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# Achieving Zero Stunting: A Sustainable Development Goal Interlinkage Approach at District Level

**Ahmad Komarulzaman [1,*], Robi Andoyo [2], Zuzy Anna [1], Aisyah Amatul Ghina [1], Putri Riswani Halim [1], Herlina Napitupulu [3], Monica Ruth Karunia [4] and Annisa Andriani [4]**

[1] SDGs Center, Universitas Padjadjaran, Kota Bandung 40132, Indonesia; z.anna@unpad.ac.id (Z.A.); amatulghina@gmail.com (A.A.G.); utiriswani@gmail.com (P.R.H.)
[2] Faculty of Agro-industrial Technology, Universitas Padjadjaran, Kabupaten Sumedang 45363, Indonesia; r.andoyo@unpad.ac.id
[3] Department of Mathematics, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran, Kabupaten Sumedang 45363, Indonesia; herlina@unpad.ac.id
[4] Department of Economics, Faculty of Economics & Business, Universitas Padjadjaran, Kabupaten Sumedang 45363, Indonesia; monicaruthkarunia@gmail.com (M.R.K.); andriannisa10@gmail.com (A.A.)
* Correspondence: ahmad.komarulzaman@unpad.ac.id

**Abstract:** The sustainable development goals (SDGs) provide an integrated framework of targets and indicators, including the elimination of stunting, to support better development planning. Indonesia faces a significant challenge as it ranks fourth globally in terms of stunting prevalence, exacerbated by disparities across regions, gender, and socioeconomic status, further compounded by the ongoing COVID-19 pandemic. Given the interlinked nature of SDGs, this study provides empirical support for the prioritization of SDG indicators, primarily in the context of stunting elimination at the district level in Indonesia. This study employed a combination of economic complexity and network theory, utilizing data from a comprehensive set of 54 indicators spanning 28 targets within 13 SDG goals in 514 districts. The analysis is based on network metrics, including *revealed comparative advantage* (*RCA*), *proximity*, *centrality*, and *density* to establish the SDG interlinkage network and identify key priority indicators. The findings highlight the importance of prioritizing indicators such as civil registration, health facilities and services, access to basic facilities and housing, and access to ICT in efforts to reduce stunting, particularly among disadvantaged households. Given the unique resources and capacities of each region, our analysis offers district-specific prioritization strategies for stunting elimination.

**Keywords:** sustainable development goals (SDGs); interlinkages; stunting; district; Indonesia



**Citation:** Komarulzaman, A.; Andoyo, R.; Anna, Z.; Ghina, A.A.; Halim, P.R.; Napitupulu, H.; Karunia, M.R.; Andriani, A. Achieving Zero Stunting: A Sustainable Development Goal Interlinkage Approach at District Level. *Sustainability* **2023**, *15*, 8890. https://doi.org/10.3390/su15118890

Academic Editor: Claudio Sassanelli

Received: 16 April 2023
Revised: 25 May 2023
Accepted: 26 May 2023
Published: 31 May 2023



## 1. Introduction

In order to create prosperity for people and the environment, in 2015, 191 UN member countries decided to commit to and adopt the 2030 Agenda for Sustainable Development [1–3]. SDGs have a broader and more relevant scope in all countries, as well as a growing focus on goals on equity and climate change than its predecessor, the Millennium Development Goals (MDGs) 2000–2015 [3]. The SDGs consist of 17 goals, 169 targets, and 244 indicators, which are comprehensive, holistic, transformative, and based on a sustainable paradigm. The SDG agenda was created integrated, based on the concept that economic prosperity, environmental protection, and social welfare cannot be addressed separately [4,5]. For example, eliminating hunger is linked to poverty reduction, so addressing undernutrition is part of addressing poverty (SDG 2 and SDG 1) [6]. Access to energy can also help women work from home and earn an independent income (SDG 7 and SDG 5) [6]. These examples show that there can be positive links between SDGs, yet improving one may have negative consequences for another, resulting in trade-offs [1].

Therefore, studies on SDG interlinkages are important to understand how specific SDGs connect with others, as this is key to unlocking their full potential [6].

Understanding the interlinkages between the SDGs could direct this study to focus specifically on tackling a specific issue, including stunting. As stunting is caused by multi-dimensional factors, the interlinkage analysis aims to help policymakers in determining which indicators should be targeted to accelerate the resolution of a region's stunting problem. Figure 1 shown that the case of stunting in Indonesia in 2021 remains high, at 22.4% [7]. The government has implemented several plans and policies, including the National Movement to Accelerate Nutrition Improvement (Gerakan Nasional Percepatan Perbaikan Gizi/Gernas PPG), the Convergence Action for the 2018 Stunting Prevention Program, Presidential Regulation Number 18 of the 2020 Medium-Term Development Plan (Rencana Pembangunan Jangka Menengah/RPJMN), and Presidential Regulation Number 72 of 2021 concerning Accelerating Nutrition Improvement [8,9]. These efforts resulted in an annual decline in the number of cases of stunting. However, these results are still insufficient and relatively slow, as the rate of stunting in 2022 is far below the target to reduce stunting cases to 10% by 2030 [10]. This case of stunting is classified as urgent and needs to be accelerated because the impact of stunting is not merely a matter of height but rather the low quality of human resources resulting from poor health conditions.

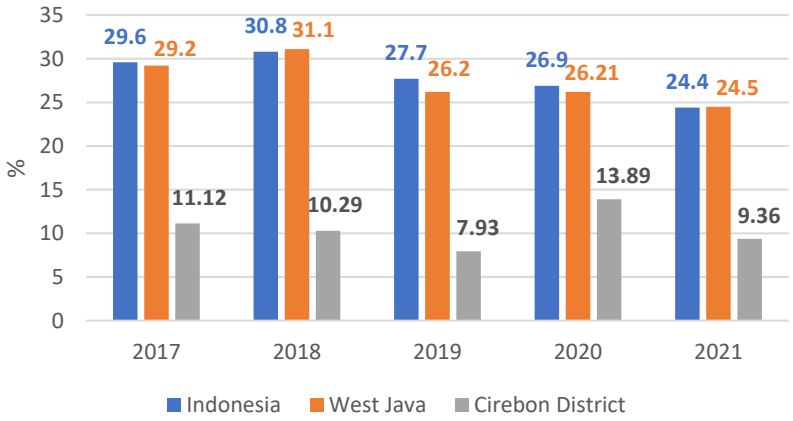


**Figure 1.** Stunting in Indonesia, West Java, and Cirebon District. Source: MoH [7].

The purpose of this study is to discover the interlinkages between the SDG indicators to identify critical indicators to reduce stunting in Indonesia at district level, using Cirebon District as a case study to be further analyzed. Prior to this, there have been national-level studies on interlinkages between SDG indicators [10–17] but none that studied them at district level. The research conducted at the national level is deemed insufficient to determine the interlinkages between the SDGs at the regional level. Due to variances in regional characteristics, priorities, and legislation, the linkage and efficacy of SDG indicators will vary among areas and cannot be expected to be homogenous as national studies [18]. As a result, the government should take into account the discrepancies in each of these locations to resolve issues with reaching indicators generally. Furthermore, local governance is vital for spearheading and promoting the SDGs [19]. This is due to the fact that the SDGs address societal issues that are visible and felt directly by local communities, organizations, businesses, and families [19].

This study uses economic complexity and network theory to create an interlinkage network for the SDGs in Indonesia using data on 54 SDG indicators from 514 districts. Identifying target relationships is necessitated due to the different impacts of target linkages on stunting problems. Several factors prompted us to conduct research on the Cirebon District. First, Cirebon District's average readiness to achieve the SDGs remains lower than the average score of districts/cities in West Java Province, particularly in terms of health and education goals [9]. Second, based on data from the 2022 Indonesian Nutrition Status Survey [7], the prevalence of stunting in Cirebon District reaches 18.6% or 15,299 infants

distributed across 10 working areas of the public health center, 28 working areas of villages in 9 sub-districts [20].

## 2. Literature Review

### *2.1. SDG Interlinkages*

Several efforts have been conducted to analyze the interlinkages of the SDGs. They have used different tools and approaches to model the network of interlinkages and analyze clusters of issues to better understand the connections. Le Blanc [12], as the pioneer in SDG interlinkage analysis, built a matrix that connects every SDG target to all the goals to which its wording references and showed that some goals and targets are well connected. UNESCAP [17] conducted a network analysis of 82 indicators from 174 countries and found a dense core of highly connected socioeconomic indicators and a periphery of environmental indicators. IGES [14] used social network analysis (SNA) and found that agriculture activities, food production, safe drinking water, sanitation, energy, and resilient infrastructure are the network's most important priorities due to their essential roles in connecting other targets. ICSU [6] used a scoring approach to identify causal and functional relations underlying progress in or the achievement of the sustainable development goals and targets. Allen et al. [11] adopted a multi-criteria analysis (MCA) decision framework that assesses and prioritizes SDG targets based upon their "level of urgency", "systemic impact", and "policy gap". El-Maghrabi et al. [13] employed network theory and economic complexity and found that the goals tend to have the strongest relationship with the other goals' SDG indicators, especially in low- and middle-income countries. SDGs Bappenas [10] used interpretive structural modeling (ISM) and showed that free primary and secondary education, double energy efficiency, universal health coverage, and enhanced renewable energy will help accomplish other SDG targets. Recently, UNDP [21] provided a visualization of SDG interlinkages that represents their synergies and trade-offs taken from various literature.

