Ceres2030
Sustainable Solutions to End Hunger

CHAPTER 1

Defining Public Policy Interventions

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INTRODUCTION

Since 2000, ending hunger has been a focus of the global agricultural development agenda sparked by Millennium Development Goal (MDG) 1, which was aimed at eradicating poverty and hunger. In 2015, the international community stepped up its commitment to combating hunger by adopting the 2030 Agenda for Sustainable Development, including the Sustainable Development Goals (SDGs). The second goal, SDG 2, aims to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture" by 2030 (United Nations, 2017). Specifically, this commitment includes targets to end hunger and ensure access to food by all (Target 2.1); double the agricultural productivity and incomes of small-scale food producers (Target 2.3) and promote sustainable food systems (Target 2.4) (United Nations, 2017).

Achieving SDG 2 will not be possible without allocating additional resources to targeted interventions that can deliver food security to the most vulnerable populations, using sustainable practices. International development practitioners can draw on many decades of agricultural research and practice. There are countless potential interventions to consider, ranging from investments in rural infrastructure and market access, to farm-level support, research, development and extension services, institutional development, safety nets and cash transfer programs (Laborde, Majeed, Tokgoz, & Torero, 2016; Schmidhuber & Bruinsma, 2011; Bodnar & de Steenhuijsen Piters, 2011; Mogues, Yu, Fan, & McBride 2012; Gilligan, Margolies, Quiñones, & Roy, 2013).

The Ceres2030 project explores and builds on this knowledge by combining state-of-the-art modelling techniques with expert evidence to estimate costs of possible policy interventions that will help in achieving SDG 2. In this technical paper the authors identify a set of interventions that can be integrated into an economic model (the "model") and how to do it. The authors first define the term "intervention," present different categories of interventions and explain how these interventions are integrated into the model. The authors conclude by outlining how the model links to other part of the Ceres2030 project, in particular how the model interacts with the evidence review process.

DEFINING INTERVENTIONS

Across policy research literature, various definitions exist for the term intervention. They stress that interventions are context-specific, covering private and public actions, policy, or project-based activities. The Merriam-Webster online/print dictionary (Merriam-Webster, 2018) provides the most apt definition of **intervention** for setting the stage:

> "the act of interfering with the outcome or course especially of a condition or process (as to prevent harm or improve functioning)"

In the context of Ceres2030 modelling work, we define an intervention a little more precisely:

> a **public action** aimed at altering the existing state of the world. The action is intended to solve **a problem** (such as a market failure). It targets **a specific population**. It is associated with a set of **expenditures** paid by one (or several) **economic agent(s)**. It has a given set of **direct effects**.

AN INTERVENTION OR AN INSTRUMENT – WHAT IS THE DIFFERENCE?

In order to make an intervention we need tools. Such tools can be called instruments. According to Merriam-Webster, an instrument is:

> "a means whereby something is achieved, performed, or furthered."

In general, interventions include "programs, projects, policy measures, reforms" (Leeuw & Vaessen, 2009), while a policy instrument is a tool, in the form of "a deliberate structured effort by governors to solve a policy problem by modifying actions of the governed" (Eliadis, Hill, & Howlett, 2005). There is a strong complementary relationship between the two; we need both to achieve the targets such as those in SDG 2.

In Ceres2030, we use "interventions" as the broader term and "instrument" to describe how the intervention is represented in the modelling framework.

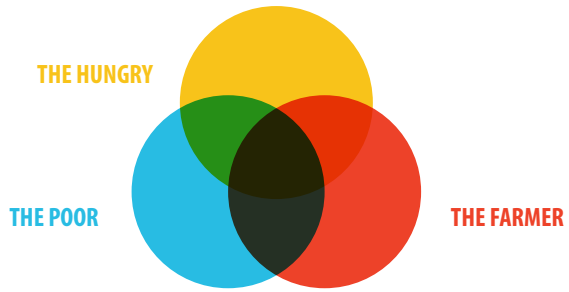
Let's illustrate the key points of our definition of an intervention. First, policy-makers might be motivated to make an intervention to address challenges faced by a given sector, region and/or population. In the context of agriculture, the challenge could be a market failure, for example in terms of overuse of water, or limited access to fertilizers, leading to inefficient "free-market" outcomes. The government might then decide to create a water licensing program, or a support for farmers to reduce the cost of fertilizer. These are examples of public interventions. They are exogenous actions (they arise independently of the market) that are not driven by market forces but will influence market behaviour and will move the economy from one equilibrium to another.

