98	67.44	87.35	63.49	77.60	60.69	97.84	78.15	36.14
MAR	71.29	95.49	56.76	75.37	83.71	41.13	65.23	87.86	66.95	39.08	65.49	68.98	91.37	95.69	60.10	78.37	72.27	68.16
MDA	74.44	99.65	58.74	76.22	83.95	70.16	72.09	88.26	73.11	26.67	89.06	79.88	81.65	97.99		64.56	69.37	75.25
MDG	49.14	0.00	40.43	41.73	59.78	68.54	44.87	8.24	63.63	8.08	31.96	62.99	94.08	99.33	65.14	47.59	50.75	48.31
MDV	67.59	91.75	44.89	85.26	95.93	42.49	76.03	96.74	75.57	33.63	11.00	86.02	63.07	87.76	60.75	51.95	69.31	76.87
MEX	70.44	87.26	56.83	81.67	99.59	76.90	78.79	86.76	73.46	46.45	21.53	81.41	81.06	89.15	74.92	47.37	53.84	60.44
MKD	71.40	89.95	64.70	80.21	90.62	55.48	76.22	80.42	67.94	35.32	53.50	72.50	76.69	89.37		79.95	72.11	69.90
MLI	51.39	26.35	48.41	34.82	11.47	33.25	59.26	18.70	67.90	13.44	73.37	60.36	91.66	99.51		70.22	49.32	51.10
MLT	75.97	99.76	62.22	91.81	99.24	60.43	83.05	94.50	85.92	66.46	94.05	84.45	43.13	62.23	59.67	86.40	75.17	42.96
MMR	64.58	85.12	56.59	55.01	73.41	60.28	66.02	53.29	68.58	23.47	68.19	69.59	94.94	98.76	55.25	55.39	71.92	42.03
MNE	70.19	99.92	50.32	78.13	96.73	59.36	69.83	84.36	69.29	43.77	63.37	72.20	60.42	85.93	33.21	51.98	74.37	100.00
MNG	63.98	95.65	42.42	66.25	97.51	66.30	65.18	56.22	75.80	26.55	63.33	43.87	62.29	66.21		73.97	63.78	66.24
MOZ	54.13	11.77	45.26	33.21	46.55	61.50	49.58	38.05	68.51	10.06	25.58	71.65	96.07	98.65	72.98	67.70	54.08	68.93
MRT	57.72	81.39	39.46	44.43	39.70	32.50	58.33	41.33	45.04	20.37	85.61	49.06	89.06	96.47	72.96	76.06	45.56	63.95
MUS	63.77	98.79	59.18	78.48	90.28	53.97	61.82	89.15	76.51	32.53	35.63	89.59	59.10	77.49	42.72	25.25	71.73	41.93
MWI	52.20	4.19	59.40	47.66	49.95	66.16	52.04	2.24	62.45	10.88	38.26	64.95	93.99	99.46		62.10	50.26	59.03
MYS	71.76	99.98	54.56	79.46	90.42	55.86	77.55	91.10	80.90	71.45	56.25	83.88	76.91	78.68	56.00	40.12	71.69	55.09
NAM	61.63	56.19	38.31	49.23	82.96	86.04	59.85	49.05	63.86	31.72	0.00	72.83	74.06	85.64	68.51	85.22	68.37	75.94
NER	50.15	7.07	44.10	38.84	8.57	37.71	44.23	15.05	64.10	4.01	80.95	51.99	92.77	99.63		74.51	55.95	68.66