### *2.2. Stunting*

A large and growing body of literature has investigated various factors related to stunting. For instance, the malnutrition that contributes to stunting is not only related to a lack of family food security (SDG 2) but also the effects of poverty (SDG 1), poor health services (SDG 3), maternal awareness (SDG 4), and access to clean water and sanitation (SDG 6) [22–24]. The linkage of these targets results in different relationships between each target based on geographical conditions and different periods [1]. In Malawi and Nepal, the availability of handwashing facilities and clean drinking water does not synergize with stunted children's growth. It has been proven that increasing access to handwashing facilities or drinking water did not reduce stunted children's growth [25–27]. Meanwhile, in rural areas of India, the linkage between the availability of handwashing facilities and clean water and sanitation (SDG 6) reduced malnutrition issues in children (stunting) [28]. According to Agostoni et al. [29], apart from the health facility factor (SDG 3), malnutrition in children is related to several other factors, such as mother education (SDG 4), agriculture and food systems (SDG 2), network social safeguards (SDG 1), and the availability of clean water and adequate sanitation (SDG 6).

### *2.3. Cirebon District at a Glance*

This analysis focuses on the case study of Cirebon District, located in West Java, Indonesia (map of the study area can be found in Figure 2). Cirebon District spans an area of 1070.29 $km^2$ and comprises 40 sub-districts and 424 villages [30,31]. The district has a population of approximately 2.291 million people, resulting in a population density of 2141 individuals per square kilometer. In terms of economic performance, the district experienced a growth rate of 8.3% in 2022, with a Gross Regional Domestic Product (GRDP) of IDR 56.65 trillion or USD 3.8 million [30]. The processing industry sector contributes significantly to the district's economy, accounting for 20.6% of the GRDP [30].

Poverty remains a concern in Cirebon District, with 12.01% of the population living below the poverty line in 2022, equating to a monthly per capita income of less than USD 28 or IDR 416,914 [30]. This poverty rate is relatively high compared to other districts and cities in West Java. Additionally, the district faces a high prevalence of stunting, with 18.6% of children affected, corresponding to 15,299 infants across 10 working areas of public health centers and 28 working areas of villages in 9 sub-districts [7,20]. The government of Cirebon District has set a target to reduce stunting cases by 3% by 2024 and aims to eliminate stunting entirely by 2030 [32].


**Figure 2.** Map of Cirebon District. Source: Wikimedia [33–35].

## 3. Materials and Methods

### *3.1. Data*

This study uses SDG indicator data of 2017 and 2018 from 514 districts in Indonesia. The data were collected from the Indonesia Socioeconomic Survey (SUSENAS) and Labor Force Survey (SAKERNAS). In addition, some indicator data are taken from official publications such as Central Agency on Statistics (BPS) and the Ministry of Health and Statistics Indonesia (RISKESDAS). All these data are compiled following the definition and methodology in the Indonesia SDG metadata [36]. Given the availability of the data, this study could only compile data for 70 indicators of 13 goals. Three goals are not included in this study, namely SDG 12 Responsible Consumption and Production, SDG 14 Life Below Water, and SDG 15 Life on Land. However, there are duplicated indicators and several indicators that have no variation across districts and hence could not be analyzed further. Gross enrolment rate for upper-secondary school/equivalent, the percentage of the population living below the national poverty line, the proportion of people who use the internet, and the proportion of people who control/own mobile phones are among the duplicated indicators. After conducting the selection process, a total of 54 indicators were deemed appropriate for further analysis, representing 28 targets across 13 goals (Table 1). The full list of indicators can be found in the Supplementary file (Table S1: List of SDG Indicators).

**Table 1.** Summary of Selected SDG Indicators.

| Goal | Number of Target | Number of Indicator |
|---|---|---|
| 1 | 2 | 8 |
| 2 | 2 | 4 |
| 3 | 3 | 5 |
| 4 | 6 | 15 |
| 5 | 1 | 2 |
| 6 | 2 | 2 |
| 7 | 1 | 1 |
| 8 | 4 | 9 |
| 9 | 2 | 2 |
| 10 | 2 | 2 |
| 11 | 1 | 1 |
| 16 | 1 | 2 |
| 17 | 1 | 1 |
| Total | 28 | 54 |

### *3.2. Economic Complexity and Network Theory*

The SDG interlinkages in this study are based on the economic complexity and network theory following [13,17] that was first developed as a country development diagnostic framework [37]. The analysis is based on a set of network metrics, including *revealed comparative advantage (RCA)*, *proximity*, *centrality*, and *density*. Inspired by these studies, the current study attempted to adopt the method into the research.

Firstly, the performance of SDG indicators is measured using *RCA*. *RCA* measures the performance of SDG indicators in each region based on the capacity of the specified region proxied by HDI's expenditure per capita. The kernel-weighted local polynomial estimator approach is used to plot SDG indicator data against expenditure per capita. The graph can be used to see whether a region is classified as having an over- or under-performed indicator. *A* region is considered over-performed if the SDG indicator excels performance expectations based on the region's capacity. The opposite is used to determine if any SDG indicators are under-performed. Mathematically, *RCA* consists of binary numbers (0 and 1) describing each indicator's comparative advantage. The way to get *RCA* is as follows:

$$RCA(i,r) = \begin{cases} 1, & x_{i,r} > Z_{\alpha=0.05} + E(x_{i,r}) \\ 0, & otherwise \end{cases}$$

where *RCA(i,r)* is the *RCA* value in specific indicator (*i*) and region (*r*), which is 1 when the statistical confidence level exceeds 95% or when the indicator is over-performed and 0 when it is under-performed.

The second step involves measuring the *proximity* between each SDG indicator. *Proximity* in this context refers to the degree of closeness or interconnectedness between the SDG indicators. Their *proximity* to other indicators determines the power to succeed in the SDG indicator. *Proximity* also indicates a region's ease of capacity to be used together to achieve the two indicators [13,17]. Based on the set of *RCA* for each indicator in each region, the *proximity* is measured by the minimum of the two conditional probabilities; that is, the probability of *A* performs better given the performance of *B*, and the probability of *B* performs better given the performance of *A*, as in the following equation [13]:

$$P(A|B) = \frac{P(A \cap B)}{P(B)} \neq P(B|A) = \frac{P(B \cap A)}{P(A)}$$

The third step entails measuring *centrality*. *Centrality* refers to the importance or prominence of each SDG indicator within the network of interlinkages. It helps identify indicators that play a significant role in connecting and influencing other indicators within the SDG framework. The term *centrality* refers to the total number of calculated SDG

*proximity* pairs [13,17]. *Centrality* is used as a connectivity metric, with a high *centrality* indicating that an SDG is strongly linked with other SDGs [13,17]. The greater the *centrality* value, the more related (central) the indicator is to other SDG indicators. The *centrality* could also be an indicator of the potential variety and contribution to the overall performance of the region's SDG program [13]. It is strongly advised that SDGs with high *centrality* be redeployed and improved to achieve the SDG goal [13,17].

$$Centrality_j = \sum_i Proximity_{ij}$$

In the fourth step, *density* is measured to assess the efficiency of achieving an indicator, considering the region's capabilities and performance on other metrics [13]. The *density* indicator shows how close an "unsuccessful" SDG is to a region's successful SDGs. Notably, *RCA* and *density* are both indicator- and region-specific, whereas *proximity* and *centrality* are merely indicator-specific [13]. The *density* of region $r$ on specific SDGs' indicators $j$ is equal to the total *proximity* of an SDG indicator $j$ to all other SDGs that over-performed divided by the *centrality* of SDG $j$, as shown in the equation below [13]. Any SDG has a *density* value between 0 and 1. The greater the *density* value of an under-performed SDG indicator, the closer its necessary capacities are to the region's current capabilities [13].

$$Density_{rj} = \frac{\sum_i Proximity_{ij} RCA_{ri}}{\sum_i Proximity_{ij}}$$

Subsequently, a network visualization is generated based on the methodology employed in UNESCAP [17] to illustrate the interlinkages across the SDG indicators. Each indicator is connected to another based on its *proximity* value, which serves as the weight of the link. The process begins by using the *maximum spanning tree (MST)* algorithm to create the initial "skeleton" of the network. The MST algorithm establishes *N-1* links (*N* being the number of indicators) that connect all network nodes to their closest partner [17]. Next, all links with a *proximity* value greater than or equal to 0.4 are added to the *minimum spanning tree (MST)* to differentiate between nodes with numerous strong connections and those with fewer connections. Once the network is constructed, it is visualized using the *Kamada Kawai* technique. This visualization method aids in representing the interrelationships between indicators in a visually informative manner.

Finally, drawing from the approach proposed by [13], the selection of priority indicators takes into account various considerations, including (1) indicators with high *centrality* as its effect on the performance of other SDG metrics is the greatest and (2) indicators with high *density*, which means they have a sufficient capacity to be over-performed. By considering these factors, the analysis helps identify priority indicators that hold strategic importance and have the potential to drive progress across multiple SDGs.

## 4. Results

### *4.1. Performance in SDG Indicators*

By using kernel-weighted polynomial smoothing, this analysis can determine the *RCA* for each indicator in each region. *A* comparative advantage exists in an indicator if the indicator's *RCA* value is 1. This comparative advantage demonstrates that the indicator in the region has better performance relative to other regions' performance with the same capacity.

