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Article

# How Is SDG 11 Linked with Other SDGs? Evidence from the United Nations Good Practices

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**Abstract** The United Nations (UN) Sustainable Development Goal 11 “Sustainable Cities and Communities” (SDG 11) is linked with the 16 other SDGs to varying extents. Studying these relationships can provide insight into the strengths and weaknesses of the current SDG framework and set the stage for improvements to the next version. We analyze data from the UN database of 221 “good practices” for SDG 11 submitted between 2018 and 2021 to determine the most and least frequent linkages between SDG 11 and other SDGs as well as differences in such linkages between developed and developing countries. We find SDG 11 most closely associated with SDG 17 “Partnership for the Goals” and SDG 13 “Climate Action”. This shows actors’ perceptions of the centrality of international partnerships and climate action in addressing urban sustainability challenges. Connections with SDG 7 “Affordable and Clean Energy”, SDG 2 “Zero Hunger”, and SDG 16 “Peace, Justice, and Strong Institutions” were surprisingly weak, given the role of clean energy in addressing the climate crisis, the prevalence of poverty and hunger within cities, and the importance of institutions. Developing countries more frequently linked SDG 11 with SDG 5 “Gender Equality” and SDG 6 “Clean Water and Sanitation”, showing a focus on basic infrastructure and gender equity dimensions of sustainability. Developed countries associated SDG 11 more strongly with natural resources, environmental sustainability, and economic production. These findings suggest that more specific targets, indicators, and international support related to energy, poverty, hunger, and institutions may be needed within post-2030 iterations of SDG 11.

**Keywords** SDGs; SDG 11; sustainable cities; United Nations; urban planning

## 1. Introduction

In 2015, the United Nations (UN) adopted the 2030 Agenda for Sustainable Development, a global guiding document for “achieving sustainable development in its three dimensions—economic, social and environmental—in a balanced and integrated manner” by pursuing “a comprehensive, far-reaching and people-centered set of universal and transformative Goals and targets” ([1], item 2). At the core of the 2030 Agenda are 17 Sustainable Development Goals (SDGs). Each SDG represents a specific field within the holistic concept of sustainable development and has associated targets and indicators.

Cities play a crucial role in the implementation of the 2030 Agenda. Over half of the global population resides in urban areas, a share projected to reach 70% by 2050 [2]. Expanding urban populations put pressure on housing, food systems, air and water quality, freshwater supplies, waste management, ecosystems, public health, and many other dimensions of sustainability [3].

SDG 11, “Make Cities and Human Settlements Inclusive, Safe, Resilient and Sustainable”, is commonly referred to as “Sustainable Cities and Communities”. Attached to it are 10 targets and 15 indicators covering a broad range of urban issues, from housing and infrastructure to cultural and natural heritage [4]. As of 2023, Brunei Darussalam was the only country out of 187 with available data that claimed to have met all SDG 11 indicators. Fifteen more nations were generally on track. The rest were moving slowly, stagnating, or even falling back in terms of SDG 11 implementation [5].

In this article, we first summarize the literature on connections between the SDGs in general and between SDG 11 and other SDGs in particular. Next, we introduce our dataset of the frequency distribution of links between SDG 11 and other SDGs, based on data from 336 SDG Good Practices collected by United Nations agencies around the world during two open calls in

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2018–2021. We summarize findings on the most frequent and least frequent linkages between SDG 11 and other SDGs as reflected by this self-reported data, and on differences in those frequencies between developed and developing countries. Finally, we discuss potential implications, which include the need for more specific targets and indicators related to energy, poverty, hunger, and institutional strength within the post-2030 iterations of SDG 11.

## 2. Literature Review

### 2.1. The SDGs as an Interlinked System

Within the complex enterprise of sustainable development, the UN SDGs can be seen as a “mutually supporting package” designed to optimize co-benefits and minimize trade-offs of the 2030 Agenda ([6], p. 353), “a system of synergetic reinforcement” ([7], p. 1177), and a set of fundamentally interdependent global objectives for unfolding the potential of sustainable development ([8], p. 8). Understanding SDG interlinkages is important for two reasons: (i) because no individual SDG can ensure advancement toward a sustainable future, and (ii) because a well-connected framework can bring more substantial changes to policies and institutions [6,7,9–12].

### 2.2. Interlinkages Between SDG 11 and Other SDGs

Some SDGs are more interconnected to the rest of the goals than others. Le Blanc (2015) [11] places SDG 11 within the middle of the pack with six to eight strong interconnections. According to Le Blanc (2015) [11], SDG 12 “Responsible Consumption and Production”, SDG 10 “Reduced Inequalities”, SDG 1 “No Poverty”, and SDG 8 “Decent Work and Economic Growth” have more than ten interlinkages with other SDGs. Misselwitz et al. (2015) [13] argue that the urban dimension of the SDGs is much broader than the scope of SDG 11, being present either explicitly or implicitly within ten other SDGs and 51 SDG targets out of 169. Other sources [6,8] indicate potential linkages between SDG 11 and all 16 other SDGs.

Within the literature, we found 15 authors who analyzed interlinkages between SDG 11 and other SDGs. These links were identified at the level of indicators, targets, and/or SDGs. In this paper, we charted a total of 64 potential linkages between SDG 11 and other SDGs (Appendix A). For example, SDG 1 (No Poverty) was commonly seen as related to SDG 11 in that poverty is a major issue within cities, and reducing it is a common goal of urban planning.