In most contexts, public interventions are intended to expand economic activity and enhance collective welfare from a utilitarian point of view. In other words, the interventions are designed to bring the most advantage to the most people: this is the definition of economic efficiency. In some cases, however, the problem the government wishes to address may not be solved by creating benefits for the largest population, as there may be small groups of vulnerable people who are disproportionately affected by the market failures identified. In these cases instruments may be needed to ensure the intervention promotes redistribution. This means that a government may want to reallocate economic resources to promote equity objectives. Such a reallocation could lead to a reduction of collective welfare from a utilitarian point of view, as public resources are redistributed from a larger population to a smaller one. As this redistributive impetus for a chosen intervention may create a new market distortion, a second instrument may be needed to deal with efficiency concerns at the same time.

It is also critical that the intervention and its instruments are designed to correctly identify and target the actual problem. In economics, as in medicine, treating symptoms rather than causes is a recipe for disaster

and sure way to waste resources. This means that we must identify the population in terms of households, farmers, products and other variables to be directly targeted by the intervention. As displayed in Figure 1.1, in the context of SDG 2, possible target populations may overlap without being identical (poor or rich households, small- or larger-scale farmers) and different interventions and instruments will reach different groups. For SDG 1, the target is the blue circle depicting people living in poverty. SDG 2 is about hunger and food insecurity—a closely correlated but not identical population to people living in poverty. SDG 2.3 is about small-scale producers, a population that overwhelmingly finds itself at the overlap of all three circles in Figure 1.1, i.e., farmers who are food insecure and poor.

FIGURE 1.1. PROPER POPULATION TARGETING



The cost side of the intervention is also important. It will indicate who is actually paying for the intervention. For example, a subsidy can be paid by the government and therefore by the taxpayer: a similar effect could be generated through a regulatory approach—then the costs are borne by producers and consumers.

Finally, the structural effects of the intervention must be identified and quantified. We focus here on the direct effects (on prices faced by the agent, on productivity) and not the final outcomes (hunger, poverty, environmental consequences). This issue is discussed more in details in Section 3.

When translating the intervention to actual instruments in the model, we associate each intervention with one policy instrument (one tax, one subsidy, one grant scheme), even if in reality a public action can take the place of a public program that combines various instruments. For instance, while we study the impact of food subsidies (e.g., food stamps), in practice the food subsidy can be delivered through universal unconditional cash transfer of a larger amount to include payments for the poor to cover health and education targets.

In the model, we do not yet integrate the institutions and the delivery conditions necessary to make the intervention happen. Such delivery mechanisms are critical and often include agencies of central or regional governments, or other public or non-governmental entities making sure that, for example, a fertilizer subsidy reaches its recipients. In the model, we make assumptions about the solutions (tailored to local conditions) and how they are put in place to ensure implementation. The institutional dimension is critical but also highly context-specific, and is therefore not yet represented in the model. To guide the actual implementation features, we rely on the findings from the evidence review process conducted as part of Ceres2030 and published in the dedicated edition of *Nature Research*.

THE FERTILIZER CASE

ILLUSTRATION OF PROBLEM IDENTIFICATION

The starting point is the claim that adding nutrients to the soil will increase yields or land productivity. At the same time we notice an under-utilization of fertilizer by smallholders, leading to below-average productivity—it is critical to assess why this is happening. There could be a number of reasons, including:

- The fertilizer is very **expensive** to purchase for smallholders because of high market prices or high costs for farmers (liquidity problem).
- The fertilizer is of **low quality** (problem of counterfeit products).
- Low efficiency of the applied fertilizer due to **mismatch between the fertilizer used and soil requirements**, (problem of lack of knowledge of soil types).
- **Lack of knowledge** about the benefits or use of fertilizers (problem of limited support through extension services).

INTERVENTION SELECTION AND EXPECTED OUTCOMES

- In cases where the bottleneck faced by smallholders is the price of fertilizers, we consider a fertilizer intervention based on a price instrument: a subsidy as a percentage of the market price for smallholders for fertilizers.
- After being mediated by farmer economic optimization (an "economic agent" response in the model), the increased use of fertilizer will include farm productivity (technical effect embedded in the model) and will generate more gross and net income, even the total cost of production increases. The net cost for the collectivity could be positive if the value of the subsidy exceeds the initial market failure (assuming its existence). Also, higher fertilizer use will lead to higher GHG emissions. While total emissions will expand, increased yields may reduce the per ton of output (intensive) emission footprint.