Since this study focuses on the stunting indicator, Figure 3 illustrates the correlation of stunting on per capita spending in all Indonesian districts. The position of Cirebon District in the plot is marked by a blue dot. Meanwhile, the other districts in West Java are shown by red dots. This indicator allowed this study to compare the performance of each SDG indicator in the Cirebon District against that of other districts in Indonesia. The red line serves as the fitted line, whereas the shaded region represents the 95% confidence

interval. This red line represents the average SDG indicator achievement for each level of per capita spending.

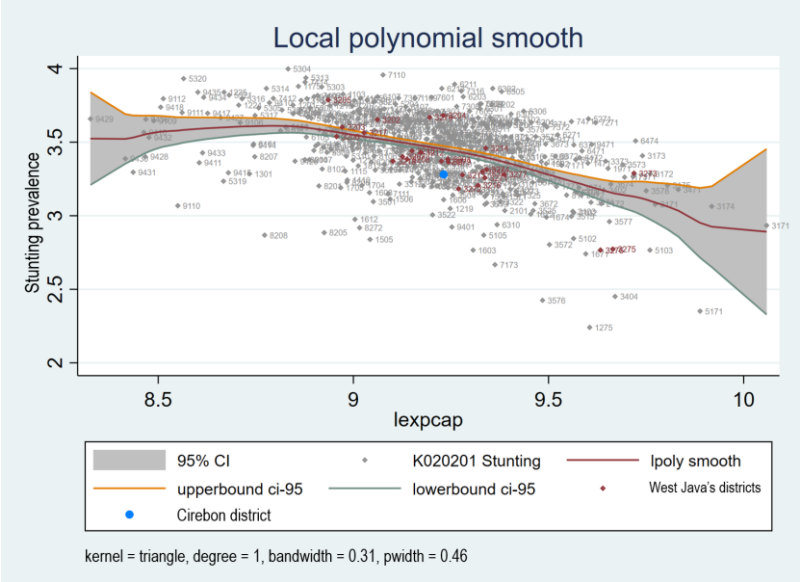


**Figure 3.** Performance of stunting in 514 districts of Indonesia 2017–2018. Note: data label refers to official district code in Indonesia.

As shown in Figure 3, the position of Cirebon District (blue dot) in the plot is below the fitted line and the shaded region. This position holds that the performance of Cirebon District in resolving stunting is much better (outperforms) than numerous regions in Indonesia (grey diamonds), including most areas in West Java (maroon diamonds) with similar capacity.

Other indicators are also shown in the Supplementary file (Figures S1–S54: Performance of SDG indicators on per capita income). Figure 4 depicts a summary of the classification. This study found that Cirebon District has 28 indicators that are classified as over-performed while the other 26 indicators have below-average performance (under-performed) (see Table A1 for the full-information of indicator status).

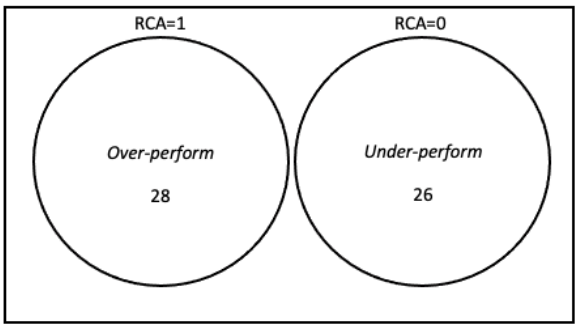


**Figure 4.** SDG Indicator Performance (*RCA*) Grouping in Cirebon District.

### *4.2. Proximity*

Table 2 shows the average *proximity* values of 13 Goals, while the *proximity* matrix of the 54 indicators used in this study can be found in the Supplementary file (Table S2: *Proximity* Matrix of (54 × 54) Indicators). The greater the *proximity* value between two SDG indicators, the stronger the interlinkages between them. Strong interlinkages between the two indicators necessitate a comparable level of capability to attain each objective.

**Table 2.** Summary of *Proximity* by Goal.

| Goal | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | 0.44 | 0.49 | 0.45 | 0.45 | 0.51 | 0.56 | 0.37 | 0.48 | 0.44 | 0.53 | 0.54 | 0.48 |
| 2 | 0.44 | - | 0.43 | 0.39 | 0.37 | 0.42 | 0.44 | 0.36 | 0.44 | 0.37 | 0.43 | 0.44 | 0.43 |
| 3 | 0.49 | 0.43 | - | 0.42 | 0.44 | 0.53 | 0.50 | 0.38 | 0.46 | 0.39 | 0.53 | 0.50 | 0.50 |
| 4 | 0.45 | 0.39 | 0.42 | - | 0.42 | 0.45 | 0.47 | 0.35 | 0.45 | 0.40 | 0.46 | 0.44 | 0.48 |
| 5 | 0.45 | 0.37 | 0.44 | 0.42 | - | 0.46 | 0.48 | 0.35 | 0.41 | 0.41 | 0.46 | 0.45 | 0.42 |
| 6 | 0.51 | 0.42 | 0.53 | 0.45 | 0.46 | - | 0.55 | 0.40 | 0.52 | 0.37 | 0.79 | 0.50 | 0.54 |
| 7 | 0.56 | 0.44 | 0.50 | 0.47 | 0.48 | 0.55 | - | 0.41 | 0.48 | 0.45 | 0.55 | 0.55 | 0.50 |
| 8 | 0.37 | 0.36 | 0.38 | 0.35 | 0.35 | 0.40 | 0.41 | - | 0.40 | 0.38 | 0.40 | 0.38 | 0.43 |
| 9 | 0.48 | 0.44 | 0.46 | 0.45 | 0.41 | 0.52 | 0.48 | 0.40 | - | 0.37 | 0.53 | 0.47 | 0.63 |
| 10 | 0.44 | 0.37 | 0.39 | 0.40 | 0.41 | 0.37 | 0.45 | 0.38 | 0.37 | - | 0.36 | 0.45 | 0.35 |
| 11 | 0.53 | 0.43 | 0.53 | 0.46 | 0.46 | 0.79 | 0.55 | 0.40 | 0.53 | 0.36 | - | 0.48 | 0.57 |
| 16 | 0.54 | 0.44 | 0.50 | 0.44 | 0.45 | 0.50 | 0.55 | 0.38 | 0.47 | 0.45 | 0.48 | - | 0.48 |
| 17 | 0.48 | 0.43 | 0.50 | 0.48 | 0.42 | 0.54 | 0.50 | 0.43 | 0.63 | 0.35 | 0.57 | 0.48 | - |

Source: Authors' calculations.

Given their *proximity* value, there are 8 goals out of 13 goals having a strong association with Goal 2 (Zero Hunger). The eight goals are Goal 1 (No Poverty), Goal 3 (Good Health and Well-Being), Goal 6 (Clean Water and Sanitation), Goal 7 (Affordable and Clean Energy), Goal 9 (Industry, Innovation, and Infrastructure), Goal 11 (Sustainable Cities and Communities), Goal 16 (Peace, Justice, and Strong Institutions), and Goal 17 (Sustainable Cities and Communities) (Partnerships for the Goals) (Table 2). With a *proximity* score of 0.44, Goal 16 (Peace, Justice, and Strong Institutions), Goal 7 (Affordable and Clean Energy), Goal 1 (No Poverty), and Goal 9 (Industry, Innovation, and Infrastructure) have the closest relationship to Goal 2 (Zero Hunger). On the other hand, Goal 8 (Decent Work and Economic Growth) has the lowest *proximity* value with a value of 0.36.

From the 54 SDG indicators listed, 34 SDG indicators are directly connected to the stunting indicator, as defined by indicators with a *proximity* value exceeding the 0.4 threshold. Among the 34 indicators are 2.1.1.(a) Underweight, 4.4.1 Youth with ICT, and 2.2.2 Wasting with values of 0.69, 0.506, and 0.502 (see Table A1). This shows that stunting is strongly related to the indicators of underweight, youth that have access to technology, and wasting in children under five.

### 4.3. Centrality

As shown in Table A1, 1.4.1.(j) Birth Certificate, 4.4.1 Youth with ICT, 3.1.2 Birth by Skilled Health Personnel, 16.9.1.(b) Birth Certificate (child), and 1.4.1(k) Electricity (Bottom 40) are among the indicators with the highest *centrality*, implying that if Cirebon District successfully provides access to these indicators, it may highly influence the success in other SDGs. However, 4.5.1 Gender gap (F/M) Net Enrolment Rate of Lower-secondary School, 8.3.1.(b) Informal Agricultural Employment (%), 8.1.1 Annual growth rate of GDP per capita, 4.5.1 Gender Gap (F/M) Net Enrolment Rate Upper-secondary School, and 4.5.1 Gender Gap (F/M) Net Enrolment Rate of University may not be strongly related to the other SDGs. This suggests that each indicator has very specific, non-transferable conditions for the SDG delivery mechanism [13]. As for 2.2.1 Stunting, this indicator is ranked 35th out of 54 indicators, meaning that the effectiveness of addressing stunting may not be sufficient to promote the achievement of other SDGs.