Country Code	Overall Score	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Goal 8	Goal 9	Goal 10	Goal 11	Goal 12	Goal 13	Goal 14	Goal 15	Goal 16	Goal 17
NGA	49.28	17.24	49.04	27.98	37.42	41.08	56.88	35.07	60.46	31.81	19.55	33.03	94.01	98.12	66.22	74.90	44.96	50.00
NIC	68.66	84.92	48.10	77.03	77.54	83.88	68.02	72.40	67.12	14.69	47.56	77.59	89.39	97.14	71.13	69.47	59.24	61.93
NLD	80.37	99.61	66.67	95.42	99.44	80.29	88.63	92.11	84.08	89.90	96.21	92.58	47.71	56.02	51.37	81.79	82.93	61.55
NOR	80.76	99.48	59.22	97.08	99.05	87.83	80.40	98.66	82.82	91.29	100.00	87.24	44.54	20.93	66.90	70.11	87.71	99.63
NPL	65.93	63.24	58.00	59.46	90.51	62.05	67.54	61.49	74.23	24.93	83.37	44.62	94.26	98.83		68.48	53.58	60.13
NZL	79.20	99.97	66.61	93.18		85.34	92.34	95.76	87.15	87.31		81.97	43.81	68.64	61.79	49.55	91.79	68.58
OMN	69.67		58.32	84.54	89.24	36.45	51.16	87.48	73.91	51.09		77.88	72.15	63.60	70.24	56.95	80.20	74.67
PAK	56.17	79.31	36.35	51.64	40.05	28.84	48.22	61.79	66.03	24.23	56.22	49.09	91.59	98.38	58.57	66.70	51.30	46.58
PAN	69.19	93.81	52.30	79.83	80.10	66.81	78.51	91.23	77.13	36.20	29.39	92.09	77.56	86.34	62.05	60.49	64.42	47.99
PER	71.75	90.13	63.38	78.48	95.45	67.74	80.33	84.71	75.47	36.22	39.83	74.97	86.99	93.82	82.06	55.26	58.06	56.94
PHL	65.50	76.39	57.58	58.05	86.09	62.20	69.34	70.18	72.49	40.13	36.44	68.61	92.66	96.52	68.14	51.12	58.32	49.16
PNG	51.66	31.24	29.57	47.57	46.07	43.88	40.97	30.76	73.07	6.19	28.19	72.55	86.52	95.67	57.71	63.02	65.42	59.83
POL	78.10	99.91	65.34	86.07	98.23	71.39	84.52	89.24	85.88	69.28	56.48	83.10	75.70	78.00	55.25	92.38	82.30	54.60
PRT	77.65	98.76	58.94	92.07	98.21	83.44	85.49	94.77	82.54	73.15	58.77	82.41	62.53	76.93	56.87	71.78	86.28	57.09
PRY	67.71	94.90	70.84	72.45	78.90	66.14	77.22	87.53	76.77	28.27	35.14	78.32	75.89	88.47		51.03	48.39	58.44
QAT	64.65		62.50	85.99	87.78	57.45	57.13	88.94	75.32	70.04		35.50	70.19	15.15	60.91	58.29	79.35	38.05
ROU	74.78	99.09	64.95	80.20	82.38	57.41	81.47	88.65	82.73	53.25	48.54	79.36	76.18	89.06	65.46	84.79	77.11	60.64
RUS	71.92	99.96	50.07	76.62	94.62	66.34	72.01	91.01	79.59	66.26	53.49	82.35	77.84	76.72	50.70	66.15	51.23	67.78
RWA	56.56	18.41	51.73	61.73	62.33	79.99	58.38	13.75	70.23	18.64	36.35	56.68	80.81	99.42		63.16	68.04	57.44
SAU	65.85		51.90	79.96	95.64	39.71	48.28	89.43	71.84	67.03		42.05	65.93	58.60	60.15	48.86	70.11	73.42
SDN	49.56	33.04	20.76	50.30	37.46	37.85	32.71	57.09	47.15	16.02	63.85	41.87	87.81	99.46	66.52	50.55	56.14	43.96
SEN	58.27	31.28	56.52	56.25	38.25	43.90	62.72	52.22	72.70	22.80	42.68	62.62	92.93	98.55	62.14	75.97	59.89	59.15
SGP	67.00	98.36	72.48	94.43	99.72	69.88	75.69	94.57	70.30	91.33		94.37	17.77	49.94	5.80	31.05	86.48	30.93
SLE	51.91	23.88	45.72	24.84	58.44	47.91	48.16	7.87	64.94	7.01	73.58	42.27	95.19	99.44	68.64	63.45	58.99	52.11
SLV	69.62	92.06	52.95	77.06	76.05	68.11	75.81	88.93	70.65	20.05	52.47	89.31	86.13	93.89	49.40	65.97	56.14	68.65
SOM	46.21	15.23	30.60	24.19		30.08	47.74	13.29	55.02	1.81		69.47	89.08	99.91	63.56	54.35	44.83	50.00
SRB	75.23	99.51	62.34	83.47	95.08	63.91	73.11	84.39	74.21	49.44	82.29	71.73	77.82	87.68		61.73	74.78	78.58