LINKING INFORMATION FROM THE LITERATURE REVIEW TO THE MODEL

While we initially consider a fertilizer intervention based on a price instrument for fertilizer in the model, the review of existing evidence may help to investigate potential additional questions such as:

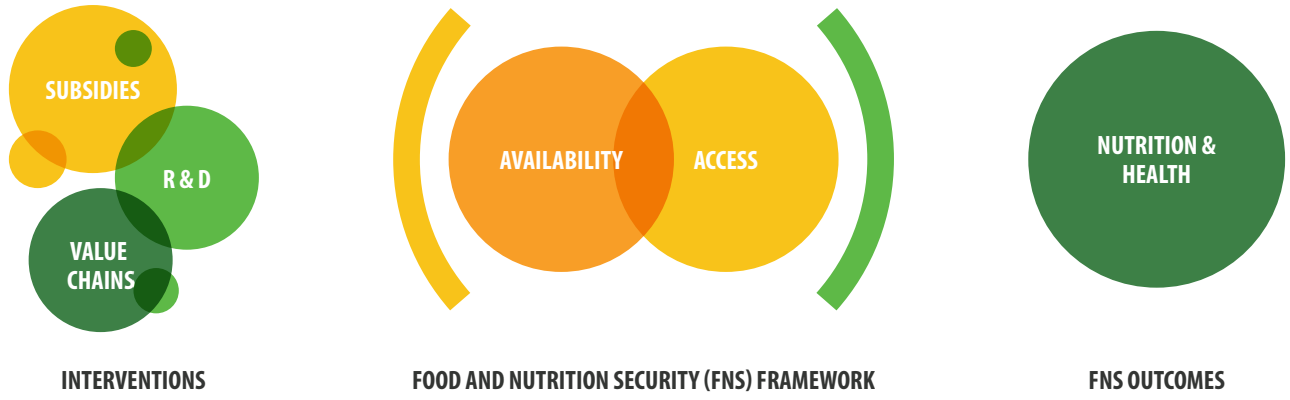
- What are the impacts of inorganic fertilizer compared to organic fertilizer on farmer income, yields, and soil health for commodity crops in specific geographies?
- How does proximity (physical distance) to inorganic fertilizer impact farmer yields, incomes, and soil health for farmers?
- How does proximity to access inorganic fertilizer impact farmer yields, incomes, and soil health in instances where a government subsidy is in place?

This way the expert evidence helps identify the effectiveness of the interventions and leads to recommendations on the optimal intervention design, the potential country-level specificities and new dimensions of fertilizer programs more sensitive to SDGs 2.3 and 2.4. Therefore, based on the outcomes of the evidence review the model could include the same intervention (subsidy) with new parameters (technical efficiency, targeted population), similar intervention with new mechanisms (changes in fertilizer quality) or new interventions (organic fertilizer promotion programs).

FROM INTERVENTIONS TO OUTCOMES

As indicated in our definition, we expect that each intervention has a clear impact with some well-identified direct effects on a number of measurable variables. Net effects, including indirect effects, and long-term impacts will be generated by the model. The ability to track the impacts of an intervention through the set of economic variables is a core added value of using a model in our analysis. The economic variables in the model provide a comprehensive accounting showing impacts of the interventions that may differ from what we initially anticipate. Indeed, various causal linkages and necessary conditions are needed to make sure that an actual intervention will deliver the expected food and nutrition outcomes (Figure 1.2).

FIGURE 1.2. FROM INTERVENTIONS TO OUTCOMES



The complex link between the root cause of the problem and the actual outcome of an intervention—as well as the strong sensitivity to local conditions—is a major feature of addressing issues of SDG 2 in our model. This is very different from the health literature, where randomized controlled trial (RCT) literature can link problems, interventions and impacts in a structured ways using a well-accepted methodology. When it comes to SDG 2, our simulation exercises consider the costs and benefits of a bundle of interventions in a specific environment with various forces at play. Interventions do not have a one-to-one effect on outcome variables, either in real life or in the model. Rather, interventions effect outcomes through multiple pathways and may have different effects depending on contextual variables such as policy.

It is important to make explicit that to identify the costs of interventions we need to model the *mechanism* of an intervention and not its *impact*. For instance, we need to model structurally the mechanism at stake to answer a question like "What is the impact of increasing R&D spending by $1?" and not the shortcut of "What is the impact of increasing agricultural productivity by 1%?" The latter question is much easier to answer but will not enable us to provide any cost estimates. Although the difference may be subtle, it is essential to the modeling technique and the information requirement (see Section 5). It also helps clarify why a key step is to identify (and quantify) the direct impact of the intervention, in this case the link between R&D knowledge stock in agriculture and actual farm productivity). Looking at other outcome indicators (e.g., farm income) is not relevant when defining the interventions, since the changes to the outcome will occur through responses by economic agents to intermediate variables that are explicitly tracked in the model.