### 4.4. Density

As the *density* value is indicator- and region-specific, this analysis will focus on the Cirebon District *density*. Cirebon District has 26 indicators that are still below their expected performance based on their capacity (Table 3). 16.9.1 Birth Certificate <5, 8.1.1 Annual growth rate of GDP per capita, 1.4.1.(g) Net Enrolment Rate Primary School (B40), 3.a.1 Smoking, and 1.4.1.(i) Net Enrolment Rate Upper-secondary School (B40) are those with the highest *density* values among under-performed indicators (see Table A1). However,

only 16.9.1.(b) Birth Certificate <5 has a high *centrality* and *density* value, which means that the region already has the required capacity to make it a successful indicator. As for the rest of the indicators, governments might be able to engage successfully with a high probability of success, but the returns would be relatively small in terms of having a broader impact on various SDG indicators.

**Table 3.** Summary of *Centrality* and *Density* of Cirebon District.

| | | ***RCA* = 0** | ***RCA* = 1** | **Total** |
|---|---|---|---|---|
| | **n** | **26** | **28** | **54** |
| *Centrality* | max | 26.21 | 26.31 | 26.31 |
| | mean | 21.06 | 23.72 | 22.44 |
| | min | 12.51 | 12.60 | 12.51 |
| *Density* | max | 0.59 | 0.58 | 0.59 |
| | mean | 0.54 | 0.55 | 0.55 |
| | min | 0.50 | 0.51 | 0.50 |

Source: Authors' calculations.

Moreover, 16.9.1 Birth Certificate < 5, 3.1.2.(a) Birth at Health Facility (B40), 1.4.1.(a) Birth in Health Facility (B40), 1.4.1.(k) Access to Electricity (B40), and 3.1.2 Birth by Skilled Health Personnel are among the indicators that have the highest *density* and high *centrality* values compared to the other indicators. Investing in closely linked and higher-*density* indicators is likely to be more cost effective, as there will be positive spill-over effects as tightly clustered SDGs will inevitably create synergies, particularly in tackling the stunting problem.

## 5. Discussions

The findings of the current study indicate that there are indicators in the analysis with a high potential to contribute to the achievement of the SDGs in Cirebon District, particularly in dealing with stunting. In the following section, the analysis discussion is divided into two parts: first, an explanation of the network visualization created to highlight the interlinkages between the SDGs' subject areas and, second, a discussion of the crucial indicators in addressing stunting.

### *5.1. Network Visualization*

In this study, a visual representation of the SDG indicator network is constructed using *proximity* values, following the methodology established by UNESCAP [17]. Figure 5 shows a core–periphery pattern, with indicators for health, education, energy, and employment occupying a fairly dense network in the center. More specifically, these indicators are electricity and gas, health facilities, health workers, safe drinking water and sanitation, formal employment, education, and public services. These indicators represent basic needs that will influence the achievement of other network indicators. The network analysis supports the findings of several studies that discuss interlinkages between SDGs [10–17].

In an earlier study, Le Blanc [12] was able to identify a clear indication that SDG 4 (education) belongs to the "core" of the SDG network, besides SDG 2 (hunger), SDG 10 (inequality), SDG 12 (sustainable consumption and production), and SDG 1 (poverty). In addition, their findings also suggest that SDG 8 (growth and employment) is among those at the top of the list, and all have links with 10 other goals or more. A network study by UNESCAP [17] shows the same core–periphery structure, with SDG 3 (health), SDG 2 (hunger), SDG 9 (infrastructure), and SDG 1 (poverty) indicators prominent in the densely connected core. Similarly, Kunčič [15] network mapping shows the strongest positive connections between SDG 3 (health) and the others. Moreover, IGES [14] discovered that SDG 6 (safe drinking water and sanitation) and SDG 7 (energy) are the network's top priorities together with SDG 9 (resilient infrastructure agriculture) and SDG 12 (food production) due to their critical roles in connecting other targets. Pereira et al. [16] also

found that the least complex goals are SDG 9 (industry, innovation, and infrastructure), SDG 3 (health), and SDG 7 (energy). Their findings suggest that the best strategy for countries might have to achieve these less complex goals before moving on to more complex goals in order to fully achieve the 2030 Agenda. Clearly, focusing on these goals will have the greatest impact on the network. This implies that the best strategy for the region to fulfill the 2030 Agenda is to consider the links between each of them.

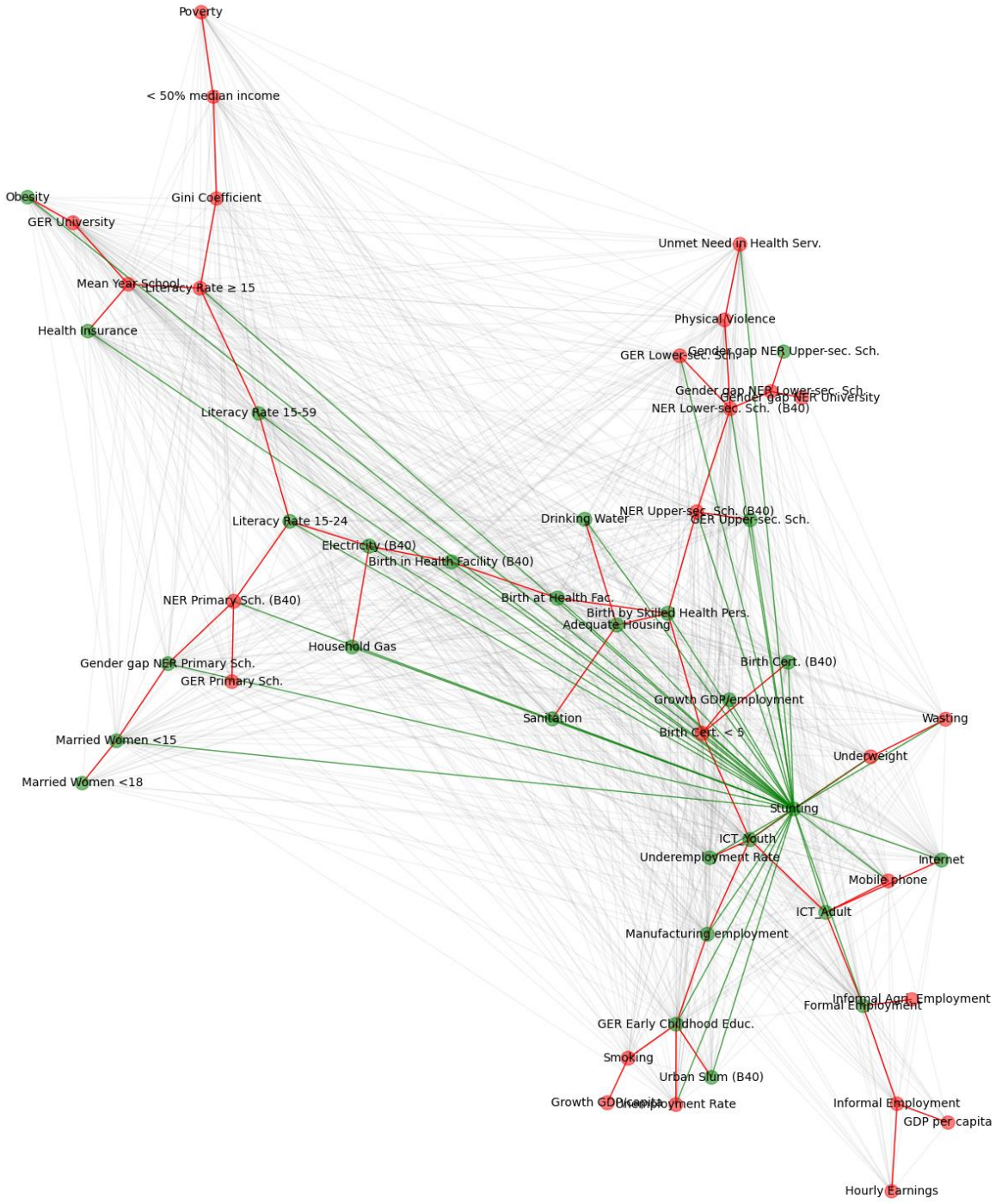


**Figure 5.** Network of SDG Indicators. Notes: The gray and green lines indicate a proximity value greater than 0.4; The green line represents the connection with the stunting indicator; The green and red dots indicate over-performed and under-performed indicators, respectively; and the size of the circle represents the density of each indicator in Cirebon District.

### 5.2. Priority Indicators

The priority indicators are chosen by ranking each metric that has already been calculated in the results section. Indicators with *proximity* values greater than the threshold value of 0.40 and a direct relationship with the stunting indicator are selected, as shown by the green line in Figure 5. Out of the 54 indicators analyzed, 34 indicators meet this criterion.

Following the initial selection of 34 indicators, a subset of those indicators with the highest *centrality* and *density* values is chosen. Based on this assessment, eight variables are chosen as priority indicators for dealing with stunting, specifically in Cirebon District, Indonesia (Table 4). High *centrality* indicates that these eight indicators have high connectivity with other indicators in the network. The achievement of indicators with high *centrality* can contribute to other linked indicators. In addition, if indicators have a high *density*, it means that these indicators are within reach or, in this case, Cirebon District has most of the capacity needed to succeed in these selected/priority indicators. These priority indicators are divided into four aspects, i.e., civil registration, health facilities and services, access to basic facilities and housing, and access to ICT.