Most authors describe links between SDG 11 and other SDGs as a positive correlation. For example, reliable and sustainable infrastructure targets 9.1 and 9.4 of SDG 9 “Industry, Innovation, and Infrastructure” play a fundamental role in efforts for resilient urban livelihoods of SDG 11 [6]. However, Vijayapur & Shashidhar (2021) [14] found negative correlations between SDG 11 and SDG 10 “Reduced Inequalities” and SDG 12 “Responsible Consumption and Production”. Tosun & Leininger (2017) [10] also found a negative correlation between SDG 11 and SDG 7. For example, boosting consumption for growth within SDG 8 “Decent Work and Economic Growth” counteracts waste reduction (SDG 11) and climate mitigation (SDG 13 “Climate Action”) [12].

Describing interlinkages with SDG 11, the Independent Group of Scientists appointed by the UN Secretary-General which produced the Global Sustainable Development Report 2019 “The Future is Now—Science for Achieving Sustainable Development” indicated that SDG 11 impacts all other SDGs while receiving the influence from all SDGs. However, this report shows important gaps in knowledge regarding relationships between SDG 11 and SDG 1 “No Poverty”, SDG 3 “Good Health and Well-being”, and SDG 5 “Gender Equality” [15]. MacDonald et al. (2018) [16] identify SDG 17 “Partnership for the Goals” as a means for achieving SDG 11 by involving local and international organizations and motivating investment, resulting in savings for local governments. Vladimirova & Le Blanc (2016) [17] argue that United Nations reports pay limited attention to the two-way linkages between SDG 11 and SDG 4 “Quality Education”, mentioning as an example that higher literacy leads to better preparedness for disaster risks in urban areas while urbanization has a positive effect on access to education.

Some countries have integrated SDGs into their national sustainability strategies in ways that emphasize their interlinkages. For example, the Government of Switzerland conceived the Urban Development, Mobility, and Infrastructure focus area as a thematic cluster of SDG 11 and SDG 9 “Industry, Innovation, and Infrastructure” addressed jointly [18]. Qatar’s National Development Strategy on the SDGs attempted to address public safety and security issues by clustering SDG 11 with SDG 16 “Peace, Justice, and Strong Institutions” [10,19].

### 2.3. Synergies and Trade-offs between SDGs

The concept of synergies and trade-offs dominates the discourse investigating interlinkages between SDGs. According to the International Council for Science (2017) ([8], p. 7), understanding these “is crucial for achieving long-lasting sustainable development outcomes”. A synergy means that progress on one SDG favors progress on others. For example, introducing school meals addresses SDG 2 “Zero Hunger” while simultaneously promoting SDG 3 (“Good Health and Well-Being”) and SDG 4 (“Quality Education”) [10]. In contrast, trade-offs occur when progress on one SDG contradicts progress on others as, for instance, when boosting consumption for economic growth within SDG 8 (“Decent Work and Economic Growth”) counteracts SDG 12 (“Sustainable Consumption and Production Patterns”) and SDG 13 (“Climate Action”) [12].

Previous studies indicate that synergies occur more frequently and are stronger than trade-offs among all SDGs [6,7,12,20–22]. Regarding SDG 11, various sources described (i) synergies with seven SDGs and (ii) trade-offs with six SDGs (Table 1) [6–8,20,21].

**Table 1.** Synergies and Trade-offs between SDG 11 and Other SDGs in the Previous Studies.

Other SDGs	SDG 11	
	Synergies	Trade-offs
SDG 1 “No Poverty”	+	
SDG 2 “Zero Hunger”	+	+
SDG 3 “Good Health and Well-Being”	+	
SDG 7 “Affordable and Clean Energy”	+	
SDG 8 “Decent Work and Economic Growth”		+
SDG 9 “Industry, Innovation, and Infrastructure”	+	
SDG 13 “Climate Action”	+	+
SDG 14 “Life Below Water”	+	+
SDG 15 “Life on Land”		+
SDG 16 “Peace, Justice, and Strong Institutions”		+

For example, the bi-directional effects between SDG 11 and SDG 14 “Life Below Water” include both (i) synergies through coastal and marine management, settlement planning, onshore and offshore infrastructure development, and restoration and conservation of coastal ecosystems, and (ii) trade-offs through water pollution generated by growing cities [8]. Mantlana & Maoela (2020) [6] clustered SDG 11 with SDG 2 (“Zero Hunger”) and determined that they have 81% co-benefit and 19% neutral positive interlinkages with SDG 9 “Industry, Innovation, and Infrastructure”.

According to Valencia et al. (2019) [23], SDG 11 reflects both synergies and trade-offs between its targets due to the multiple and complex interactions within its key areas. For example, efforts at increasing housing (target 11.1) can help create more inclusive urbanization (11.3) but can also lead to the conversion of green areas (11.7) and farmland (11.a) into built environments, negatively affecting the livelihoods of farmers, disturbing local ecosystems, and pushing food production further away from consumers [23].

### 2.4. Interlinkages between SDGs in the Context of Developing and Developed Countries

Several authors argue that national policies need to adjust SDG implementation according to the level of development, available resources, and local conditions and circumstances [10,12,21,24]. For example, Koch & Krellenberg (2018) [25] found that few of the original targets and indicators of SDG 11 were relevant to the German context. Germany had already met or nearly achieved indicators related to the built-up area, transport infrastructure, and change in open space per capita; the country is also far ahead of the SDG targets and indicators in terms of energy consumption in transport and the proportion of household members spending over 40% of their income on living expenses [25,26]. In a similar vein, Vladimirova & Le Blanc (2016) [17] argued that most of the flagship UN reports had a strong focus on developing countries and said relatively little about developed countries. These authors claimed that if the SDGs represented an agenda applicable to all countries, the perspective had to integrate different regions and contexts more consistently [17].

