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Country-specific progress toward the Sustainable Development Goals: Past, present, and prospects

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Two-thirds of the journey to achieving the Sustainable Development Goals (SDGs) has passed. However, insights into country-specific progress covering pre- and post-SDG and the prospects remain limited. Here, we compare the progress of 117 SDG indicators for 167 countries and project the achievements by 2030. Our results reveal the progress of the SDGs across the world varies depending on the initial SDG scores of the indicators in 2015. For indicators with low scores (0 to 50%), the proportion of countries showing advancement is greater than that demonstrating regression (25 vs. 16%). Countries that foster scientific research and promote manufacturing industry (SDG9) have the best performances. For indicators with high scores (70 to 90%), the proportion showing regression is greater than that with advancement (16 vs.10%). The increased coverage of immunization vaccines and prevention of infectious diseases (SDG3) have the worst performances. For indicators with moderate scores (50 to 70%), the proportion showing regression is slightly greater than that showing advancement (11 vs. 9%). When the score was low and high, the impact of the pandemic was significantly greater than that for moderate scores. By 2030, the global SDG score will reach approximately 63%, with a SD of 8%. Overall, 78 countries will reach the moderate score (60 to 70%), and 12 countries will remain with a low score (40 to 50%). Countries need to achieve an annual growth rate of 4% to meet the overall SDGs by 2030. Our comprehensive long-term assessment provides essential knowledge on global SDG progress, complementing UN reports.

SDGs | time-series | country-specific | progress

Significance

Tracking country-specific SDG progress is critical for accelerating efforts toward sustainable development, guiding the development of adequate policies. We conduct a comprehensive comparison of long-term indicators to show systematic progress differences across performance levels. Our results reveal that much progress has been made for low-scoring indicators in 2015; however, great challenges remain for high-scoring indicators. When the score was low and high, the pandemic impact was significantly greater than that for moderate scores. By 2030, the global score will reach approximately 63%. If targeted in 2030, countries need to achieve 4% in annual growth rate. Our long-term assessment emphasizes the need to reinforce international collaboration and funding and aid to accelerate implementation and serve as a foundation for future explanatory research.

The next few years are critical for the 2030 Agenda for Sustainable Development, comprising 17 Sustainable Development Goals (SDGs), as two-thirds of the time to achieve them has passed (1–4). Global poverty reduction has stalled, and climate change as well as water, food, and energy security are worsening. With the combined impact of the COVID-19 pandemic, rising conflicts, and increasing global living costs, the world faces significant economic, social, and environmental crises (3, 5, 6). Thus, tracking the progress of the SDGs, which covers their past, present, and prospects, is crucial for accelerating efforts to achieve them by 2030. The 17 SDGs are presented as highly connected, "interrelated" and "indivisible" agendas, which should be implemented from a holistic and integrated perspective (7–11). Previous research on SDG progress has focused on thematic groups of goals, such as education (12), health (13, 14), climate (15), biodiversity (16, 17), or a group of goals (18). Also, some assessments on SDG progress have focused on either a specific country (19–22) or a group of countries at the regional level (23–25). These studies are essential for guiding these countries or regions toward sustainable development. Still, they cannot reveal global disparities in SDG progress and achievement among nations over the long term.

Also, the United Nations (UN) reports the annual and the quadrennial progress of the 17 SDGs. However, these assessments almost inevitably focus on the aggregated global or regional levels, which mask variation in progress across countries (2, 5). Annual progress reports from the Sustainable Development Solution Network (SDSN) analyze the differences in progress among nations. However, their analyses focus on the current single year due to the inconsistent data sources for each year's assessment (26). The SDSN has started providing historical time series progress data in recent years. For example, their 2024 report includes time series data from 2000 to 2023. These data were calculated retroactively based on the indicators and methods in the 2024 report to make the data comparable across time from 2000 to 2023 (27). However, in addition to online visualization, more in-depth analyses of these time series data, especially considering the progress of the SDGs

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from pre-SDG implementation in 2015 (pre-2015) to post-implementation (post-2015), are still lacking. In addition, there are different extents of missing data in the time series for some of the indicators in the SDSN database. Furthermore, although the SDSN assessed whether countries are on track to achieve the 2030 goals based on their historical performance since 2015, the SDSN ignored the longer historical trajectory from pre-2015 to 2015, which could also have an inevitable impact on their projected performance in 2030.

To address these shortcomings, we collected data for 117 indicators from pre-2015 as early as possible to post-2015 as late as possible by combining the SDSN database, additional public databases, and satellite remote sensing data (26). We analyzed the overall trends in SDG progress for 167 countries by comparing the average annual change rate of the indicators between pre-2015 and 2015, and between 2015 and post-2015. Based on this comparison, we classified countries into three categories according to their SDG progress trends: advancement (post-2015 is better than pre-2015), regression (post-2015 is worse than pre-2015), and stagnation (post-2015 is equal to pre-2015) (please see *Materials and Methods* for more details). To exclude the impact of COVID-19 and the intensified geopolitical situation after 2019, we selected a different period to conduct this comparison analysis, from pre-2015 to 2015, and the post-adoption phase from 2015 to 2019. Furthermore, we predicted possible country-specific SDG progress by 2030 at the indicator level based on neural network forecasting. Our unique time series analysis of the progress and achievement of the SDGs can provide essential knowledge on how far countries have gone and how far they have to go to achieve the SDGs.

Results

From Past to Present: Changes in SDG Progress. Globally, in 2015, the proportion of countries with indicators showing low SDG scores (0 to 50%) accounted for 49% of the total, among which the proportion of countries showing advancement, i.e., post-2015 SDG progress is better than pre-2015, was 25%. This percentage was higher than that associated with regression (16%), i.e., post-2015 SDG progress is worse than pre-2015. These results indicate that at low SDG scores, advancement is dominant. In addition, 8% of the countries showed stagnation, i.e., post-2015 SDG progress is equal to pre-2015 (Fig. 1*A*). With respect to low-scoring indicators showing advancement, SDG9 is the goal with the highest proportion of countries (38%) (Fig. 1*B*), which is reflected mainly in the following indicators: 9.5.2 scientific publication (66%), 9.2.1 manufacturing value (53%), and 9.2.2 manufacturing employment (48%) (Fig. 2). This means that improving scientific research and developing manufacturing are important for advancing the progress of low-scoring indicators. At the national level, the proportion of indicators was used to analyze their performance for different SDG scores. At low SDG scores (0 to 50%), Sierra Leone had the highest proportion of indicators with an advancement (47%), especially on SDG3 and SDG4. Sierra Leone had the greatest increase of the SDG score in Indicator 3.6.1 "road traffic injuries" (4.4%) for SDG3 and Indicator 4.6.1 "literacy rate of young females" (1.6%) for SDG4 (Figs. 3*A* and 2*C*) and the spreadsheets of "0-50-advancement," "0-50-regression," and "0-50-stagnation" in the Dataset S1).

The proportion of countries with indicators showing moderate scores (50 to 70%) accounts for 22% of the total in 2015. Among them, 11% show regression, which is slightly higher than the percentage showing advancement (9%). In addition, the proportion showing stagnation was only 2% (Fig. 1*A*). With respect to regression (14%) (Fig. 1*B*), SDG8 and SDG12 accounted for the greatest proportion of countries, which were reflected mainly in Indicator 8.2.1 "employment-related GDP" (35%) and Indicator 12.4.L2 "import-related air pollution" (19%), respectively (Fig. 2). These findings suggest that increasing employment's contribution to GDP and reducing import-related air pollution are crucial steps to improve SDG progress, particularly for indicators with moderate scores. Here, Nicaragua (25%) was the country with the highest proportion of indicators showing a regression, especially on SDG15. Nicaragua had the greatest decrease of the SDG score in Indicator 15.1.2b (–1.1%) "protection of freshwater area important to biodiversity" for SDG15 (Figs. 3*D* and 2*F* and the spreadsheets of "50-70-advancement," "50-70-regression," and "50-70-stagnation" in the Dataset S1).

