CoSAI
Commission on Sustainable Agriculture Intensification

Funding Agricultural Innovation for the Global South: Does it Promote Sustainable Agricultural Intensification?

Methodology Report

About this document

This document illustrates in detail the research and modelling methodology followed to estimate funding on innovation in agriculture, innovation in SAI, and break-down by various tags and conducted by Dalberg Advisors Asia. This report aims to serve as a guide to replicating the research and analysis for future studies.

The document covers the following five sections:

This methodology document accompanies the report: *Funding Agricultural Innovation for the Global South: Does it Promote Sustainable Agricultural Intensification?*

The **full report**, **case studies** and **associated data files** can be accessed on the CoSAI website: **https://wle.cgiar.org/cosai/innovation-investment-study**

See Annex 1 for descriptions of the data files.

1. Summary

The section below provides a summary of the methodology followed to estimate agricultural innovation funding and SAI innovation funding in the Global South across various funding sources. For more details on assumptions taken, sources used, and experts consulted, please refer to the following sections of this document.

1.1 Overall research and analysis approach

The study adopted a 3-pronged approach. These 3 approaches were used with different weightages across all funding sources i.e., private companies, institutional investors, governments, bilateral organizations, multilateral organizations, and international philanthropies depending on the availability of information on each.

Secondary research
Collation of and building on secondary sources to investigate the state funding in innovation, including market research studies, government budget documents, annual reports, academic papers, public databases, as well as country-level databases to ascertain funding towards agriculture, agricultural innovation, SAI and other tags such as funding recipients, funding instruments, and so on.

Interviews with experts
In-depth, semi-structured interviews with over 40 stakeholders such as executives in large agribusinesses, bilateral and multilateral agencies, agricultural scientists, think tanks, NGOs, international philanthropies, PE/VC funds, and other country-level agricultural experts.

Modelling
Extrapolation of trends in available and existing research to fill gaps where data is not available. This was done using assumptions and proxy data points that were validated by agricultural and modelling experts within Dalberg Advisors and external experts who have done similar exercises in the past to better understand data scarce environments.

1.2 Research and analysis methodology by each funding source

While all the above three tools were used, the specific approach to estimating agriculture varied by each funding source.
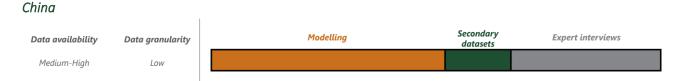
Governments (domestic)

Data availability	Data granularity	Modelling	Secondary datasets	Expert interviews
High	Low			

We conducted a deep dive study on four countries i.e., China, India, Brazil, and Kenya representing ~50% of agricultural government funding in the Global South and extrapolated these findings to the rest of the Global South. We selected four of the largest agricultural funders in the Global South and analyzed their agriculture related budgets to estimate the overall agricultural funding by governments. We then analyzed programs within these the budget line items to ascertain extent of 'innovation focus' based on the definition of innovation mentioned in Chapter 1. Overall agricultural funding data availability in most cases was high, given that most governments publish their agriculture and related budgets, however granularity of information was low, for example in some countries like Brazil, state level budgets are not easily available and hence was modelled out. Similarly, for China, there was limited granularity or project level information available to accurately ascertain where government funds were going. In these cases, assumptions around innovation funding and value chain splits were made based on proxy data points and then validated through expert interviews.

Due to poor data granularity across all countries except India, we assessed SAI related funding only for India. Brazil, Kenya, and China's agricultural budgets had limited granularity available to tag sustainability intentions for programs and projects. India on the other hand had detailed budgets, as well as websites for each agriculture related program which made it easier to tag funding amounts based on sustainability intentions. We did this by reading through mission statements and program descriptions on websites.

India

Data availability	Data granularity	Modelling	Secondary datasets	Expert interviews
High	Medium-High			

Given availability of granular data in Indian budget documents as well as government websites, we used government published budget data (https://www.indiabudget.gov.in/) and secondary research to inform our analysis. This was done by manually going through each agriculture related budget line item and conducting detailed research on programs under the budget line item to assess funding flows by each required tag. For example, this website[1] was used to tag flows towards the National Livestock Mission by the Government of India. Experts were used to validate findings.

China

Data availability	Data granularity	Modelling	Secondary datasets	Expert interviews
Medium-High	Low			

China published annual data on funding on two main sources related to agriculture – one, the National General Public Budget and two, the Ministry of Science & Technology Statistical Yearbooks. Both these sources provided details on agricultural funding but limited granularity that made it impossible to understand whether the funding was in agricultural innovation or in specific innovation areas. China's funding in innovation was then estimated by analyzing one year's budget data and conducting secondary research on each line item to ascertain whether the funding was flowing towards innovation or not. China's National General Public Budgets as well as final innovation values were also

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[1] India – Department of Animal Husbandry and Dairy, "National Livestock Mission"

discussed with experts to allocate assumptions around innovation funding as well as validate overall innovation funding values resulting from the model.

Brazil

Data availability	Data granularity	Modelling	Secondary datasets	Expert interviews
Medium-High	Low - Medium			

The Brazil government publishes its agricultural and overall funding on their government run transparency portal (http://www.portaltransparencia.gov.br/). This website was used as the primary source for agricultural funding by the federal government. Agricultural funding by state governments were extrapolated using a similar transparency portal available for the state of Minas Gerais in Brazil and FAO.Stat data on central and general funding by the Brazil government. Agricultural funding was tagged as innovation based on analysis of the Brazil government's 2018 funding by researching websites and programs for each budget line item. Where alternate data was available, for example for EMBRAPA, this was used to assess innovation flows and splits. Assumptions made through an analysis of 2018 budgets and EMBRAPA data were validated through agricultural experts in Brazil.

Kenya

Data availability	Data granularity	Modelling	Secondary datasets	Expert interviews
High	Low - Medium			

The Kenyan government's funding in agricultural programs was available for recent years i.e., 2018 and 2019. Data for these two years was extrapolated to the remaining years using government funding trends on the FAO-MAFAP database. Assumptions on percentage of innovation flows, value chain splits, and other splits were made using analysis of the Kenyan program budget data for 2018 and 2019 and then superimposed on the overall estimated agricultural funding data for 2010-2017.

Extrapolation to the rest of the Global South

Finally, findings from the four countries were extrapolated to calculate innovation funding in the rest of the Global South. This extrapolation was conducted separately for R&D related innovation funding and non-R&D related innovation funding.

1. **Extrapolating R&D funding|** We anchored extrapolations of R&D funding on the ASTI database.

   a) For countries where ASTI data was available, we used the R&D funding for that country.

   b) Where ASTI data was missing, we used regional averages on % of GDP spent on agri-R&D (sourced from Pardey et al. that also uses ASTI data to calculate these averages).

   c) Where certain years' ASTI data was missing, we used an average of % of GDP spent on agri-R&D for years where data was available and multiplied that with the agri value added data for that year.

   d) Where data on agricultural value added was missing, we filled gaps by multiplying the sub-regions ag value added per sq km area into the area of the country where data is

missing. Assuming the regions have common geographical characteristics, and over and above this, ag- value added was corelated with the overall area available.

2. **Extrapolating non-R&D innovation funding |** We extrapolated non-R&D funding by assigning countries into three typologies based on their R&D/Agricultural GDP funding as calculated in (1.) above. The three typologies were as follows –

   a) Research heavy countries: These had an R&D to non-R&D innovation funding ratio similar to Brazil.

   b) Programmatic funders: These have an R&D to non-R&D innovation funding ratio similar to Kenya.

   c) Balanced spenders: These have an R&D to non-R&D innovation funding ratio similar to India.

While conducting the above extrapolation, we noticed that the size of the agricultural economy may make a difference to the typology. For example, a large country may have lesser R&D funding/agricultural GDP but may not be a programmatic funder. These adjustments were made by assigning each country a size tag based on the size of the agricultural economy and adjusting their typology conditions using a multiplier.

Split of innovation related funding by value-chains, innovation area, etc. was done using proportions resulting from the analysis of the four selected countries.

Private corporations

Data availability	Data granularity	*Modelling*	*Secondary datasets*	*Expert interviews*
Low	*Low - Medium*			

Funding by private corporations were estimated by selecting representative companies in each agricultural sub-category and extrapolating innovation funding to the rest of the category. Private company funding in agriculture was first separated into 8 categories – Agriculture Machinery, Fertilizers, Seeds and Pesticides, Agriculture commodities (processing), Animal Genetics, Animal Health, Animal Nutrition, Meat Processors, Dairy Processors, and Seafood Processing. Representative companies were selected in each of these categories (See Table 1. List of companies researched below) based on their size and data availability and analyzed to understand the agricultural innovation funding in each category. The companies analyzed include the following –

Table 1. List of companies researched.