Laumann et al. (2022) [27] ranked SDG 11, SDG 13 “Climate Action” and SDG 17 “Partnership for the Goals” as highly important across many country groupings. For developing countries, these authors prioritized interlinkages between SDG 11 and SDG 1 “No Poverty”, SDG 4 “Quality Education”, SDG 8 “Decent Work and Economic Growth”, SDG 5 “Gender Equality”, and SDG 16 “Peace, Justice, and Strong Institutions” [27]. Based on such analyses, we assumed that interlinkages between SDGs in developed and developing countries might differ because of differing needs and national implementation frameworks.

### 3. Materials and Methods

#### 3.1. Data

To investigate interlinkages with SDG 11, we utilized the United Nations SDG Good Practices dataset collected through two open calls, the first in 2018–2019 (OC1) [28] and the second in 2020–2021 (OC2) [29]. Each submission contained a brief description of an SDG-related initiative and its implementation, beneficiaries, budget, resources, timeline, and evaluation. Actors indicated which SDGs their initiative addressed upon submission [3].

An Inter-Agency Review Team of 30 experts in sustainable development from across the UN system reviewed more than 1400 self-reported good practices submitted by various actors [30]. It approved 511 initiatives from OC1 and 464 initiatives from OC2 to include in the SDG Good Practices dataset. Of these, 186 and 150 practices respectively addressed the implementation of SDG 11 (34.4% of the total of both open calls). Developing countries submitted 202 of 336 good practices addressing SDG 11 (60.1%), while developed countries submitted 120 good practices (35.7%), and those with economies in transition contributed 14 good practices (4.2%).

Twenty-three SDG 11 good practices addressed that goal exclusively. This group was not relevant to our analysis, which focuses on interconnections between SDG 11 and others, so we eliminated it. This relatively small proportion decreased from 21 in the first Open Call to just two in the second. These submissions appeared to ignore the widespread emphasis on SDG interconnections. For example, Pradhan et al. (2017) ([7], p. 1177), like other sources, stress that “no SDG can individually move forward to address the global sustainability challenge of ensuring human well-being, economic prosperity, and environmental protection”.

Meanwhile, 92 submissions addressed all 17 SDGs. We eliminated these as well. These projects were less specific, mainly building general capacity for the 2030 Agenda implementation, increasing awareness of the SDGs, or establishing political and methodical frameworks for their implementation. The number of those practices was stable between the two open calls (44 and 48, respectively). Some examples included the Youth Leadership Program of the West Asia nations [31], a new Kigali City 2050 masterplan in Rwanda [32], and the development of a local SDG platform in Japan [33].

The remaining 221 submissions addressing SDG 11 in combination with one or more other SDGs formed the data sample for this study ( $N = 221$ ). Table 2 displays the frequency distribution of the interlinkages between SDG 11 and other SDGs.

**Table 2.** Frequency distribution of the interlinkages by SDGs and open calls.

SDG 11	Other SDGs associated with SDG 11																Total
	1	2	3	4	5	6	7	8	9	10	12	13	14	15	16	17	
OC1	48	27	48	47	48	51	33	57	38	42	53	49	19	43	37	59	699
OC2	47	35	49	40	43	33	23	44	35	51	46	55	17	35	24	59	636
Both OCs	95	62	97	87	91	84	56	101	73	93	99	104	36	78	61	118	1,335

*Note:* Because many good practices addressed several SDGs, the total number of interlinkages between SDG 11 and other SDGs is much greater than the total number of good practices under review.

We should note that this dataset has some limitations. First, the SDG Good Practices are self-reported data, and there might be tendencies for entities to focus on some SDGs and types of practices more than others. Second, the UN experts screening the submissions may have introduced biases in terms of accepting those submissions as good practices. Third, the UN’s promotion and communication efforts may have reached some countries and institutions more effectively than others, thus influencing the geographical mix and content of submissions. Because of these things, the UN dataset does not necessarily represent all SDG 11 initiatives. However, it is the best dataset available for analysis, and the UN is the entity that originally developed the SDGs

and is most responsible for promoting them through its agencies and programs around the world. Being composed of almost all countries, the UN has access to information from all of them and incorporates various perspectives on SDGs and the global sustainable development agenda in general, providing a high-level platform for reporting on the SDGs.

### 3.2. Data Analysis

After establishing our dataset of 221 good practices addressing SDG 11 and at least one other SDG but not all, we characterized the countries submitting these as developed, developing, or in transition based on the official UN classification [34]. We then tabulated the total number of interlinkages between SDG 11 and other SDGs and the average proportions of interlinkages per submission and used chi-square tests to analyze differences in distribution, including by type of economy. These methods are described in greater detail in Appendix B.

## 4. Results

### 4.1. Interlinkages between SDG 11 and Other SDGs

Table 3 demonstrates the proportions of interlinkages arranged from the highest to the lowest.