In 2015, the proportion of countries with indicators showing high SDG scores (70 to 90%) accounted for 30% of the total. Among them, the percentage with regression was 16%, which was considerably greater than that with advancement (10%). Furthermore, 4% of countries show stagnation (Fig. 1*A*). The proportion of countries with regression (26%) was greatest for

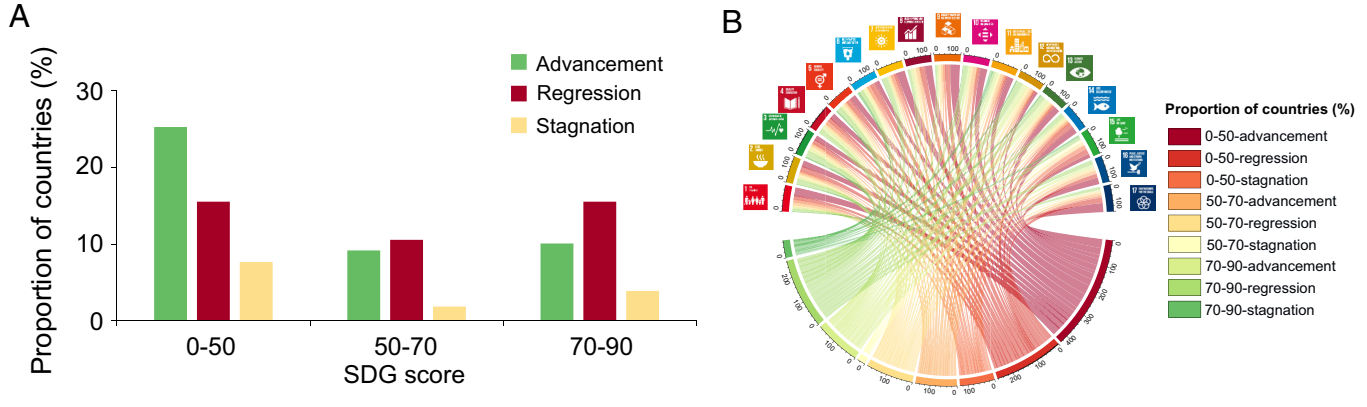

Fig. 1. Proportion of countries showing different trend change categories at the global scale. The 9 categories of trend change are calculated based on the SDG score for the indicators in 2015. Take "0-50-advancement" as an example, "0-50" means the SDG score in 2015 is in the range of 0 to 50% and "advancement" means the performance of post-2015 is better than that of pre-2015 (please see *Materials and Methods* for more details on the explanations of each group). (*A*) The global proportion of countries of each trend change category, considering the initial levels in 2015 (ranges of % achievement). (*B*) The global proportion of countries of each trend change category at the goal level. The width of the arc represents the cumulative proportion of countries for the specific trend change category with the consistent color in the legend on the right (*Lower* semicircle) or that goal (*Upper* semicircle). The number outside the circle is the scale line number of each trend change category (*Lower* semicircle) or that goal (*Upper* semicircle). Different colors indicate different SDGs following the official UN color palette on the upper semicircle.

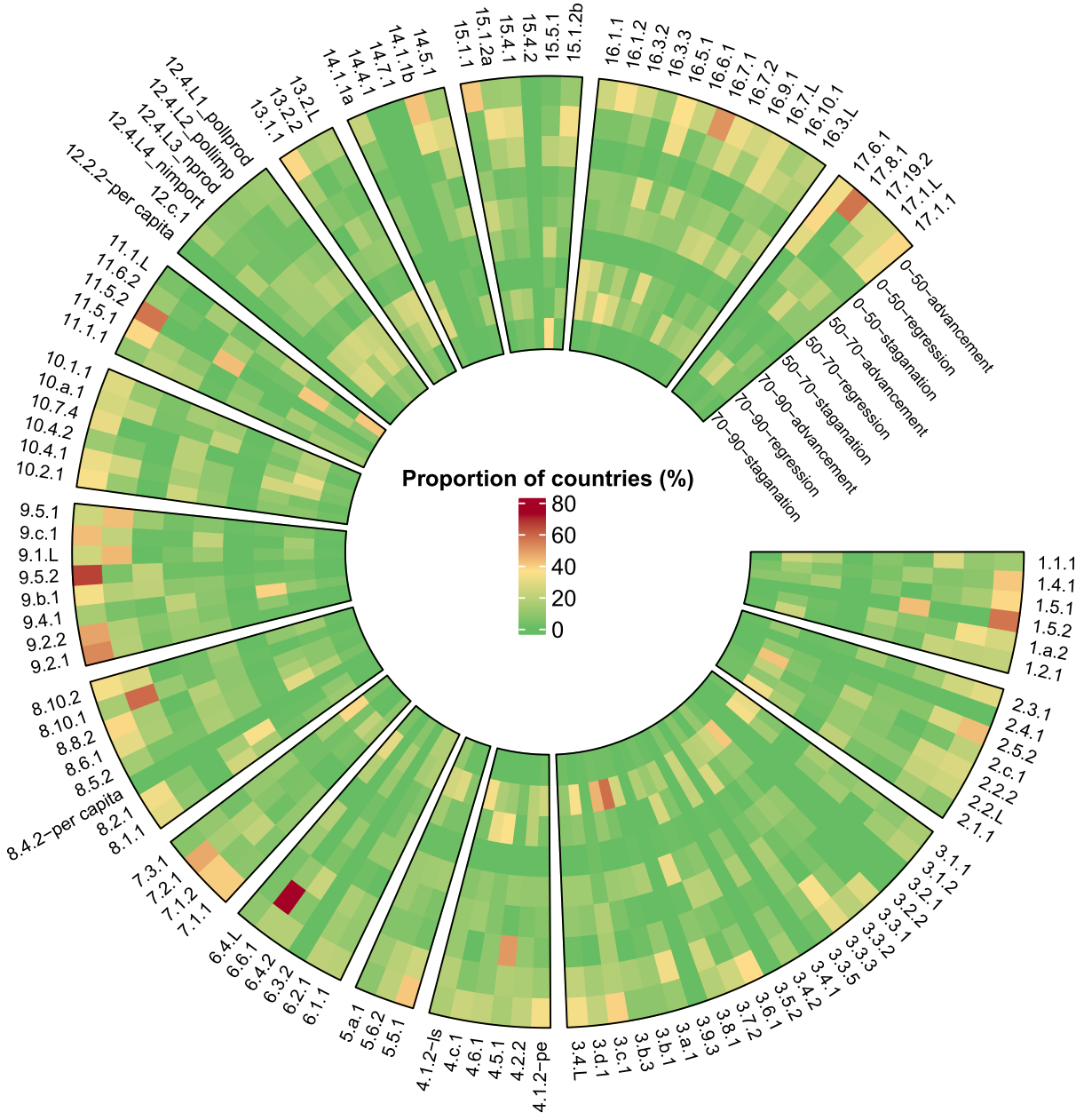

Fig. 2. Proportion of countries showing different trend change categories globally at the indicator level. It covers 117 indicators of the 17 SDGs, with each sector containing indicators belonging to the corresponding goal. Take "0-50-advancement" as an example, "0-50" means the SDG score in 2015 is in the range of 0 to 50% and "advancement" means the performance of post-2015 is better than that of pre-2015 (please see *Materials and Methods* for more details on the explanations of each group). The 9 categories of trend change are calculated based on the SDG score for the country-specific indicators in 2015 and then aggregated into the results at the global scale (please see *Materials and Methods* for more details on the calculation and *SI Appendix*, Table S1 for more details on the meaning of the indicators for each goal). The closer the color is to orange, the higher the proportion of countries is; and the closer the color is to green, the lower the proportion of countries is.

SDG3 (Fig. 1*B*), which was reflected mainly in Indicator 3.b.1 "vaccine coverage" (58%), Indicator 3.b.3 "Infants receiving vaccines provided by health facilities" (45%), and Indicator 3.3.1 "HIV infections" (41%) (Fig. 2). This finding suggests that increasing immunization vaccine coverage and health facility access, as well as preventing the spread of infectious diseases like AIDS, are key priorities for improving SDG progress in countries with high SDG scores. With respect to high SDG scores (70 to 90%), Croatia and Portugal had the highest proportions of indicators with a regression (31%), especially on SDG3 and SDG16 for Croatia and on SDG12 for Portugal. Croatia had the greatest decrease of the SDG score in Indicator 3.b.1 "vaccine coverage" (−1.4%) for SDG3 and Indicator 16.3.2 "rule of law for justice" (−3.5%) for SDG16. Portugal had the greatest decrease of the SDG score Indicator 12.4.L4 "nitrogen emissions associated with imports" (−1.8%) for SDG12 (Figs. 3*G* and 2*I*) and the spreadsheets of "70-90-advancement," "70-90-regression," and "70-90-stagnation" in the Dataset S1).

