UNDP Global Policy Network Brief

How Likely Are We to Achieve the SDGs at the Current Pace?

Public Budgets and Policy Priorities in Colombia

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This policy brief analyses the possible convergence of SDG indicators for Colombia. The methodology uses an agent-based model to depict the distribution of public resources for the SDGs within governments, modelling budgeting inertia, interdependency, and spillovers across the 17 SDGs, with the purpose of informing policymakers of the prospective implications of current budgetary policy. Using historical budget and development indicators, we find that (i) at the current pace, only 18 percent of SDG indicators will reach their targets by 2030; (ii) there are structural bottlenecks in close to 65 percent of SDG indicators that do not respond to boosts in resources; and (iii) budget reallocations could have a greater impact on SDG achievement than simply increasing resources. To accelerate SDG achievement, governments need to redesign some of the current programs and implement results-based budgeting anchored by SDG indicators.

As part of the Decade of Action (2020-2030), interest in sustainable development and its integration in policymaking has grown among countries. National plans and policies are becoming more SDG-aligned, especially at a narrative level. National and subnational SDG-oriented reports[2] demonstrate countries' progress to align high-level national policymaking to the 169 SDG targets. This growing global interest in sustainable finance since 2015 is also driving awareness toward sustainable and green projects with the potential of being scaled up.

SDG integration into policy planning in Colombia: In 2018, the Government of Colombia issued the high-level policy documents CONPES[3] 3918 and 3934, which established the national monitoring framework to assess progress towards the 2030 Agenda and the SDGs. The national SDG framework outlined by the Government of Colombia defined a 2015 baseline and a specific 2030 target for each of the 161 indicators established. The national framework also defined a leading government entity for each SDG and a set of national institutions to support these entities. Despite aiming at 130 of the 169 SDG targets, the

national SDG framework with its 161 unique national indicators de facto covers 85 of the 169 global SDG targets (corresponding to 50 percent of the global targets).[4]

Nationally established target values for SDG indicators have a trade-off: If target values for indicators are calculated using projected trends, they could easily be achieved by 2030, whilst lagging behind the actual spirit of the SDGs. On the other hand, if target values for SDG indicators are ambitious, analytics will show a long way to go. This is reflected in Colombia's target values for its indicators, as some indicators have goals that are close to current levels (even if the global optimum would call for a more ambitious target), while other indicators show levels well below the nationally defined target. Of the 99 indicators considered, 41 are above the 80 percent mark for their nationally defined target. Despite being defined according to a perception of 'realistic' achievement 'at the current pace', there are 17 indicators whose values are below 50 percent of their nationally defined numerical target. Given that the target values for SDG indicators were defined by the 2014-2018 national administration, it is important to update them.[5]

Actionable Solution #1: As 2023 marks the halfway distance towards 2030, countries should embark on a national revision and update their national SDG indicators' target values. Very similar to the nationally determined contribution (NDC) definitions, countries must establish, communicate and publish target values for their national SDG monitoring framework. The specific indicator and numerical target would be chosen using a sovereign approach but communicated globally.

SDG acceleration requires adequate diagnostics, analytics, and monitoring. To integrate considerations of the efficiency of public expenditure, identification of bottlenecks and estimated times of convergence in SDGs, we use the Policy Priority Inference (PPI) methodology developed by Castañeda and Guerrero (2020),[6] which provides insights into the prospective behaviour of SDGs, calibrating a joint behaviour of budgets with SDG indicators. Applying PPI has strengthened the evidence-based toolbox available for SDGs in Colombia.

Model and methodology

One of the most relevant challenges that governments face for achieving the SDGs - or any development agenda - is prioritizing resources across hundreds of interdependent policy issues while, at the same time, dealing with the political economy of policymaking. A complexity analysis is necessary to cope with such issues and to assess the feasibility of development goals, inefficiencies in the use of public funding and policy coherence, while identifying accelerators and other critical matters. The framework and computational tool, developed by Guerrero and Castañeda (2020) in close collaboration with policymakers, is interdisciplinary, combining complexity economics, computational social science, and behavioural sciences.[7]