**Table 3.** Proportions of the interlinkages by SDGs and open calls.

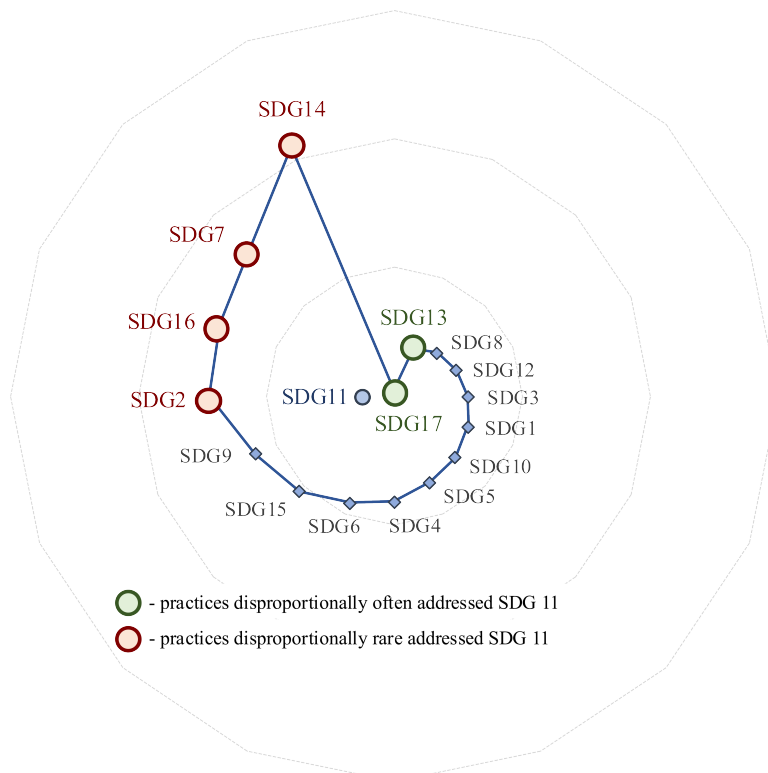
SDG Linked to SDG 11	OC1		OC2		Both OCs	
	Inter-linkages	% of the total	Inter-linkages	% of the total	Inter-linkages	% of the total
SDG 17 “Partnership for the Goals”	59	8.4	59	9.3	118	8.8
SDG 13 “Climate Action”	49	7.0	55	8.6	104	7.8
SDG 8 “Decent Work and Economic Growth”	57	8.2	44	6.9	101	7.6
SDG 12 “Responsible Consumption and Production”	53	7.6	46	7.2	99	7.4
SDG 3 “Good Health and Well-Being”	48	6.9	49	7.7	97	7.3
SDG 1 “No Poverty”	48	6.9	47	7.4	95	7.1
SDG 10 “Reduced Inequalities”	42	6.0	51	8.0	93	7.0
SDG 5 “Gender Equality”	48	6.9	43	6.8	91	6.8
SDG 4 “Quality Education”	47	6.7	40	6.3	87	6.5
SDG 6 “Clear Water and Sanitation”	51	7.3	33	5.2	84	6.3
SDG 15 “Life on Land”	43	6.1	35	5.5	78	5.8
SDG 9 “Industry, Innovation, and Infrastructure”	38	5.4	35	5.5	73	5.5
SDG 2 “Zero Hunger”	27	3.9	35	5.5	62	4.6
SDG 16 “Peace, Justice, and Strong Institutions”	37	5.3	24	3.8	61	4.6
SDG 7 “Affordable and Clean Energy”	33	4.7	23	3.6	56	4.2
SDG 14 “Life Below Water”	19	2.7	17	2.7	36	2.7
In Total (interlinkages   % of the total)	699	100.0	636	100.0	1335	100.0
Mean (interlinkages per SDG)	43.7	-	39.8	-	83.4	-
Median (interlinkages per SDG)	47.5	-	41.5	-	89.0	-

On average, SDG 11 was associated with six other SDGs per practice, showing the complex nature of sustainable urban development. Actors frequently considered it embedded in higher-level, more comprehensive, multisectoral initiatives such as represented within SDG 17 [12]. This finding coincided with the one by Le Blanc (2015) [11] that most SDGs have interlinkages with six to eight other SDGs.

To examine the significance of differences in the numbers of interlinkages between SDG 11 and other SDGs, we conducted a one-sample chi-square test for the hypothesis of equal proportions. The chi-square was significant,  $\chi^2(15, N = 1335) = 80.92, p < 0.001, \alpha = 0.05$ , illustrating a statistically significant difference in the distribution of interlinkages by SDGs from what we should expect hypothesizing the equal distribution of the interlinkages by SDGs.

Next, we used standardized residuals as a follow-up test to specify a source of significance for the critical  $|R| = 1.96$ . The follow-up test revealed that the interlinkages between (i) SDG 11 and SDG 17 “Partnership for the Goals” ( $R_{17} = 3.78$ ) and (ii) SDG 11 and SDG 13 “Climate Action” ( $R_{13} = 2.25$ ) occurred significantly more often than the interlinkages of SDG 11 with other SDGs (Figure 1).

On the other hand, the interlinkages of SDG 11 with SDG 14 “Life Below Water” ( $R_{14} = -5.19$ ), SDG 7 “Affordable and Clean Energy” ( $R_7 = -3.00$ ), SDG 16 “Peace, Justice, and Strong Institutions” ( $R_{16} = -2.46$ ), and SDG 2 “Zero Hunger” ( $R_2 = -2.35$ ) occurred significantly less than with other SDGs. Besides those shown in Figure 1, the differences in the frequency distribution for the interlinkages of SDG 11 with other SDGs were not statistically significant ( $|R| < 1.96$ ). Figure 1 illustrates the frequency and statistical significance of reported relationships between SDG 11 and other SDGs in the UN dataset.