We can identify three types of direct channels that have different implications from a modeling point of view:

1. Accounting channel: the interventions change some "accounting" relations, i.e., Economic agents have more or less money to spend on a set of goods for consumption or production purposes.
2. Behavioural channel: while the interventions may directly affect an economic variable with a clear first-order impact (e.g., an ad valorem subsidy decreases the price paid by consumer for good X), the change in actual consumption depends on behavioural parameters (e.g., elasticities), translated into behavioural equations of the model (e.g., first-order conditions of the model). This means that the instrument is indirectly but closely linked to the variable at stake (e.g., consumption of good X by the consumer). It may require adjusting some model parameters to mimic literature findings to guarantee a correct first-order response, but the implementation—or not—of the intervention will not change these structural parameters.
3. Technological channel. Here the direct impact will change the structural parameters of the model, either in terms of the price or quantity responses through adjustments in technology or preferences.

CATEGORIES OF INTERVENTIONS

Based on the various aspects of the SDG 2 agenda, a number of interventions could be relevant. Indeed, the long-term drivers of food and nutrition security vary widely (Laborde, Majeed, Tokgoz, & Torero, 2016) and due to the important role of income levels and poverty, any policy promoting inclusive growth affects food and nutrition security. However, to frame the debate and focus on interventions with the most direct impact on SDG 2, while simultaneously achieving SDGs 2.3 and 2.4, Ceres2030 will have a strong focus on farm-level production and agricultural value chain interventions. To organize these interventions, we can design various classification methodology:

- By proximity to the target,
- By nature of the instrument (i.e., price policies, investment policies etc.) or
- By policy domain (i.e., social, agricultural, environmental).

We will rely on this last approach, by domain of policies, since it is how many policy portfolios are organized and helps to connect our approach to actual government expenditures and ODA statistics. Bizikova et al. (2017) reviewed a large set of interventions and confirm the relevance of the framework provided in Laborde et al. (2016) Therefore, we will continue to use this classification with five broad categories (Figure 1.3):

1. Social safety nets to support poor consumers through cash transfers and food stamps
2. Farm support to poor producers to improve productivity and incomes
3. Rural development, such as infrastructure, education, storage, access to markets and value chain development
4. Enabling policies, such as legal and policy reform and building institutions
5. Nutrition, with a particular focus on stunting, wasting, anemia and exclusive breastfeeding

FIGURE 1.3. FIVE CATEGORIES OF SPENDING

CATEGORY I: SOCIAL SAFETY NETS

Support to consumers through cash transfers and food stamps

CATEGORY II: FARM SUPPORT

Helping producers through fertilizer and seed subsidies, capital investments (e.g. tractors), R&D, improved technology, extension services and better organizing

CATEGORY III: RURAL DEVELOPMENT

Infrastructure, education, storage, market access and value chains

CATEGORY IV: ENABLING POLICIES

Land reform, tax reform, trade and investment policies and institutional reform

CATEGORY V: NUTRITION

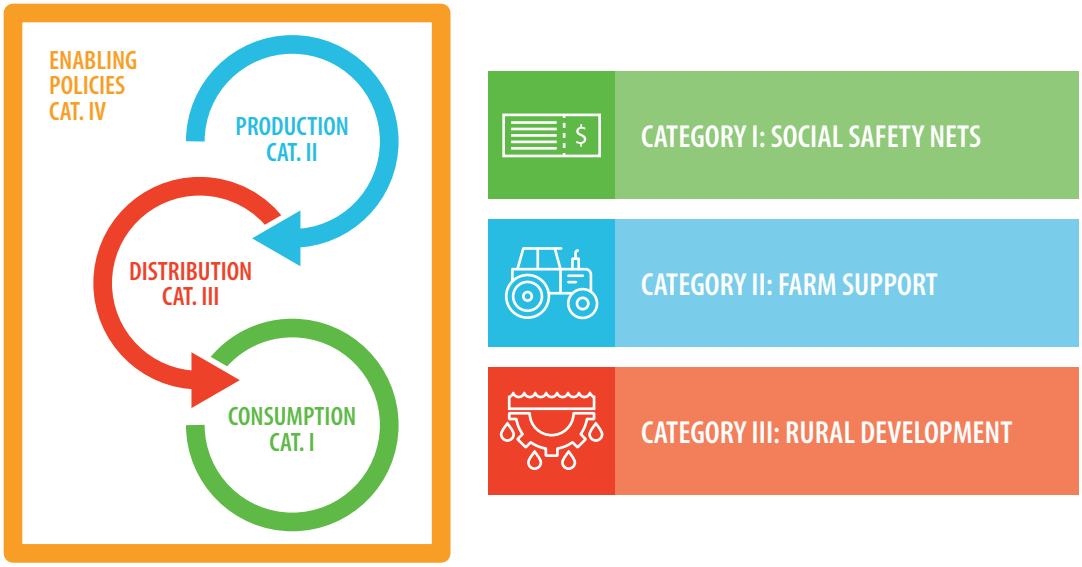
Addressing the global nutrition concerns, including stunting, exclusive breastfeeding, wasting, anemia, low birth weight and overweight