**Table 4.** Priority Indicators for Stunting Handling in Cirebon District.

| Indicator | Ranking | | |
|---|---|---|---|
| | ***Proximity* to Stunting** | ***Centrality*** | ***Density*** |
| Birth Certificate (child) | 8 | 4 | 1 |
| Birth at Health Facility | 19 | 6 | 2 |
| Birth in Health Facility (B40) | 16 | 7 | 3 |
| Electricity (B40) | 14 | 5 | 4 |
| Birth by Skilled Health Personnel | 9 | 3 | 5 |
| Adequate Housing | 10 | 10 | 7 |
| Youth with ICT | 2 | 2 | 8 |
| Sanitation | 21 | 9 | 9 |

Source: Authors' calculations.

The empirical finding of this study shows that the role of a birth certificate is vital to prevent and reduce stunting. Birth certificates ensure that people (in our case, children) are registered in the system [38]. In a survey of 31 low-middle-income nations, it was discovered that children without birth certificates primarily come from low-income, uneducated households [39]. The absence of birth registration violates children's fundamental rights, particularly their right to nationality, and may also affect young children's ability to access specialized health treatments and social welfare programs (such as cash transfer schemes), as well as school enrolment [39]. The findings of a previous study in sub-Saharan Africa evidenced that children aged 2–5 who have birth certificates are less likely to suffer from malnutrition [40]. The reason is that birth certificates can help ensure the accuracy of a child's nutrition assessment, and the data from the evaluation can help measure child nutrition as a form of child malnutrition prevention or reduction.

Table 5 indicates that the proportion of Cirebon District children under 5 years of age that owned birth certificates in 2018 was 71.36%, a decrease of 8.07% from the previous year. This decrease demonstrates that Cirebon District has not done a good job of protecting individual rights and ensuring that everyone has access to justice and social services by issuing adequate birth certificates. Hence, improvement in birth certificate coverage is urgent and has to be hastened to support stunting elimination in Cirebon District.

**Table 5.** SDG Priority Indicator Statistics in Cirebon District (%).

| Aspect | Indicator | 2017 | 2018 |
|---|---|---|---|
| Civil registration | Proportion of children under 5 years of age whose births were registered by the civil registration | 79.43 | 71.36 |
| Health | Proportion of births at health facility | 85.97 | 86.43 |
| | Proportion of births in health facility (B40) | 87.25 | 81.37 |
| | Proportion of births attended by skilled health personnel | 97.72 | 99.49 |
| Access to basic facilities and housing | Proportion of urban population living in adequate housing | 50.33 | 56.97 |
| | Proportion of population using safely managed sanitation | 79.24 | 81.83 |
| | Access to electricity (B40) | 100 | 99.55 |
| Access to ICT | Proportion of youth with ICT | 69.92 | 80.14 |

Source: SDGs Bappenas [36].

Next, the health facility and services factors, such as Birth at Health Facility, Birth in Health Facility (B40), and Birth by Skilled Health Personnel, are among health-related SDG indicators associated with stunting. These findings are as expected, since access to health facilities and services is essential to decrease the risk of child stunting by providing quality health services. This is in line with a previous study by Mtoi & Nyaruhucha [41] who reported that the place of birth is significantly associated with reductions in stunting, particularly when mothers delivered their babies at health facilities. Similarly, Ayelign & Zerfu [42] and Budhathoki et al. [43] found that children born at a health facility had a lower risk of stunting than those born at home. Aside from the birthplace, the findings are consistent with previous research that has found that the role and presence of skilled health personnel have a significant impact on stunting reduction. Mtoi & Nyaruhucha [41] also found that the kind of assistance the mother received during delivery was related to lower chances of malnourishment. A study by Torlesse et al. [44] in Indonesia reported that the odds of stunting in children 0–23 months old were more than double if a doctor or midwife did not provide antenatal care. These two studies concluded that having qualified health personnel on hand is vital. According to Potter et al. [45], health personnel have an essential role as educators. The involvement of health personnel as educators will be essential for preventing and reducing stunting. After all, adequate access to health facilities and services will allow mothers to receive all necessary treatment and information to protect their children from infections that can cause stunting.

As shown in Table 5, the proportion of births at health facilities (B40) increased by 0.46% between 2017 and 2018. With current growth rates, this SDG target will most likely be met gradually. Meanwhile, the proportion of births in Cirebon District health facilities has decreased from 87.25% in 2017 to 81.37% in 2018, representing a 5.88% decrease over a one-year period. Furthermore, the Cirebon District has done an excellent job of maintaining and increasing the proportion of births attended by skilled health personnel. Given the current achievement and importance of these indicators, it is imperative for Cirebon District to expedite progress in order to ensure that all children, youth, and women have equitable access to high-quality healthcare and services.

Furthermore, this study shows an interlinkage between stunting and basic facilities and housing, such as adequate housing, sanitation, and access to electricity. Several studies attempted to investigate the relationship between these factors and stunting, and their findings were consistent with ours. First, we will discuss how adequate housing can affect stunting reduction. Home is more than shelter; it is vital to the well-being of children and families. One of the many advantages that come with having access to adequate and affordable housing is improved health [46]. However, because poor households have a more limited ability to obtain adequate housing, children are at a higher risk of malnutrition [47–49]. A study of five health centers in Konawe District, Southeast Sulawesi Province, discovered that poor housing conditions, such as limited access to clean water, the absence of a sanitary latrine, and the use of poor housing roof material, all contributed

significantly to underweight among children [50]. Adequate housing can also depend on the area people live in. Kumar et al. [51] found that in low- and middle-income countries, children living in urban areas are generally less likely to be stunted and underweight than children living in rural areas. This advantage is mainly due to better housing, greater food availability, electricity, piped water, sanitation, and transportation in urban areas [52].

For the case of Cirebon District, there is an increase in the proportion of the urban population living in adequate housing from 50.33% in 2017 to 56.97% in 2018, representing a 6.64% increase (Table 5). The current path shows that Cirebon District is making moderate progress toward ensuring access for all to adequate, safe, and affordable housing and upgrading slums, despite the fact that it remains low. Accordingly, in order to effectively eliminate stunting in the region, it is crucial to expedite efforts aimed at improving access to quality housing facilities.

Moreover, previous research has highlighted the importance of sanitation in lowering the risk of stunting. Danaei et al. [53] provided a consistent and comparable set of global estimates of the impact of risk factors on stunting. They discovered that poor sanitation is one of the leading risk factors for stunting around the world. Ikeda et al. [48] found that improvements in sanitation facilities made the largest contribution to the decrease in the prevalence of stunting. A previous study in Indonesia by Torlesse et al. [44] found that unimproved sanitation in households with untreated water was associated with more than twice the odds of stunting in their children. Similarly, a recent study by Mulyaningsih et al. [54] attempted to investigate the causes of childhood stunting in Indonesia. Their findings also stated that children who live in areas without access to water, sanitation, and hygiene are at a higher risk of stunting.

Regarding sanitation, Cirebon District was able to increase safely managed sanitation services by 81.83% in 2018 (Table 5), leaving 18.17% of the population with unimproved sanitation. It is imperative that Cirebon District must ensure improved sanitation access in order to contribute to the reduction in stunting prevalence and make significant progress by 2030.

Next, several previous studies in Bangladesh, India, and Vietnam show that basic housing needs, i.e., access to electricity in the household, could substantially lower the chance of stunting in children [55–57]. Numerous electronic appliances, such as refrigerators and electric ovens, facilitate the preparation and storage of food in the household and aid in the decrease in child malnutrition [55]. In addition, other electronic devices such as televisions and radios act as media information to address the nutritional requirements of children [55,58]. In fact, with the rapid evolution of technology, media-related information can now be accessed in real time through the internet. These findings are linked to prior studies that suggest that household internet access is associated with reduced stunting [59–61]. Internet-based information dissemination and awareness raising tend to increase the likelihood that mothers will provide adequate nutrition for their children, thereby reducing stunting [60].

In the case of Cirebon District, as shown in Table 5, universal access to electricity among poor and vulnerable households was reached in 2017. Given that access to electricity is a priority indicator for reducing stunting, it is important to maintain this achievement and prevent any declines as was the case in 2018. Moreover, a significant improvement is shown in the proportion of youth with ICT. In 2018, 80.14 percent of adolescents in the Cirebon District had access to ICT. This significant rise in the Youth with ICT indicator might be attributed to the rapid pace of technological advancement. This development can be utilized to improve performance on other SDG indicators, such as reducing the prevalence of stunting in the region.

## 6. Conclusions

This study employs an integrated methodology to investigate the interlinkages between stunting and other SDG indicators. The SDG interlinkages in this study are based on the economic complexity and network theory following El-Maghrabi et al. [13] and UNESCAP [17] that was first developed as a country development diagnostic framework. Applying this methodology to specific problems and regions can result in the identification of key targets, connections, and networks that can be utilized for SDG prioritization [62]. The multidimensional nature of the stunting issue necessitates an interlinkage analysis method between SDG indicators. Given the disparities in geographical conditions and the performance of each SDG indicator, the results obtained may differ from other studies because this study employs a case that is more focused on the district level.

