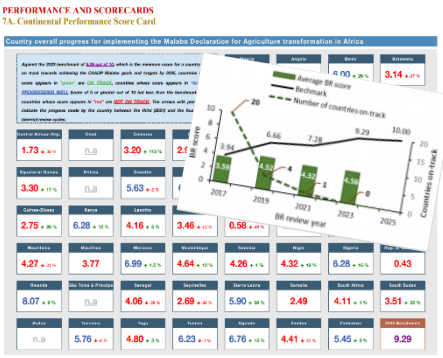
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Africa Cannot Achieve the Malabo Declaration Commitments: Statistical impossibility or logical fallacy?

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Introduction



The results of the recently released Comprehensive Africa Agriculture Development Programme (CAADP) 4th Biennial Review (BR) report indicate that Africa's performance in 2023 toward achieving the Malabo Declaration commitments by 2025 has strayed farther away from being on-track.[1] Using a scorecard method to review progress in 58 indicators that represent the commitments, previous BR reports show that the number of countries assessed to be on-track to achieve the commitments has dwindled over time, from twenty in 2017 to four in 2019 and only one in 2021. In the 4th BR in 2023, none of the 49 participating countries was on on-track. This seems to conflict with evidence of positive trends in other continent-level reports on related development indicators. According to the African Economic Outlook for example, the contribution of agriculture to overall economic growth in Africa has remained stable, especially as growth in the services and industry sectors has been irregular—and even negative in 2020 due to the COVID-19 pandemic.[2] The latest editions of the Africa Agriculture Trade Monitor,[3] Africa Agriculture Status Report,[4] and Annual Trends and Outlook Report[5] also show substantial progress in terms of expansion of agricultural investments, trade, and growth and improvement in poverty and nutrition outcomes, amid challenges associated with the pandemic, climate change, conflicts, and epidemics such as the locust and fall armyworm infestations. The BR scoring method and data have some issues that contribute to the seemingly worsening performance.

The BR scoring method and issues

The 58 indicators, data sources, and scoring method used in preparing the Africa Agriculture Transformation Scorecard (AATS) of the BR are documented in the African Union (AU) BR Technical Guidelines and Notes.[6] The 58 indicators represent the seven thematic areas of the Malabo Declaration commitments[7] and capture various components of agricultural transformation pathways, from the upstream

(for example, policies, governance, and mutual accountability) through the midstream (for example, value chain decisions and behavior such as input use and on-farm investment, and intermediate results such as agricultural productivity and prices) to the downstream (for example, broader development objectives and outcomes such as growth, poverty reduction, food security, and nutrition). The indicators are organized under performance categories, which are in turn organized under thematic areas. For each indicator, the data are censored and a score of 0 is given if the value of the indicator is zero or worse and a score of 10 is given if the value of the indicator is equal to or greater than the target in 2025. Values of the indicator between zero and the target are normalized or linearly interpolated between 0 and 10 to arrive at the score for each indicator (I-Score). The I-Scores within a performance category are averaged (arithmetic mean) to get a C-Score; these are in turn averaged within a thematic area to get a T-Score. T-Scores are then averaged to get the overall score (O-Score) for a country. Country-level O-Scores are averaged for the relevant countries in a region or for all countries to get the region- or continent-level O-Score, respectively. In each review year, the O-Score is compared with a benchmark (3.94 in 2017, 6.66 in 2019, 7.28 in 2021, and 9.29 in 2023) to determine whether a country is "on-track" (if the score is equal to or greater than the benchmark) or "not-on-track" (if the score is lower than the benchmark) to achieve the Malabo Declaration commitments by 2025.

To achieve the Malabo Declaration commitments, a country must get an O-Score of 10 or an I-Score of 10 on all 58 indicators. This is statistically impossible.