Category	Company Name
Crops & Pesticides	Bayer AG
	Syngenta
	Monsanto[2]
Farm Machinery	John Deere
	Mahindra
	Jain Irrigation
Fertilizers	Yara International
	Mosaic
Animal Genetics	Genus PLC
	NeoGen
Meat Processing	Tyson Foods
	BRF
Commodity specific processing operations (where core)	Archer Daniels Midland
	Bunge
Animal Health	Bayer Animal health
	BIV
	Zoetis
Animal Nutrition	Bluestar Adisseo
	Nutreco
Seafood Processing	Nippon Suisan Kaisha
	Thai Union

R&D and innovation related marketing funding for each representative company were estimated using annual reports and expert interviews. While R&D funding in most cases is published in annual reports of the selected publicly listed companies, innovation related marketing funding was estimated using proxy data points in the annual reports and expert interviews. Further, the Global South share, and 'agricultural production' share of R&D funding was estimated using proxies such as sales splits.

Innovation funding for the sampled companies, were extrapolated to the rest of the category using multipliers that adjusted for smaller companies having different R&D intensity ratios from the larger sampled companies. Acknowledging the strong likelihood that smaller companies in the categories mentioned above will have different R&D intensity ratios than the larger sampled companies where data was available, we used multipliers that adjust for this difference while extrapolating R&D intensity ratios to the revenue of the categories. These multipliers were calculated using the variation of R&D intensity ratios in the 2020 EU Industrial R&D Investment Scoreboard which has 2500 companies, their R&D funding and their intensity ratios. We first mapped categories in the database that were closest to the agri-business categories and added companies to categories as appropriate (for example, Bayer was tagged as a pharma and biotechnology company but also plays a huge role in

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[2] In 2018 Bayer AG acquired Monsanto. Hence, from 2018 onwards this report does not consider Monsanto's R&D funding since they were included in Bayer's reported financials

fertilizers and hence was also tagged under chemicals while analyzing the R&D intensity ratio spread for the fertilizer category). We then assessed R&D intensity ratios for the top 20% companies and the bottom 80% companies and used the resulting multiplier to calculate R&D ratios for the remaining category.

M, multiplier = (R&D ratio for 100% of companies)/ (R&D ratio for top 20% of companies, by sales)

R&D of extrapolated share of agricultural category = [(R&D of sample companies/Industry share of sampled companies) *M]

Finally, based on the innovation type being funded, sustainability domains mapped to each innovation type under a category. For example, within crops and pesticides companies, innovation funding was related to either biologicals, seed development, pesticides, or precision agriculture. Each of these were assigned a tag around sustainability based on information provided in the annual reports of represented companies.

PE/VC investors

Data availability	Data granularity	Modelling	Secondary datasets	Expert interviews
High	Medium			

We used a bottom-up and top-down approach to analyze institutional funding in agricultural innovation. Since there is no single database that provides a comprehensive view on funding in agribusiness startups, the bottom-up analysis was done on data from 'Tracxn' and trends analyzed on funding in agricultural startups. These trends were extrapolated to the top-down funding value estimated sourced from other secondary sources such as AgFunder (for VC funding) and other market research organizations such as McKinsey Global Private Markets Review 2019. Assumptions around percentage of overall VC and PE funding flowing towards agriculture and the Global South were made proxies available on news articles and other research documents.

Bilateral and multilateral agencies

Data availability	Data granularity	Modelling	Secondary datasets	Expert interviews
High	Medium			

Bilateral and multilateral funding data was sourced from OECD.Stat, and analyzed using existing descriptions, columns, and an automated word crawl code. For bilateral, multilateral, and philanthropic funding, the study anchored on funding data collated by OECD.Stat. This data was first triangulated with other sources such as USAID annual reports and BMGF grants database and then analyzed using the existing columns on 'FinanceType Name', 'Recipient Name', 'Purpose Name', and 'Long Description'. The long description values were read using a 'word search code' that searched the description for specific key words and then accordingly tagged it into a specific innovation type and sustainability domain. For example, any funding with a description mentioning 'climate change', 'deforestation', or 'soil conservation' (amongst other words), was tagged as 'intended to be environmentally sustainable'. (Full sets of tagging terms are included in the Methods Paper.) The findings from this analysis were then calibrated using a sample set of 100 projects that were manually tagged to make sure that there was limited error in the analysis.

1.3 Validation methodology

The outputs, trends, and assumptions were validated using two broad methods –

1. **Other available research on agricultural innovation funding:** We used existing reports and analysis on innovation funding to see whether trends in our analysis broadly align and mark out areas where trends different from existing research. Examples of data sources (non-exhaustive) used for validation include the following

    a) ASTI Network. n.d. "ASTI Database." https://www.asti.cgiar.org/network

    b) Dehmer, Steven P., Philip G. Pardey, Jason M. Beddow, and Yuan Chai. 2019. "Reshuffling the Global R&D Deck, 1980-2050." *PLOS ONE* 14 (3). https://doi.org/10.1371/journal.pone.0213801.

    c) Pardey, Philip G., Connie Chan-Kang, Steven P. Dehmer, and Jason Beddow. 2016. "Agricultural R&D Is on the Move." *Nature* 537 (7620): 301–3. htttps://doi.org/10.1038/537301a.

    d) FAO. n.d. "FAOSTAT Database." http://www.fao.org/faostat/en/#data.

    e) IFPRI, "SPEED Database"

    f) Fuglie, Keith. 2016. "The Growing Role of the Private Sector in Agricultural Research and Development World-Wide." Global Food Security 10: 29–38.

    g) World Intellectual Property Organization, "Global Innovation Index", 2020

    h) UNCTAD, SDG Investment Trends Monitor, 2020

    i) IVC Association, "PE/VC Agenda India Trend Book", 2020

    j) Graff, Gregory D., Felipe de Figueiredo Silva, and David Zilberman. 2020. "Venture Capital and the Transformation of Pandrivate R&D for Agriculture." In Economics of Research and Innovation in Agriculture. University of Chicago Press. https://www.nber.org/system/files/chapters/ c14420/c14420.pdf.

    k) Biovision. 2020. "Money Flows Report: What Is Holding Back Investment in Agroecological Research for Africa?" http://www.ipes-food.org/_img/upload/files/Money%20Flows_ Full%20report.pdf.

2. **Interviews:** In most cases, the research conducted in this report was new and difficult to validate through existing reports and databases. Hence, we consulted various experts across funding sources and walked them through our final outputs and assumptions to test overall validity

2. Detailed Methodology

This section provides details on the methodology used to estimate overall innovation and innovation in SAI related funding in the Global South. The aim here is to make sure that the methodology used in the 2021 version of this report can be replicated in the future.

The estimation of funding was done by conducting a deep dive into the overall value of the five main funding sources:

1. Governments

2. Private Companies

3. PE/VC

4. Philanthropies

5. Bilateral/Multilateral Agencies

Each of these funding sources were analyzed separately. Data was collected for each funding source, compiled, triangulated, and validated. Finally, any overlaps between funding sources were adjusted to come up with the final agricultural innovation and innovation in SAI funding for the Global South.

Before we deep dive into the methodology for each funding source, please also note what was considered as 'Innovation', 'Global South', and 'Agriculture' for the purposes of this study.

1. **Innovation:** Any funding that aims to drive creation or adoption of new technologies or practices in agriculture. This includes i. Basic Science and Research funding, ii. New Product or Service Development, iii. Process Innovations, iv. Marketing or Behavioural Innovations, v. Business Model Innovations, vi. Systems Innovation, vii. Policy Innovation, viii. Knowledge or Educational Innovations, ix. Financial Innovation

2. **Global South:** The term Global South as used here includes Asia (except for Japan, Singapore, and South Korea), Central America, South America, Mexico, Africa, and the Middle East (except for Israel). This includes Caribbean nations, South Africa, and other countries that may not be considered as part of the Global South in other studies but come under our definition mentioned above.

3. **Agriculture:** The study includes all funding within the on-farm food value-chain and any off-farm processes that are essential to the production of a consumable food product. Given that the aim of this report is to understand the Global South's preparedness for a sustainable and food secure future, we have limited the scope to funding that can produce consumable food. Hence, this excludes three types of funding - one, retail expenditure such as restaurants and online retail marketplaces: two, non-essential value-added funding such milk flavoring, manufacturing of potato chips, and three, non-food agricultural funding such as funding in cannabis or cotton production systems. Wherever any of these categories are mentioned under agriculture, they have been excluded from our analysis.