Based on the findings, this study suggests that the effort to eliminate stunting in Cirebon District can be focused on four key aspects, i.e., civil registration, health facility and services, access to basic facilities and housing, and access to ICT. Primarily, priority can be given more to the poor households. It is worth noting that out of the eight priority indicators identified, seven have shown significant progress in the Cirebon District. However, access to adequate housing lags behind the other indicators. Therefore, the Cirebon District government needs to intensify its efforts to improve the achievement of these priority indicators. This is crucial as these indicators have a direct impact on other indicators, particularly in reducing the prevalence of stunting in the district. Furthermore, these findings provide additional evidence of the interconnectedness among SDG indicators, underscoring the multifaceted nature of stunting elimination.

The implications of this study suggest that the Cirebon District government can prioritize specific policy options to address the issue of stunting. These policy options are drawn based on the understanding that stunting is a complex issue with multiple dimensions and that the indicators within the SDGs are interconnected. These policy options include (1) ensuring birth certificate ownership to enable effective monitoring of child growth and development; (2) ensuring equitable access to health facilities and healthcare personnel to enhance healthcare services for all residents; (3) increasing access to clean water, proper sanitation, and effective wastewater management to ensure equitable health conditions for the population; (4) improving access to essential services in order to enhance the availability of adequate housing; and (5) investing in ICT education for the youth to foster their skills and knowledge in the digital age.

Moreover, the findings of this study can have implications for policymakers in terms of prioritizing their limited financial resources. It is crucial to have clear policy directives and adequate funding assistance to facilitate and promote practical linkages between SDG indicators, thereby fostering more integrated programming. By implementing the policy options identified in this study, the Cirebon District government could make significant progress in reducing stunting cases and, at the same time, achieving the sustainable development goals more effectively.

This study reported findings on how to apply an interaction approach to SDGs at the district level in Indonesia, where previous research had mostly focused on analyzing at the national level. Nevertheless, this research has some limitations. Due to data limitations and difficulties in finding data at the district level, this study could only cover 54 SDG indicators, introducing a possibility for bias. This study only conducted a correlation analysis of the SDG indicators. This means that this study can serve as a valuable resource for understanding the interconnections among the SDGs and can provide valuable insights to districts that have not been previously explored yet. Therefore, future research agendas are expected to enrich interlinkage research with more complete and high-quality data, followed by a more complete analysis that is not limited to correlations and also includes synergies and trade-offs to generate more impactful results.

**Supplementary Materials:** The following are available online at https://www.mdpi.com/article/10.3390/su15118890/s1, Table S1: List of SDGs Indicators, Table S2: *Proximity* Matrix of (54 × 54) Indicators, Figures S1–S54: Performance of SDG indicators on per capita income.

**Author Contributions:** Conceptualization, A.K., R.A., Z.A. and H.N.; methodology, A.K. and H.N.; software, A.K., A.A.G., P.R.H. and H.N.; validation, A.K., A.A.G. and P.R.H.; formal analysis, A.K., A.A.G. and P.R.H.; investigation, A.K., A.A.G. and P.R.H.; resources, R.A., M.R.K. and A.A.; data curation, A.K., A.A.G. and P.R.H.; writing—original draft preparation, A.K., R.A., Z.A., M.R.K. and A.A.; writing—review and editing, A.K., R.A., Z.A., M.R.K. and A.A.; visualization, H.N., M.R.K. and A.A.; supervision, Z.A.; project administration, R.A.; funding acquisition, A.K. and R.A. All authors have read and agreed to the published version of the manuscript.

**Funding:** This study was financially supported by the Ministry of Education and Culture Republic of Indonesia, Directorate General of Higher Education (DGHE) through Universitas Padjadjaran National Competitive Research Grant, contract number 1827/UN6.3.1/LT/2020.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** The data that support the findings of this study are available from the corresponding author, [A.K.], upon reasonable request.

**Conflicts of Interest:** The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

## Appendix A

**Table A1.** Summary of *RCA*, *Proximity*, *Centrality*, and *Density* of SDG Indicators in Cirebon District.

| No | Goal | Code | Indicator | *RCA* | *Proximity* to Stunting | Rank of *Proximity* to Stunting | *Centrality* | Rank of *Centrality* | *Density* | Rank of *Density* |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1.2.1 | Poverty | 0 | 0.37 | 42 | 21.43 | 38 | 0.53 | 44 |
| 2 | 1 | 1.4.1.(a) | Birth in Health Facility (B40) | 1 | 0.46 | 16 | 26.02 | 7 | 0.58 | 3 |
| 3 | 1 | 1.4.1.(f) | Urban Slum Households (B40) | 1 | 0.45 | 20 | 20.04 | 45 | 0.54 | 33 |
| 4 | 1 | 1.4.1.(g) | Net Enrollment Rate Primary School (B40) | 0 | 0.40 | 34 | 24.02 | 22 | 0.57 | 11 |
| 5 | 1 | 1.4.1.(h) | Net Enrollment Rate Lower-secondary School (B40) | 0 | 0.50 | 4 | 24.65 | 16 | 0.55 | 21 |
| 6 | 1 | 1.4.1.(i) | Net Enrollment Rate Upper-secondary School (B40) | 0 | 0.47 | 13 | 24.90 | 15 | 0.56 | 15 |
| 7 | 1 | 1.4.1.(j) | Birth Certificate (B40) | 1 | 0.47 | 11 | 26.31 | 1 | 0.55 | 23 |
| 8 | 1 | 1.4.1.(k) | Electricity (B40) | 1 | 0.46 | 14 | 26.18 | 5 | 0.57 | 4 |
| 9 | 2 | 2.1.1.(a) | Underweight | 0 | 0.69 | 1 | 21.58 | 37 | 0.54 | 31 |
| 10 | 2 | 2.2.1 | Stunting | 1 | 0.00 | 54 | 22.19 | 35 | 0.54 | 39 |
| 11 | 2 | 2.2.2 | Wasting | 0 | 0.50 | 3 | 21.40 | 39 | 0.55 | 22 |
| 12 | 2 | 2.2.2 | Overweight | 1 | 0.40 | 36 | 21.14 | 41 | 0.54 | 37 |
| 13 | 3 | 3.1.2 | Birth by Skilled Health Personnel | 1 | 0.47 | 9 | 26.25 | 3 | 0.57 | 5 |
| 14 | 3 | 3.1.2.(a) | Birth at Health Facility | 1 | 0.46 | 19 | 26.17 | 6 | 0.58 | 2 |
| 15 | 3 | 3.8.1.(a) | Unmet Need in Health Services | 0 | 0.50 | 5 | 22.72 | 29 | 0.54 | 35 |
| 16 | 3 | 3.8.2 | Health Insurance | 1 | 0.42 | 28 | 22.27 | 34 | 0.53 | 46 |
| 17 | 3 | 3.a.1 | Smoking | 0 | 0.35 | 46 | 20.35 | 43 | 0.56 | 13 |