The same basket of indicators and targets is used for all countries to generate a comparable assessment of cross-country progress. This is logical for downstream indicators—such as poverty reduction, food security, and nutrition—because all countries pursue the same goal for these indicators. It seems less logical for upstream indicators—such as those on policies and public programs—because different countries can select various options that are available to them, which are influenced by their resource endowments and nonagricultural sources of growth and development, etc. Take the indicator on government agriculture expenditure (GAE) as a percent of total government expenditure (BR Indicator 2.1i), for example, which has an annual target of 10 percent. Whether this target is desirable for a country depends on its context, because increasing the share of GAE implies decreasing the share for other sectors, with possible adverse implications for overall development outcomes. Thus, countries will tend to be more selective with some of the indicators and targets, especially those upstream, and performance in these indicators will depend on their stage of agricultural and overall economic transformations as well as on their associated trajectories and speeds. This is likely for countries such as those in northern Africa that have made significant progress in several of the outcome indicators (for example, poverty reduction and improved nutrition) but are behind on some of the CAADP-specific processes and mechanisms. This is often referred to as the "substitutability" or "compensation" issue. In addition to the diversity of agricultural transformations and heterogeneity in national pathways,[8,9] this suggests that it will be unlikely for any country to concurrently get an I-Score of 10 on all upstream indicators and, by extension, on all 58 indicators in the BR. Thus, while the existing BR scoring method shows it is mathematically possible for a country to achieve the Malabo Declaration commitments, it is statistically impossible. So, if no country can achieve the commitments, then for a country to be "on-track" seems a logical fallacy. The same applies to regions or Africa as a whole, as all countries in a region or on the continent must get an O-Score of 10 for the region or for Africa to achieve the commitments.

Indicators with missing data are scored 0. This creates a false equivalence between unobserved and observed performance and underestimates the progress made.

Another issue with the BR scoring method is that a 0 score is given for indicators with missing data. In the 4th BR, for example, about 41 percent of the data required to calculate the indicators were missing (Table 1). Therefore, the O-Score for a country reduces in proportion to the number of indicators with missing data, which has two implications for the BR results. First, the O-Score underestimates the performance of a country to the extent that the true unobserved value is positive. Second, the O-Scores mix unobserved (or unknown) performance with observed performance and create a false equivalence between the two, underestimating the progress made. For many countries with severe missing data, using a classification of "unknown" to characterize their performance may be better than deeming them "not-on-track." Take Libya and the Sahrawi Arab Democratic Republic, for example, which in the 4th BR had only 2.1 percent and 6.3 percent of the required data, respectively. Classifying their performance as not-on-track does not seem useful and may be misleading.

Table 1. CAADP BR data reporting rate and scores for Africa, 2017–2023

Review year	Missing data (% of total)	O-Benchmark	O-Score	Number of countries:		
				Reporting	On-track	Not-on-track
2017	25.1	3.94	3.59	47	20	27
2019	20.0	6.66	4.52	49	4	45
2021	29.3	7.28	4.32	51	1	50
2023	40.9	9.29	4.56	49	0	49

Source: Author's calculation based on CAADP BR reports and Benin et al. 2020.[10]
Note: Missing data are calculated as a percentage of the total required (number of variables * years * countries) that are missing.

Outliers with illogical or impossible values are scored either 0 or 10, which underestimates or overestimates the progress made.

Outliers with illogical or impossible values are also prevalent in the BR, but they are not dropped from the calculations. Instead, they are scored either 0 for those less than zero or 10 for those greater than the target. Like the case for missing data, this treatment mixes unobserved (or unknown) performance with observed performance and creates a false equivalence between the two, which underestimates or overestimates the progress depending on whether a false score of 0 or 10 is given, respectively. Together with the treatment of missing data, the BR results mislead on the true progress made by countries in achieving the Malabo Declaration commitments.

How the I-Scores are aggregated to get the O-Score gives more weight to upstream indicators than to downstream ones. Thus, the BR results reflect progress in the CAADP processes more than in the actual transformation and outcomes.