**Figure 1.** Statistically significant interlinkages between SDG 11 and other SDGs.

#### 4.2. Interlinkages between SDG 11 and Other SDGs by Types of Economy

Figure 2 illustrates the proportions of the interlinkages between SDG 11 and each of the other SDGs by type of economy. As can be seen, developing countries frequently linked the implementation of SDG 11 with SDGs related to social and equity issues, and developed countries linked SDG 11 with SDGs tended toward economic and environmental dimensions (Appendix C).

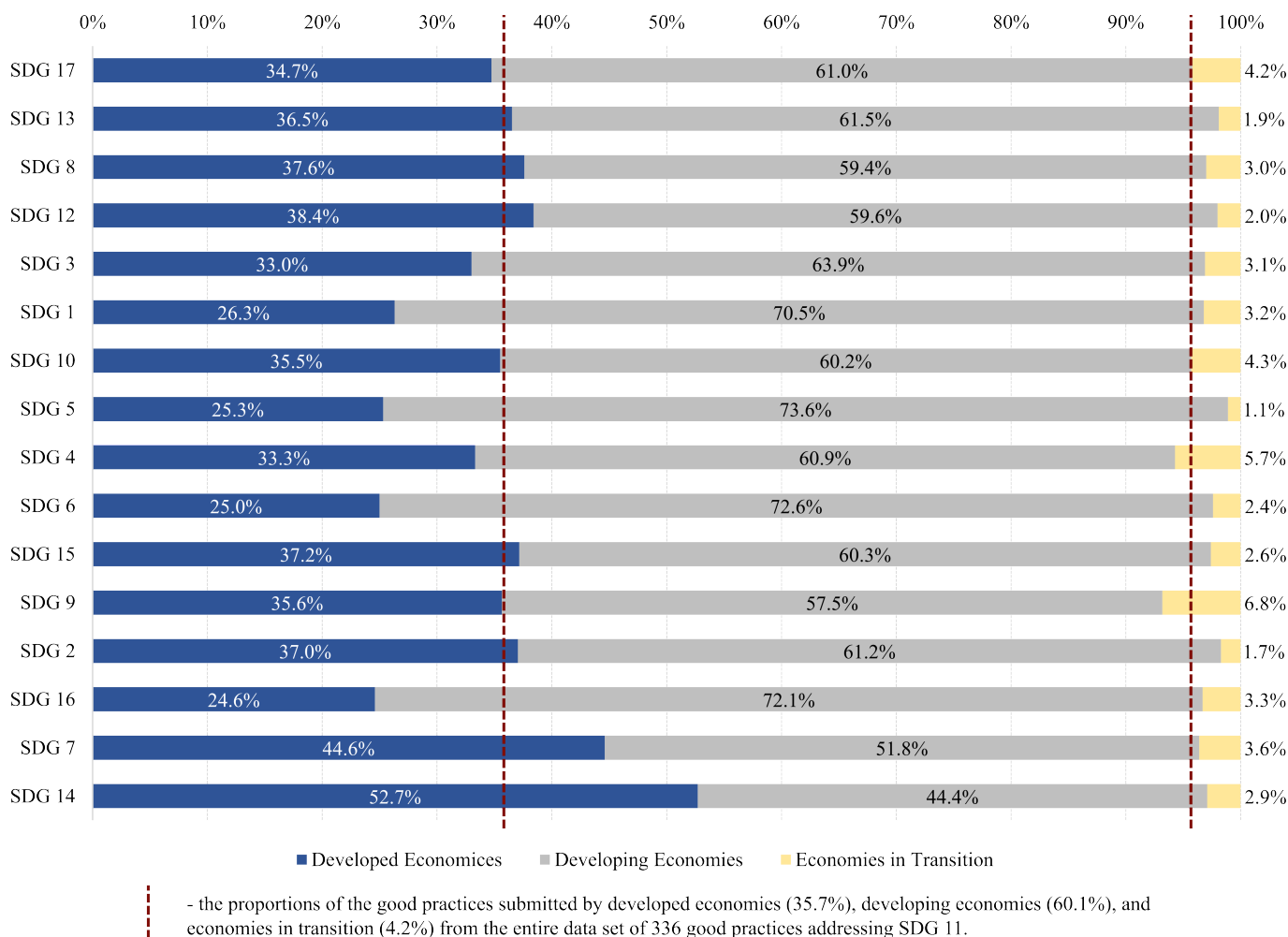
Because our point of interest was the difference in the proportion of interlinkages between developed and developing countries, we eliminated from the analysis seven good practices submitted by the countries with economies in transition (with 43 interlinkages in total). As a result, we got a sample of 214 good practices submitted by developed and developing countries, indicating 1292 interlinkages between SDG 11 and other SDGs.

The chi-square test did not show a statistically significant difference in the distribution of the SDG 11 interlinkages with other practices for submissions of developed and developing countries.

### 5. Discussion

#### 5.1. Most Frequent Interlinkages between SDG 11 and Other SDGs

Even though the actors submitting good practices connected SDG 11 with ten out of 16 other SDGs approximately equally, they chose to link it more often to SDG 17 “Partnership for the Goals” and SDG 13 “Climate Action”. This coincides with findings from previous studies, which



**Figure 2.** Proportions of the interlinkages of SDG 11 and other SDGs by types of economy.

claim that (i) SDG 17 is tightly positively connected with SDG 11, (ii) both of these SDGs are highly important across many country groupings, and (iii) multi-stakeholder partnerships are crucial for achieving SDG 11 because of the need for sophisticated implementation structures to ensure collaborative actions [16,21,22,27]. We could add that partnerships are intrinsically natural for urban areas, given their dense population and more sophisticated social, cultural, and physical landscapes. Many submissions specified a participatory approach and inclusiveness as crucial elements of their “goodness” for promoting SDG 11 and sustainable development in general [3]. For example, the participation model of Helsinki, Finland allowed 38,000 city employees to contribute to decisions on public funds allocation by voting for the proposals most relevant in their fields, thus affecting millions of euros of public investment [35].