SSD	43.66	0.00	25.90	26.83	1.64	52.41	40.57	22.15	51.44	2.13	42.35	17.71	74.59	99.61		74.13	46.30	100.00
STP	62.57	38.40	59.00	63.97	82.90	44.63	61.18	42.44	65.59	18.88	53.36	85.41	77.11	96.76	83.07	65.10	70.90	55.09
SUR	68.36	56.51	61.89	73.59	66.81	69.14	73.40	89.30	75.59	22.89		83.04	75.13	76.21	77.31	77.49	69.19	76.11
SVK	77.51	98.23	67.74	87.33	93.93	69.51	84.92	91.81	82.22	61.26	81.90	81.57	67.33	74.25		87.99	79.80	48.56
SVN	79.80	99.67	66.37	91.53	97.58	77.10	92.56	93.74	88.12	73.20	100.00	83.23	57.32	63.56	46.27	84.88	86.97	54.51
SWE	84.72	99.03	67.68	96.63	99.72	89.38	93.39	98.68	83.60	96.91	93.49	88.85	55.90	66.36	54.04	80.16	85.36	91.13
SWZ	53.40	22.95	42.05	42.92	71.40	56.95	45.81	59.77	48.55	14.07	0.00	83.39	72.01	83.89		64.68	59.66	75.30
SYR	59.33		35.28	61.39	53.52	33.92	66.36	88.31	61.43	15.22	46.57	42.22	90.09	91.61	47.25	55.47	53.51	72.40
TCD	43.75	23.16	33.02	21.08	13.96	27.79	39.97	1.55	53.91	8.48	53.42	39.35	90.97	99.71		74.04	33.18	65.76
TGO	52.70	21.78	54.05	42.11	62.59	42.11	49.71	15.87	70.88	13.07	39.63	41.02	93.25	99.08	61.02	78.16	52.56	58.94
THA	74.54	99.99	62.90	77.19	88.68	69.48	76.92	83.51	81.56	53.50	62.27	83.34	78.34	87.45	64.37	67.47	71.06	59.08
TJK	69.43	87.71	52.24	69.06	97.15	48.51	58.46	91.23	69.39	11.90	77.94	80.28	85.77	95.84		69.62	73.24	53.08
TKM	63.03	31.71	53.55	68.28	90.66	59.21	58.63	81.37	68.93	12.45		79.46	84.69	53.47		62.99	73.26	64.42
TTO	65.76	98.49	47.26	77.16	88.60	68.31	74.05	89.94	78.34	27.90		67.57	65.56	39.22	62.33	69.00	58.85	66.91
TUN	71.37	97.80	53.62	74.67	86.92	49.94	63.33	91.99	62.68	41.81	64.78	65.04	87.44	92.65	63.46	66.93	69.64	80.63
TUR	70.30	99.68	59.74	81.17	98.76	46.25	75.52	88.66	69.71	59.34	39.34	70.39	81.46	88.85	45.89	52.81	65.69	71.90
TZA	56.64	23.42	50.46	44.66	49.23	71.08	50.10	34.57	73.26	22.37	56.21	65.27	92.28	99.28	73.12	60.78	52.46	44.31
UGA	53.49	24.53	50.49	46.21	60.39	59.77	44.93	7.10	72.21	25.18	57.10	45.50	88.69	99.28		67.57	49.09	46.80
UKR	74.24	99.76	57.53	70.21	91.68	67.13	78.62	91.90	72.51	34.45	98.69	71.69	82.73	89.48	53.26	64.21	62.89	75.42
URY	74.28	99.89	61.35	83.21	88.42	74.35	78.31	96.86	76.59	44.61	56.53	86.57	61.70	85.52	60.02	53.04	68.22	87.52
USA	76.43	98.93	66.26	88.85	99.75	73.96	83.72	93.37	85.20	93.79	47.66	89.14	54.72	58.06	63.73	59.53	74.76	67.85
UZB	71.02	67.50	59.86	77.41	94.44	73.89	58.36	89.48	70.88	27.69	51.17	86.62	91.45	94.09		62.71	76.76	66.08
VEN	61.68	24.81	46.13	62.19	80.08	68.04	78.13	92.51	77.71	30.95	21.61	44.64	83.37	84.73	60.05	77.91	36.13	79.65
VNM	73.80	96.13	67.64	72.08	96.61	72.05	73.14	82.51	74.92	44.59	77.12	77.72	92.76	95.72	58.94	46.65	64.32	61.74
VUT	60.89	60.12	47.33	65.19	64.19	37.06	51.85	34.92	76.16	22.61	71.54	85.22	66.16	95.93	62.49	52.58	68.99	72.70
YEM	52.33		27.48	44.42	55.52	6.72	38.43	69.25	37.47	8.94	39.36	46.70	91.56	97.72	71.49	51.39	36.40	72.51
ZAF	63.41	50.02	60.12	49.64	79.97	82.47	68.07	79.01	60.28	57.57	0.00	77.84	82.48	80.33	63.98	57.65	53.08	75.47
ZMB	52.67	13.08	44.00	43.92	64.66	63.43	51.02	47.26	64.00	18.14	0.93	61.27	93.30	98.43		69.77	44.71	53.08
ZWE	59.51		39.92	44.96	78.22	75.72	48.90	46.51	71.62	17.81	55.96	54.58	94.88	97.11		77.50	49.67	61.34