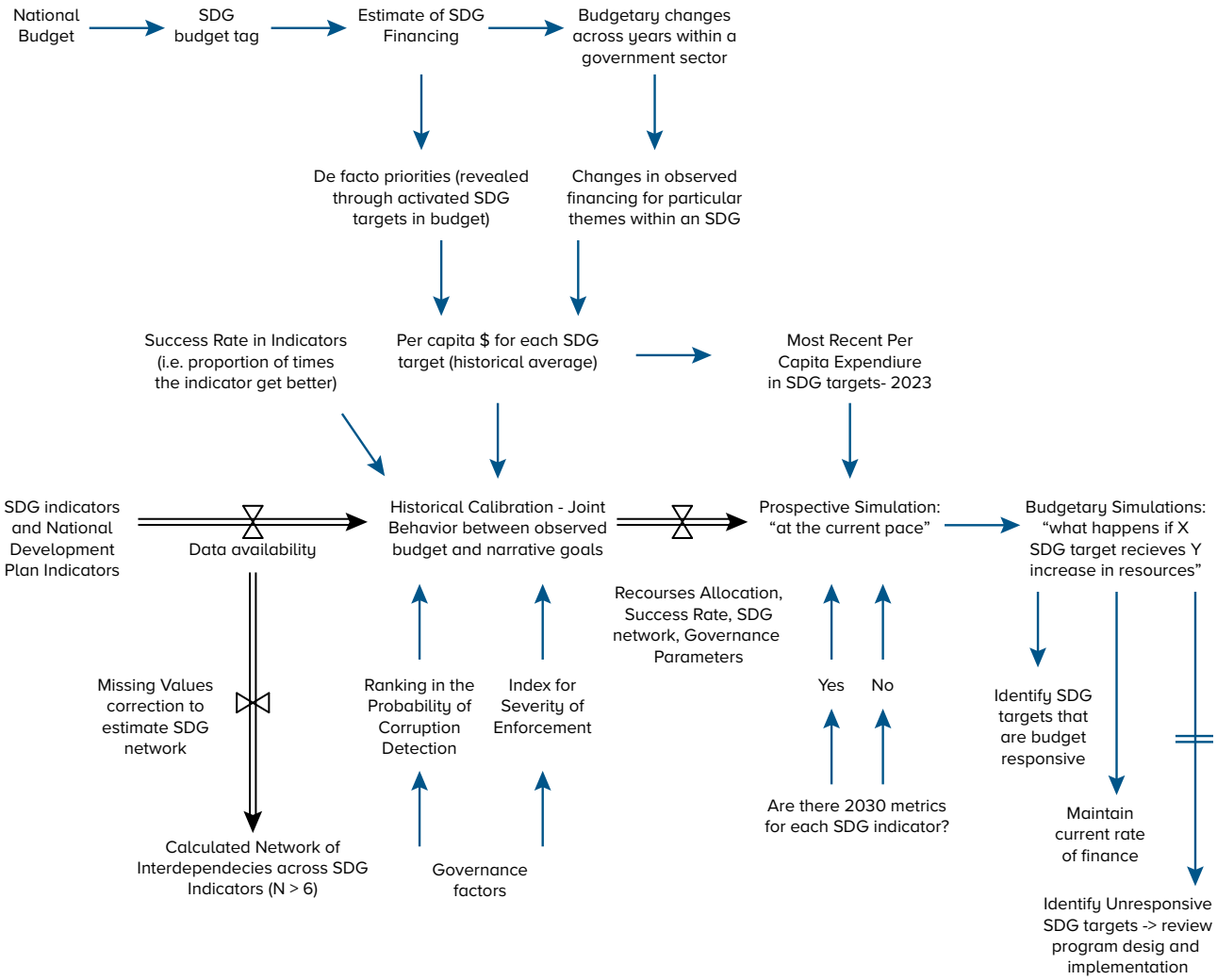
Using an agent-based model that considers the allocation and use of public resources, a central budgetary authority distributes its national budget across government programs, which are associated with the SDGs and their targets. A second level of government officials implement these programs (policies) with the purpose of increasing indicator performance using public resources.

Indicator progress depends on long-term structural factors, the allocated budget, the efficiency of the use of resources and externalities (spillover among indicators). Structural factors are inferred from parameter calibration. Budget allocation and efficiency in public resources are endogenous, and reinforcement learning by implementing government officials complements these methodological features. In agent-based modelling, the performance of a system is explained through the behaviour of featured agents. However, in contrast to neoclassical economic models, these agents do not act in isolation but are rather affected by interdependency with other agents and the operating context. Empirically, in contrast to econometric models that use aggregated variables and relationships depending on a pool of countries, agent-based modelling allows one to consider the context specificities of each country and study how a particular intervention can modify observed outcomes in that country. A Bayesian network is used to model interdependencies across SDG indicators,[8] leaving causal relations to occur in a different analytical framework where central budgetary authorities and public

officials make interrelated decisions that affect the aggregate dynamics of indicators, either through the SDG network or by direct injection of budgetary resources (see references for additional methodological details).