It is also natural that SDG 11 should be closely linked to SDG 13 “Climate Action”, since cities contribute over 70% to the global emission of greenhouse gases (GHG) [36], and the climate crisis is arguably the leading sustainability challenge currently. Laumann et al. (2022) [27] detail interlinkages between SDG 11 and SDG 13 by the impact of urbanization, air pollution, and urban population on climate change. Our findings also aligned with the claim that climate change was inextricably linked to the achievement of all other SDGs [10,12].

### 5.2. Least Frequent Interlinkages between SDG 11 and Other SDGs

SDG 14 “Life Below Water”, SDG 7 “Affordable and Clean Energy”, SDG 16 “Peace, Justice, and Strong Institutions”, and SDG 2 “Zero Hunger” had significantly fewer interlinkages with SDG 11 than observers should expect according to the hypothesis of equal proportions.

City governments quite likely do not view oceans and other large bodies of water (the focus of SDG 14) as central to their policy concerns. However, more than 90% of urban settlements are coastal, and cities enter about 17 million metric tons of plastic into the ocean annually [37,38]. The International Council for Science (2017) [8] highlighted a broad range of bi-



directional effects between SDGs 11 and 14. Substantial educational efforts appear needed to help local authorities take these connections more seriously.

The lack of a stronger connection with SDG 7 “Affordable and Clean Energy” is also surprising. Cities require enormous amounts of energy in order to function; this energy use is connected closely to GHG emissions and climate action. This finding reinforces two previous studies indicating rare links between SDG 11 and SDG 7 “Affordable and Clean Energy” [7,10]. The relatively small number of targets and indicators for SDG 7 may contribute to this situation; SDG 7 includes just five targets (out of 169 for all SDGs) and six indicators (out of 230), while, for example, SDG 17 “Partnership for the Goal” comprises 19 targets and 24 indicators. This lack of connection may therefore be an artifact of the way SDG 7 is framed, suggesting that a rethinking of SDG 7 may be needed in the future.

We found four previous studies mentioning that target 16.6 (effective institutions) generates positive interlinkages between SDG 11 and SDG 16 “Peace, Justice, and Strong Institutions” [11,15,22,27]. Also, problems of crime, violence, and insecurity seem to be the main urban challenges around the world [39]. So, it is surprising that more submissions did not link these two. Likewise, the submissions rarely mentioned SDG 2 “Zero Hunger” within the context of sustainable urban development actions, even though poverty and hunger are widespread problems in cities, especially in the developing world. The global community may wish to highlight these two issues more highly within future versions of SDG 11.

### 5.3. SDG 11 Interlinkage Differences between Developing and Developed Countries

We have not found a statistically significant difference between developing and developed countries in the frequency distribution of interlinkages between SDG 11 and other SDGs for the confidence level  $\alpha = 0.05$ . However, if we increase the confidence level to  $\alpha = 0.10$ , which is a frequent practice in social sciences, some differences do appear. In particular, developing countries addressed SDG 11 in combination with SDG 14 “Life Below Water” less often than developed countries, despite the fact that the ocean provides developing countries with about 11% of their gross domestic product compared to less than 2% in developed countries [37]. Globally, more than three billion people rely on the ocean for their livelihoods through tourism, trade, fishing, or other jobs, and the vast majority of those people live in developing countries [37,38]. Developing countries also produce the most plastic waste contaminating the ocean [40]. Allen et al. (2019) [41] also mentioned that SDG 11 targets 11.1 (safe and affordable housing) and 11.3 (inclusive and sustainable urbanization) have direct linkages with target 14.2 (protect and restore ecosystems) of SDG 14 in developing countries. Quite likely, developing countries face more pressing needs for their limited urban sustainability resources than addressing ocean pollution and may not have developed institutions allowing them to take action on this front. The international community may wish to raise the profile of ocean-related urban sustainability challenges and provide additional support in the future.

If we increase the confidence interval to  $\alpha = 0.15$ , then two other linkage differences appear. Developed countries less frequently addressed urban sustainability in relation to gender issues (SDG 5 “Gender Equality”) and freshwater quality (SDG 6 “Clear Water and Sanitation”). One of the possible explanations for this difference is that issues targeted by SDGs 5 and 6, though still important for industrialized nations, are less common and pressing there than in developing countries.

Finally, although significance levels are relatively low, our analysis generally supports the claims by Laumann et al. (2022) [27] that developing countries more strongly link SDG 11 with SDG 1 “No Poverty”, SDG 4 “Quality Education”, SDG 5 “Gender Equality”, and SDG 16 “Peace, Justice, and Strong Institutions”. Contrary to those authors, our analysis finds that actors from developed countries more frequently linked SDG 11 with SDG 8 “Decent Work and Economic Growth” than those from less industrialized countries.

## 6. Conclusions

Our analysis of the 2018–2021 SDG Good Practices data confirmed the highly connected nature of the SDGs within the 2030 Agenda and identified specific interlinkages between SDG 11 “Sustainable Cities and Communities” and the other SDGs.