(Source: Sachs et al. 2020)

Appendix 4: SDG Index 2020 overall scores

Rank	Country	Score
1	Sweden	84.72
2	Denmark	84.56
3	Finland	83.77
4	France	81.13
5	Germany	80.77
6	Norway	80.76
7	Austria	80.70
8	Czech Republic	80.58
9	Netherlands	80.37
10	Estonia	80.06
11	Belgium	79.96
12	Slovenia	79.80
13	United Kingdom	79.79
14	Ireland	79.38
15	Switzerland	79.35
16	New Zealand	79.20
17	Japan	79.17
18	Belarus	78.76
19	Croatia	78.40
20	Korea, Rep.	78.34
21	Canada	78.19
22	Spain	78.11
23	Poland	78.10
24	Latvia	77.73
25	Portugal	77.65
26	Iceland	77.52
27	Slovak Republic	77.51
28	Chile	77.42
29	Hungary	77.34
30	Italy	77.01
31	United States	76.43
32	Malta	75.97
33	Serbia	75.23
34	Cyprus	75.21
35	Costa Rica	75.08
36	Lithuania	74.95
37	Australia	74.87
38	Romania	74.78
39	Bulgaria	74.77
40	Israel	74.60
41	Thailand	74.54
42	Moldova	74.44

Rank	Country	Score
43	Greece	74.33
44	Luxembourg	74.31
45	Uruguay	74.28
46	Ecuador	74.26
47	Ukraine	74.24
48	China	73.89
49	Vietnam	73.80
50	Bosnia and Herzegovina	73.48
51	Argentina	73.17
52	Kyrgyz Republic	73.01
53	Brazil	72.67
54	Azerbaijan	72.61
55	Cuba	72.58
56	Algeria	72.27
57	Russian Federation	71.92
58	Georgia	71.88
59	Iran, Islamic Rep.	71.81
60	Malaysia	71.76
61	Peru	71.75
62	North Macedonia	71.40
63	Tunisia	71.37
64	Morocco	71.29
65	Kazakhstan	71.06
66	Uzbekistan	71.02
67	Colombia	70.91
68	Albania	70.82
69	Mexico	70.44
70	Turkey	70.30
71	United Arab Emirates	70.30
72	Montenegro	70.19
73	Dominican Republic	70.17
74	Fiji	69.95
75	Armenia	69.86
76	Oman	69.67
77	El Salvador	69.62
78	Tajikistan	69.43
79	Bolivia	69.27
80	Bhutan	69.27
81	Panama	69.19
82	Bahrain	68.83
83	Egypt, Arab Rep.	68.79
84	Jamaica	68.66

Rank	Country	Score
85	Nicaragua	68.66
86	Suriname	68.36
87	Barbados	68.29
88	Brunei Darussalam	68.15
89	Jordan	68.05
90	Paraguay	67.71
91	Maldives	67.59
92	Cabo Verde	67.18
93	Singapore	67.00
94	Sri Lanka	66.88
95	Lebanon	66.68
96	Nepal	65.93
97	Saudi Arabia	65.85
98	Trinidad and Tobago	65.76
99	Philippines	65.50
100	Ghana	65.37
101	Indonesia	65.30
102	Belize	65.08
103	Qatar	64.65
104	Myanmar	64.58
105	Honduras	64.44
106	Cambodia	64.39
107	Mongolia	63.98
108	Mauritius	63.77
109	Bangladesh	63.51
110	South Africa	63.41
111	Gabon	63.40
112	Kuwait	63.14
113	Iraq	63.14
114	Turkmenistan	63.03
115	Sao Tome and Principe	62.57
116	Lao PDR	62.06
117	India	61.92
118	Venezuela, RB	61.68
119	Namibia	61.63
120	Guatemala	61.54
121	Botswana	61.45
122	Vanuatu	60.89
123	Kenya	60.17
124	Guyana	59.74
125	Zimbabwe	59.51