In addition to the detailed approach laid out below, all values have been adjusted to reflect constant 2019 prices as well as constant 2019 exchange rates. This has been done to exclude fluctuation in prices and exchange rates to affect overall funding.

Conversion of units to - USD in constant 2019 prices

$V_{USD(C19)}$ = USD value in 2019 constant prices

$V_{USD(Y)}$ = USD value in current prices of year 'Y'

GDP Deflator = GDP deflator for year 'Y' with base year 2019

$V_{USD(C19)} = V_{USD(X)}/GDPDeflatorX$

Conversion of units to - USD in constant 2019 exchange rate

$V_{USD (C10, X19)}$ = USD value in 2019 constant prices and 2019 exchange rate

$V_{USD (C19, X19)} = (V_{USD(C19)} /(Exchange\ rate\ for\ current\ year))*(Exchange\ rate\ for\ 2019)$

Governments

Approach

Given there are 180+ countries in the Global South, we first assessed the number of countries that contribute to 80%+ of overall government agricultural funding. Using **FAO.Stat and IFPRI – SPEED** data, we rank ordered countries based on their government funding in agriculture using this ranking as a proxy for ranking of innovation funding. Data between 2014 – 2017 showed that China contributed to ~80% of government funding in agriculture in the Global South[3] and **China, India, and Brazil cumulatively contributed to ~90% of government funding in the Global South**. Hence, we selected these three countries as well as Kenya (as a country from the African region where data will be sufficiently available for our estimations) to arrive at an understanding of the innovation and SAI funding for a majority of the Global South. Hence, the government funding estimation was divided into 5 separate sections of research:

1. China
2. Brazil
3. India
4. Kenya
5. Other Global South (extrapolated)

Country-wise methodology

India

We used a three-step process to analyze data on India:

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[3] This analysis was done on the 157 countries in the FAO.Stat database where agricultural funding data was available.

1. **Identify agriculture related government ministries and departments**.

2. **Collect data** and information on government funding for each ministry/department.

3. **Tag each relevant line item** based across various parameters based on available information on government websites including SAI tags.

1. Identifying ministries/departments

We first went through a list of ministries in the Indian government and identified the following which had some funding related to agriculture or agricultural innovation:

- Ministry of Science & Technology
- Ministry of Agriculture and Farmers Welfare
- Ministry of Agriculture
- Ministry of Finance
- Ministry of Rural Development
- Ministry of Fisheries, Animal Husbandry and Dairying
- Ministry of Food Processing Industries
- Ministry of Tribal Affairs
- Ministry of Commerce and Industry
- Ministry of Chemicals & Fertilizers
- Ministry of Panchayati Raj
- State Governments (agricultural departments)

2. Collecting data

For each of the above ministries/departments, we collected line item level data from budget documents published by the union government on https://www.indiabudget.gov.in/.

3. Tagging data

Finally, we used available information on each line item as published in the budget document as well as individual websites and secondary sources to tag a line item. List of tags assigned:

1. Percentage of funding in 'agricultural production': Any one of the following values were assigned – 0%, 10%, 15%, 50%, 80%, or 100% based on either available data on the website or a subjective read of the websites focus on innovation.

2. Percentage of funding in 'innovation': Any one of the following values were assigned – 0%, 20%, or 100% based on either available data on the website or a subjective read of the websites focus on innovation. Where there was only a partial indication of innovation related funding, this was tagged as '20% whereas in cases where innovation focus was clear, it was tagged as 100% or 0%.

3. Innovation layer (across three levels): Based on available indications on the website.

4. Value-chain: Based on available indications on the website.

5. Funding source (org): Assumed to be the Government.

6. Funding Recipient (org): Based on available indications on the website.

7. <u>Funding target country</u>: Based on available indications on the website.

8. <u>Funding instrument</u>: Based on available indications on the website.

9. <u>Innovation stage</u>: Based on available indications on the website.

10. <u>Innovation Area</u>: Based on available indications on the website.

11. <u>Spatial scale</u>: Based on available indications on the website.

12. <u>Holding size</u>: Based on available indications on the website.

13. <u>USAID Main domain</u>: Based on available indications on the website.

14. <u>USAID Sub-domain</u>: Based on available indications on the website.

Table 2. Examples of websites used to assess funding.

Funding type	Source website
Funding by the Department of Biotechnology:	https://dbtepromis.nic.in/bindcurrentyear.aspx https://www.indiabudget.gov.in/doc/eb/sbe88.pdf
Funding on Rashtriya Krishi Vikas Yojana (RKVY)	https://rkvy.nic.in/ https://rkvy.nic.in/static/download/pdf/RKVY_14th_Fin._Comm.pdf
Horticulture Mission for Northeast and Himalayan States	https://midh.gov.in/tmnehs/

China

For China, due to the lack of information on budget line items, we used high-level assumptions to tag China's government funding in agriculture across the 14 points mentioned above.

1. Identifying data sources on China's agricultural funding

We first identified the 'agriculture' section of China's National General Public Budget to provide all agriculture related funding for the country across ministries (i.e., Ministry of Finance, Ministry of Agriculture, and so on) and across levels of government (i.e., Central and Local). However, since agricultural science & technology and education related funding were not included in the 'agriculture' section of these documents, we used the Ministry of Science & Technology Statistical Yearbooks data to estimate agriculture related innovation funding. To summarize, we used two main sources of information on China's funding.

1. The 'Agriculture' section of the National General Public Budgets: These budgets include sub-line items namely – Agriculture; Forestry and grassland; Water conservation; South-to-North Water Diversion; Poverty alleviation; Comprehensive agricultural development; Comprehensive Rural Reform; and Other agriculture, forestry and water funding.

2. Ministry of Science & Technology Statistical Yearbooks (2013 – 2019): Includes government funding on science & technology and university funding on science & technology.

2. Tagging data across data sources

Given the lack of information on each budget line item, it was not possible to tag each line item across all years. Hence, assumptions were made on line items of the latest year of National General Public

Budgets i.e., 2019 to come up with assumptions around how the funding splits across innovation areas, value-chains, and other tags.

A. Based on manual tagging of 2019 data we were able to assign values to each line item for the following tags:

1. Percentage of funding in 'agricultural production'

2. Value-chain

3. Innovation Area

B. Tags assigned based on analysis of latest year's data:

1. Funding source (org): Assumed to be the government

2. Funding Recipient (org): Assumed to be universities/research institutes for science & tech funding, end-consumer for financing/subsidies, and government agencies for all other funding

3. Funding target country: Assumed to be China

4. Funding instrument: Assumed to be grants for all funding, but a mix of subsidies and guarantees for financing/subsidies

C. Tags not assigned due to insufficient data

1. Innovation layer (across three levels)

2. Innovation stage

3. Spatial scale

4. Holding size

5. USAID Main domain

6. USAID Sub-domain

Based on assumptions arrived in A. above, we were able to tag China's agriculture funding by value-chain and innovation areas. This provided a matrix of value-chain and innovation areas on which we could assign values to determine the overall funding in innovation. For example, we could assume that 100% of science & tech funding across all value-chains is classified as innovation, but only 2% of institutional/infrastructure related funding spent on developing and promoting innovation, and ~0% of subsidies, policy related funding on innovation. These assumptions were made based on expert interviews and secondary research.

*Note – Given the lack of granularity in China's budget documents, **this study was not able to tag the Chinese government's funding based on SAI domains.***

Brazil

For Brazil, we followed a similar process to China given limited details published by the Brazilian government on focus areas of government funded programs.

1. Identify data sources:

Through secondary research, we identified one main data source for Brazil's government funding i.e., the transparency portal http://www.portaltransparencia.gov.br where the government publishes actual expenses and commitments made by each federal government authority. The agriculture related departments/ministries covered here include:

1. Ministry of Agriculture, Livestock and Supply - Units with direct link

2. Brazilian Agricultural Research Corporation

3. National Supply Company

4. Coffee Economy Defense Fund

5. Ministry of Economy - Units with direct link

6. São Francisco and Parnaíba Valleys Development Company

7. National Department of Works Against Drought

8. Ministry of Regional Development - Units with direct link

9. Amazon Development Superintendence

10. Midwest Development Superintendence

11. Northeast Development Superintendence

12. Ministry of Fisheries and Aquaculture - Units with direct link

13. State Agriculture Funding*

14. Ministry of Education*

*Amongst the above listed ministries, the state government and Ministry of Education related agriculture funding were not directly on the portal and hence had to be estimated and extrapolated. Similarly, the website did not publish data for 2010–2013 and hence this data had to be extrapolated using high-level FAO.Stat data on agricultural funding by Brazil.