A comparison of the proportion of countries between Pre-2015-2019 and Pre-2015-Post-2015 at the global level was shown and the results revealed that when the SDG score was low (0 to 50%) and the score was high (70 to 90%), the impact of the pandemic was significantly greater than that when the score was moderate (50 to 70%) (*SI Appendix*, Fig. S1 *A*–*I*). In addition, the comparison of the proportion of indicators was provided to analyze the impact of the pandemic at the national level (*SI Appendix*, Fig. S2 *A*–*I*). As far as

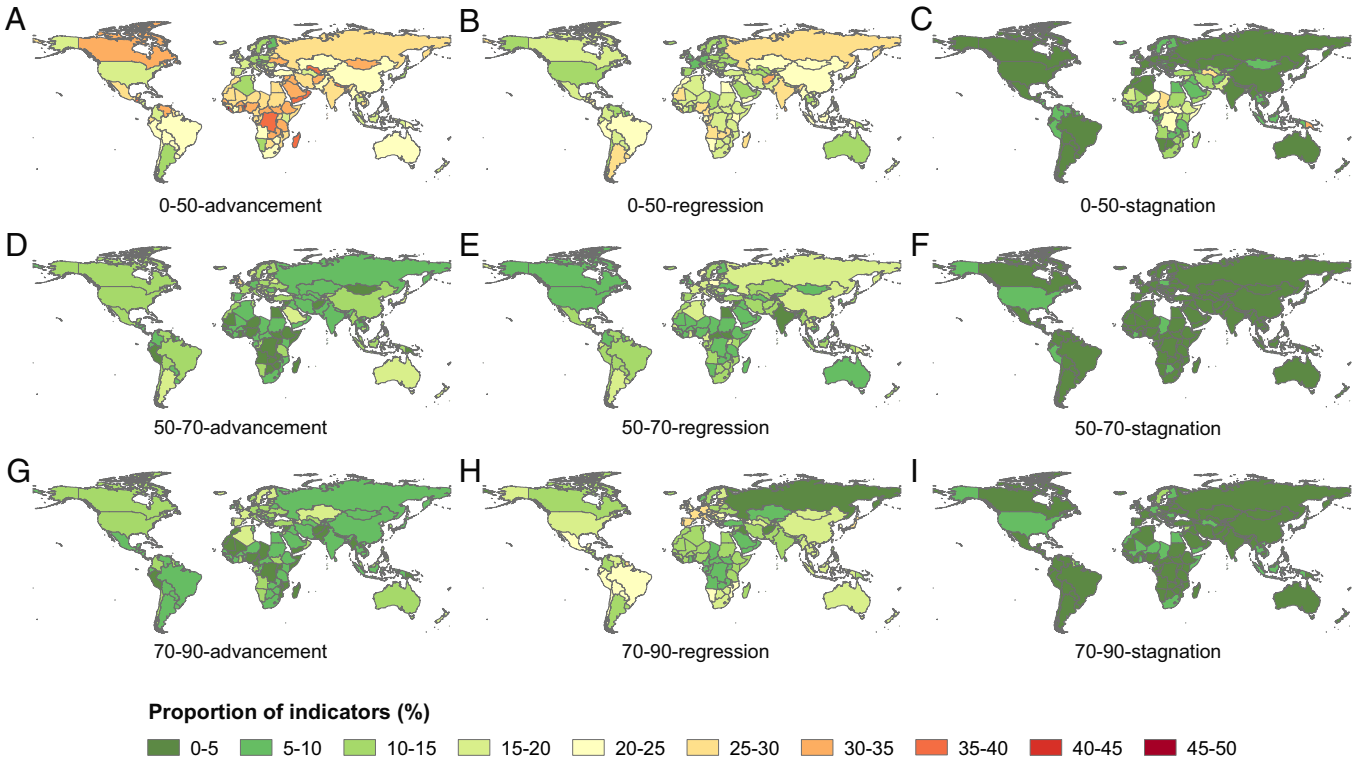

Fig. 3. Proportion of indicators at the national level for the 9 categories. The 9 categories of trend change are calculated based on the SDG score of the indicators in 2015 (please see *Materials and Methods* for more details). Take "0-50-advancement" as an example, "0-50" means the SDG score in 2015 is in the range of 0 to 50% and "advancement" means the performance of post-2015 is better than that of pre-2015 (please see *Materials and Methods* for more details on the explanations of each group). (*A*) is for 0-50-advancement. (*B*) is for 0-50-regression. (*C*) is for 0-50-stagnation. (*D*) is for 50-70-advancement. (*E*) is for 50-70-regression. (*F*) is for 50-70-stagnation. (*G*) is for 70-90-advancement. (*H*) is for 70-90-regression. (*I*) is for 70-90-stagnation.

the advancement is concerned (decreasing of the proportion of countries means worsening), at a low score (0 to 50%), the most affected goal was SDG4 (−4%), with the greatest decrease in Indicator 4.6.1 "literacy rate" (−18%) (*SI Appendix*, Fig. S1*A*). The most affected country was Bhutan, with the largest difference in the proportion of indicators between Pre-2015 to 2019 and Pre-2015–Post-2015 (−10%) (*SI Appendix*, Fig. S2*A*) and the spreadsheets of "0-50-advancement" in the Datasets S1 and S2). For the SDGs with high scores (70 to 90%), the most affected was SDG1 (−7%), with the greatest decrease of Indicator 1.5.2 "disaster loss" in the proportion of countries (−18%) (*SI Appendix*, Fig. S1*G*). The most affected countries were Nicaragua, Barbados, Bahrain, and Belize in the difference of the proportion of indicators (all -8%) (*SI Appendix*, Fig. S2*G*) and the spreadsheets of "70-90-advancement" in the Datasets S1 and S2). From the perspective of regression (increasing of the proportion of countries means worsening), for low-score indicators (0 to 50%), the most affected goals were both SDG1 (+5%), with the greatest increase of Indicator1.5.1 "disaster loss" (+10%) (*SI Appendix*, Fig. S1(b)). The most affected country was Laos (+10%) (*SI Appendix*, Fig. S2*B*) and the spreadsheets of "0-50-regression" in the Datasets S1 and S2). With respect to the goals at the high score of 70 to 90%, the most affected were both SDG2 and SDG3 (+4%), which were reflected mainly in Indicator 2.c.1 "food price anomalies" (+7%) for SDG2 and Indicator 3.1.2 "healthcare for birth" (+15%) for SDG3 (*SI Appendix*, Fig. S1*H*). The most affected country is Hungary (+9%) (*SI Appendix*, Fig. S2*H*) and the spreadsheets of "70-90-regression" in the Datasets S1 and S2).

From the Present to 2030: Possible Progress for SDG Achievement. By 2030, the overall status of the global SDG score is predicted to reach 63% (55 to 71%), with a SD of 8% (8 to 9%). The point forecast result is used in the analysis with the results of low 95% and high 95% CI listed in the bracket to understand the uncertainty range (please see detailed explanation in method, Fig. 4 *A* and *B* and the Datasets S4–S8 for the detailed forecasted scores covering the CI of low 95%, low 80%, point, high 80%, and high 95%. Each *SI Appendix* includes the scores at the indicator, goal, and overall levels). The number of countries with moderate SDG scores of 60 to 70% is predicted to be the greatest, with 78 countries. However, 12 countries are predicted to have the lowest score of 40 to 50%, including the Central African Republic, Chad, and South Sudan in Central Africa, and Afghanistan in South Asia. Only 37 countries are predicted to reach the highest SDG score of 70 to 80% by 2030. They are distributed mainly in Western and Northern Europe, including Denmark, Austria, the United Kingdom, and Finland (Fig. 4*C*). The rapid progress on specific SDGs also varies, such as SDG1 in Saudi Arabia, SDG2 in Vietnam, SDG5 in New Zealand, and SDG17 in Denmark (please see the spreadsheet of "Overall SDG Score" in the Dataset S6 for each goal at the national level). At the goal level, SDG11 and SDG12 are predicted to increase the fastest, while SDG9 and SDG17 are predicted to be the two lowest goals, with 34 and 25 countries having the lowest performing by 2030 (Figs. 4*D* and 5 *A* and *B*). With respect to the differences among countries, SDG1, SDG4, SDG13, and SDG17 show the greatest discrepancies among nations, with the SD reaching 22% (Fig. 4*E*). If the overall SDGs are to be achieved by 2030, countries across the world need to achieve an average annual growth rate of 4% in SDG scores. Among these, the Central African Republic, Somalia, South Sudan, Afghanistan, Chad, and Syria need to achieve an annual growth rate of 7% (Fig. 5*C*). At the goal level, it is also necessary to achieve an average annual growth rate of 3 to 6% (Fig. 5*D*).