Rank	Country	Score
126	Syrian Arab Republic	59.33
127	Senegal	58.27
128	Cote d'Ivoire	57.91
129	Gambia, The	57.86
130	Mauritania	57.72
131	Tanzania	56.64
132	Rwanda	56.56
133	Cameroon	56.54
134	Pakistan	56.17
135	Congo, Rep.	55.25
136	Ethiopia	55.23
137	Burkina Faso	55.22
138	Djibouti	54.56
139	Afghanistan	54.22
140	Mozambique	54.13
141	Lesotho	54.00
142	Uganda	53.49
143	Burundi	53.46
144	Eswatini	53.40
145	Benin	53.31
146	Comoros	53.07
147	Togo	52.70
148	Zambia	52.67
149	Angola	52.59
150	Guinea	52.47
151	Yemen, Rep.	52.33
152	Malawi	52.20
153	Sierra Leone	51.91
154	Haiti	51.69
155	Papua New Guinea	51.66
156	Mali	51.39
157	Niger	50.15
158	Congo, Dem. Rep.	49.71
159	Sudan	49.56
160	Nigeria	49.28
161	Madagascar	49.14
162	Liberia	47.12
163	Somalia	46.21
164	Chad	43.75
165	South Sudan	43.66
166	Central African Republic	38.54

(Source: Sachs et al. 2020: 26–27)

Appendix 5: List of countries by indices

Country Code	Country	Income group*	Regional group**	Gini Index ^a	WHR ranking ^b	HDI ^c	SDG Index ^d
AFG	Afghanistan	LIC	E_Euro_Asia		2.523	0.511	54.22
ALB	Albania	UMIC	E_Euro_Asia	33.2	5.117	0.795	70.82
DZA	Algeria	LMIC	MENA	27.6	4.887	0.748	72.27
AGO	Angola	LMIC	Africa	51.3		0.581	52.59
ARG	Argentina	UMIC	LAC	42.9	5.929	0.845	73.17
ARM	Armenia	UMIC	E_Euro_Asia	29.9	5.283	0.776	69.86
AUS	Australia	HIC	OECD	34.4	7.183	0.944	74.87
AUT	Austria	HIC	OECD	30.8	7.268	0.922	80.70
AZE	Azerbaijan	UMIC	E_Euro_Asia	26.6	5.171	0.756	72.61
BHR	Bahrain	HIC	MENA		6.647	0.852	68.83
BGD	Bangladesh	LMIC	E_S_Asia	32.4	5.025	0.632	63.51
BRB	Barbados	HIC	LAC			0.814	68.29
BLR	Belarus	UMIC	E_Euro_Asia	25.3	5.534	0.823	78.76
BEL	Belgium	HIC	OECD	27.2	6.834	0.931	79.96
BLZ	Belize	UMIC	LAC	53.3		0.716	65.08
BEN	Benin	LMIC	Africa	47.8	5.045	0.545	53.31
BTN	Bhutan	LMIC	E_S_Asia	37.4		0.654	69.27
BOL	Bolivia	LMIC	LAC	41.6	5.716	0.718	69.27
BIH	Bosnia and Herzegovina	UMIC	E_Euro_Asia	33.0	5.813	0.780	73.48
BWA	Botswana	UMIC	Africa	53.3	3.467	0.735	61.45
BRA	Brazil	UMIC	LAC	53.4	6.330	0.765	72.67
BRN	Brunei Darussalam	HIC	E_S_Asia			0.838	68.15
BGR	Bulgaria	UMIC	E_Euro_Asia	41.3	5.266	0.816	74.77
BFA	Burkina Faso	LIC	Africa	35.3	4.834	0.452	55.22
BDI	Burundi	LIC	Africa	38.6	3.775	0.433	53.46
CPV	Cabo Verde	LMIC	Africa	42.4		0.665	67.18
KHM	Cambodia	LMIC	E_S_Asia		4.830	0.594	64.39
CMR	Cameroon	LMIC	Africa	46.6	5.142	0.563	56.54
CAN	Canada	HIC	OECD	33.3	7.103	0.929	78.19
CAF	Central African Rep.	LIC	Africa	56.2		0.397	38.54
TCO	Chad	LIC	Africa	43.3	4.355	0.398	43.75
CHL	Chile	HIC	OECD	44.4	6.172	0.851	77.42
CHN	China	UMIC	E_S_Asia	38.5	5.339	0.761	73.89
COL	Colombia	UMIC	LAC	51.3	6.012	0.767	70.91
COM	Comoros	LMIC	Africa	45.3	4.289	0.554	53.07
COD	Congo, Dem. Rep.	LIC	Africa	42.1		0.480	49.71
COG	Congo, Rep.	LMIC	Africa	48.9	5.342	0.574	55.25
CRI	Costa Rica	UMIC	LAC	48.2	7.069	0.810	75.08
CIV	Cote d'Ivoire	LMIC	Africa	41.5	5.306	0.538	57.91
HRV	Croatia	HIC	E_Euro_Asia	29.7	5.882	0.851	78.40
CUB	Cuba	UMIC	LAC			0.783	72.58
CYP	Cyprus	HIC	E_Euro_Asia	32.7	6.223	0.887	75.21
CZE	Czech Republic	HIC	OECD	25.0	6.965	0.900	80.58