To treat all seven thematic areas of the Malabo Declaration equally, a normative assumption is used in aggregating the scores across the indicators: themes are equally weighted, performance categories within a theme are equally weighted, and indicators within a performance category are equally weighted. As a result, indicators within a theme with the greatest number of performance categories

and indicators have the lowest weight in the O-Score.[11] As such, indicators under Theme 3, which capture most of the downstream indicators—such as broader development objectives and outcomes (for example, growth, food security, nutrition, healthy diets, etc.)—have the lowest weight in the O-Score (Table 2). The indicators on child nutrition (stunting, underweight, or wasting), for example, carry a weight of about 0.003, which is 10–16 times less than an indicator in Theme 1 or 2 on the CAADP and mutual accountability processes that carries a weight of about 0.029–0.048. Similarly, the indicator on growth in agricultural productivity carries a weight of about 0.007, which is 4–7 times less than an indicator in Theme 1 or 2. Together, the 26 indicators in Theme 3, which constitute 45 percent of all indicators, account for only 25 percent of the O-Score, whereas the 8 indicators in Themes 1 and 7, which constitute only 14 percent of all indicators, account for 28 percent of the O-Score. The indicators in Themes 2, 4, 5, and 6 account for 14 percent, 14 percent, 12 percent, and 7 percent of the O-Score, respectively. This means, for example, that the BR results reflect progress in the CAADP processes more than in the core agricultural transformation indicators and broader development objectives and outcomes.

Table 2. Distribution of the BR performance categories, indicators, and weights across Malabo Declaration thematic areas, 2023

Thematic area	Number of performance categories (PCs)	Number of indicators	Average number of indicators per PC	Share of indicators in total number	Sum of weights of indicators	Average weight of indicators	Ratio of share of indicators to sum of weights
1	3	3	1.0	0.05	0.11	0.037	2.2
2	4	6	1.5	0.10	0.14	0.023	1.4
3	7	26	3.7	0.45	0.25	0.010	0.6
4	4	7	1.8	0.12	0.14	0.020	1.2
5	3	7	2.3	0.12	0.12	0.017	1.0
6	2	4	2.0	0.07	0.07	0.018	1.0
7	5	5	1.0	0.09	0.17	0.034	1.9
Total	**28**	**58**	**2.1**	**1.00**	**1.00**	**0.017**	**1.0**

Source: Author's calculation based on the 4th CAADP BR report and data.
Note: Data reporting rate is calculated as a percentage of the total required (number of variables * years * countries) that are reported.

Suggestions for addressing the issues

Basket of indicators and targets

To implement the Malabo Declaration, AU Member States had to first domesticate it by developing their own National Agricultural Investment Plans (NAIPs) so that continent-level commitments and targets could be "linked to the specific targets and commitments stated by individual countries in their respective NAIPs" (see page 8 of the AU NAIP Toolkit for Malabo Domestication).[12] This recognizes the potential differences in some of the indicators and targets for different countries. Thus, the BR must also collect information on country-level targets associated with the indicators, which can be used to identify a subbasket of indicators where the continent-level targets are likely to be out of reach or less relevant for many different countries. It could then use the top *x*-number of indicators in the subbasket for each

country in the calculation of the score. This will help address the “substitutability” or “compensation” issue and make it more likely for countries to concurrently get an I-Score of 10 on all indicators in the BR.

Missing data and outliers with illogical or impossible values

Prior analysis[13] suggests that the missing data and outliers could be reduced by complementing data from national sources with international databases such as FAOSTAT, the OECD Creditor Reporting System, and World Development Indicators. Because these sources of data and others are listed in the BR Technical Guidelines, it seems that those involved with the BR data compilation at the country level may not be aware of or exclude them for one reason or another. Outliers with illogical or impossible values must be treated as missing data. It would be useful to institute a threshold for the quantity and quality of data that a country must surpass to be included in the BR and calculation of the scores, as done in the reporting on the Sustainable Development Goals, for example, where countries that are missing data on more than 20 percent of the indicators are excluded.[14] Then, missing data for the countries included can be imputed using some of the approaches suggested in literature, such as single imputation methods (for example, replacing with mean, median, or mode) and multiple imputation methods (for example, replacing based on regression or simulation), depending on the type of missing data.[15]

Weighting of indicators and countries

Although there is no reason to assign higher weights to some of the BR indicators over others, the substantial difference in the weights across the indicators derives from how the number of performance categories and indicators are distributed under the seven thematic areas of the Malabo Declaration. A good way to resolve this is to equally weight all 28 performance categories, which have a more balanced distribution in the number of indicators (Table 2). The performance categories are also more indicative of the objectives and goals of the Malabo Declaration.