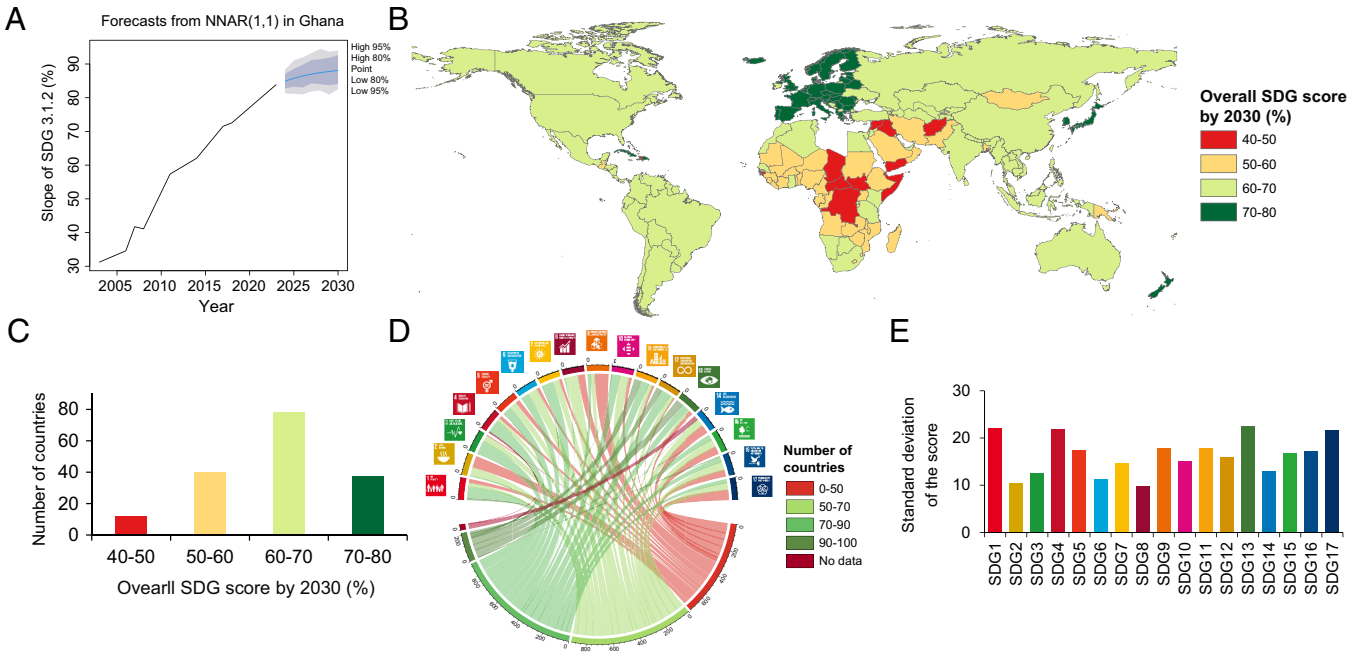

Fig. 4. The forecasted SDG scores by 2030 for 17 goals and the overall SDG scores aggregated from the forecasted result at the indicator level. (*A*) An example of the forecasted result of SDG3.1.2 in Ghana covering the CI of the low 95%, low 80%, point, high 80%, and high 95%. NNAR(1,1) indicates that $P = 1$ and $k = 1$ in the neural network (see details in the methodology section). The intermediate point forecast result is shown in Fig. 4 *B*–*E*. The full data of the forecast results covering all the CI are shown in the *SI Appendix* at the indicator, goal and overall levels (please see the spreadsheet of specific goal for the result at the indicator level and the spreadsheet of "Overall SDG Score" for the result at the goal and overall levels in the Datasets S4–S8 covering the CI of the low 95%, low 80%, point, high 80%, and high 95% in sequence). (*B*) The spatial pattern of the overall SDG score by 2030 at the national level. (*C*) The distribution of the overall SDG score by 2030 from (*B*). (*D*) The distribution of the SDG score by 2030 for the individual goal. The width of the arc represents the cumulative number of countries for the level in the legend (*Lower* semicircle) or that goal (*Upper* semicircle). The number outside the circle is the scale line number of each level (*Lower* semicircle) or that goal (*Upper* semicircle). Different colors indicate different SDGs following the official UN color palette on the upper semicircle. (*E*) The SD of the SDG score by 2030 for each goal.

Discussion

Based on the initial SDG score in 2015 for 117 indicators, we assess the SDG progress of 167 countries from pre-2015 to post-2015 and provide suggestions on how to accelerate country-specific SDG implementation for indicators with varying SDG scores. We further evaluated the possible progress of the 117 indicators by 2030 and identified the goal with the lowest score. The results systematically identify the differences among countries in terms of how far they have come and how far they must go to achieve sustainable development from pre-2015 to 2030. We believe our findings can make an essential contribution to accelerating country-specific SDG efforts during this critical two-thirds term.

The International Dimensions of the Goals. Although fully achieving all the SDGs in the remaining five years will be challenging, every inch of progress matters. The SDGs are still the global framework for sustainable transformation of our common future (28). Since the SDGs cannot be achieved in isolation, there is a need for further international collaboration and funding, as well as related development aid. With respect to collaboration related to SDG17, we have shown that this is not heading in the right direction and exhibits significant disparities among countries. Further effort is needed to involve partners from low-income countries, as it has been noted that current SDG partnerships may perpetuate the global North–South divide (29). Not only among countries but also along supply chain collaborations, there must be improvements to support the achievement of the SDGs (30). With respect to development aid, one study revealed that in approximately three-quarters of the 146 studied aid-recipient countries, at least five SDGs were propelled by aid, but there were also some heterogeneous effects. Further efforts are needed. However, the main bottleneck remains.

We noticed that specific transnational initiatives exist for funding, most notably the Joint SDG Funds (31). However, financing still falls short of target (32), e.g., to close the $2.5 trillion annual financing gap for developing countries (33), even though economic benefits are prevalent (34). Additionally, if advanced and transparent assessment is considered, selective investment mechanisms, such as bonds and funds, can improve SDG achievement (35–38). When it comes to practical implementation, international organizations and their treaties may be seen as orchestrators and barometers of international cooperation and their dynamics. However, one study pointed out that at the beginning of SDG implementation, over the period 2012 to 2019, there was a failure to reduce fragmentation in the governance of sustainability at a global level. There was counterintuitively an increase in silos around certain SDGs and sustainability dimensions (39). International organizations face certain challenges to address and further strengthen international cooperation in achieving SDGs. In addition to funding, resource limitations, intranational heterogeneity, and geopolitical divides, there is a lack of political will among many governments, problem shifting, the nonbinding nature of the goals and targets, and the holistic scope of the SDGs (40). A derived policy advice would be that such organizations focused on SDG implementation need to be further empowered both financially and politically, and their treaties abided.