Country Code	Country	Income group*	Regional group**	Gini Index ^a	WHR ranking ^b	HDI ^c	SDG Index ^d
DNK	Denmark	HIC	OECD	28.2	7.620	0.940	84.56
DJI	Djibouti	LMIC	Africa	41.6		0.524	54.56
DOM	Dominican Republic	UMIC	LAC	41.9	5.545	0.756	70.17
ECU	Ecuador	UMIC	LAC	45.7	5.764	0.759	74.26
EGY	Egypt, Arab Rep.	LMIC	MENA	31.5	4.283	0.707	68.79
SLV	El Salvador	LMIC	LAC	38.8	6.061	0.673	69.62
EST	Estonia	HIC	OECD	30.3	6.189	0.892	80.06
SWZ	Eswatini	LMIC	Africa	54.6	4.308	0.611	53.40
ETH	Ethiopia	LIC	Africa	35.0	4.275	0.485	55.23
FJI	Fiji	UMIC	Oceania	36.7		0.743	69.95
FIN	Finland	HIC	OECD	27.3	7.842	0.938	83.77
FRA	France	HIC	OECD	32.4	6.690	0.901	81.13
GAB	Gabon	UMIC	Africa	38.0	4.852	0.703	63.40
GMB	Gambia, The	LIC	Africa	35.9	5.051	0.496	57.86
GEO	Georgia	UMIC	E_Euro_Asia	35.9	4.891	0.812	71.88
DEU	Germany	HIC	OECD	31.9	7.155	0.947	80.77
GHA	Ghana	LMIC	Africa	43.5	5.088	0.611	65.37
GRC	Greece	HIC	OECD	32.9	5.723	0.888	74.33
GTM	Guatemala	UMIC	LAC	48.3	6.435	0.663	61.54
GIN	Guinea	LIC	Africa	33.7	4.984	0.477	52.47
GUY	Guyana	UMIC	LAC	45.1		0.682	59.74
HTI	Haiti	LIC	LAC	41.1	3.615	0.510	51.69
HND	Honduras	LMIC	LAC	48.2	5.919	0.634	64.44
HUN	Hungary	HIC	OECD	29.6	5.992	0.854	77.34
ISL	Iceland	HIC	OECD	26.1	7.554	0.949	77.52
IND	India	LMIC	E_S_Asia	35.7	3.819	0.645	61.92
IDN	Indonesia	UMIC	E_S_Asia	38.2	5.345	0.718	65.30
IRN	Iran, Islamic Rep.	UMIC	MENA	42.0	4.721	0.783	71.81
IRQ	Iraq	UMIC	MENA	29.5	4.854	0.674	63.14
IRL	Ireland	HIC	OECD	31.4	7.085	0.955	79.38
ISR	Israel	HIC	OECD	39.0	7.157	0.919	74.60
ITA	Italy	HIC	OECD	35.9	6.483	0.892	77.01
JAM	Jamaica	UMIC	LAC	45.5	6.309	0.734	68.66
JPN	Japan	HIC	OECD	32.9	5.940	0.919	79.17
JOR	Jordan	UMIC	MENA	33.7	4.395	0.729	68.05
KAZ	Kazakhstan	UMIC	E_Euro_Asia	27.8	6.152	0.825	71.06
KEN	Kenya	LMIC	Africa	40.8	4.607	0.601	60.17
KOR	Korea, Rep.	HIC	OECD	31.4	5.845	0.916	78.34
KWT	Kuwait	HIC	MENA		6.106	0.806	63.14
KGZ	Kyrgyz Republic	LMIC	E_Euro_Asia	29.7	5.744	0.697	73.01
LAO	Lao PDR	LMIC	E_S_Asia	38.8	5.030	0.613	62.06
LVA	Latvia	HIC	OECD	35.1	6.032	0.866	77.73
LBN	Lebanon	UMIC	MENA	31.8	4.584	0.744	66.68