From 221 good practices addressing SDG 11 in combination with some but not all other SDGs, we found that actors most frequently linked sustainable urban development actions with

climate change and institutional partnerships. We also found that they least often linked these efforts with promoting clean energy, conserving the marine biosphere, and reducing hunger. The lack of connection with the latter SDGs is surprising, and can potentially be addressed by re-thinking the framing and targets of future iterations of the SDGs, and by global efforts at education and assistance related to these topics. For example, SDG 11 does not have a specific target or indicator related to energy; this seems a major lack given the importance of transitioning energy systems to renewable sources to prevent further global warming and the large role of energy within urban economies and social welfare. Likewise, no SDG 11 target or indicator specifically mentions hunger or access to safe and healthy food systems. This also would seem a need within a more holistically framed UN urban sustainability goal.

Even though our analysis did not reveal a statistically significant difference in the proportion of SDG 11 interlinkages with other SDGs between developed and developing countries at the  $\alpha = 0.05$  confidence level, some patterns appear to exist at less stringent levels. Developed countries more frequently linked urban actions to conserving the ocean than developing countries, whereas developing countries paid more attention to gender equality and access to clean water and sanitation.

Future research could explore these issues with new data sets as those become available or investigate cause-and-effect relationships between actions toward SDG 11 and those involving other SDGs through more in-depth qualitative case studies. Researchers should also explore how the SDG framework can be enhanced in its next iteration to improve the balance between the various urban dimensions of sustainability, for example, to give more weight to clean energy, water system impacts, and hunger within cities. Finally, interlinkages between other SDGs can be explored using our methods and data sources, as well as the data from additional monitoring frameworks for sustainable urban development available globally (the New Urban Agenda, to mention a few), to gain additional insight into how various actors position their sustainable development initiatives within the framework of the 2030 Agenda.

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### Data Availability

No new data were created or analyzed in this work. Data sharing is not applicable to this article.

### Author Contributions

Conceptualization: G.N., & S.W.; Data curation: G.N.; Formal analysis: G.N.; Framing: S.W.; Supervision: S.W.; Visualization: G.N.; Writing – original draft: G.N., & S.W.; Writing – review & editing: S.W.

### Conflicts of Interest

The authors have no conflict of interest to declare.

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**Appendix A**

**Table A1.** Interlinkages between SDG 11 and other SDGs from the literature review.

##	Source	Data for Analysis	SDGs interlinked with SDG 11														Σ		
			1	2	3	4	5	6	7	8	9	10	12	13	14	15		16	17
1.	Le Blanc (2015) [11]	SDGs through the targets.	1		1		1					1	1				1		6
2.	Misselwitz et al. (2015) [13]	Systematic analysis of SDGs, targets, and indicators	1		1							1	1				1		5
3.	Nilsson et al. (2016) [12]	The interactions of SDGs							1					1					2
4.	Vladimirova & Le Blanc (2016) [17]	37 reports by the flagship UN organizations				1													1
5.	Pradhan et al. (2017) [7]	UN data on SDG indicators for 227 countries						(1)						1					1
6.	The International Council for Science (2017) [8]	Science-informed analysis of interactions across SDG domains			1										1				2
7.	Tosun & Leininger (2017) [10]	Voluntary National Reviews by six countries		1	1			1	(1)					1					4
8.	MacDonald et al. (2018) [16]	Surveys of 111 local governments																1	1
9.	Qatar National Development Strategy on the SDGs (2017) [19]	Strategic planning						1	1				1	1	1	1	1		7
10.	Fuso Nerini et al. (2018) [20]	SDG targets and the published evidence							1										1
11.	Weitz et al. (2018) [21]	34 SDG targets										1					1	1	3
12.	UN DESA (2019) [15]	UN reports and data	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
13.	Mantlana & Maoela (2020) [6]	Published UN reports and academic manuscripts									1								1
14.	Vijayapur & Shashidhar (2021) [14]	2019–2020 Aayog Report by the National Institution for Transforming India (NITI)	1		1		1	1			1		1				1		7
15.	Laumann et al. (2022) [27], all countries	400 indicators of the World Bank & the average temperature in												1				1	2
15.1	developing countries	2000–2019	1			1	1			1							1		5
In Total			5	2	6	3	4	4	3	3	3	4	5	6	3	2	7	4	64

Note: (1) indicates the sources specifically mentioned no interlinkages between SDG 11 and other SDGs.

## Appendix B

### Method for Analyzing Relative Proportions of Interlinkages

To analyze the interlinkages, we first calculated the total number of interlinkages between SDG 11 and each of the other SDGs by adding the numbers of the corresponding interlinkages for each practice:

$$I_{[SDG_{11} \leftrightarrow SDG_x]} = \sum_{n=1}^{221} I_{n[SDG_{11} \leftrightarrow SDG_x]}$$

where:

$I_{[SDG_{11} \leftrightarrow SDG_x]}$ —the total number of interlinkages between SDG 11 and SDG  $x$ ,  $x$ —a specific number of another SDG linked with SDG 11,  $x = [1, 10]$  and  $[12, 17]$ ;

$I_{n[SDG_{11} \leftrightarrow SDG_x]}$ —a dummy variable indicating the presence of the interlinkage between SDG 11 and SDG  $x$  in a good practice  $n$ :

- $I_{n[SDG_{11} \leftrightarrow SDG_x]} = 1$ , if there was an interlinkage between SDG 11 and SDG  $x$  in a good practice  $n$ ; or
- $I_{n[SDG_{11} \leftrightarrow SDG_x]} = 0$ , if there was no interlinkage between SDG 11 and SDG  $x$  in a good practice  $n$ .