The Impact of the Pandemic and Intensified Geopolitics. Existing studies on the impact of the pandemic and the intensified geopolitical situation on the SDGs were mostly conducted either at the local scale (41), or from the perspective of SDG interactions (42), theory-based frameworks (43), or literature review (44). Our results indicate a clear impact of the pandemic and intensified geopolitical situation after 2019 on the progress of the different

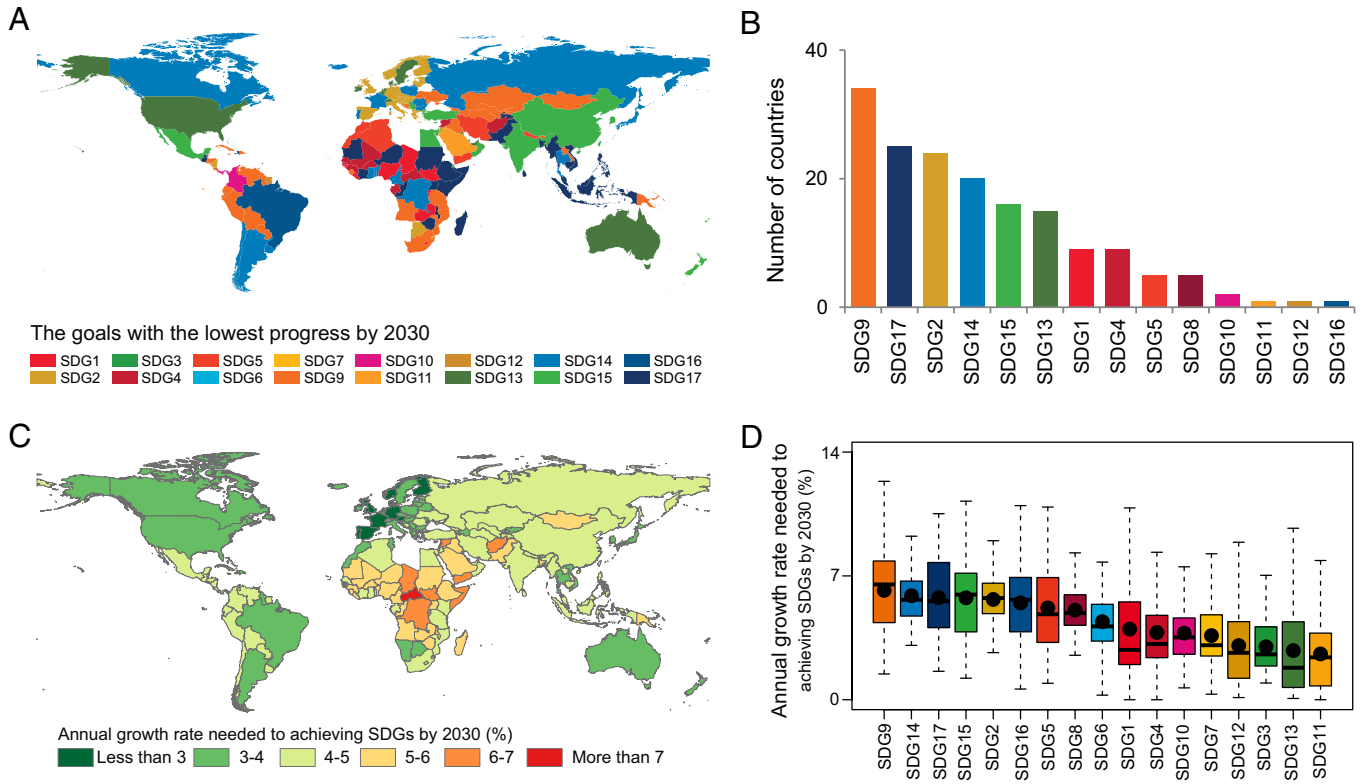

Fig. 5. The goals with the lowest progress and the needed annual progress to achieve the SDGs by 2030 at the national level. The results were aggregated from the forecast at the indicator level for each country (please see the spreadsheet of "Overall SDG Score" in the Dataset S6 for each goal at the national level). (*A*) The goals with the lowest progress by 2030 for each country. (*B*) The number of countries calculated from Fig. 5*A* for each goal. (*C*) The spatial pattern of the needed progress per year to fulfill the overall SDGs in 2030 at the national level, inferred from the overall SDG score. (*D*) Statistics of the needed progress per year to fulfill the individual goal in 2030. The black line in each box shows the minimum needed progress, lower quartile, median, upper quartile, and maximum needed progress for each SDG. The solid black circle indicates the arithmetic mean of the needed progress at the goal level. Different colors indicate different SDGs following the official UN color palette for Fig. 5 *A*, *B* and *D*.

SDGs at the global scale. Our results suggest that the impact on indicators at low scores (0 to 50%) and the high scores (70 to 90%) is significantly greater than that at moderate scores (50 to 70%), which emphasizes the need for countries to make differentiated diagnoses of the indicators at different SDG scores. For indicators with low SDG scores (0 to 50%), the focus needs to be on increasing the literacy rate (SDG4) and reducing disaster damage (SDG1). For indicators with high scores (70 to 90%), the focus needs to be on reducing disaster damage (SDG1), stabilizing food prices (SDG2), and increasing healthcare coverage for births (SDG3). Furthermore, the international community needs to strengthen assistance to the underdeveloped countries, especially Bhutan and Laos, to help them recover from the serious negative impact of these crises.

Trend Breaks in SDG Achievement. Additionally, one needs to study certain trend breakers and their influence on SDG achievement; in this study, we forecast them based on past trends. For SDG1 in Saudi Arabia, the country took several actions to fight poverty through social protection programs, housing initiatives, charity, education, and skill development, support for women and youth (45). In 2024, the country pledged more than 600 m US$ to help end polio and fight poverty (46). Saudi Arabia is predicted to achieve SDG1 on time with the SDG score of 100%. Vietnam established the National Action Plan on Zero Hunger by 2025 and deepened its cooperation with international partners to advance sustainable agriculture (47). The country took an integrated and holistic approach at the institutional and policy levels for implementing SDG2, with the Ministry of Agriculture taking the lead and the participation of 7 other ministries (48). As a result, Vietnam is predicted to have the highest score, 78% across the world. The principle of equality for all is enshrined in New Zealand's law. New Zealand recognizes that addressing gender equality is essential to achieving other goals and has mainstreamed gender across its international development assistance program. The country has also developed a National Action Plan to implement United Nations Security Council resolution 1325 on Women, Peace, and Security (49). The score of SDG5 in New Zealand is predicted to be the highest at 94% by 2030. Denmark established the 2030-panel in its parliament to provide advice on SDG implementation at the political level and prioritizes the SDGs in its foreign, trade, and security policies in the country-specific context. Denmark built strong partnerships with both international organizations and the private sector, such as the initiative of Partnering for Green Growth, the Global Goals 2030 (P4G), and the Data Partnerships for the SDGs (50, 51). SDG17 in Denmark is predicted to be at the top of 84% by 2030.

Potential Synergies and Trade-Offs Across the Goals. Regarding the coverage of trade-offs and synergies, two approaches can be adopted. On the one hand, the use of aggregated indicators may help in covering these interactions (8), which is why we computed the SDG score. However, such aggregated metrics reveal which specific measures, related to the SDGs, contribute most to higher scores. On the other hand, analyzing specific synergies and trade-offs between SDGs can help identify the priority areas for targeted policy intervention. Our results can be combined with studies in the literature that have focused on this (11, 52, 53). Building infrastructure like roads (SDG9) is necessary for poverty alleviation (SDG1) and economic development (SDG8) but may

be detrimental for coastal (SDG14) and land ecosystems (SDG15) (54). Economic development (SDG8) will bring carbon emissions (SDG13) under the traditional fossil fuel-based economic mode (SDG7); however, it will have green growth (SDG8) under the clean energy-based mode (SDG7) (55). Succeeding authors also note beneficial shifts related to SDG12, including sufficient, healthy, and sustainable nutrition (SDG2); enhanced access to modern energy in developing regions; and a more ambitious lifestyle shift in industrialized economies (SDG7) (15).

Emphasizing Global Disparities. While focusing on the country level is reasonable and well justified as SDGs are implemented at this level, it should also be noted that the combined SDG progress or regression in goal achievement of many small countries may have far less global impact than changes in a single large country do. For example, under the point forecast, although 62 countries would reach a score of 90 to 100% by 2030 for SDG13 (Climate Action), 56% are in Sub-Saharan Africa and 15% are in Latin America and the Caribbean. They account for only 6% of the world's GDP and 3% of the global carbon emissions in 2021 (56). However, as representatives of developing and developed countries, the United States and China would score only 45 and 77, respectively, in SDG13 (climate action) by 2030. The United States had the highest historical cumulative carbon emissions from 1751 to 2017, accounting for 25% of global carbon emissions (57); it also has the second-highest current carbon emissions, i.e., 13% of the global total in 2021 (54). China's historical cumulative carbon emissions from 1751 to 2017 accounted for 13% of global emissions (57), and its carbon emissions were highest in 2021 (57). By combining historical and current carbon emissions and adopting common but differentiated responsibilities, cooperation between China and the United States will be crucial in combating climate change (SDG13) and achieving the Paris Agreement worldwide.