Source: Laborde et al., 2016.

This classification could be easily remapped to a food system or value chain approach with interventions taking place at the production, distribution, processing, and consumer levels (Figure 1.4). While Ceres2030 considers some aspects of Category V (nutrition), the full integration of nutrition interventions (SDG 2.2) is beyond the scope of the project, given the time and resources available, and because nutrition interventions require a scale of resources far beyond a focus on the very poor. Efforts to model and identify effective interventions to achieve SDG 2.2 are currently being undertaken by other organizations, including the World Bank, Results for Development and 1000 Days.

Therefore, we can also present our interventions as value chain interventions for sustainable income generation into various enabling environments (covered in Categories I, II, III and IV). While not directly targeted to SDG 2.3 and SDG 2.4, or even SDG 2.1, the Category IV interventions can affect the efficiency and costs of other interventions and will be part of the assessment.

FIGURE 1.4. VALUE CHAINS INTERVENTIONS FOR SUSTAINABLE INCOME GENERATION



The Appendix provides a list of interventions in this setting.

REQUIREMENTS TO MODEL AN INTERVENTION

In order to include an intervention in the model, we need to properly specify the features of the instrument in the model. The various elements directly linked to the definition (Section 2) are summarized in Figure 1.5. Three main elements that are needed include:

- Direct impact of the instrument
- Population involved in the intervention (and targeted by the instrument)
- Nature and value of the expenditures.

The notion behind the direct impact of the instrument was introduced in Section 3. To summarize, the direct impacts can be directly embedded in the instrument used either as:

i. A price wedge (subsidy or tax), changing price-based decisions in the model.

ii. A direct payment (income transfer), changing income constraint-based decisions.

iii. A modification of endowments (additional factor of production, e.g., investment in goods or land, changing the supply of a production factor for a household).

iv. A change in technology through a change of input-output coefficients in a specific production function (e.g., wheat technology used by smallholders).

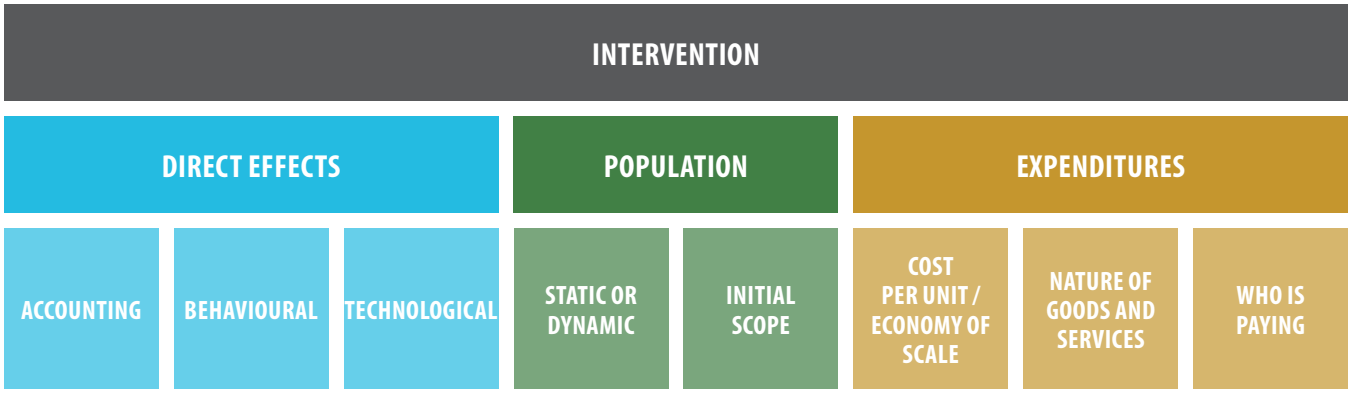
v. A wider shift in factors of production (e.g., labour, land or total factor productivity) or input (e.g., fertilizers) productivity. This category can be seen as subcases of cases iii and iv, but we keep it separated for the sake of clarity.

vi. Shifts in environmental outcome parameters when technological changes are required: for example, GHG emissions for soil emissions when new practices are introduced (e.g., no tillage) or water use by unit of outputs (e.g., drip irrigation).