2. Tag budget line items

Tagging of budget line items was conducted in a similar manner to China above. We broke down data for the latest available year i.e., 2019 and manually tagged this to feed assumptions on tags across years.

A. Based on manual tagging of 2019 data we were able to assign values to each line item for the following tags:

1. Percentage of funding in 'agricultural production'

2. Percentage of funding towards 'innovation'

3. Value-chain

4. Innovation Area

B. Tags assigned based on analysis of latest year's data:

1.   Funding source (org): Assumed to be the government

2.   Funding Recipient (org): Assumed to be largely universities/research institutes for EMBRAPA funding, and government agencies for remaining funding

3.   Funding target country: Assumed to be Brazil

4.   Funding instrument: Assumed to be grants for all funding, but a mix of subsidies and guarantees for financing/subsidies

C. Tags not assigned due to insufficient data

1.   Innovation layer (across three levels)

2.   Innovation stage

3.   Spatial scale

4.   Holding size

5.   USAID Main domain

6.   USAID Sub-domain

Note – Given the lack of granularity in Brazil's budget documents, **this study was not able to tag the Brazil government's funding based on SAI domains.**

Kenya

For Kenya, we used a similar process as covered for Brazil and China. This process was used since Kenya constituted a small percentage of the total agricultural funding in the Global South and hence a deep dive similar to India would be inefficient and imprudent in reaching our goals.

1. Identifying data sources

Based on secondary research we identified two main data sources that provided Kenya's agriculture related funding:

1.   For 2018 and 2019 – We used published budget data on agricultural funding. This data covered funding by the following ministries/departments:

   a)   Ministry of Agriculture, Livestock, Fisheries, and Irrigation

   b)   Ministry of Environment and Forestry

   c)   Ministry of Water and Sanitation

   d)   Ministry of Lands and Physical Planning

   e)   State Department for Public Service and Youth

   f)   State Department for East African Communities

   g)   State Department for Regional and Northern Corridor Development

   h)   State Department for Correctional Services

  i) State Department for University Education

  j) State Department for Environment and State Department for Natural Resources

  k) State Department for Water Services

2. <u>For 2010 – 2017</u> - We used the FAO MAFAP database that provides agriculture related funding across the following categories – 1) Payments to the agents in the food and agriculture sector, and 2) General support to the food and agriculture sector

2. Tag budget line items

Tagging of budget line items was conducted in a similar manner to China and Brazil above. We broke down data for the latest available year i.e., 2019 and manually tagged this to feed assumptions on tags across years.

A. Based on manual tagging of 2019 data we were able to assign values to each line item for the following tags -

1. Percentage of funding in 'agricultural production'

2. Value-chain

3. Innovation Area

B. Tags assigned based on analysis of latest year's data:

1. Funding source (org): Assumed to be the government

2. Funding Recipient (org): Assumed to be universities and research institutes for science & tech related funding and government agencies for most of the rest. However, based on data, assumed ~20% of institutional/infra related funding is provided to bilateral/multilateral agencies for implementation of programs and 10% of marketing/extension funding flows towards agricultural research institutes.

3. Funding target country: Assumed to be Kenya

4. Funding instrument: Assumed to be grants for all funding

C. Tags not assigned due to insufficient data

1. Innovation layer (across three levels)

2. Innovation stage

3. Spatial scale

4. Holding size

5. USAID Main domain

6. USAID Sub-domain

Other Global South countries

Findings from the four countries above were extrapolated to calculate innovation funding in 188 countries which constituted the rest of the Global South region.

This extrapolation was conducted separately for R&D related innovation funding and non-R&D related innovation funding –

Extrapolating R&D funding

We anchored extrapolations of R&D funding on the ASTI database which provided agricultural R&D funding for 125 countries in the Global South.

- For countries where ASTI data is available, we used the R&D funding for that country.
- Where ASTI data is missing, we used regional averages values for % of GDP spent on agri-R&D (sourced from Pardey et al. that also uses ASTI data to calculate these averages) and multiplied that value with the agricultural value-add of the country as sourced from FAO.Stat.
- Where certain years' ASTI data is missing, we use an average of % of GDP spent on agri-R&D for years where data was available and multiplied that with the agri value added data for that year.
- Where data on agricultural value added is missing, we filled gaps by multiplying the sub-regions' agricultural value added per sq km area into the area of the country where data is missing. Assuming that the regions have common geographical characteristics, and over and above this, ag- value added is corelated with the overall area available.

Extrapolating non-R&D innovation funding

We extrapolated non-R&D funding by assigning countries into three typologies based on their R&D/Agricultural GDP funding as calculated in (1.) above. The three typologies were as follows –

- Research heavy countries – These have an R&D to non-R&D innovation funding ratio similar to Brazil.
- Programmatic funding – These have an R&D to non-R&D innovation funding ratio similar to Kenya.
- Balanced funding - These have an R&D to non-R&D innovation funding ratio similar to India.

While conducting the above extrapolation, we noticed that the size of the agricultural economy may make a difference to the typology. For example, a large country may have lesser R&D funding/agricultural GDP but may not be a programmatic funding. These adjustments were made by assigning each country a size tag based on the size of the agricultural economy and adjusting their typology conditions using a multiplier.

Table 3. Value of R&D funding/agricultural value-added used to identify country typology, adjusted for size of agricultural economy.

Country size (ag value added, USD mn)	Small (0-2,000)		Medium (2,000-15,000)		Large (>15,000)	
R&D to ag value-added ratios based on country typology	*Lower limit*	*Higher limit*	*Lower limit*	*Higher limit*	*Lower limit*	*Higher limit*
1. Balanced	0.0100	0.0300	0.0040	0.0120	0.0020	0.0060
2. Research heavy	0.0300		0.0120		0.0060	
3. Program heavy	-	0.0100	-	0.0040	-	0.0020

Breaking up innovation funding by each tag

To further break-down innovation funding by each tag, we used assumptions based on our analysis of Kenya, India, China, and Brazil. Hence, the percentage break-down of innovation funding by value-chain, innovation area, and funding recipient were calculated using the average of proportions that resulted from the analysis of the mentioned four countries.

Note – due to lack of data availability, SAI funding was not modelled or estimated for the other Global South countries.

Private Corporations

To estimate innovation funding and innovation in SAI funding by private corporations, we followed the following steps -

1. Selection of main categories of agri-businesses

2. Sample company selection within each category

3. Estimating innovation funding for the sample companies

4. Assessing share of innovation funding in the Global South

5. Assigning tags to innovation funding

6. Extrapolation to rest of the category

7. Tagging for extrapolated values

8. SAI tagging & estimation

Selection of main categories

The estimate for total agriculture innovation funding by private corporations is an aggregation of funding by 9 individual categories identified, which represent areas where most private companies operate.

9 categories have been identified where most private companies operate within agriculture. These categories have been outlined by assessing the value chain for each of crops, livestock, fisheries & aquaculture and highlighting all categories that involve meaningful form of innovation from the current study's perspective. The categories selection include:

1. Farm Mechanization

2. Fertilizers

3. Crops and Pesticides

4. Commodity specific processing operations (where core)

5. Animal Genetics

6. Animal Health

7. Animal Nutrition

8. Meat Processors

9. Seafood companies (across fishing, processing, distribution, and branding & marketing)

Certain categories have deliberately been excluded. These include Novel Foods, Commercial Plantations, and Warehousing. Novel foods are an emerging area but is yet to involve large private corporations at significant scale. Our understanding is new-age start-ups are leading innovation here and therefore gets covered under institutional funding (fourth source of innovation funding). Similarly for Warehousing, experts suggest new-age start-ups are leading innovation and large private companies are mainly offering traditional services. Lastly, innovation in commercial plantations is limited and in areas which get covered under other identified categories (commodity-specific seed development or processing).

Sample country selection within each category

Company selection follows a two-step process. The first step involves identifying the top 5-10 largest companies operating globally. The second step involves selecting 2-3 companies within this list of large companies. Selecting multiple companies helps ensure comprehensiveness in focus innovation areas covered under a respective category. Size variation, to some extent, allows to accommodate differences in funding magnitude for relatively smaller versus larger companies. Although, selection of companies is constrained by data availability issues, which often prevails as the driving factor during company selection.

As a result, few categories have three companies selected for detailed analysis (categories with better data availability), while most other categories have only two companies.

Table 4. Companies selected for each category.