Limitations and Prospects. This study provides important and valuable insight, but it has some limitations. First, although we tried our best to collect publicly available data for 117 indicators covering 167 countries, data gaps for some SDGs are still inevitable. For example, for SDG2, SDG5, and SDG12, data on food loss and food waste, the gender pay gap, hazardous chemicals, and so on are still lacking (26–27). Governments and the international community must increase investments in SDG data collection and monitoring systems and build strong data partnerships to support derived SDG decisions and strategies. As more data become available in the future, our assessment can easily be applied to an updated SDGs database to provide a more comprehensive and detailed picture. Second, for some indicators, the upper boundary value is set to be the average of the current top 5 countries, as the indicators do not have explicit target values in their definitions. This might lead to some differences in achieving the goal. Third, due to economic, social, and environmental heterogeneity, the SDG progress may vary at the subnational level within a country. The national aggregation of the SDG score still conceals the subnational disparities. Fourth, regarding our forecasting of future SDG achievement extents, these projections are based on continuing past trends, which should be considered when analyzing policy implications for those outcomes. Inadequate future achievements according to our predictions should serve as a stimulus to deviate from current practices and accelerate the implementations. The influence of such policy changes at both national and global levels, as examined in this study, should be part of future research. Finally, for the comparison of the average annual change rate between Pre-2015 to 2015 and 2015 to 2019, although such a comparison can exclude the impact of COVID-19, it would be possible to underestimate the progress of the SDGs, as some actions for implementing SDGs may have time-lag effects before any progress is evident.

Materials and Methods

Data. Although there were 99 indicators in the SDSN database at the global scale, we found that 33 indicators had missing data in the time period of pre-2015 or post-2015 in the time series and removed them from our analysis. Following the UN official document of the SDG indicators, we tried to collect the additional indicator data available and introduce the indicator data from satellite remote sensing as a further supplement. Finally, we retained 66 indicators from the SDSN covering the time period from pre-2015 to post-2015 and added 51 new indicators from various publicly available data sources (see *SI Appendix*, Table S1 for more details of the indicators). We extended the time series of 32 indicators for which data were available before 2000 and constructed longer time series. The starting years of those indicators also varied for different indicators (see *SI Appendix*, Table S1 for more details for each indicator). In addition, we further used 6 indicators from satellite observations. Finally, we formed a dataset of 117 indicators covering 167 countries around the world, including the time period from pre-2015 to post-2015. In comparison, the SDSN has used 99 indicators for global SDG progress assessment in recent year (See *SI Appendix*, Table S1 for more details on the data collection for each indicator). Afterward, we followed the SDG score calculation method from the SDSN, such as finding the maximum and minimum values of each indicator and converted the original indicator value into the SDG score at the indicator level, which served as the basic data for this study. Afterward, we evaluated the progress and predicted the future at the SDG and overall levels based on the official UN SDG indicator document. Through the above large-scale data collection and processing of time series data, this study significantly improves the characterization of the temporal variation in national SDG indicator data globally.

The SDG score is presented on a scale of 0 to 100 and can be interpreted as a percentage of optimal SDG performance. Therefore, the difference between 100 and a country's SDG Index score is the distance, in percentage points, that must be overcome to reach optimum SDG performance. Briefly, the SDG indicator came from a mix of official and nonofficial data sources, generally following the official SDG indicators endorsed by the UN Statistical Commission. Most (approximately two-thirds) are drawn from the databanks of international organizations [FAO (58), ILO (59), UNEP (60), UNICEF (61), WHO (62), World Bank (63), and other sources] which follow extensive and rigorous data-validation processes. Other data sources (approximately one-third) include less traditional statistics, such as household surveys [Gallup World Poll (64)], civil society organizations and networks [including the Tax Justice Network (65), the World Justice Project (66), or Reporters sans Frontières (67)], peer-reviewed journals, and satellite remote sensing (68). We aggregated the value of the indicator from pixel level into national level through Google Earth Engine (69). These nonofficial sources complement other data sources and help increase data availability and timeliness for key SDG indicators and targets (70–71).

Identifying the Trend Change From the Past to the Present. Considering that there are differences in the changes in the SDG score for indicators with different initial SDG scores in 2015, the indicators that are already close to being achieved are likely to show significantly different progress from those indicators that are far from the targets. Therefore, countries were divided into four groups: 0 to 50%, 50 to 70%, 70 to 90%, and 90 to 100% (2, 26), on the basis of the average SDG score of the indicators in 2015, the initial year of the SDGs. For indicators in the 90 to 100% interval (please see details in the Dataset S3 at the national level), since they are already close to being achieved, there is little room for their SDG scores to increase; thus, in our analysis, we focus mainly on the three intervals of 0 to 50%, 50 to 70%, and 70 to 90%. We calculated the average annual change rate from pre-2015 to 2015 and from 2015 to post-2015. Pre-2015 refers to the early year before 2015 when the data are available for individual indicators. It varies among different indicators (Please see *SI Appendix*, Table S1 for the early year of each indicator). Post-2015 is the current year after 2015 when the data are available for this indicator. It also varies among indicators (Please see *SI Appendix*, Table S1 for the current year of each indicator). Based on these long-time series data covering pre-2015 to post-2015, we classified them into three categories: advancement, regression, and stagnation.

1. Advancement: The average annual change rate of the indicator's SDG score from 2015 to post-2015 is greater than that from pre-2015 to 2015.
2. Regression: The average annual change rate of the indicator's SDG score from 2015 to post-2015 is less than that from pre-2015 to 2015.
3. Stagnation: The average annual change rate of the indicator's SDG score from 2015 to post-2015 is equal to that from pre-2015 to 2015.

At the indicator level, for each of the 167 countries, the proportions of countries that experienced advancement, regression, and stagnation were evaluated. All 117 indicators were evaluated for each country. On this basis, the assessment results for the indicators of the SDGs, from a single SDG to the overall SDGs, were obtained. The indicators with the greatest proportion of countries were detected for the 9 situations considering the different SDG scores of the indicators and their performances, including 0–50-advancement, 0–50-regression, 0–50-stagnation, 50–70-advancement, 50–70-regression, 50–70-stagnation, 70–90-advancement, 70–90-regression, and 70–90-stagnation.

At the national level, for the 167 countries, the proportion of indicators that show advancement, regression, and stagnation was evaluated among the 117 SDG indicators of each country. The countries with the highest proportion of indicators were detected for the 9 situations considering the different SDG scores of the indicators and their performances, including 0–50-advancement, 0–50-regression, 0–50-stagnation, 50–70-advancement, 50–70-regression, 50–70-stagnation, 70–90-advancement, 70–90-regression, and 70–90-stagnation.

The world continues to face severe challenges following 2019 with the onset of the COVID-19 pandemic. To differentiate the impact, comparisons between Pre-2015-to-2015 and 2015 to 2019 were also conducted following the same procedures described above. Afterward, further comparisons between the results from Pre-2015 to 2015–Post-2015 and the results from Pre-2015 to 2015–2019 were conducted. At the goal level, a comparison of the proportion of countries was conducted considering the different SDG scores of the indicators and their performances, including advancement, regression, and stagnation. At the national level, a comparison of the proportion of indicators was conducted considering the different scores of the indicators and their performances.

Projecting the Possible Progress for SDG Achievement by 2030. Artificial neural networks are forecasting methods that are based on simple mathematical models of the brain. They allow complex nonlinear vrelationships between the response variable and its predictors, compared with the simple linear extrapolation method. With time series data, the lagged values of the time series were used as inputs to a neural network autoregression (NNAR) model (72). Here, we use feed-forward neural networks with a single hidden layer and lagged inputs to forecast the univariate time series of each SDG score. Since the SDG score is not a seasonal variable, we use the "nnetar" function, standing for neural network time series forecasts within the "forecast" package, to fit an nnar(p,k) model, where P is the number of lagged inputs and k is the number of nodes in the hidden layer.

