INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI

DST4AFIN

Decision Support Tool for Prioritizing Agrifood Investments

Ghana.2022.1

Samuel Benin, Senior Research Fellow, IFPRI

DST4AFIN[1] is an innovative, Excel-based user-interactive optimization simulation model. It is designed to answer two broad categories of questions: (1) what is the cost-effective allocation of a budget across various investments to achieve specified targets for particular development outcomes, such as agricultural growth, food security, child nutrition, or environmental health? and (2) how will various shocks affect the investment allocations?

The model's underlying investment–outcome predictive parameters are estimated with machine-learning regularized regression methods: kernel-based regularized least squares (KRLS), lasso regularized regression (LRR), and support vector regression (SVR). Like ordinary least squares, the estimated predictive parameters minimize the sum of squared residuals or a loss function, where regularization is used to prevent overfitting by adding a penalty term to the loss function. This approach results in a high predictive accuracy of the estimators.

This customized version for Ghana (DST4AFIN–Ghana.2022.1) uses data from various sources that provide annual observations at the national level from 1995 to 2022; these sources are documented in the tool. Investments are captured using expenditures on 13 government functions and subfunctions of

[1] The tool was initially conceptualized to help users evaluate different options to achieve the outcomes of the Comprehensive Africa Agriculture Development Programme (CAADP) at the country level. The conceptual paper, *Making the CAADP BR Forward Looking: A Decision Support Tool for Transforming African Agrifood Systems*, and a demonstration tool developed with a small number of indicators from the CAADP fourth biennial review data (2015–2022) can be accessed here.

defense, agriculture (disaggregated into non-cacao crops and livestock, cacao, fishery, forestry, and research), transport and communications, other economic, education, health, social protection, local government, and general. There are 31 outcome indicators for agrifood and other sectors of the economy covering production, growth, income, employment, trade, education, nutrition, and human and environmental health. Shocks are captured using 13 variables that include private sector investment of domestic and foreign sources, overseas development assistance (ODA) flows, and broader systemic factors, including fiscal, monetary, political, biophysical, natural, and environmental factors. A presentation on the customized version for Ghana can be accessed here.

To use the tool in Excel, the program's Visual Basic for Applications (VBA) and Solver references must be enabled. Starting from the main ribbon, select "Developer" > "View Code" > "Tools" > "References" and then check the relevant boxes. To create a scenario and run a simulation, provide scenario information through the interactive features in the "Simulations" tab:

- Select a baseline year
- Select the number of outcomes to simulate
- Select the outcome indicators and set their targets in terms of change from the baseline
- Set the maximum amount by which the other outcomes may change
- Set the weights for the investments (default is equal weights)
- Provide the unit costs for the investments (or use those provided in the tool)
- Provide the total budget to be allocated, as a percentage of total government expenditure
- If desired, set the percentage of the total budget to allocate to the agrifood sector (non-cacao crops and livestock, cacao, fishery, forestry, and research)
- If desired, select up to five sources of shocks and set their levels in terms of change from the baseline
- Select the machine-learning estimated parameters used to calibrate the model: KRLS, LRR, or SVR

Next, click the "Run" button to execute. If there is a feasible solution, the "Results" tab will be activated. This will show the results on the outcomes as the percentage change from their respective baseline values, except for those outcome indicators measured as growth rates, for which the change is shown in percentage points. Results for prioritized investments are presented in three ways: first, as percentage change from their respective baseline values; second, as the budget allocation in local currency units; and third, as a percentage in the total budget. For the budget allocations, a negative value means that some of the existing expenditure has been reallocated from that investment to other investments. These results are also displayed as charts. If there is no feasible solution, the "Simulations" tab will be re-activated, and the user can amend the scenario and re-run it.

The tool's "Readme" tab provides additional information about using the tool, including step-by-step instructions on how to create a scenario and run a simulation. In addition, an instructional video is available on YouTube.

Through the tool's "Data" tab, users can view the data used in developing the optimization model. This allows users to make their own judgment about the data's reliability and reduces the black-box effect

associated with many economic modeling tools. The available data include the annual observations on all the indicators (outcomes, investments, and other factors), the estimated investment–outcome predictive parameters for the three machine-learning methods, and the in-sample predictive performance for all the outcomes and the three machine-learning methods.

DST4AFIN can be customized for any country, using available data as well as the investments and outcomes of interest, and can help a variety of stakeholders make informed decisions, whether for policy formulation, planning, research, or advocacy.

LEARN MORE
Samuel Benin
International Food Policy Research Institute (IFPRI)
Senior Research Fellow
Email: S.Benin@cgiar.org

This publication has been prepared as an output of Strengthening CAADP Biennial Review and Supporting ReSAKSS and CAADP projects and has not been independently peer reviewed. Any opinions expressed here belong to the author(s) and are not necessarily representative of or endorsed by IFPRI.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
A world free of hunger and malnutrition
IFPRI is a CGIAR Research Center
1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info