While cases i to iii are straightforward to implement based on their nature (explicit variable in the model with endogenous behaviour), cases iv, v and vi requires an actual set of parameters, based on the intervention literature, to properly calibrate the direct effect. They also imply strong assumptions about the actual efficiency of an intervention in achieving its primary goal. These changes can be discrete (swapping to alternative technology) at the household or sectoral level based on a fixed or unitary cost, or continuous, with a smooth relation between spending and endowments or productivity changes (e.g., impacts of R&D spending on agricultural total factor productivity). In the former case, the endogenous size of the population included in the intervention will lead to a continuous behaviour at the aggregated level. This helps us to separate a direct discrete impact at the household level and a smooth behaviour at the macro level, leading us to the next feature of the intervention—population targeting.

In practice, it is a simple implementation issue where we need to know if the targeted population is static over time and outcomes (e.g., based on the demographic structure of the household), or dynamic over time (e.g., based on income level, crop specialization). It should be based on data available but also observable by the policy-makers to be actually relevant. For instance, we will define some safety nets based on an income level (observable) instead of nutritional status (caloric intake). The latter, while being directly linked to our target, is not an observable criterion for the implementation strategy. Indeed, while the targeting issue is key to achieve proper outcomes at a reasonable cost, we should not artificially overestimate the capacity to implement extremely precisely targeted programs. The targeting of the population can include actual conditionality criteria of some programs.

FIGURE 1.5. ELEMENTS USED TO DEFINE INTERVENTIONS IN THE MODEL



The last aspect to consider is the nature and value of the expenditures. Since we do not discuss this dimension elsewhere, we detail it in this section.

We refer here to the direct public cost of the interventions. This represents the demand side of the intervention and also represent the Keynesian, pro-growth effects, of public expenditures. These expenditures can include both investments (e.g., infrastructure), and recurrent costs (e.g., subsidies). The cost should include any potential overhead of implementation costs, but no opportunity costs of public funding since the model takes care of public account constraints and maintains public account balance through tax adjustments. By default, the public cost is allocated between the local government and international donor community based on the co-funding rule of the model[1] and is assumed homogenous across intervention. the donor share can be also defined exogenously and be specific to each intervention.

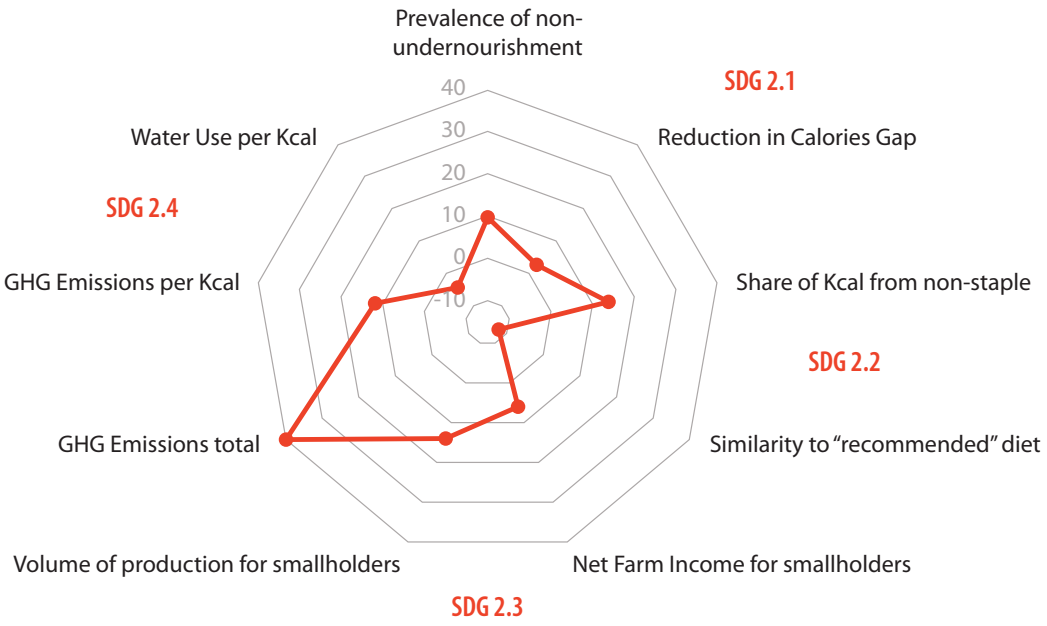
[1] Our model determines the total additional expenditures required for each country annually and the split between the country share and the donor share. To calculate the donor share, we created a rule based on average annual donor contributions from 2009 to 2013. We called this the "co-funding" rule. (Laborde et al., 2016)