For nonseasonal time series data, default $P =$ the optimal number of lags (according to the Akaike information criterion, AIC) for a linear AR(p) model. For the seasonal time series, the default values are $P = 1$ and P is selected from the optimal linear model fitted to the seasonally adjusted data. If k is not specified, it is set to $k = (p + P + 1)/2$ (rounded to the nearest integer). For example, the NNAR (2, 2) model is a neural network with the last 2 observations (y_{t-1}, y_{t-2}) used as inputs for forecasting the output y_t, and with 2 neurons in the hidden layer. The nnar(p, 0) model is equivalent to an ARIMA (p,0,0) model, but without the restrictions on the parameters to ensure stationarity. In regard to SDG score forecasting, the network is applied iteratively. The long time-series data of each indicator we collected were sequenced by the year and linearly interpolated whether there are missing values in the time -series. Afterward, the time-series data were used as inputs to predict the progress by 2030 at the indicator level using the NNAR model. To forecast one step ahead, we use the available historical inputs of the score of the long time series. For forecasting two steps ahead, we use the one-step forecast as an input, along with the long time-series score data. This process continues until we have computed all the required forecasts of the SDG score by 2030.

A forecast example of SDG3.1.2 in Ghana is given in Fig. 4*A*. The forecast results cover the CI, which range from the low 95%, low 80%, point, high 80% to high 95%, to understand the uncertainty. We predict the possible scores of all 117 SDG indicators and aggregate them into each goal and the overall SDG performance for 2030 using arithmetic averages for 167 countries based on the annual data from as early as possible to recent years following this neural network algorithm. In total, we run the forecast for 16,408 times covering the data available at the indicator level for each country. The intermediate point forecast result was used to show the forecast score for 2030 in the analysis with the results of the CI of the low 95% and high 95% shown in the brackets. The full detailed scores covering all the CI of the low 95%, low 80%, point, high 80%, and high 95%, are provided in the Datasets S4–S8 in excel files at the indicator, goal and overall levels for the 167 countries.

We sequenced the 17 SDGs by their scores for 2030 from low to high using the point forecast result. The lower the score is, the lower the achievement of the goal. The first goal is identified as the most urgent goal to be reinforced by each national government. We also provide the average annual increase rate for the 17 SDGs and the overall SDG score at the national level if all the SDGs are targeted to be achieved by 2030.

Data, Materials, and Software Availability. All study data are included in the article and/or supporting information.

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1. Transforming our World: The 2030 agenda for sustainable development, UN A/RES/70/1 (2015).
2. U. N. Desa, *The Sustainable Development Goals Report 2024–June 2024* (UN DESA, New York, USA, 2024).
3. Editorials, We must act now to save sustainability. *Nature* **618**, 647 (2023), 10.1038/d41586-023-01989-9.
4. W. C. Clark, L. Van Kerkhoff, L. Lebel, G. C. Gallopin, Crafting usable knowledge for sustainable development. *Proc. Natl. Acad. Sci. U.S.A.* **113**, 4570–4578 (2016).
5. Independent Group of Scientists appointed by the Secretary-General, *Global Sustainable Development Report 2023: Times of crisis, times of change: Science for accelerating transformations to sustainable development* (United Nations, New York, 2023).