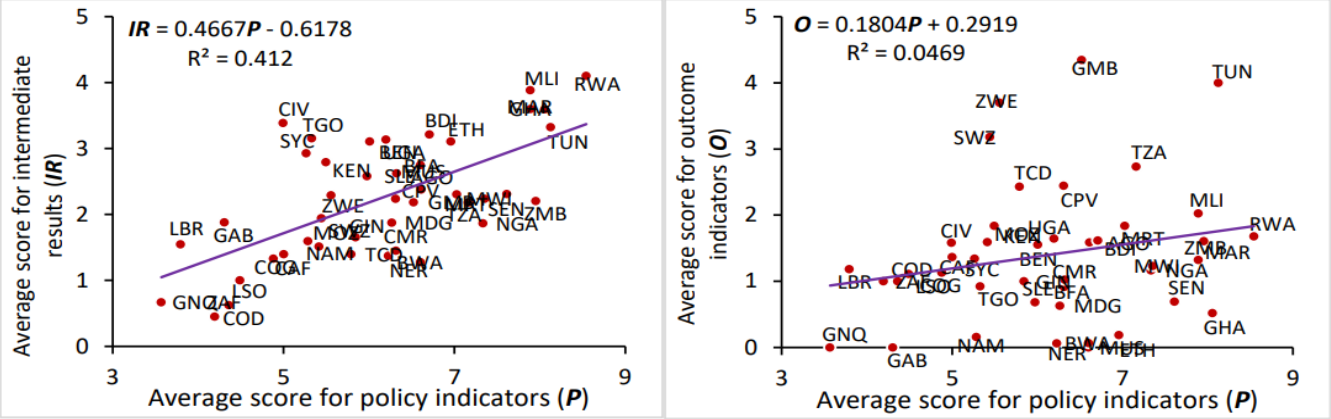
The simple average method used for aggregating the O-Scores across countries in a region or on the continent to obtain the region- or continent-level O-Scores, respectively, does not account for the varying sizes of economies. First, the region- or continent-level values of the indicators must be obtained. This can be done by using a weighted average method, where the contributions of countries to the variable of interest at the regional or continental level are used as weights in aggregating the country-level indicators to obtain the respective region- or continent-level indicators. This is equivalent to adding up the data on each variable for all countries in the region or continent, and then using the aggregated values to generate the indicators. These in turn can be compared with the benchmarks or target to derive the on-track or not-on-track status for the relevant region or the continent. Otherwise, the region- and continent-level O-Scores are underestimated (smaller countries have lower performance or larger countries have higher performance) or overestimated (smaller countries have higher performance or larger countries have lower performance).

Using the BR scores for relational analysis

An appealing thing about the scores is that they can be aggregated across indicators and countries and used in relational analysis. This can be done, for example, at the performance category or thematic level, where the analyst must work with only 28 or 7 sets of aggregated scores, respectively. Figure 1 shows an example of correlation between the average score for the group of policy indicators and intermediate results and outcomes, which show that the correlation between the policy indicators and the

intermediate results is stronger than that between the policy indicators and the outcomes. This is consistent with the logical framework of first putting in place the relevant policies, investments, and accountability mechanisms that will help to drive the sector's transformation in terms of intensification (for example, increased use of high-yielding inputs and sustainable production practices), which will in turn lead to broader outcomes (for example, poverty, food security, and nutrition).

Figure 1. Correlation between BR scores for different categories of indicators, 2019



Source: Benin (2021).[16]

Note: Based on scores of 44 countries that participated in the 2017 and 2019 BRs. The equation and R^2 (r-squared) are for the trendline.