Value chain/category	List of companies
Crops	
Farm Mechanization	Deere
	Mahindra
	Jain Irrigation
Fertilizers	Mosaic
	Yara
Crops and Pesticides	Syngenta
	Bayer
	Monsanto
Commodity specific processing operations (where core)	Bunge
	Archer Daniels Midland
Fisheries and Aquaculture	
Seafood companies	Thai Union Group
(across fishing, processing, distribution, and branding & marketing)	Nippon Suisan Kaisha
Livestock	
Animal Genetics	Genus
	NeoGen
Animal health	Zoetis
	Bayer
	BIV

Animal Nutrition	Bluestar Adisseo
	Nutreco
Meat Processors	BRF
	Tyson Foods

Estimating innovation funding for the sampled companies

Estimating innovation funding for a given company involved calculating their R&D related innovation funding, which was based on their reported R&D numbers in most cases. Additionally, we estimated their marketing/adoption related innovation funding, which was calculated by assuming a percentage of revenues going towards such activities.

Estimating R&D innovation funding

R&D related innovation funding is estimated based on the reported R&D funding by the company in their annual report in most cases. In few cases where R&D figures are not available, a certain share of company revenues has been assumed to be the R&D funding. We assumed all of this R&D funding to be considered as 'innovation' related.

Estimating marketing/adoption of innovation funding

Marketing / adoption related innovation funding for a company has been calculated by using the company revenue as the base figure given that data reporting on such activities and desired format remains a challenge. A percentage of the total revenue has been assumed to be dedicated towards marketing / adoption activities for estimating the marketing / adoption related innovation funding for respective companies.

These assumptions are based on combination of expert interviews, company's reported selling, general & administrative expenses, and industry benchmarks. Industry experts suggest that such costs usually lie within the range of 2-8% of revenues, with outliers existing. Using this as the frame of reference, we look at the SGA expenses reported by the company as a percentage of revenue and adjust it downwards (usually by 50%) to exclude non-adoption related expenses such as distribution, transportation etc. Further, these percentages are sense-checked and compared with similar sampled companies. Additionally, another rule of thumb applied is that B2B companies are likely to be towards the lower end of the range while consumer/farmer facing companies will have a higher adoption funding.

Similar to the R&D funding, an adjustment factor is applied to account for only the funding that is assumed to be directed towards innovative products within the company's portfolio.

Assessing share of innovation funding in the Global South

All estimated innovation funding figures have been discounted to account only for funding focused towards the Global South. As a rule of thumb, the geographical split sales data for each sampled company has been used a proxy for assuming the innovation share of Global South.

Given that the sales data is not available under a Global South header, continent-wise sales data has been used and adjusted to account for countries that needed to be included or excluded. Since in most cases the split of sales is not available at relevant category level (e.g., animal health, seeds etc.), the company level geographic sales data has been used. In cases where geographical sales split at the company level was also not available, a 30% share has been assumed for Global South based on a 2014

paper by Fuglie which suggests that ~30% of total sales by agriculture companies are towards emerging countries.

Assigning tags to innovation funding

The estimated annual R&D and marketing/adoption related innovation funding has been tagged for each sampled company as per various tags including value-chain, innovation area, etc. The key element in the tagging process has been breaking down the annual innovation estimates by a type under the third layer of innovation types to arrive at a line item to tag. For e.g., Syngenta's innovation funding was separated into three types – biologicals, seed development, and crop protection. These were identified by looking at the different revenue segments reported by the company and comparing them to the list of innovation types identified as part of the inception report (inclusions have been made in the list as innovation areas have surfaced). Further, in case there are innovation areas mentioned in the annual report that feature in our list but not reported as a separate revenue segment, we have outlined them as separate innovation areas (for e.g., biologicals, precision agriculture).

In most cases, where innovation types can be directly mapped to a revenue segment, share of segment sales has been used as a proxy to estimate the share of innovation funding directed towards the respective innovation type. In cases where the innovation type does not have a corresponding revenue segment, a blanket, single-digit percentage of total innovation funding has been assumed for that type and adjustments have been made across other innovation types to account for such inclusions.

The remaining tagging has been carried out in a straightforward fashion through assumptions and available information in the annual report.

Extrapolation of sampled company funding to rest of the category

The estimated annual R&D and marketing/adoption related innovation funding for sampled companies have been used to extrapolate to the entire category after using multipliers to adjust for different R&D intensity ratios of smaller companies. The extrapolation has the following steps:

1. **Estimating overall category sales.** First, we estimated the market share of sampled companies using annual company revenue information and industry size estimates from industry reports (for e.g. the farm machinery industry size was estimated through available research in the following industry reports - link1 and link2)

2. **Adjusting R&D intensity ratios for extrapolated share:** We then used the R&D intensity ratios of the sampled companies and extrapolated this to the remaining category. However, this extrapolation was adjusted by using a multiplier that adjusted R&D intensity ratios for the non-sampled part of the category, since there are likely to be smaller sized companies with different R&D intensity ratios. These multipliers were calculated using the variation of R&D intensity ratios in the 2020 EU Industrial R&D Investment Scoreboard which has 2500 companies, their R&D funding and their intensity ratios. We first mapped categories in the database that were closest to the agri-business categories and added companies to categories as appropriate (for example, Bayer was tagged as a pharma and biotechnology company but also plays a huge role in fertilizers and hence was also tagged under chemicals while mapping R&D intensity ratio spread for the fertilizer category). We then assessed R&D

intensity ratios for the top 20% companies and the bottom 80% companies and use the ratio of R&D.

Table 5. Mapping of agri-business categories with the EU2500 database categories.

Agr-business category in this report	Grouping as per EU2500 database
Farm Mechanization	Industrial engineering
Fertilizers	Chemicals*
Crops and Pesticides	Pharmaceuticals & Biotechnology
Commodity Processing Operations (where core)	Food Producers
Animal Genetics	Pharmaceuticals & Biotechnology
Animal Health	Pharmaceuticals & Biotechnology
Animal Nutrition	Pharmaceuticals & Biotechnology
Meat Processors	Food Producers
Seafood Processing	Food Producers

Bayer which was included in 'Pharmaceuticals & Biotechnology' in the EU2500 database was added to 'Chemicals' as well while calculating the multiplier for the 'fertilizers' category.

M, R&D extrapolation multiplier = (R&D intensity ratio of all companies in the category)/(R&D intensity ratio of top 20% companies in the category)

Total innovation funding of the category = [Sampled companies funding/Industry revenue share of sampled companies] * M

Table 6. Multipliers used on the R&D intensity ratios.

Category as per EU2500	Multiplier
Food Producers	0.9179
Pharmaceuticals & Biotechnology	1.0420
Industrial Engineering	0.8025
Chemicals	1.5000

Tagging for extrapolated values

The extrapolated annual R&D and marketing/adoption related innovation funding have been tagged for each category in a similar fashion compared to the innovation funding of sampled companies.

Innovation areas at a category level are a culmination of all innovation areas identified as focus areas for the sampled companies under that category. The split of innovation funding across these areas for the category has been calculated based on the investment trends observed in case of sampled companies. For cases where the trend from sampled companies may seem inaccurate for the ecosystem, it can be manually overwritten to represent a more realistic picture.

SAI tagging & estimation

Bottom-up tagging for all line items has been conducted from an SAI perspective. Each line item has been tagged with a combination of the five impact intention domains, as mentioned in USAID's SAI framework. The combination of tags is primarily influenced by the innovation type the funding in the line item belongs to.

Table 7. Mapping by innovation types used.

Innovation type	SAI tag
Seed development and biotech	#Productivity; #Human Condition
Biologicals	#Other economic; #Environmental; #Productivity
Pesticides	#Other economic; #Productivity
Precision agriculture	#Other economic; #Productivity
Farm mechanization	#Productivity
Irrigation systems	#Environmental; #Other economic
Fertilizers/manure	#Productivity
Precision agriculture	#Other economic; #Productivity
Commodity specific processing operations (where core)	#Other economic
Animal health	#Productivity; Other economic
Animal Nutrition	#Productivity; Other economic
Animal Genetics	#Productivity; Other economic
Meat & poultry processing	#Human Condition; #Other economic
Seafood processing	#Other economic
Seafood processing	#Other economic
Aquaculture production	#Other economic; #Environmental; #Productivity

However, for some companies where there was an indication in the annual report regarding sustainability intentions, we have manually changed the SAI tag. These companies include –

- Bayer AG
- Monsanto (seed development only)
- Syngenta (seed development only)
- John Deere
- Bluestar Adisseo
- Genus PLC
- BRF

PE/VC Funds

The estimation for institutional funding involves a mixed approach of top-down estimation and bottom-up tagging. The top-down estimates provide the high-level investment numbers, whereas the bottom-up tagging provides the trends applicable to institutional funding made. It was necessary to use this method since every database with company/investment level details was not comprehensive enough to add up to the total agricultural funding in the Global South. For example, using the Tracxn database for overall estimation of investment flows has been de-prioritized as coverage of deals by

the platform appears to be limited (specially in case of China). Further, significant percentage of deals have undisclosed investment amounts and therefore the platform may not be able to offer comprehensive investment estimates. Hence, a top-down estimation was required to get to the total funding before applying break-ups on each tag to this top-line number using an analysis of available bottom-up data (in this case sourced from Tracxn). Both the top-down estimation and bottom-up tagging have been discussed in detail below.