The methodology considers some of the complexities of the political economy underpinning the policymaking process: the multidimensionality of development, interlinkages between development areas and the inefficiencies of policy interventions. Overall, the framework and its computational tools allow policymakers and other stakeholders to embrace a complexity (and a quantitative) view to tackle the challenges of SDG achievement.

Figure 1: Visual Representation of the PPI Methodology to Estimate SDG Convergence Times in Colombia



Source: Own elaboration based on Guerrero and Castañeda (2020).

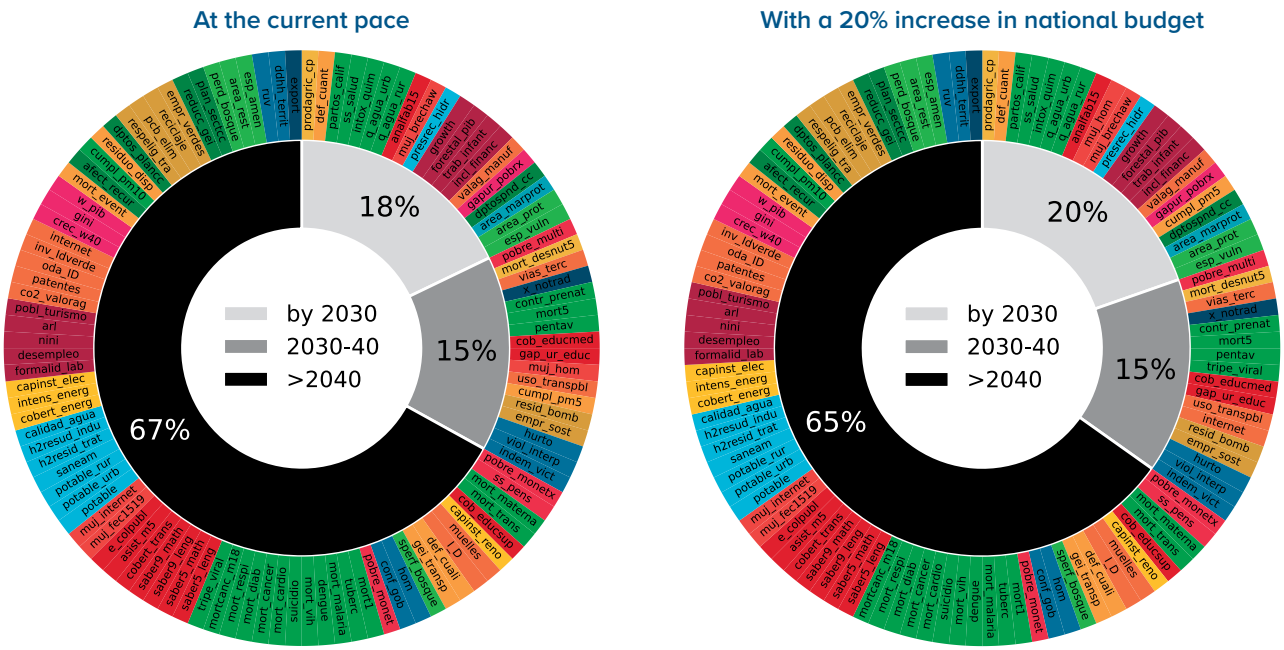
The PPI computational model uses country development indicators and public expenditure for development programs. Data in both were compiled for Colombia for 2000-2022. We used the SDG budget tag developed by the government with UNDP support, where public expenditure for Colombia was tagged with the 169 SDG targets for multiple fiscal years.[9]

Feasibility of achieving the SDGs 'at the current pace'

Using the Bayesian network of interactions amongst SDG indicators along with historical budgetary data and development indicators, a calibrated model was estimated for Colombia.[10]

Using this calibrated model, the feasibility of the 2030 Agenda (with current trends) can be estimated (i.e. convergence times), and budget injections can be simulated to determine whether there is indeed an acceleration of SDG achievement after a resource mobilization effort. Figure 2 maps SDG convergence times at the current pace and with a simulated 20 percent increase in the overall public budget:

Figure 2: SDG convergence times estimated for Colombia



Source: UNDP-Colombia

At the current pace of policymaking, the entire 2030 Agenda will not be achieved by 2030, as only 18 percent of indicators would reach their targets by 2030, and an additional 15 percent would reach their targets between 2030 and 2040. Perhaps more importantly, 67 percent of national SDG indicators considered in the simulation would not achieve their targets by 2030 or 2040.[11]

Using stepwise budgetary simulations (5, 10, 15 and 20 percent annual (real) increase in government budget) it was found that lagged indicator performance is not due to a lack of budgetary support. While some indicators show an almost null budget elasticity (the extent to which an indicator responds to changes in its associated budget), others respond to an increased budget (thus labeled as 'inelastic' to budget injections). Using a simulated budget scenario with a 20 percent increase in the overall availability of public resources for SDGs, we can identify which indicators' trajectories are not explained by budget or efficiency of resources, but rather explained by long-term structural considerations (including program design and/or implementation).

A significant increase in public resources available (20 percent) for development indicators in the context of SDG targets only slightly increases the number of indicators that achieve nationally defined numerical 2030 targets. In the as-is scenario, 18 percent of SDG indicators were on track to achieve their goals by 2030, while the 20 percent increase in budget only increases the percentage of SDG indicators converging to their targets by 2030 from 18 to 20 percent (i.e. comparing the light gray areas in Fig. 2).

The most responsive indicators to budget increases are: (i) incidence of monetary poverty; (ii) premature mortality rates for lower tract respiratory infections; (iii) percent of students with a satisfactory and advanced performance on the math component of 5th grade standardized exams; (iv) percent of population with access to adequate sanitation; and (v) percent of installed capacity in renewable energy.

Actionable Solution #2: There are opportunities to accelerate SDG achievement in the short term for specific SDG indicators, if more public resources are devoted to programs with indicators that are budget responsive. In the case of Colombia, these relate to (i) reducing monetary poverty; (ii) reducing respiratory infections; (iii) increasing performance in math components of standardized tests; (iv) increasing access to adequate sanitation; and (v) increasing installed capacity in renewable energy. Prospective simulations for these indicators show that these themes are responsive to increased budget and can thus be the focus of short-term solutions by increasing budget allocations.

Identification of bottlenecks to accelerate SDG achievement

With these budgetary simulations, it is possible to identify a list of SDG indicators that will not reach their targets regardless of the amount of allocated resources. This set of indicators can be narrowed by consecutive simulations with ever-increasing resources, resulting in a list of indicators with "bottlenecks", specifically when more resources do not move the needle in their favour. The policy implication of these indicators is that governments need to revise the design or implementation of programs that do not respond to increased budgets.

Development can be thought of as a factory where resources are combined in a policy-programmed machine, resulting in output equivalent to development indicators. In the case of the SDGs, resources are combined following an intrinsically national policy 'recipe', with expected outputs being the SDG indicators in a specific time frame (2030). Using this analogy, it is clear from the previous results that for certain SDG indicators, simply allocating more resources will not automatically accelerate SDG achievement, as the results-producing machine has not changed its programming. More resources poured in (input) do not change the way national policymaking occurs, thus creating a lack of progress in SDG indicators. If resource mobilization continues to be the focus of SDG achievement, governments will need to review the design, causal chain and implementation of current policy programs. Otherwise, more resources with the same policy operation will not accelerate SDG achievement.[12]

Concluding remarks

Despite ever-increasing global calls for more resources for SDGs, national governments still have a long way to go in optimizing their resources to effectively accelerate SDG achievement. The lack of results-based budgeting[13] strategies in developing countries is hindering policymakers' ability to assess budget effectiveness in the framework of associated development or SDG indicators. SDG implementation thus has a blind spot, where budgetary officials do not necessarily look at development indicators' responsiveness to budget variations but are rather focused on deliverables. On the other hand, planning officials see variations in indicators but do not necessarily look at budgetary input or its effectiveness. This brief uses a computational framework to analyse the joint behaviour between SDG-oriented budgets and SDG indicators. Using SDG budget tags for 2020, 2021 and 2022 national budgets and development data for 2000-2022, the model calculates a network of observed interdependencies across SDGs to calibrate a joint behaviour between SDG budgets and results, allowing for simulations at the current pace of SDG-related public expenditures.

Setting 2030 metrics for national SDG indicators is a necessary but insufficient condition, as previously established 2030 metrics in Colombia for SDG were defined by extrapolating from past trends, as opposed to selecting goals reflecting the ambitious spirit of the globally agreed upon SDGs.