Country Code	Country	Income group*	Regional group**	Gini Index ^a	WHR ranking ^b	HDI ^c	SDG Index ^d
LSO	Lesotho	LMIC	Africa	44.9	3.512	0.527	54.00
LBR	Liberia	LIC	Africa	35.3	4.625	0.480	47.12
LTU	Lithuania	HIC	OECD	35.7	6.255	0.882	74.95
LUX	Luxembourg	HIC	OECD	35.4	7.324	0.916	74.31
MDG	Madagascar	LIC	Africa	42.6	4.208	0.528	49.14
MWI	Malawi	LIC	Africa	44.7	3.600	0.483	52.20
MYS	Malaysia	UMIC	E_S_Asia	41.1	5.384	0.810	71.76
MDV	Maldives	UMIC	E_S_Asia	31.3	5.198	0.740	67.59
MLI	Mali	LIC	Africa	33.0	4.723	0.434	51.39
MLT	Malta	HIC	E_Euro_Asia	28.7	6.602	0.895	75.97
MRT	Mauritania	LMIC	Africa	32.6	4.227	0.546	57.72
MUS	Mauritius	HIC	Africa	36.8	6.049	0.804	63.77
MEX	Mexico	UMIC	OECD	45.4	6.317	0.779	70.44
MDA	Moldova	LMIC	E_Euro_Asia	25.7	5.766	0.750	74.44
MNG	Mongolia	LMIC	E_S_Asia	32.7	5.677	0.737	63.98
MNE	Montenegro	UMIC	E_Euro_Asia	38.5	5.581	0.829	70.19
MAR	Morocco	LMIC	MENA	39.5	4.918	0.686	71.29
MOZ	Mozambique	LIC	Africa	54.0	4.794	0.456	54.13
MMR	Myanmar	LMIC	E_S_Asia	30.7	4.426	0.583	64.58
NAM	Namibia	UMIC	Africa	59.1	4.574	0.646	61.63
NPL	Nepal	LMIC	E_S_Asia	32.8	5.269	0.602	65.93
NLD	Netherlands	HIC	OECD	28.1	7.464	0.944	80.37
NZL	New Zealand	HIC	OECD		7.277	0.931	79.20
NIC	Nicaragua	LMIC	LAC	46.2	5.972	0.660	68.66
NER	Niger	LIC	Africa	34.3	5.074	0.394	50.15
NGA	Nigeria	LMIC	Africa	35.1	4.759	0.539	49.28
MKD	North Macedonia	UMIC	E_Euro_Asia	33.0	5.101	0.774	71.40
NOR	Norway	HIC	OECD	27.6	7.392	0.957	80.76
OMN	Oman	HIC	MENA			0.813	69.67
PAK	Pakistan	LMIC	E_S_Asia	31.6	4.934	0.557	56.17
PAN	Panama	HIC	LAC	49.8	6.180	0.815	69.19
PNG	Papua New Guinea	LMIC	Oceania	41.9		0.555	51.66
PRY	Paraguay	UMIC	LAC	45.7	5.653	0.728	67.71
PER	Peru	UMIC	LAC	41.5	5.840	0.777	71.75
PHL	Philippines	LMIC	E_S_Asia	42.3	5.880	0.718	65.50
POL	Poland	HIC	OECD	30.2	6.166	0.880	78.10
PRT	Portugal	HIC	OECD	33.5	5.929	0.864	77.65
QAT	Qatar	HIC	MENA			0.848	64.65
ROU	Romania	HIC	E_Euro_Asia	35.8	6.140	0.828	74.78
RUS	Russian Federation	UMIC	E_Euro_Asia	37.5	5.477	0.824	71.92
RWA	Rwanda	LIC	Africa	43.7	3.415	0.543	56.56
STP	Sao Tome and Principe	LMIC	Africa	56.3		0.625	62.57
SAU	Saudi Arabia	HIC	MENA		6.494	0.854	65.85
SEN	Senegal	LMIC	Africa	40.3	5.132	0.512	58.27
SRB	Serbia	UMIC	E_Euro_Asia	36.2	6.078	0.806	75.23
SLE	Sierra Leone	LIC	Africa	35.7	3.849	0.452	51.91