Top-down estimation

This involves estimating overall PE/VC funding in agricultural innovation based on values reported in research reports as the starting point. For years where data was not available, we extrapolated values based on simple CAGRs.

PE funding in agriculture: We first conducted research on overall PE funding globally which was sourced from the McKinsey Global Private Markets Review 2019[4]. These values were then discounted to arrive at the overall global PE investment in agriculture assuming ~ 1% of PE funding flows towards agricultural production. This value was arrived at using secondary sources that indicated ~2% of PE funding were in agriculture in India (Economic Times article 2020[5]). We discounted this value since India's share of PE funding in agriculture is likely to higher than other countries.

VC funding in agriculture: Similarly for VC funding in agriculture, we used AgFunder's Global Investment Reports[6] to estimate overall VC funding in agriculture globally.

Global South share: We used secondary sources including region-wise splits in AgFunder reports and Statista to estimate the share of Global South amongst global PE and VC funding in agriculture. We assumed ~15% of global PE/VC agricultural funding was targeted towards the Global South. These assumptions were also validated by experts in the agricultural PE/VC space.

Adjustment for innovation: Post the estimation of total upstream funding for the Global South, an adjustment factor has also been provided to account for only the share of investment considered as innovation investment. The adjustment factor has currently been assumed to be 100% as most startups remain early stage and most of the funding is likely to count towards innovation.

Bottom-up trends analysis

The funding database published by 'Tracxn' has been used for bottom-up tagging. Tracxn compiles all VC/PE funding globally based on available public information. While the database is not comprehensive since it relies on public reporting of a deal, it was deemed comprehensive enough to

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[4] McKinsey&Company. 2019. "Private Markets Come of Age: McKinsey Global Private Markets Review." https://www.mckinsey.com/~/media/mckinsey/industries/private%20equity%20and%20principal%20investor s/our%20insights/private%20markets%20come%20of%20age/private-markets-come-of-age-mckinsey-Global-private-markets-review-2019-vf.ashx.

[5] Economic Times "Private equity, VC funding hit record high of $48 billion in 2019: Report" 2020. https://economictimes.indiatimes.com/news/economy/finance/private-equity-vc-investments-hit-record-high-of-48-billion-in-2019-report/articleshow/74190932.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

[6] AgFunder. 2021. "AgriFoodTech Investment Report." https://research.agfunder.com/2015/2015-agfunder-Global-report.pdf

understand trends in funding in the Global South. Only agriculture related funding made during 2010-19 in startups from the Global South countries have been leveraged from this database.

Manual tagging: For 566 rounds of funding covering ~ 294 unique companies, we manually tagged the company to an innovation type, value-chain, spatial scale, innovation stage, funding instrument, funding recipient (all start-ups i.e., private companies), and holding size. We used the company description provided in the Tracxn database to assign these tags.

Auto-population of tags based on assumptions: For some tags where information was not available, we autopopulated the tags making assumption on innovation types. This was done to tag sustainability domains and sub-domains, Gliessman's[7] categorization, and innovation area. For example, we tagged as "Farmer engagement platforms (including marketplaces and information platforms)" as focused on the following sustainability domains -" Other Economic"and "Productivity". These assumptions were assigned based on our understanding of each innovation type and then validated by experts. The objective has been to expedite the tagging process while ensuring reasonable level of accuracy.

Finally, values, from the bottom-up tagging were analyzed to come up with proportions for each tag which were then assigned to the top-down estimates to estimate break-down of funding flows by each tag.

Philanthropies and Bilateral/Multilateral Agencies

To assess funding by international philanthropies, bilateral and multilateral agencies in agricultural innovation, we used data from the OECDstat Creditor Reporting System (CRS)[8] that covers information on a project/program level. Data from this database was analyzed to tag investments. We used various tagging methodologies depending on the quality of data available:

Directly sourced from the database

Table 8. Certain tags that were easy to ascertain on the database.

Column in OECDstat CRS	Relevant tag for this study
Year	Year of funding
Recipient Name	Funding Recipient (country)
Finance Type Name	Funding instrument
Channel of Delivery Name	Funding Recipient (organization) - *after mapping each recipient name to an assigned*

Interpreted based on project descriptions

Tags such as sustainability domains, spatial scale, holding size, innovation layers, and value-chain were not directly available in the database. In these cases, we created a word-crawl algorithm that searched the short and long project description to find key words and assign it to a specific value-chain, sustainability domain etc. For example, any description that mentioned 'climate change' was assumed to be focused on environmental sustainability and any description that mentioned 'cheese' was

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[7] Gliessman, S. R. 2015. Agroecology: The Ecology of Sustainable Food Systems, Third Edit. Taylor & Francis, Boca Raton.

[8] OECD.Stat. n.d. "Creditor Reporting System." https://stats.oecd.org/Index.aspx?DataSetCode=crs1.

assumed to be focused on livestock & dairy. However, before running this word crawl, we translated all descriptions that were not in English to English to make the search as accurate as possible. We also extracted unique words from all descriptions and manually separated them into each category to make sure we don't miss out any words in this search methodology.

Assumed based on 'purpose type' assigned in the database

Finally, for 'innovation area' and the percentage of the funding/investment value classified as innovation, we used the column 'purpose type' in the OECDstat CRS database and mapped each one of them to an innovation area and a percentage value to determine the value of this going towards innovation. These assumptions were made by assessing a sample set of row items for each 'purpose type'.

Note – In a large number of cases the 'purpose type' in the OECDstat CRS database was not accurately assigned and hence some manual data cleaning was required to change these values.

3. Validation Methodology

The input data, estimation methodology, assumptions, and final outputs were using a mix of two source – (i) Available research reports covering the same or similar topics, and (ii) Semi-structured interviews with experts.

1. **Other available research on agricultural innovation funding (refer to Table below)**: We used existing reports and analysis on innovation funding to see whether trends in our analysis broadly align and mark out areas where trends different from existing research. Examples of data sources (non-exhaustive) used for validation include the following

2. **Interviews** As shown in the tables above, in most cases, the research conducted in this report was new and difficult to validate through existing reports and databases. Hence, we consulted various experts across funding sources and walked them through our final outputs and assumptions to test overall validity. Refer to the section 'List of Experts Consulted' (Table 12) for a comprehensive list of experts consulted during the study.

Table 9. Triangulation of estimated innovation funds.

	Estimated value in this report (USDbn per year)	Triangulation	Flags/Reasons for deviation	Source
Total innovation funding	65-90	– Total funding in agriculture is ~ USD 200-250 bn per year (Gross Fixed Capital Formation) – China, which accounts for more than half of the capex in developing economies for the pre-2015 period and more than 70% in 2015–2016, in line with this report's estimates – Overall split of government and private R&D is 65-35, in line with this report's estimates	No output triangulation possible given the data points published in this report uses unique definitions around "innovation" and "SAI". The methodology to estimation has been triangulated with experts within the target geographies and sector.	– UNCTAD, "SDG Investment Trends Monitor", 2020 – Graff, Gregory D., Felipe de Figueiredo Silva, and David Zilberman. 2020. "Venture Capital and the Transformation of Private R&D for Agriculture." In Economics of Research and Innovation in Agriculture. University of Chicago Press. https://www.nber.org/system/files/chapters/c14420/c14420.pdf.
Government	~43			
R&D	~12	– Public R&D funding is ~ 1.5-2 bn per year as per SDG Investment Trends Monitor Report – Public R&D funding is ~ 6 bn a year for countries covered in ASTI database. vs ~9 bn for same years based on our estimations.	– SDG Investment Trends Monitor Report likely covers a lesser number of countries. – R&D funding in this report is higher than ASTI database, due to higher number of countries included (188 vs 125) and units being represented in 2019 prices and not current prices.	– UNCTAD, "SDG Investment Trends Monitor", 2020 – ASTI Network. n.d. "ASTI Database." https://www.asti.cgiar.org/network.
Non-R&D	~31	– Based on Global Innovation Index, the average rank of countries marked as "research heavy" in the extrapolated countries is significantly higher than the other countries	No output triangulation possible given the data points published in this report uses unique definitions around "innovation" and "SAI". The methodology to estimation has been triangulated with experts within the target geographies and sector.	– Global Innovation Index 2020
Private Corporations	~15	– 75% of overall funding in agriculture is from the private sector	This report does not include funding by individuals in its estimates. Hence, while private corporations' and companies' funding have been included, funding by farmers taking loans for agricultural equipment, new seeds, etc. have not been included in this report's analysis. This limitation has been highlighted in the main report.	– UNCTAD, "SDG Investment Trends Monitor", 2020