Aside from identifying indicators that could be accelerated with more public resources, given the responsiveness of some indicators to an increased budget, results in the framework of the joint behaviour between SDG indicators and budget allow us to conclude that (i) there are bottlenecks in SDG indicators where governments need to review the design and implementation of associated budgetary programs; (ii) the global strategy should go beyond a simple budget increase and integrate reallocation and budget optimization, which show greater potential for SDG acceleration, supported by SDG resource mobilization from the private sector; and (iii) budgetary policymaking must depart once and for all from historical dynamics of budget programming and towards results-based budgeting. Budget availability is a necessary but not a sufficient condition for SDG achievement.

Actionable Solution #3: Governments need to identify bottlenecks in SDGs through a joint budget-vs-results perspective and expenditure-efficiency optics, and thus review the design, implementation and expected SDG causal chain within public projects. SDG budget tagging and prospective simulations can contribute to strengthening SDG acceleration strategies.

Actionable Solution #4: Governments should implement pilots of SDG-driven budget optimization strategies, which are a promising way to accelerate SDG achievement. Reallocating some of the budget away from inelastic indicators (unresponsive to budget changes) and towards elastic or responsive indicators could have more impact on SDG achievement than resource mobilization.

Actionable Solution #5: SDG acceleration requires a short-term transition to SDG results-based-budgeting. Developing countries are transitioning from historical, institutional, or inflationary budgeting dynamics to program-based budgeting, as a step on the road to results-based budgeting. These transitions must be accelerated, using SDGs as the results compass.

Annex: The Policy Priority Inference model and the network calibration

In this ABM (Agent-Based Model), a budget resource allocation process is established, along with the application of these resources to various government programs. The game describes a problem of collective action/principal-agent, in which the central authority allocates resources to n public servants, who are mandated to use them through the implementation of government programs, aiming to improve associated performance indicators. A behavioural game is employed because the government and officials use learning mechanisms to address the challenges presented by the environment and perform their tasks. A political economy game is used because the incentives of the government do not necessarily align with those of the officials, who make decentralized decisions. While the government seeks to advance various indicators by injecting resources and avoiding unnecessary expenditures, officials responsible for each policy are concerned with their political reputation (i.e., that their indicator advances more than others), but they also have incentives to behave inefficiently.

Now, the game takes place in a network where each node is identified with a development indicator. This way, the model establishes interdependencies between different indicators, whether positive (synergies) or negative (trade-offs). Indicators (nodes) can be instrumental or collateral. An indicator is instrumental when there is a government program that receives public resources with the purpose of improving the performance of the associated indicator (e.g., 'gross enrollment in secondary education'). In contrast, an indicator is collateral when it is not linked to any government program, measures a very aggregated concept, and its performance depends on many factors of different nature (e.g., GDP growth, Gini coefficient).

Once the network is defined, where the relationships between each pair of nodes are assumed to be fixed throughout the simulation, the government allocates budget resources for the various policies that make up the vector of instrumental indicators. These resources are received by different officials responsible for implementing the policies, who decide the amount of their contributions based on the reputation-inefficiency dilemma. Opting for a high level of inefficiency increases the probability of being detected and, if so, being sanctioned with the consequent loss of benefits. Both monitoring and sanctions depend on the quality of the country's governance institutions, for which data from recognized governance field surveys (such as the World Bank's 'Worldwide Governance Indicators') are used.

The contributions that are ultimately used in the implementation of government programs increase the probability of advancement in the corresponding indicator. This probability is also affected, positively or negatively, by the network spillover effects; that is, by the interdependencies between related indicators. As indicators advance and sanctions against inefficient officials are applied, the government adapts and modifies the budget distribution, and officials adjust their efficiency levels as they learn from their experiences. In the model, this process repeats itself until a boundary condition is met (e.g., the number of algorithmic periods equivalent to a specific year on the calendar is reached, or certain goals in the indicators are achieved).

The estimation of networks is a cutting-edge topic in various fields of knowledge, and this is no exception in the literature of sustainable development. Ospina-Forero et al. (2020)[14] provide a comprehensive review of quantitative methods suitable for estimating networks with relatively limited data, as is the case with Sustainable Development Goals (SDGs) networks that rely on short time series data (10-25 years). From this work and others (Guerrero and Castañeda, 2021b), it is concluded that the Bayesian method known as spasebn[15] is suitable for use with Colombian data. This method allows for the estimation of acyclic, directed, and weighted networks, so the topology must meet these characteristics. Moreover, the method has the advantage of, by design, reducing the number of false positives in network links. To reduce spurious correlations and inter-temporal dependencies in the data series, the method is applied to the first differences of historical data.