6. Y. Zeng *et al.*, Environmental destruction not avoided with the sustainable development goals. *Nat. Sustain.* **3**, 795–798 (2020), 10.1038/s41893-020-0555-0.
7. J. Liu *et al.*, Nexus approaches to global sustainable development. *Nat. Sustain.* **1**, 466–476 (2018), 10.1038/s41893-018-0135-8.
8. T. Schaubroeck, Aggregate SDGs to cover trade-offs and prioritization. *Nature* **584**, 344–344 (2020), 10.1038/d41586-020-02374-6.
9. Prajal Pradhan, A threefold approach to rescue the 2030 agenda from failing. *Natl. Sci. Rev.* **10**, nwad015 (2023), 10.1093/nsr/nwad015.
10. X. Zhou, M. Moinuddin, Z. Xu, Sustainable Development Goals Interlinkages and Network Analysis: A Practical Tool for SDG Integration and Policy Coherence, (Institute for Global Environmental Strategies, 2017).
11. Q. Xing *et al.*, Intranational synergies and trade-offs reveal common and differentiated priorities of sustainable development goals in China. *Nat. Commun.* **15**, 2251 (2024).
12. J. Friedman *et al.*, Measuring and forecasting progress towards the education-related SDG targets. *Nature* **580**, 636–639 (2020).
13. C. J. Murray, Choosing indicators for the health-related SDG targets. *Lancet* **386**, 1314–1317 (2015).
14. L. Alkema *et al.*, Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: A systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. *Lancet* **387**, 462–474 (2016).
15. B. Soergel *et al.*, A sustainable development pathway for climate action within the UN 2030 agenda. *Nat. Clim. Change* **11**, 656–664 (2021), 10.1038/s41558-021-01098-3.
16. M. Blicharska *et al.*, Biodiversity's contributions to sustainable development. *Nat. Sustain.* **2**, 1083–1093 (2019).
17. Y. Zhang, Y. Li, J. Liu, Global decadal assessment of life below water and on land. *iScience* **26**, 106420 (2023).
18. E. A. Moallemi *et al.*, Early systems change necessary for catalyzing long-term sustainability in a post-2030 agenda. *One Earth* **5**, 792–811 (2022), 10.1016/j.oneear.2022.06.003.
19. D. Firoiu, G. H. Ionescu, R. Pîrvu, R. Bădîrcea, I. C. Patrichi, Achievement of the sustainable development goals (SDG) in Portugal and forecast of key indicators until 2030. *Technol. Econ. Dev. Econ.* **28**, 1649–1683 (2022).
20. Z. Xu *et al.*, Assessing progress towards sustainable development over space and time. *Nature* **577**, 74–78 (2020), 10.1038/s41586-019-1846-3.
21. L. Gao, B. A. Bryan, Finding pathways to national-scale land-sector sustainability. *Nature* **544**, 217–222 (2017).
22. E. Mulholland, A. Dimitrova, M. Hametner, *SDG Indicators and Monitoring: Systems and Processes at the Global, European, and National Level* (ESDN Office, Vienna, Austria, 2018).
23. C. Allen, G. Metternicht, T. Wiedmann, Initial progress in implementing the Sustainable Development Goals (SDGs): A review of evidence from countries. *Sustainability Sci.* **13**, 1453–1467 (2018).
24. Y. Huan, T. Liang, H. Li, C. Zhang, A systematic method for assessing progress of achieving sustainable development goals: A case study of 15 countries. *Sci. Total Environ.* **752**, 141875 (2021).
25. UN Escap, Asia and the pacific SDG progress report 2024: Showcasing transformative actions (2024).
26. J. D. Sachs, G. Lafortune, G. Fuller, The SDGs and the UN Summit of the Future. Sustainable Development Report 2024. Paris: SDSN (Dublin University Press, Dublin, 2024), 10.25546/108572.
27. Online resources of Sustainable Development Report from SDSN, https://dashboards.sdgindex.org/explorer [Accessed on July 12, 2023].
28. O. M. van den Broek, R. Klingler-Vidra, The UN sustainable development goals as a north star: How an intermediary network makes, takes, and retrofits the meaning of the sustainable development goals. *Regul. Gov.* **16**, 1306–1324 (2022).
29. M. Blicharska, C. Teutschbein, R. J. Smithers, SDG partnerships may perpetuate the global North-South divide. *Sci. Rep.* **11**, 22092 (2021), 10.1038/s41598-021-01534-6.
30. C. Chauhan, P. Kaur, R. Arrawatia, P. Ractham, A. Dhir, Supply chain collaboration and sustainable development goals (SDGs). Teamwork makes achieving SDGs dream work. *J. Bus. Res.* **147**, 290–307 (2022), 10.1016/j.jbusres.2022.03.044.
31. O. A. Guerrero, D. Guariso, G. Castañeda, Aid effectiveness in sustainable development: A multidimensional approach. *World Dev.* **168**, 106256 (2023), 10.1016/j.worlddev.2023.106256.
32. S. Kulkarni *et al.*, Investment needs to achieve SDGs: An overview. *PLoS Sustain. Transform.* **1**, e0000020 (2022), 10.1371/journal.pstr.0000020.
33. J. X. Zhan, A. U. Santos-Paulino, Investing in the sustainable development goals: Mobilization, channeling, and impact. *J. Int. Bus. Policy* **4**, 166–183 (2021), 10.1057/s42214-020-00093-3.
34. W. L. Filho *et al.*, The economics of the UN Sustainable Development Goals: Does sustainability make financial sense?. *Discov. Sustain.* **3**, 20 (2022), 10.1007/s43621-022-00088-5.
35. S. Barua, Financing sustainable development goals: A review of challenges and mitigation strategies. *Bus. Strat. Dev.* **3**, 277–293 (2020), 10.1002/bsd2.94.
36. T. Lagoarde-Segot, Financing the sustainable development goals. *Sustainability* **12**, 2775 (2020), 10.3390/su12072775.
37. T. Gibon, I. -Ş Popescu, C. Hitaj, C. Petucco, E. Benetto, Shades of green: Life cycle assessment of renewable energy projects financed through green bonds. *Environ. Res. Lett.* **15**, 104045 (2020), 10.1088/1748-9326/aba a0c.
38. I.-S. Popescu, T. Schaubroeck, T. Gibon, C. Petucco, E. Benetto, Investment funds are responsible for substantial environmental and social impacts. *Commun. Earth Environ.* **5**, 1–17 (2024), 10.1038/s43247-024-01479-4.
39. M. Bogers *et al.*, The impact of the Sustainable Development Goals on a network of 276 international organizations. *Glob. Environ. Change* **76**, 102567 (2022), 10.1016/j.gloenvcha.2022.102567.
40. F. Biermann *et al.*, Eds., *Essential Concepts for Implementing the Sustainable Development Goals: An A-Z Guide* (Routledge, London, 2025), 10.4324/9781003519560.
41. P. Pradhan *et al.*, The COVID-19 pandemic not only poses challenges, but also opens opportunities for sustainable transformation. *Earth's Future* **9**, e2021EF001996 (2021).
42. R. M. Elavarasan *et al.*, Impacts of COVID-19 on sustainable development goals and effective approaches to maneuver them in the post-pandemic environment. *Environ. Sci. Pollut. Res.* **29**, 33957–33987 (2022).
43. W. Zhao *et al.*, Achieving the sustainable development goals in the post-pandemic era. *Humanit. Soc. Sci. Commun.* **9**, 258 (2022).
44. J. Srinivas, N. Kolloju, A. Singh, S. Naveen, S. Naresh, The covid-19 pandemic and its impact on sustainable development goals-2030. *J. Knowl. Econ.* **15**, 15485–15498 (2024).
45. No Poverty in Saudi Arabia. https://units.imamu.edu.sa/administrations/en/sustainable/Goals/NoPoverty/Pages/default.aspx, (2025), [Accessed 8 Aug 2025].
46. Saudi Arabia pledges more than US$600m to help end polio and fight poverty in 2024 (2025), https://www.philanthropyage.org/articles/saudi-arabia-pledges-more-than-us-600m-to-help-end-polio-and-fight-poverty/, [Accessed 8 Aug 2025].
47. Viet Nam commits to achieve #ZeroHunger in Viet Nam by 2025, https://vietnam.un.org/en/4056-viet-nam-commits-achieve-zerohunger-viet-nam-2025, [Accessed 8 Aug 2025].
48. Viet Nam deepens cooperation with FAO to advance sustainable agriculture, https://vietnamnews.vn/economy/1691831/viet-nam-deepens-cooperation-with-fao-to-advance-sustainable-agriculture.html, [Accessed 8 Aug 2025].
49. New Zealand commits to supporting women's education, leadership and participation, and improving women's safety (updated), https://www.unwomen.org/en/get-involved/step-it-up/commitments/new-zealand, [Accessed 8 Aug 2025].
50. P4G–Partnering for Green Growth and the Global Goals 2030, https://um.dk/en/danida/sustainable-growth/partnerships/p4g-partnering-for-green-growth-and-the-global-goals-2030, [Accessed 8 Aug, 2025].
51. Lessons Learned Report–Advancing Inclusive SDG Data Partnerships, https://www.effectivecooperation.org/sites/default/files/documents/Lessons%20Learned%20Report%20Final%20%281%29.pdf, [Accessed 8 Aug 2025].
52. M. Pedercini, S. Arquitt, D. Collste, H. Herren, Harvesting synergy from sustainable development goal interactions. *Proc. Natl. Acad. Sci.* **116**, 23021–23028 (2019), 10.1073/pnas.1817276116.
53. H. Xiao *et al.*, Global transboundary synergies and trade-offs among sustainable development goals from an integrated sustainability perspective. *Nat. Commun.* **15**, 500 (2024), 10.1038/s41467-023-44679-w.
54. Sustainable infrastructure needs to look beyond climate change, https://medium.com/wwftogetherpossible/sustainable-infrastructure-and-nature-b86bae00a72b, [Accessed 9 August 2025].
55. X. Pan *et al.*, Energy and sustainable development nexus: A review. *Energy Strateg. Rev.* **47**, 101078 (2023).
56. IEA-EDGAR CO2, a component of the EDGAR (Emissions Database for Global Atmospheric Research) Community GHG database version 7.0 (2022) Including or based on data from IEA (2021) Greenhouse Gas Emissions from Energy, www.iea.org/data-and-statistics, as modified by the Joint Research Centre.
57. Global Carbon Budget, With major processing by Our World in Data. "Cumulative CO_2 emissions". Global Carbon Project, "Global Carbon Budget" [original data] (2023).
58. FAO, Prevalence of undernourishment (% of population) (Food and Agriculture Organization, Rome, 2023), http://data.worldbank.org/indicator/SN.ITK.DEFC.ZS.
59. ILO, Ratio of female to male labor force participation rate (%) (modeled ILO estimate) (International Labour Organization, Geneva, 2023), https://data.worldbank.org/indicator/SL.TLF.CACT.FM.ZS.
60. UNEP, SCP-HAT database v2.0 (UN Life Cycle Initiative, UN One Planet Network, UN International Resource Panel, Paris, 2024).
61. UNICEF *et al.*, *Prevalence of Stunting, Height for Age (% of Children under 5)* (United Nations Children's Fund, New York, 2023).
62. WHO, Global Health Observatory. Obesity (age- standardized estimate). (World Health Organization, Geneva, 2023), http://apps.who.int/gho/data/view.main.CTRY2450A?lang=en.
63. World Bank, *GDP per capita, PPP (current international $)*. (World Bank, Washington, D.C., 2023), https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD.
64. Gallup, Gallup World Poll, https://www.gallup.com/analytics/318875/global-research.aspx (2023).
65. L. Ates *et al.*, "The corporate tax haven index: A new geography of profit shifting" in *Combatting Fiscal Fraud and Empowering Regulators*, B. Unger, L. Russel, J. Ferwerda, Eds. (Oxford University Press, Oxford, UK, 2021).
66. The World justice project: Rule of Law Index. (The World Justice Project, Washington, D.C., 2022), https://worldjusticeproject.org/rule-of-law-index/.
67. Reporters sans frontières. World Press Freedom Index (2023) https://rsf.org/en/ranking.
68. M. Friedl, D. Sulla-Menashe, *MODIS/Terra+Aqua Land Cover Type Yearly L3 Global 500m SIN Grid V061* (NASA EOSDIS Land Processes DAAC, 2022).
69. N. Gorelick *et al.*, Google Earth Engine: Planetary-scale geospatial analysis for everyone. *Remote Sens. Environ.* **202**, 18–27 (2017).
70. G. Lafortune, G. Fuller, J. Moreno, G. Schmidt-Traub, C. Kroll, SDG index and dashboards detailed methodological paper. Sustainable development solutions network (2018), https://raw.githubusercontent.com/sdsna/2018GlobalIndex/master/2018GlobalIndexMethodology.pdf.
71. E. Papadimitriou, A. R. Neves, W. Becker, JRC statistical audit of the sustainable development goals index and dashboards, EUR 29776 EN, (2019), ISBN 978-92-76-08995-7, 10.2760/723763, JRC116857.
72. R. J. Hyndman, G. Athanasopoulos, *Forecasting: principles and practice* (OTexts, Melbourne, Australia, ed. 3, 2021), OTexts.com/fpp3.