R&D	~7.5	– This report's estimate is ~30-40% higher than estimated values by Fuglie for 2010-2014. – Globally, annual industry funding on agricultural R&D in 2009 were in the range of $10 billion (Fuglie et al, 2011) to $16 billion – (Pardey et al, 2015)	Fuglie uses country of incorporation to assess funding towards Global South whereas this report uses geographical split of sales as a proxy for regional split of R&D funding. Hence, Fuglie likely excludes large parts of Bayer, Deere, and other large corporations' R&D funding from the Global South.	– Fuglie, Keith. 2016. "The Growing Role of the Private Sector in Agricultural Research and Development World-Wide." *Global Food Security* 10: 29–38.
Non-R&D	~7.6	-	– No output triangulation possible given the data points published in this report uses unique definitions around "innovation" and "SAI". The methodology to estimation has been triangulated with experts within the target geographies and sector.	-
Institutional Investors	~3	– This report's estimate of India's PE/VC funding in agriculture is ~ 630 - 860 million in India for 2019. This value is slightly lower than the USD 883 million estimated for India in food and agriculture in 2019 based on the IVC Association research report	The difference is likely since some funding in restaurant related start-ups and consumer retail have not been included in our study, but have been included in the IVC Association report	IVC Association, "PE/VC Agenda India Trend Book 2020"
Bilateral and multilateral investors	~4.2	*Estimates based on bottom-up project level data and has been triangulated with experts*		
International philanthropies	~0.48			

Table 10. Triangulation of estimated percentage of innovation funding focused on SAI.

	Estimated value in this report (USDbn per year)	Triangulation	Flags	Source
Total	<7%	No output triangulation possible given the data points published in this report uses unique definitions around "innovation" and "SAI". The methodology to estimation has been triangulated with experts within the target geographies and sector.		Biovision "Money Flows: What is holding back investment in agroecological research for Africa", 2020
Government	~6%	For Kenyan research institute, 13% was considered "agroecological".	The definition of SAI in this report is stricter and hence SAI % value is lower. Further, Sustainability intentions are mentioned more clearly in R&D funding than non-R&D related innovation funding.	Same as above.
R&D	-	-	No output triangulation possible given the data points published in this report uses unique definitions around "innovation" and "SAI". The methodology to estimation has been triangulated with experts within the target geographies and sector.	
Non-R&D	-	-	Same as above.	
Private Corporations	~9%	-	Same as above.	
R&D	-	-	Same as above.	
Non-R&D	-	-	Same as above.	
Institutional Investors	~11%	-	Same as above.	
Bilateral and multilateral investors	~7%	~85% of BMGF funding was restricted to increasing economic efficiency. Hence, only 15% could be classified as SAI. Our number is lower, given that we have taken stricted conditions that is. Productivity + environmental		Biovision. 2020. "Money Flows Report: What Is Holding Back Investment in Agroecological Research for Africa?" http://www.ipes-food.org/_img/upload/files/Money%20Flows_Full%20report.pdf.
International philanthropies	~0.48			

4. Detailed List of Assumptions and Extrapolations

Table 11. List of assumptions made (also covered in the previous section) and extrapolations wherever sufficient data was missing.

Section	Extrapolation made	Percentage or Multiplier used	Justification
Government funding: China	**1. Budget line-item wise percentage of funding considered as 'agriculture' related (moderate)**		
	Agriculture	100%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage funding in agriculture. Source: Ministry of Finance, National General Public Budget 2019
	Forestry and Grassland	67%	Most of the sub line items under 'Forestry & Grassland' are directed towards preservation of forests and wetlands rather than agriculture. We have included line items related to biodiversity protection such as: 0.8% towards animal and plant protection, 24.3 % towards forestry cultivation, 11.6% towards forest ecological benefit compensation, and 4.6% towards forest resource management Source: Ministry of Finance, National General Public Budget 2019
	Water Conservation	100%	Mainly the funding is targeted towards creating water conservation infrastructure with focus on irrigation activities. Source: Ministry of Finance, National General Public Budget 2019
	South-to-North Water Diversion	50%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage funding in agriculture. Source: Ministry of Finance, National General Public Budget 2019
	Poverty Alleviation	60%	Focused on providing financial incentives and subsidies to alleviate poverty and enhancing socio economic development Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged to have an idea about the percentage funding in agriculture. Excluded funding on rural infrastructure construction largely for roads and other public infrastructure. Source: Ministry of Finance, National General Public Budget 2019

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Comprehensive Agricultural Development	100%	Various government policies for land governance, institutional operation, etc. to stimulate agricultural development. Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged to have an idea about the percentage funding in agriculture. Source: Ministry of Finance, National General Public Budget 2019
	Comprehensive Rural Reform	100%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged to have an idea about the percentage funding in agriculture. Source: Ministry of Finance, National General Public Budget 2019
	Target Price Subsidies	100%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage funding in agriculture. Source: Ministry of Finance, National General Public Budget 2019
	Other Agriculture, Forestry and Water funding	100%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage funding in agriculture. Source: Ministry of Finance, National General Public Budget 2019
	Science & Technology (ag related)	100%	Analysis of Ministry of Science & Technology Statistical Yearbooks 2014-2019
	Promote Financial funding for Agriculture	100%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage funding in agriculture. Source: Ministry of Finance, National General Public Budget 2019
	Inclusive Financial Development funding	100%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage funding in agriculture. Source: Ministry of Finance, National General Public Budget 2019
	2. Budget line item-wise split of funding by value-chains (moderate)		

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Agriculture	Crops: 45%; Livestock, dairy, & poultry: 45%; Fisheries & aquaculture: 10%; Novel foods: 0%; Cross-cutting: 0%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage segmentation of value chain. Link for crops: https://www.eria.org/Chapter%204%20China.pdf
	Forestry and Grassland	Crops: 40%; Livestock, dairy, & poultry: 60%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 0%	Forest cultivation, animal, and plant protection, are considered as focused on crops. Remaining is cross cutting for e.g., forest resource management, wetland protection etc. Link for crops: https://www.eria.org/Chapter%204%20China.pdf; Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage segmentation of value chain.
	Water Conservation	Crops: 8%; Livestock, dairy, & poultry: 5%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 87%	Farmland irrigation forms 6% of total, solid and water conservation is 2% of total. Both considered part of crops. Livestock drinking water and rural water considered focused on livestock i.e., 5% of total. Remaining line items focused on general water conservation for agricultural systems Link for crops: https://www.eria.org/Chapter%204%20China.pdf Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage segmentation of value chain.
	South-to-North Water Diversion	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 100%	South to North Water Diversion is a government plan for diversion project construction to improve water availability for agriculture and rural areas in general. Link for crops: https://www.eria.org/Chapter%204%20China.pdf Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage segmentation of value chain. Link for South-to-North Water Diversion: https://www.water-technology.net/projects/South_north
	Poverty Alleviation	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 100%	Poverty alleviation is focused on providing financial incentives and subsidies to alleviate poverty and enhancing socio economic development with some subsidies on rural agriculture. Link for crops: https://www.eria.org/Chapter%204%20China.pdf; Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage segmentation of value chain. Link for details on poverty alleviation: https://web.worldbank.org/archive/website00819C/WEB/PDF/CHINA_-4.PDF

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Comprehensive Agricultural Development	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0% ; Cross-cutting: 100%	Comprehensive agricultural development focuses on government policies on land and infrastructure development to boost agriculture and marked as cross cutting. Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage segmentation of value chain.
	Comprehensive Rural Reform	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 100%	Comprehensive rural reform focuses on village level subsidy programs across the value chain and hence marked as cross cutting. Link for crops: https://www.eria.org/Chapter%204%20China.pdf; Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage segmentation of value chain.
	Other Agriculture, Forestry and Water Funding	Crops: 56%; Livestock, dairy, & poultry: 34%; Fisheries & aquaculture: 10% ; Novel foods: 0% ; Cross-cutting: 0%	Link for crops: https://www.eria.org/Chapter%204%20China.pdf Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about the percentage segmentation of value chain.
	Science & Technology (ag related)	Crops: 60%; Livestock, dairy, & poultry: 10% ; Fisheries & aquaculture: 6% ; Novel foods: 0% ; Cross-cutting: 34%	Analysis of Ministry of Science & Technology Statistical Yearbooks 2014-2019
3. Percentage split of funding in agriculture basis various innovation area (moderate)			
	Agriculture	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 10% Institutional / Infra (incl operations): 60% Policies: 0% Financing/subsidies: 15% General admin: 10%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about these percentages coupled with secondary research (detailed links present in the assumptions tab of the government excel). Source: Ministry of Finance, National General Public Budget 2019

