



Method Paper

The Crop Science Sustainability Challenge for Smallholder Farmers

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Introduction

Smallholder Farmers play a pivotal role in ensuring food security in low- and middle-income countries. In Asia and Sub-Saharan Africa, for example, smallholder farmers – many of them are women – provide more than half of the food supplyⁱ. But many still struggle to make a living as they are highly vulnerable to extreme weather conditions and crop losses. They often lack access to the solutions available.

As a global leader in agriculture, Bayer wants to help improve local food supply and reduce poverty in rural communities. The Crop Science Sustainability Challenge is to support 100 million smallholder farmers in low- and middle-income countries by 2030. Our progress is monitored with a Key Performance Indicator (KPI), which is defined as **‘Number of smallholder farmers in low- and middle-income countries (LMICs) supported by products, services and partnerships’**.

Since the KPI is defined specifically for Bayer’s Crop Science business, we cannot rely on standardized measuring methods. We defined a proprietary methodology based on available and reliable data and conservative assumptions.

This document aims to provide a general description of the methodology applied to calculate the respective KPI, as well as the different data sources used.

Definitions

In the following table important terms are defined.

Key terms	Definition
Smallholder farmer	A farmer who farms crops on less than 10 ha (FAO ⁱⁱ).
Low- and middle-income countries (LMICs)	All countries included in the World Bank list ⁱⁱⁱ of countries with low-income, lower middle-income, and upper middle-income economies as per 1 July 2019 are considered to be low- and middle-income countries.
Products & services	Commercial products e.g., seeds, traits and crop protection products as well as services such as trainings, advisory services or digital solutions.
Using Bayer products & services	Any smallholder in LMICs using at least one product or service provided by Bayer in the reporting period.
Average Bayer farmer spend	Average expenditure of all Bayer farmers per treated ha in a specific country per main crop group and product.
Product lines	Crop protection (Herbicides, Fungicides, Insecticides), Seed Growth, Corn/Rice/Vegetable seeds, Cotton Traits
Country-crop combination	Combination of different main crop groups and countries.
Crop main group	There are 14 crop main groups defined at Bayer, such as cereals, corn/maize, rice etc. The crop main groups overarch various crops. For example, the crop main group of cereals includes the crops wheat, barley etc.

Methodology

For this challenge, all Crop Science business units in the low- and middle-income countries (LMICs) have been taken into scope.

There are two channels contributing to the target of supporting 100 million smallholder farmers:

- commercial channel, which provides smallholder farmers with Bayer products and services such as trainings, advisory services or digital solutions via local commercial channels in a country
- partnership channel (non-commercial), in which we support smallholder farmers together with partners.

In the KPI derivation performed in 2019 and 2020, we have only considered data from the commercial channel. In 2021, Bayer established the partnership channel and its contribution to the target is incorporated into the calculation of the CS KPI.

Commercial Channel

The calculation process of the commercial channel is performed in four steps to obtain the number of smallholder farmers in LMICs supported by products and services.



Step 1: Collect relevant raw data

Purpose	To collect relevant raw data for the calculation of the total number of farmers supported by Bayer.
Assumption	Smallholder farmers buy specific products.
Process	Sales data (denominated in Euro terms) as well as crop main group and country specific raw data for each product line (i.e. herbicides, fungicides, insecticides, seeds, traits, vector control) are collected from different data sources (see below in the section Data Sources). Only data about relevant crop main groups for smallholder farmers in LMICs are considered.
Output	<ul style="list-style-type: none"> • Sales and volume data specific to country-crop combination and product line. • Crop main group and country specific data, e.g., on seasons per crop, seeding rates, average farm sizes, average farmer spend per ha in LMICs.

Step 2: Calculate total number of farmers supported

Purpose	To derive the total number of farmers supported per product line.
Process	Two major calculation approaches are considered: The number of farmers supported by the crop protection and vegetable seeds product lines are calculated by a sales approach with the following formula:

$$\text{Number of farmers} = \frac{\text{Bayer Sales [EUR]}}{\text{Avg. Bayer farmer spend} \left[\frac{\text{EUR}}{\text{ha}} \right] \times \text{Avg. farm size[ha]}}$$

For the product lines of corn and rice seeds, seed growth* and traits the calculation follows a volume approach with the following formula:

$$\text{Number of farmers} = \frac{\text{Bayer Sales Volume [kg]}}{\text{Avg. Bayer farmer seeding rate} \left[\frac{\text{kg}}{\text{ha}} \right] \times \# \text{ Seasons} \times \text{Avg. farm size[ha]}}$$

*Seed growth calculation considers sales volumes in liters and a dose rate parameter.