The nature of the expenditures specifies on what the money is spent (or potentially collected) by the government: financial transfers/payments to economic agents (subsidies, grants) or purchase of goods and services, either private or public (for example, R&D investment is a purchase of research services). Regarding the sourcing (foreign or domestic) of these expenditures, when involving the purchases of goods and services, they follow the average sourcing in the economy (default Armington assumption used in the MIRAGRODEP CGE model) but alternative procurement rules can be specified. Considering on which goods and services the money is spent, and the necessary factors to produce them, is an important general equilibrium constraint to consider, especially when large investments, in a short period of time, by 2030, are expected to take place in a small economy. It can lead to adverse crowding out affects through competition for scarce factors of productions (e.g., engineers) or real exchange rate appreciation (large capital inflows).

Finally, the actual cost information is essential. While financial transfers are straightforward, the amount of spending on goods and services requires more information and cost specification. The quantity of goods and services needed to deliver the intervention can be expressed in per unit of intervention (investment per hectare of cropland, cost per farmer) assuming linear (default option) or non-linear scaling up costs (economies or diseconomies of scale). Since we convert the cost information in base price, the endogenous prices change in the model will also impact the costing exercise.

While this information profile for each intervention is translated into the model, we can use the model to move from a direct impact on a specific lever (e.g., extension services on worker productivity) to their mediated impacts through model mechanisms on a set of indicators (see Figure 1.6). This individual assessment will describe the actual impact of individual interventions in the model and will be a simple way to show how the model reacts, along with expected impacts. Of course, these results are inherently country-specific. The consolidated impacts of the various interventions when simulated together in the model will generate different results due to their interactive effects, and the net impacts will be different from a simple weighted addition of individual profiles

FIGURE 1.6. EXAMPLE OF THE IMPACT OF A FERTILIZER SUBSIDY INTERVENTION ON THE SDG 2 SUB-TARGETS (ILLUSTRATIVE EXAMPLE)



Combining these outcome profiles with the features of an intervention (name, problem targeted, population, direct effects and nature/value of expenditures) allows us to generate an intervention ID card as displayed in Figure 1.7.

FIGURE 1.7. EXAMPLE OF AN INTERVENTION ID CARD OF THE IMPACT OF A FERTILIZER SUBSIDY INTERVENTION IN THE MODEL

NAME: Fertilizer subsidies

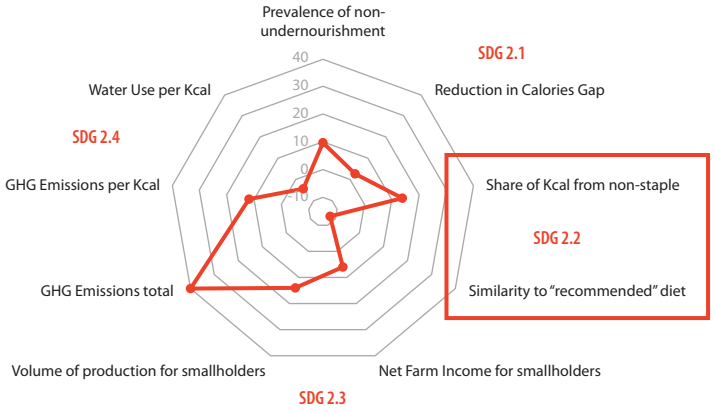
EXISTING POLICIES:
India, Ghana, Malawi

PROBLEM TO SOLVE:
High fertilizer cost for smallholders
Credit constraint for smallholders

TARGETED GROUP:
Smallholders

CURRENT EXPENDITURES:
Domestic: [ ] bn USD
ODA: [ ] bn USD

REFERENCES:
[...]
[...]
[...]



Medium impact of $1 million spending

INTERVENTIONS: LINKAGES BETWEEN THE EVIDENCE REVIEW PROCESS AND THE COST ESTIMATES IN THE ECONOMIC MODEL

Studying and costing interventions is a primary mission of Ceres2030. As discussed above, the list of interventions relevant for SDG 2 covers a wide range of topics, interventions and instruments (see Section 4). However, not all relevant interventions can be included in the model. The requirements listed in Section 5 may lead to selection biases, also known as the "streetlight" effect, ("Streetlight Effect," n.d.) implying that we will look for interventions that will fit the model framework and can be included in the model. The interaction with the review to identify evidence for interventions' effectiveness may provide instruments beyond our narrow model-centred view. However, we need to be cognizant that not all interventions identified in the literature can be included in the model.