**Table A1.** *Cont.*

| No | Goal | Code | Indicator | *RCA* | *Proximity* to Stunting | Rank of *Proximity* to Stunting | *Centrality* | Rank of *Centrality* | *Density* | Rank of *Density* |
|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 4 | 4.1.1.(d) | Gross Enrollment Rate of Primary School | 0 | 0.36 | 44 | 20.62 | 42 | 0.54 | 36 |
| 19 | 4 | 4.1.1.(e) | Gross Enrollment Rate of Lower-secondary School | 0 | 0.46 | 18 | 22.82 | 28 | 0.55 | 27 |
| 20 | 4 | 4.1.1.(f) | Gross Enrollment Rate of Upper-secondary School | 1 | 0.41 | 30 | 23.92 | 23 | 0.53 | 41 |
| 21 | 4 | 4.1.1.(g) | Mean Year School | 0 | 0.38 | 38 | 23.60 | 25 | 0.54 | 38 |
| 22 | 4 | 4.2.2.(a) | Gross Enrolment Rate of Early Childhood Education | 1 | 0.44 | 23 | 22.62 | 32 | 0.56 | 16 |
| 23 | 4 | 4.3.1.(b) | Gross Enrollment Rate of University | 0 | 0.37 | 43 | 23.19 | 26 | 0.56 | 17 |
| 24 | 4 | 4.4.1 | Youth with ICT | 1 | 0.51 | 2 | 26.28 | 2 | 0.57 | 9 |
| 25 | 4 | 4.4.1 | Adults with ICT | 1 | 0.47 | 12 | 25.65 | 8 | 0.56 | 18 |
| 26 | 4 | 4.5.1 | Gender gap (F/M) Net Enrollment Rate of Primary School | 1 | 0.40 | 35 | 23.86 | 24 | 0.54 | 32 |
| 27 | 4 | 4.5.1 | Gender gap (F/M) Net Enrollment Rate of Lower-secondary School | 0 | 0.32 | 48 | 17.22 | 50 | 0.52 | 48 |
| 28 | 4 | 4.5.1 | Gender Gap (F/M) Net Enrolment Rate Upper-secondary School | 1 | 0.29 | 51 | 12.60 | 53 | 0.51 | 51 |
| 29 | 4 | 4.5.1 | Gender Gap (F/M) Net Enrolment Rate of University | 0 | 0.23 | 53 | 12.51 | 54 | 0.53 | 40 |
| 30 | 4 | 4.6.1.(a) | Literacy Rate $\geq$ 15 | 0 | 0.41 | 31 | 24.12 | 21 | 0.55 | 24 |
| 31 | 4 | 4.6.1.(b) | Literacy Rate 15–24 | 1 | 0.46 | 15 | 25.07 | 12 | 0.55 | 25 |
| 32 | 4 | 4.6.1.(b) | Literacy Rate 15–59 | 1 | 0.45 | 22 | 24.91 | 14 | 0.53 | 43 |
| 33 | 5 | 5.3.1 | Married Women < 15 | 1 | 0.44 | 24 | 24.30 | 20 | 0.55 | 26 |
| 34 | 5 | 5.3.1 | Married Women < 18 | 1 | 0.37 | 41 | 19.63 | 47 | 0.53 | 45 |
| 35 | 6 | 6.1.1.(a) | Access to Safely Drinking Water | 1 | 0.42 | 27 | 24.35 | 18 | 0.56 | 12 |
| 36 | 6 | 6.2.1.(b) | Sanitation | 1 | 0.45 | 21 | 25.61 | 9 | 0.57 | 10 |
| 37 | 7 | 7.1.2.(b) | Household Gas | 1 | 0.44 | 25 | 25.50 | 11 | 0.56 | 14 |
| 38 | 8 | 8.1.1 | Annual growth rate of GDP per capita | 0 | 0.30 | 50 | 13.53 | 52 | 0.57 | 6 |
| 39 | 8 | 8.1.1.(a) | GDP per capita | 0 | 0.36 | 45 | 18.44 | 49 | 0.51 | 52 |
| 40 | 8 | 8.2.1 | Annual growth rate of GDP per employed person | 1 | 0.42 | 26 | 22.68 | 30 | 0.55 | 28 |
| 41 | 8 | 8.3.1 | Informal Employment (%) | 0 | 0.33 | 47 | 20.29 | 44 | 0.52 | 47 |
| 42 | 8 | 8.3.1.(a) | Formal Employment (%) | 1 | 0.41 | 32 | 24.32 | 19 | 0.53 | 42 |
| 43 | 8 | 8.3.1.(b) | Informal Agricultural Employment (%) | 0 | 0.26 | 52 | 14.89 | 51 | 0.52 | 49 |
| 44 | 8 | 8.5.1 | Hourly Earnings | 0 | 0.31 | 49 | 19.16 | 48 | 0.51 | 53 |
| 45 | 8 | 8.5.2 | Unemployment Rate | 0 | 0.41 | 33 | 19.93 | 46 | 0.55 | 29 |
| 46 | 8 | 8.5.2.(a) | Underemployment Rate | 1 | 0.48 | 6 | 22.64 | 31 | 0.54 | 30 |
| 47 | 9 | 9.2.2 | Manufacturing employment | 1 | 0.48 | 7 | 23.00 | 27 | 0.57 | 7 |
| 48 | 9 | 9.c.1.(a) | Mobile phone | 0 | 0.42 | 29 | 24.55 | 17 | 0.55 | 20 |
| 49 | 10 | 10.1.1 | Gini Coefficient | 0 | 0.38 | 39 | 21.69 | 36 | 0.51 | 50 |
| 50 | 10 | 10.2.1 | <50% median income | 0 | 0.37 | 40 | 21.24 | 40 | 0.50 | 54 |
| 51 | 11 | 11.1.1(a) | Adequate Housing | 1 | 0.47 | 10 | 25.53 | 10 | 0.57 | 8 |
| 52 | 16 | 16.1.3.(a) | Physical Violence | 0 | 0.40 | 37 | 22.61 | 33 | 0.54 | 34 |
| 53 | 16 | 16.9.1 | Birth Certificate < 5 | 0 | 0.48 | 8 | 26.21 | 4 | 0.59 | 1 |
| 54 | 17 | 17.8.1 | Access to Internet | 1 | 0.46 | 17 | 25.00 | 13 | 0.56 | 19 |

Note: *RCA* = 1 classified as over-performed; *RCA* = 0 classified as under-performed.

## References


1. Miola, A.; Borchardt, S.; Neher, F.; Buscaglia, D. *Interlinkages and Policy Coherence for the Sustainable Development Goals Implementation: An Operational Method to Identify Trade-Offs and Co-Benefits in a Systemic Way*; Publications Office of the European Union: Luxembourg, 2019. [CrossRef]
2. United Nations. The 17 Goals. 2019. Available online: https://sdgs.un.org/goals (accessed on 3 February 2023).
3. WHO. Monitoring Health for The SDGs. 2022. Available online: https://www.who.int/data/gho/data/themes/sustainable-development-goals#:~:text=TheUnitedNationsSustainableDevelopment,achievebytheyear2030 (accessed on 3 February 2023).
4. EU. Uncovering SDG Interlinkages: Interconnectedness and Policy Coherence for Sustainable Development. 2022. Available online: https://knowsdgs.jrc.ec.europa.eu/intro-interlinkages (accessed on 3 February 2023).
5. UNDP. Sustainable Development Goals. 2022. Available online: https://www.undp.org/sustainable-development-goals (accessed on 3 February 2023).
6. ICSU. *A Guide to SDG Interactions: From Science to Implementation*; International Council for Science (ICSU): Paris, France, 2017.
7. MoH. *Buku Saku Hasil Studi Status Gizi Indonesia (SSGI) Tahun 2022*; Ministry of Health: Jakarta, Indonesia, 2022.
8. Cegah Stunting. Perpres No 72 Tahun 2021. Available online: https://cegahstunting.id/unduhan/regulasi (accessed on 3 February 2023).
9. Yusuf, A.A.; Komarulzaman, A.; Alisjahbana, A.S.; Anna, Z.; Gina, A.A.; Setiawan, A.; Megananda. *Seri Menyongsong SDGs: Kesiapan Kabupaten/Kota di Provinsi Jawa Barat*, 1st ed.; Unpad Press: Bandung, Indonesia, 2018.
10. SDGs Bappenas. *Peta Jalan SDGs Indonesia*; Bappenas: Jakarta, Indonesia, 2017.
11. Allen, C.; Metternicht, G.; Wiedmann, T. Prioritising SDG targets: Assessing baselines, gaps and interlinkages. *Sustain. Sci.* **2018**, *14*, 421–438. [CrossRef]
12. Le Blanc, D. Towards Integration at Last? The Sustainable Development Goals as a Network of Targets. *Sustain. Dev.* **2015**, *23*, 176–187. [CrossRef]
13. El-Maghrabi, M.H.; Gable, S.; Rodarte, I.O.; Verbeek, J. *Sustainable Development Goals Diagnostics: An Application of Network Theory and Complexity Measures to Set Country Priorities*; World Bank: Washington, DC, USA, 2018.
14. IGES. *IGES Research Report Sustainable Development Goals Interlinkages and Network Analysis: A Practical Tool for SDG Integration and Policy Coherence*; IGES: Kanagawa, Japan, 2017.
15. Kunčič, A. Prioritising the Sustainable Development Goals Using a Network Approach: SDG Linkages and Groups. *Teor. Praksa* **2019**, *56*, 418–437.
16. Pereira, G.; Gonzalez, A.; Blanco, G. Complexity Measures for the Analysis of SDG Interlinkages: A Methodological Approach. In Proceedings of the 6th International Conference on Complexity, Future Information Systems and Risk, Prague, Czech Republic, 24–25 April 2021; SCITEPRESS-Science and Technology Publications: Valletta, Malta, 2021; pp. 13–24. [CrossRef]
17. UNESCAP. *Asia-Pacific Countries with Special Needs Development Report 2016*; United Nations: New York, NY, USA, 2016.
18. Amin-Salem, H.; El-Maghrabi, M.; Rodarte, I.O.; Verbeek, J. *Sustainable Development Goal Diagnostics: The Case of the Arab Republic of Egypt*; World Bank: Washington, DC, USA, 2018. [CrossRef]
19. Ansell, C.; Sørensen, E.; Torfing, J. The Key Role of Local Governance in Achieving the SDGs. In *Co-Creation for Sustainability: The UN SDGs and the Power of Local Partnerships*; Emerald Publishing Limited: Bingley, UK, 2022; pp. 9–22. [CrossRef]
20. DPRD Kab. Cirebon. Angka Stunting di Kabupaten Cirebon Masih Tingg. 2022. Available online: http://dprd-cirebonkab.go.id/angka-stunting-di-kabupaten-cirebon-masih-tinggi/ (accessed on 4 March 2023).
21. UNDP. SDGs Interlinkages for Indonesia. 2021. Available online: https://data.undp.org/sdg-push-diagnostic/IDN/synergies-and-tradeoffs (accessed on 3 February 2023).
22. Agustina, D.N.; Sartono, B.; Notodiputro, K.A. Analysis of Multidimensional Stunting Intervention Factor Using Mixed Model. *IOP Conf. Ser. Earth Environ. Sci.* **2021**, *948*, 012067. [CrossRef]
23. Beal, T.; Tumilowicz, A.; Sutrisna, A.; Izwardy, D.; Neufeld, L.M. A review of child stunting determinants in Indonesia. *Matern. Child Nutr.* **2018**, *14*, e12617. [CrossRef]
24. Karpati, J.; De Neubourg, C.; Laillou, A.; Poirot, E. Improving children's nutritional status in Cambodia: Multidimensional poverty and early integrated interventions. *Matern. Child Nutr.* **2020**, *16*, e12731. [CrossRef]
25. Malawi Government. *Malawi 2022 Voluntary National Review Report for Sustainable Development Goals (SDGs)*; Malawi Government: Lilongwe, Malawi, 2022; pp. 2–5.
26. National Planning Commission. *National Review of Sustainable Development Goals*; Government of Nepal National Planning Commission Singha Durbar: Kathmandu, Nepal, 2020.
27. Su, H.; Krol, M.S.; Hogeboom, R.J. The role of context in identifying linkages between SDG 2 (food) and SDG 6 (water). *Sustain. Sci.* **2022**, *17*, 1605–1618. [CrossRef]
28. Parikh, P.; Kwami, C.S.; Khanna, R.; Lall, M.; Reddy, H.; Benton, L.; Sharma, S.; Vijay, V.K.; Manikam, L.; Lakhanpaul, M. Linkages between environmental factors (WASH and energy) and Infant and Young Child Feeding practices in rural India: Implications for cross-sectoral interventions for child health. *J. Water Sanit. Hyg. Dev.* **2021**, *11*, 902–915. [CrossRef]
29. Agostoni, C.; Baglioni, M.; La Vecchia, A.; Molari, G.; Berti, C. Interlinkages between Climate Change and Food Systems: The Impact on Child Malnutrition—Narrative Review. *Nutrients* **2023**, *15*, 416. [CrossRef]
30. BPS. *Kabupaten Cirebon Dalam Angka 2023*; BPS-Statistics of Cirebon Regency: West Java, Indonesia, 2023; ISBN 0215-4242.