The total number of interlinkages between SDG 11 and all other SDGs was calculated by addition of the numbers of all interlinkages between SDG 11 and each other SDG for all good practices in the sample:

$$I_{\text{total}} = \sum_{x=1}^{17} I_{[SDG_{11} \leftrightarrow SDG_x]}$$

Next, we calculated the proportions of the interlinkages between SDG 11 and each of the other SDGs ( $I_{[SDG_{11} \leftrightarrow SDG_x]}$ ) in the total number of intersections between SDG 11 and all other SDGs ( $I_{\text{total}}$ ). Then, we compared those proportions among SDGs, noticing the ones with the highest and lowest proportions of interlinkages. Finally, we compared how the proportions of the interlinkages differed between the developed and developing countries.

To examine the significance of the difference in frequency distribution among SDGs for the entire data sample, we utilized a one-sample chi-square test for the hypothesis of equal proportions (e.g., assuming that interlinkages should be distributed equally among SDGs). To analyze the difference in the distribution of the interlinkages by types of economy, we utilized a chi-square test of homogeneity to test whether the observed differences were significant [42]. To conduct both chi-square tests, we utilized the *Statistical Package for Social Science* (IBM SPSS Statistics), version 29.0.0.0(241).

### Appendix C

**Table C1.** Frequency distribution and the proportions of interlinkages by type of economy.

Specificity of a Good Practice	OC1 (interlinkages, % of the total)						OC2 (interlinkages, % of the total)						Both OCs (interlinkages, % of the total)						In Total	
	Developing		Developed		Transition		Developing		Developed		Transition		Developing		Developed		Transition			
	##	%	##	%	##	%	##	%	##	%	##	%	##	%	##	%	##	%	##	%
Addressed SDG 11 only	16	3.2	5	2.0	-	-	1	0.2	-	-	1	3.2	17	1.9	5	1.0	1	2.0	23	1.6
Addressed all SDGs	25	5.0	22	8.8	1	5.3	19	4.8	20	7.9	5	16.1	44	4.9	42	8.4	6	12.0	92	6.3
Associated SDG 11 with other SDGs, including:	459	91.8	222	89.2	18	94.7	378	95.0	233	92.1	25	80.7	837	93.2	455	90.6	43	86.0	1,335	92.1
SDG 17 “Partnership for the Goals”	34	7.4	23	10.4	2	11.1	38	10.0	18	7.7	3	12.0	72	8.6	41	9.0	5	11.6	118	8.8
SDG 13 “Climate Action”	32	7.0	16	7.2	1	5.5	32	8.5	22	9.4	1	4.0	64	7.6	38	8.3	2	4.7	104	7.8
SDG 8 “Decent Work and Economic Growth”	34	7.4	22	9.9	1	5.5	26	6.9	16	6.9	2	8.0	60	7.2	38	8.3	3	7.0	101	7.6
SDG 12 “Responsible Consumption and Production”	32	7.0	20	9.0	1	5.5	27	7.1	18	7.7	1	4.0	59	7.0	38	8.3	2	4.7	99	7.4
SDG 3 “Good Health and Well-Being”	36	7.8	11	4.9	1	5.5	26	6.9	21	9.0	2	8.0	62	7.4	32	7.0	3	6.9	97	7.3
SDG 1 “No Poverty”	34	7.4	13	5.9	1	5.5	33	8.7	12	5.2	2	8.0	67	8.0	25	5.5	3	6.9	95	7.1
SDG 10 “Reduced Inequalities”	26	5.7	15	6.7	1	5.6	30	7.9	18	7.7	3	12.0	56	6.7	33	7.3	4	9.3	93	7.0
SDG 5 “Gender Equality”	39	8.5	9	4.1	-	-	28	7.4	14	6.0	1	4.0	67	8.0	23	5.1	1	2.3	91	6.8
SDG 4 “Quality Education”	30	6.5	15	6.7	2	11.1	23	6.1	14	6.0	3	12.0	53	6.3	29	6.4	5	11.6	87	6.5
SDG 6 “Clear Water and Sanitation”	38	8.3	12	5.4	1	5.6	23	6.1	9	3.9	1	4.0	61	7.3	21	4.6	2	4.7	84	6.3
SDG 15 “Life on Land”	27	5.9	15	6.7	1	5.6	20	5.3	14	6.0	1	4.0	47	5.6	29	6.4	2	4.7	78	5.8
SDG 9 “Industry, Innovation, Infrastructure”	23	5.0	13	5.9	2	11.1	19	5.0	13	5.6	3	12.0	42	5.0	26	5.7	5	11.6	73	5.5
SDG 2 “Zero Hunger”	17	3.7	9	4.1	1	5.6	21	5.6	14	6.0	-	-	38	4.5	23	5.1	1	2.3	62	4.6
SDG 16 “Peace, Justice, and Strong Institutions”	29	6.3	7	3.1	1	5.6	15	4.0	8	3.4	1	4.0	44	5.3	15	3.3	2	4.7	61	4.6
SDG 7 “Affordable and Clean Energy”	19	4.1	13	5.9	1	5.6	10	2.6	12	5.2	1	4.0	29	3.5	25	5.5	2	4.7	56	4.2
SDG 14 “Life Below Water”	9	2.0	9	4.1	1	5.6	7	1.9	10	4.3	-	-	16	2.0	19	4.2	1	2.3	36	2.7
In Total (interlinkages)	500	100	249	100	19	100	398	100	253	100	31	100	898	100	502	100	50	100	1,450	100