Output Total number of farmers supported per crop main group and product line by Bayer in each LMICs

Step 3: Correct for overlaps across product lines

Purpose To correct for double counting of farmers, using more than one product line.

Assumption One farmer may purchase more than one Bayer product within a year. For example, farmers who buy seeds from Bayer may also buy crop protection products from Bayer.

Process Considering that it is difficult to calculate the different possible combination uses of the products, we follow the maximum reach principle: Within each crop main group per country, we identify the product line with the largest number of farmers. Only this number is further used, and other product line values are ignored. For instance, considering the country Indonesia and the crop main group of corn/maize, the number of farmers supported will be calculated for all product lines. If the maximum number of farmers is supported in the product line seed, then the number of Bayer farmers supported for seed will be taken, and the number of farmers supported through herbicides, fungicides, etc. will be ignored. The same procedure will be carried out for other crop main groups in Indonesia, such as rice, vegetables, etc.

Output Number of unique farmers supported in LMICs per crop main group.

Step 4: Calculate final number of smallholders supported

Purpose To calculate the number of smallholder farmers in LMICs supported by Bayer.

Process Data for smallholder shares for each country-crop combination are obtained from public census sources or, if not available, from Bayer's country representatives. This step is necessary because the number of farmers obtained in step 3 includes not only smallholder farmers, but also farmers with bigger farms.

The final KPI is derived by multiplying the total number of unique farmers supported from step 3 with the smallholder share for each country-crop combination.

Output Number of smallholder farmers in LMICs supported by Bayer per crop main group.

Data Sources

The following sources are used in our KPI derivation process.

Source	Description
Public Census	Publicly available census data provided by governments or other official institutions, for example The Food and Agriculture Organization of the United Nations provides information about smallholder farmers in step 4.
Private Panel / Survey	Dedicated surveys and panel data by private third parties are used to obtain specific data points, such as average farm size, crop cycles, smallholder share etc., in step 1 and step 4.
SAP	SAP is the Enterprise Resource Process System used by Bayer. Data is extracted for sales and volume data in step 1.
World Bank	A list of low- and middle-income and high-income countries as per 1 July 2019 is obtained from this international financial institution, which is used to define the country scope in step 1.
Expert Opinion	In case none of the above-mentioned data sources holds the information needed or does not reflect properly the business perspective, an estimation of value is provided by a Bayer internal expert. Logic (e.g. calculation) is outlined and checked prior to any inclusion.

Partnership Channel

Our non-commercial partners must fulfill criteria of inclusion set by Bayer in order to be considered in the 100 million challenge. These include that the partner follows the same KPI definitions, and a Due Diligence Process has been in place. All partners agree to provide Bayer full insights into the data trail, calculation rules and all control processes.

Step 1: Gathering data from our Partners

Step 2: Correct overlaps with commercial channel

For each partnership, the smallholder farmer reach is derived based on smallholder farmer reach information provided by the partner and an overlap factor that corrects the partnership's reach for any potential overlap with Bayer's commercial channel.

Total KPI calculation

The number of smallholder farmers supported is calculated by summing up the number of smallholder farmers reached through commercial products and partnerships.

Step 1: Calculation reach of commercial sub-component

Step 2: Calculation reach of partnership sub-component

Step 3: Calculation of KPI

Outlook

As described, the approach adopted for the year 2023 reflects commercial and partnership channels. For the time being, the reach through services, such as trainings, advisory, or digital services, completely overlaps with the reach of the established channels. We aim to extend service offerings and digital business models for smallholder farmers. As this happens, we will include the methodology in this paper accordingly.

ⁱ <http://www.fao.org/3/ar588e/ar588e.pdf>

ⁱⁱ <http://www.fao.org/3/a-i6858e.pdf>

ⁱⁱⁱ <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>