Such first-level relational analysis in addition to more advanced multivariate regressions of the scores can be used to analyze the effect of various AU Decisions (for example, on fertilizer, seed and biotechnology, land tenure security, fisheries and aquaculture, livestock, mechanization, food fortification and biofortification, etc.) on various outcomes. This can be done by first identifying the relevant indicators associated with the Decisions and then averaging their scores to get a composite score or index for each Decision. Then the relational analysis can be performed by regressing the composite score of the outcome (dependent variable) on those of the Decisions (independent variables) to assess how a change in a Decision is likely to affect a change in the outcome, which can be used to make policy recommendations.

Because the reliability of the estimated relationships (or regression coefficients) depends on the independent variables having minimum correlation (or multicollinearity) with each other, the critical thing is the extent to which the scores associated with the indicators preserve the order and variation of their observed values. Censoring and normalizing the indicators to create the scores from 0 to 10 removes the order and variation in their values at both the lower and upper ends and bunches them at 0 and 10, respectively. As such, the scores associated with the different indicators may become more collinear, reducing their utility for conducting rigorous regression analysis. This is more likely for indicators that are measured as a change, where values of zero or worse are censored and scored 0. These include indicators on, for example, increase in agricultural production (BR indicator 4.1i) and productivity (3.2i and 3.2ii) and reduction in postharvest losses (3.3) and poverty (4.1iii and 4.1iv). Because values worse than zero are common (for example, a decrease in agricultural productivity or an increase in poverty), censoring at zero is an issue. For these indicators in the 4th BR for example, about 40 percent of the observed values were zero or worse. The censoring needs to be revised to accommodate negative rates of change (for example, for agricultural production) or positive rates of change (for example, for poverty).

Conclusions

The BR process has been very successful. In addition to BR reports being produced in a timely fashion every two years since 2017, the BR reports have tracked progress in implementing related AU Decisions and declarations, such as those on agricultural water management, food fortification and biofortification, biotechnology, and some subsectors—seed, fisheries and aquaculture, and livestock. The BR uses a scorecard with a relatively simple scoring method. Each of the 58 indicators used is censored, normalized, and scored from 0 to 10 (I-Score); these are averaged across indicators for a country to get an overall score (O-Score) and compared with a benchmark for the review year to determine whether a country is on-track or not-on-track to achieve the Malabo Declaration commitments by 2025.

While the simplicity is appealing, methodological and data quality issues have become more apparent with increasing missing data problems and the rapidly declining number of countries that are assessed to be on-track to achieve the Malabo Declaration Commitments by 2025; 20 in 2017, 4 in 2019, 1 in 2021, and 0 in 2023. Using the same basket of indicators and targets to review progress for all countries without adjusting for issues of "substitutability" or "compensation" among some of the indicators makes it impossible for any country to concurrently get an I-Score of 10 on all 58 indicators, which is the "pass" mark to achieve the Malabo Declaration commitments. By giving a score of 0 for indicators that are zero, worse, or missing, the results underestimate countries' performance. And the average method used to aggregate I-Scores to get country-level O-Score leads to a weighting system biased against the core indicators associated with agricultural transformation (for example, technology adoption, farm-level investments, and agricultural productivity and production) and broader outcomes (for example, food security and nutrition).

Solutions to the issues include: (1) having a sub-basket of indicators and targets on which countries can be evaluated on a selective basis; (2) defining a threshold of data quantity and quality for a country to be included in the review; (3) using recognized data imputation methods for missing data and outliers; and (4) equally weighting all performance categories under which the indicators are organized. Recognizing the potential of using the scores to conduct relational analysis from which reliable policy implications can be derived, censoring of the indicators at zero should be revised to preserve more of the order and variation in their observed values at that end of the spectrum.

Other interventions to address the data issues include: (1) harmonizing the critical analysis across the various BR technical working groups; (2) strengthening the capacity of the BR country reporting teams and training them on data quality issues; (3) making the BR data entry portal (eBR) accessible throughout the year for Member States to upload/update data as they get them; and (4) making the BR data publicly available to promote more analysis of the data and learning from the analytics. The AU must also explore the option of using direct import of data from national and international statistical databases to minimize errors with compilation and reentry of data. Improving the quality of the data used in the review will enhance use of the BR report as a strategic tool for accelerating agrifood system transformation and improving food system governance in Africa.

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