It is important to note that the links in these networks (or any network constructed from development indicators) should not be interpreted as a set of causal relationships. Instead, these links describe conditional relationships between indicators that do not change in the short term. In this sense, the spillover effects in the network (i.e., net sum of weights in incoming links) relate to possible realizations of these conditional

probabilities. In the Agent-Based Model (ABM), these impacts on indicator growth may or may not materialize, contributing to the generation of stochastic dynamics observed in the data. Causal relationships in the model, in a generative sense[16], stem from interdependent decisions made by the central authority and public servants and how they impact the aggregated dynamics of indicators, either through the network or direct injection of public resources. Thus, one can argue that the evolution of indicators iteratively moves between the micro and macro levels.

Endnotes

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2 The most representative SDG-oriented reports are Voluntary National Reviews (VNRs) and Local Voluntary Reviews (VLRs).

3 CONPES refers to the Colombian National Council for Economic and Social Policy. This council serves as the highest national planning authority and acts as an advisory body to the government on all matters related to the economic and social development of the country. The documents published by this entity are known as CONPES policy documents.

4 For a detailed assessment of the national SDG monitoring framework, See Palacios, L.; Ruiz, M.; Sánchez, O. (2023). Global and National SDG Monitoring Frameworks: An Assessment for Colombia. Documento de trabajo. UNDP Colombia. https://www.undp.org/es/colombia/publicaciones/documento-trabajo-marco-global-nacional-monitoreo-ods-valoracion-marco-colombiano.

5 For a detailed assessment of the national SDG monitoring framework, See Palacios, L.; Ruiz, M.; Sánchez, O. (2023). Global and National SDG Monitoring Frameworks: An Assessment for Colombia. Documento de trabajo. UNDP Colombia.

6 See https://policypriority.org/publications/ for a full list of detailed methodological documents and selected applications of the PPI methodology.

7 Guerrero, O., & Castañeda, G. (2020). Policy Priority Inference: A Computational Framework to Analyze the Allocation of Resources for the Sustainable Development Goals. Data & Policy, 2.

8 Through the Sparsebn R-package.

9 2020, 2021 and 2022 national budgets have been SDG tagged. These results were backward extrapolated to match the requirements of the PPI methodology.

10 Calibrated parameters replicated stylized facts, with a small error margin in over 92% of the Monte Carlo simulations.

11 The results showed in this brief are different from the results included in Guerrero and Castañeda (2020), as new indicators from the National Development Plan 2022-2026 were included. The results of the first exercise (2020) indicated that at the current pace, 36% of the indicators analysed were going to reach their targets by 2030, 21% by 2040, and 42% were not going to converge.

12 Given the low power of resource mobilization to move the SDG needle (a 20% resource increase only increases from 43 to 45% the achievement of 2030 targets), a complementary simulation is to test the extent to which budget reallocation amongst indicators accelerates SDG gap reduction. This is an extension to the results presented here (available upon request) and shows that budget optimization is more powerful in accelerating SDG achievement in comparison to an overall increase in resources. However, current budgetary laws restrict in practice the ability of governments to reallocate across sectors, creating budget inflexibilities. A practical measure to accelerate SDG achievement under current budgetary limitations would be to establish a high-level legal-financial roundtable within existing mechanisms, to design legal strategies that would reduce current budget inflexibilities. Despite this medium-term limitation, the budget reallocation simulations provided highlight the potential of truly transitioning from entity-level to results-based budgetary allocations.

13 Results-based budgeting is a process of defining a public budget based on three aspects: (i) a set of predefined objectives and expected results, (ii) expected results are in line with the budget requirements and (iii) performance in achieving these results is measured by objective performance indicators. Source: https://www.coe.int/t/budgetcommittee/Source/RBB_SEMINAR/RBB_Manual_en.pdf

14 Ospina-Forero, Luis and Castañeda Ramos, Gonzalo and Guerrero, Omar A, Estimating Networks of Sustainable Development Goals (May 9, 2019). Available at SSRN: https://ssrn.com/abstract=3385362 or http://dx.doi.org/10.2139/ssrn.3385362

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Online ISSN: 3005-3307