Country Code	Country	Income group*	Regional group**	Gini Index ^a	WHR ranking ^b	HDI ^c	SDG Index ^d
SGP	Singapore	HIC	E_S_Asia		6.377	0.938	67.00
SVK	Slovak Republic	HIC	OECD	25.0	6.331	0.860	77.51
SVN	Slovenia	HIC	OECD	24.6	6.461	0.917	79.80
SOM	Somalia	LIC	Africa	36.8			46.21
ZAF	South Africa	UMIC	Africa	63.0	4.956	0.709	63.41
SSD	South Sudan	LIC	Africa	44.1		0.433	43.66
ESP	Spain	HIC	OECD	34.7	6.491	0.904	78.11
LKA	Sri Lanka	LMIC	E_S_Asia	39.3	4.325	0.782	66.88
SDN	Sudan	LIC	Africa	34.2		0.510	49.56
SUR	Suriname	UMIC	LAC	57.9		0.738	68.36
SWE	Sweden	HIC	OECD	30.0	7.363	0.945	84.72
CHE	Switzerland	HIC	OECD	33.1	7.571	0.955	79.35
SYR	Syrian Arab Republic	LIC	MENA	37.5		0.567	59.33
TJK	Tajikistan	LIC	E_Euro_Asia	34.0	5.466	0.668	69.43
TZA	Tanzania	LMIC	Africa	40.5	3.623	0.529	56.64
THA	Thailand	UMIC	E_S_Asia	34.9	5.985	0.777	74.54
TGO	Togo	LIC	Africa	43.1	4.107	0.515	52.70
TTO	Trinidad and Tobago	HIC	LAC	40.3		0.796	65.76
TUN	Tunisia	LMIC	MENA	32.8	4.596	0.740	71.37
TUR	Turkey	UMIC	OECD	41.9	4.948	0.820	70.30
TKM	Turkmenistan	UMIC	E_Euro_Asia	40.8	5.066	0.715	63.03
UGA	Uganda	LIC	Africa	42.8	4.636	0.544	53.49
UKR	Ukraine	LMIC	E_Euro_Asia	26.6	4.875	0.779	74.24
ARE	United Arab Emirates	HIC	MENA	26.0	6.561	0.890	70.30
GBR	United Kingdom	HIC	OECD	35.1	7.064	0.932	79.79
USA	United States	HIC	OECD	41.4	6.951	0.926	76.43
URY	Uruguay	HIC	LAC	39.7	6.431	0.817	74.28
UZB	Uzbekistan	LMIC	E_Euro_Asia	35.3	6.179	0.720	71.02
VUT	Vanuatu	LMIC	Oceania	37.6		0.609	60.89
VEN	Venezuela, RB	UMIC	LAC	44.8	4.892	0.711	61.68
VNM	Vietnam	LMIC	E_S_Asia	35.7	5.411	0.704	73.80
YEM	Yemen, Rep.	LIC	MENA	36.7	3.658	0.470	52.33
ZMB	Zambia	LMIC	Africa	57.1	4.073	0.584	52.67
ZWE	Zimbabwe	LMIC	Africa	50.3	3.145	0.571	59.51

* Income groups as defined by the World Bank (2021): High-income countries (HIC), Upper-middle-income countries (UMIC), Lower-middle-income countries (LMIC), Low-income countries (LIC)

** Regional groups defined in the SDR 2020 (Sachs et al. 2020): East and South Asia (E_S_Asia), Eastern Europe and Central Asia (E_Euro_Asia), Latin America and the Caribbean (LAC), Middle East and North Africa (MENA), Oceania (Oceania), OECD members (OECD), Sub-Saharan Africa (Africa)

^a Source: World Bank 2019a

^b Source: Helliwell et al. 2021

^c Source: UNDP 2020

^d Source: Sachs et al. 2020

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