In order to classify the potential interventions into groups that can (or cannot) be modelled, we use a tiered approach that echoes work done by the UN in the classification of SDG indicators (Inter-Agency and Expert Group on SDG Indicators, 2018). We therefore have three groups:

- Tier 1: Interventions will be modeled in Ceres2030. Data/parameters and modeling technique available.
- Tier 2: Interventions could be modeled in Ceres2030. Not enough data/parameters but modeling techniques available.
- Tier 3: Interventions will not be modeled in Ceres2030. Not enough data/parameters, or the modeling techniques of Ceres2030 are not suitable or adapted to the data/parameters.

The list of interventions in the Appendix belongs to the Tier 1 category. Tier 2 category interventions include fertilizer quality issues, water-saving technologies, energy saving technologies, improved management practices and climate-resilient technologies. Tier 3 covers insurance and risk management, institutional reform along the value chains and intra-household decision making. Other interventions, like those to address land degradation or biodiversity, could be considered as Tier 2, assuming that proper costs and impacts on productivity are available.

Similarly, the evidence review, as the other significant activity in the Ceres2030 project, will focus on SDG 2.3 and SDG 2.4 interventions. Therefore, we expect a partial overlap between the intervention space that will be included in the model and that covered by the evidence review process.

Still, the goal of Ceres2030 is to use the evidence-gathering process to fine-tune the mechanics of each model intervention (nature of and solution to a problem), the choice of parameters for the direct effects, and expand the scope of interventions that can actually be modeled (Tier 2 above).

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APPENDIX

#	INTERVENTION	TARGETING / COVERAGE	STRUCTURAL EFFECTS	NATURE OF EXPENDITURE
I.1	Food subsidy	Food items for household with income below the poverty line ($1.95 PPP)	Food cost reduction per capita through an endogenous homogenous subsidy rate at the household level	Cost of the public subsidies
II.1	Investment subsidy	All agricultural sectors, all producers	Ad volumen subsidy to domestic investments	Cost of the public subsidies
II.2	Fertilizer subsidy	Crop sectors, all producers	Ad valorem subsidy on chemical inputs consumed by agricultural sectors and yield effects captured changes in the production function.	Cost of the public subsidies
II.3	Capital endowment	All agricultural sectors, only smallholders	Allocation of physical capital (e.g., machinery, livestock) given to targeted households	Investment goods bought through public expenditures
II.4	Production subsidy	All staple crops sectors, all producers	Ad valorem production subsidy applied to the farm gate price	Cost of the public subsidies
II.5	R&D NARS	All agricultural sectors, all producers	Agricultural TFP is increased based on the stock evolution of NARS R&D.	Additional NARS expenditures spent on public services
II.6	R&D CGIAR	All agricultural sectors, all producers Affects all Africa at once	Agricultural TFP is increased based on the stock evolution of CGIAR R&D.	Additional CGIAR expenditures spent on public services
II.7	Extension Services	Agricultural sectors, smallholders	Efficiency of production factors, i.e., difference between physical and efficient units, for smallholders	Public services expenditures
III.1	Storage-Post Harvest losses	Crop sectors, smallholders	Efficiency of production factors for smallholders and reduction of an initial shadow tax on factors of production	Aggregated capital goods for expenditures based on unit costs by type of investments
III.2	Rural Infrastructure (irrigation)	Crop sectors, all producers	Agricultural TFP is increased based on the growth of irrigated area.	
III.3	Rural Infrastructure (road)	Agricultural sectors, all producers	Agricultural TFP is increased based on the growth of road infrastructure.	

Ceres2030
Sustainable Solutions to End Hunger

ABOUT CERES2030

Ceres2030 brings together three institutions who share a common vision: a world without hunger, where small-scale producers enjoy greater agricultural incomes and productivity, in a way that supports sustainable food systems. Our mission is to provide the donor community with a menu of policy options for directing their investments, backed by the best available evidence and economic models.

The partnership brings together Cornell University, the International Food Policy Research Institute (IFPRI) and the International Institute for Sustainable Development (IISD). Funding support comes from Germany's Federal Ministry of Economic Cooperation and Development (BMZ) and the Bill & Melinda Gates Foundation (BMGF).

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IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

IISD International Institute for Sustainable Development