31. BPS. Jumlah Desa/Kelurahan Menurut Kecamatan 2021. 2022. Available online: https://cirebonkab.bps.go.id/indicator/101/67/1/jumlah-desa-kelurahan-menurut-kecamatan.html (accessed on 3 February 2023).
32. CirebonKab. Pemkab Cirebon Optimis Angka Stunting Bisa Terus Ditekan. 2022. Available online: https://www.cirebonkab.go.id/news/2023/04/pemkab-cirebon-optimis-angka-stunting-bisa-terus-ditekan (accessed on 3 February 2023).
33. Wikimedia. West Java in Indonesia. 2011. Available online: https://commons.wikimedia.org/wiki/File:West_Java_in_Indonesia.svg (accessed on 3 February 2023).
34. Wikimedia. Location map of Cirebon Regency, Indonesia. 2017. Available online: https://commons.wikimedia.org/wiki/File:Indonesia_Cirebon_Regency_location_map.svg (accessed on 3 February 2023).
35. Wikimedia. Map of West Java Highlighting Cirebon Regency. 2017. Available online: https://commons.wikimedia.org/wiki/File:Map_of_West_Java_highlighting_Cirebon_Regency.svg (accessed on 3 February 2023).
36. SDGs Bappenas. Metadata Indikator TPB SDGS. 2017. Available online: https://sdgs.bappenas.go.id/4-metadata/ (accessed on 1 March 2023).
37. Gable, S.; Lofgren, H.; Osorio Rodarte, I. *Trajectories for Sustainable Development Goals: Framework and Country Applications*; World Bank: Washington, DC, USA, 2015.
38. World Bank. Indonesia Accelerates Fight Against Childhood Stunting. 2018. Available online: https://www.worldbank.org/en/news/feature/2018/06/26/indonesia-fights-stunting-commitment-convergence-and-communities (accessed on 25 March 2023).
39. Jeong, J.; Bhatia, A.; Fink, G. Associations between birth registration and early child growth and development: Evidence from 31 low- and middle-income countries. *BMC Public Health* **2018**, *18*, 673. [CrossRef]
40. Comandini, O.; Cabras, S.; Marini, E. Birth registration and child undernutrition in sub-Saharan Africa. *Public Health Nutr.* **2016**, *19*, 1757–1767. [CrossRef]
41. Mtoi, E.H.; Nyaruhucha, C.N.M. Child Care Practices and Nutritional Status of Under-Five Children in Tanzania: Evidence from Fishing Communities in Pangani District. *Int. J. Asian Soc. Sci.* **2019**, *9*, 390–405. [CrossRef]
42. Ayelign, A.; Zerfu, T. Household, dietary and healthcare factors predicting childhood stunting in Ethiopia. *Heliyon* **2021**, *7*, e06733. [CrossRef]
43. Budhathoki, S.S.; Bhandari, A.; Gurung, R.; Gurung, A.; Kc, A. Stunting Among Under 5-Year-Olds in Nepal: Trends and Risk Factors. *Matern. Child Health J.* **2020**, *24*, 39–47. [CrossRef]
44. Torlesse, H.; Cronin, A.A.; Sebayang, S.K.; Nandy, R. Determinants of stunting in Indonesian children: Evidence from a cross-sectional survey indicate a prominent role for the water, sanitation and hygiene sector in stunting reduction. *BMC Public Health* **2016**, *16*, 669. [CrossRef]
45. Potter, P.A.; Perry, A.G.; Stockert, P.A.; Hall, A. *Fundamentals of Nursing*, 10th ed.; Elsevier: Amsterdam, The Netherlands, 2020.
46. Habitat for Humanity. *Housing and the Sustainable Development Goals: The Transformational Impact of Housing*; Habitat for Humanity: Atlanta, GA, USA, 2021.
47. Akombi, B.J.; Agho, K.E.; Hall, J.J.; Merom, D.; Astell-Burt, T.; Renzaho, A.M.N. Stunting and severe stunting among children under-5 years in Nigeria: A multilevel analysis. *BMC Pediatr.* **2017**, *17*, 15. [CrossRef]
48. Ikeda, N.; Irie, Y.; Shibuya, K. Determinants of reduced child stunting in Cambodia: Analysis of pooled data from three Demographic and Health Surveys. *Bull. World Health Organ.* **2013**, *91*, 341–349. [CrossRef]
49. Siswati, T.; Hookstra, T.; Kusnanto, H. Stunting among children Indonesian urban areas: What is the risk factors? *J. Gizi dan Diet. Indones. Indonesian J. Nutr. Diet.* **2020**, *8*, 1–8. [CrossRef]
50. Tasnim, T.; Dasvarma, G.; Mwanri, L. Housing Conditions Contribute to Underweight in Children: An Example From Rural Villages in Southeast Sulawesi, Indonesia. *J. Prev. Med. Public Health* **2017**, *50*, 328–335. [CrossRef]
51. Kumar, A.; Kumari, D.; Singh, A. Increasing socioeconomic inequality in childhood undernutrition in urban India: Trends between 1992–93, 1998–1999 and 2005–06. *Health Policy Plan.* **2015**, *30*, 1003–1016. [CrossRef]
52. WHO. *Reducing Stunting in Children*; WHO: Geneva, Switzerland, 2018.
53. Danaei, G.; Andrews, K.G.; Sudfeld, C.R.; Fink, G.; McCoy, D.C.; Peet, E.; Sania, A.; Smith Fawzi, M.C.; Ezzati, M.; Fawzi, W.W. Risk Factors for Childhood Stunting in 137 Developing Countries: A Comparative Risk Assessment Analysis at Global, Regional, and Country Levels. *PLoS Med.* **2016**, *13*, e1002164. [CrossRef]
54. Mulyaningsih, T.; Mohanty, I.; Widyaningsih, V.; Gebremedhin, T.A.; Miranti, R.; Wiyono, V.H. Beyond personal factors: Multilevel determinants of childhood stunting in Indonesia. *PLoS ONE* **2021**, *16*, e0260265. [CrossRef]
55. Fujii, T.; Shonchoy, A.S.; Xu, S. Impact of Electrification on Children's Nutritional Status in Rural Bangladesh. *World Dev.* **2018**, *102*, 315–330. [CrossRef]
56. Hoang, V.-N.; Nghiem, S.; Vu, X.-B. Stunting and academic achievement among Vietnamese children: New evidence from the young lives survey. *Appl. Econ.* **2018**, *51*, 2001–2009. [CrossRef]
57. Pillai, V.K.; Maleku, A. Women's Education and Child Stunting Reduction in India. *J. Sociol. Soc. Welf.* **2019**, *46*, 6. [CrossRef]
58. Amadu, I.; Seidu, A.-A.; Duku, E.; Frimpong, J.B.; Hagan, J.E., Jr.; Aboagye, R.G.; Ampah, B.; Adu, C.; Ahinkorah, B.O. Risk factors associated with the coexistence of stunting, underweight, and wasting in children under 5 from 31 sub-Saharan African countries. *BMJ Open* **2021**, *11*, e052267. [CrossRef]
59. Banda, A.; Nyirenda, E.T.; Mapoma, C.C.; Bwalya, B.B.; Moyo, N. Influence of Infant and Young Child Feeding Practices on Stunting in Children aged 6–23 months in Zambia. *Adv. Nutr. Food Sci.* **2022**, *7*, 117–127. [CrossRef]

60. Pertiwi, M.R.; Lestari, P.; Ulfiana, E. Relationship Between Parenting Style and Perceived Information Sources With Stunting Among Children. *Int. J. Nurs. Health Serv.* **2019**, *2*, 273. [CrossRef]
61. Takele, K.; Zewotir, T.; Ndanguza, D. Understanding correlates of child stunting in Ethiopia using generalized linear mixed models. *BMC Public Health* **2019**, *19*, 626. [CrossRef]
62. Swain, R.B.; Ranganathan, S. Modeling interlinkages between sustainable development goals using network analysis. *World Dev.* **2020**, *138*, 105136. [CrossRef]