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Forestry and Grassland	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 87% Policies: 0% Financing/subsidies: 0% General admin: 13%	Forestry and grassland funding is largely towards institutional support to protect forest. Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about these percentages coupled with secondary research (detailed links present in the assumptions tab of the government excel). Source: Ministry of Finance, National General Public Budget 2019
	Water Conservation	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 98% Policies: 0% Financing/subsidies: 0% General admin: 2%	Water conservation largely includes funding for building new infrastructure projects. Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about these percentages coupled with secondary research (detailed links present in the assumptions tab of the government excel). Source: Ministry of Finance, National General Public Budget 2019
	South-to-North Water Diversion	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 99% Policies: 0% Financing/subsidies: 0% General admin: 2%	South-North Water Diversion project is an infrastructure project by the government of China. Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about these percentages coupled with secondary research (detailed links present in the assumptions tab of the government excel). Source: Ministry of Finance, National General Public Budget 2019
	Poverty Alleviation	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 99% General admin: 1%	Poverty alleviation programs are focused on subsidising rural agricultural sector and farmers. Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about these percentages coupled with secondary research (detailed links present in the assumptions tab of the government excel). Source: Ministry of Finance, National General Public Budget 2019
	Comprehensive Agricultural Development	Science & Tech: 0% Product Development: 5% Marketing extension / behaviour Change: 0% Institutional / Infra (incl operations): 95% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about these percentages coupled with secondary research (detailed links present in the assumptions tab of the government excel). Source: Ministry of Finance, National General Public Budget 2019

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Comprehensive Rural Reform	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 100% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about these percentages coupled with secondary research (detailed links present in the assumptions tab of the government excel). Source: Ministry of Finance, National General Public Budget 2019
	Other Agriculture, Forestry and Water Funding	Science & Tech: 0% Product Development: 0% Marketing extension / behaviour Change: 0% Institutional / Infra (incl operations): 100% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed sheet for each year from the Chinese Ministry of Finance. Agricultural public government funding is analysed and tagged broadly to have an idea about these percentages coupled with secondary research (detailed links present in the assumptions tab of the government excel). Source: Ministry of Finance, National General Public Budget 2019
	Science & technology (ag related)	Science & Tech: 100% Product Development: 0% Marketing extension / behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 0% General admin: 0%	Analysis of Ministry of Science & Technology Statistical Yearbooks 2014-2019
	4. Percentage split of innovation in agriculture basis funding organisations, funding recipients, funding instruments, spatial scale, holding size, and innovation stage	Refer to the China assumptions sheet in the government funding excels for detailed information	Estimate made by consultants based on secondary research and analysis of the budgetary line items (refer detailed methodology above and the excel for government funding for the detailed links). These assumptions have been made with low confidence and limited verification and hence have only been used in the report in cases where there is high confidence (e.g., funding recipient).
	5. SAI matrix (strict, moderate and broad): a matrix with percentage values across innovation area and value chain.	N/A	--
	6. China's Science and Tech Funding for years 2010, 2011, 2012 and 2019	Simple CAGR	Since the Chinese statistical yearbook was available for only 2013-2018, the rest of the years S&T funding was calculated using extrapolation. The CAGR of the 5-year period between 2013-2018 was used for the calculation of the values for the remaining year

Section	Extrapolation made	Percentage or Multiplier used	Justification
Government funding: Brazil	**1. Budget line item wise split of total funding in innovation in agriculture (moderate):**		
	Ministry of Agriculture, Livestock and Supply - Units with direct link	9%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly to have an idea about the percentage spent in innovation. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Brazilian Agricultural Research Corporation	100%	The Brazilian Agricultural Research Corporation is a state-owned research corporation affiliated with the Brazilian Ministry of Agriculture. Their mission is to "develop research, development and innovation solutions for the sustainability of agriculture, for the benefit of Brazilian society. Source links: http://www.portaltransparencia.gov.br/despesas/lista-consultas https://www.embrapa.br/
	National Supply Company	0%	The National Supply Company (CONAB) is a public company under the Ministry of Agriculture, Livestock and Food Supply - MAPA. It undertakes to manage the supply and agricultural policies, to ensure the basic needs of society and it is responsible for implementing the Food Acquisition Program (PAA) at the federal level. The PAA's objective is to ensure income to family producers through the acquisition of production at prices consistent with the market, as well as to provide access to food by vulnerable populations. Source links: http://www.portaltransparencia.gov.br/despesas/lista-consultas http://www.abc.gov.br/training/informacoes/InstituicaoCONAB_en.aspx
	Coffee Economy Defense Fund	0%	The Coffee Economy Defense fund aims: To promote the elaboration, execution and monitoring of public policies for coffee agribusiness, in order to enable the socioeconomic development of this sector. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas https://www.gov.br/agricultura/pt-br/assuntos/politica-agricola/cafe/arquivos/RelatoriodeAtividadesdoFuncafe2012.pdf/@@download/file/relatoriodeatividadesdofuncafe2012.pdf
	Ministry of Economy - Units with direct link	3%	It includes various economic subsidies provided by the government of Brazil to provide price support to the farmers, acquire agricultural products, develop agricultural industries, enhance rural credit schemes, etc. Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly to have an idea about the percentage spent in innovation. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas

Section	Extrapolation made	Percentage or Multiplier used	Justification
	São Francisco and Parnaíba Valleys Development Company	5%	Brazil's São Francisco and Parnaíba Valley Development company (Codevasf) is a state-run firm responsible for the economic development of the São Francisco, Parnaíba, Itapecuru and Mearim river basins. Codevasf is tasked with using natural resources in a sustainable manner and pursuing productive activities to achieve social and economic inclusion. The company receives public funding to build infrastructure for irrigation projects and the rational use of water resources. It also develops recovery programs for areas affected by ecological degradation and conducts socio-economic and environmental surveys and studies. Codevasf was created in 1974 as the successor company of the São Francisco Valley regulator, Suvale, and is based in Brasilia. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas https://www.bnamericas.com/en/company-profile/companhia-de-desenvolvimento-dos-vales-do-sao-francisco-e-do-parnaiba-codevasf
	National Department of Works Against Drought	49%	Its main function is to combat the problems of water scarcity and related inconveniences. The main area of activity is the semi - arid climate territories of the Northeast Region of Brazil and the northern part of Minas Gerais. It mainly works in implementation of irrigation projects and sustainable aquacultural production Source links: http://www.portaltransparencia.gov.br/despesas/lista-consultas https://es.wikipedia.org/wiki/Departamento_Nacional_de_Obras_Contra_a_Seca
	Ministry of Regional Development - Units with direct link	0%	It mainly includes the implementation of irrigation projects, management transfer services for irrigation services and regional development for structuring of various productive activities. Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly to have an idea about the percentage spent in innovation. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Amazon Development Superintendence	0%	A local authority of the federal government of Brazil aiming to promote the development of the Amazon region by creating special financial and tax incentives In 2001, Amazon Development Agency (Agência de Desenvolvimento da Amazônia) replaced SUDAM. The agency emphasizes projects that call for territorial occupation for the extraction of regional resources by regional labor. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas https://en.wikipedia.org/wiki/Superintend%C3%AAncia_do_Desenvolvimento_da_Amaz%C3%B4nia

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Midwest Development Superintendence	0%	It focuses on the implementation of the public irrigation projects and structuring of production activities. Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly to have an idea about the percentage spent in innovation. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Northeast Development Superintendence	100%	The Superintendency for the Development of the Northeast (Superintendência do DEsenvolvimento do NordEste—SUDENE) was a Brazilian government agency concerned with the economic development of the country's northeastern coastal and Sertão regions. Established in 1959 under President Juscelino Kubitschek, the agency attempted to address the growing economic unrest that prevailed in the impoverished Northeast by means of creating tax breaks for producers and exporters. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas https://www.encyclopedia.com/humanities/encyclopedias-almanacs-transcripts-and-maps/development-superintendency-northeast-sudene
	Ministry of Fisheries and Aquaculture - Units with direct link	9%	It includes the management costs for the ministry employees, development of fisheries and aquaculture infrastructure, implementation of fisheries vessels and MEL of the fisheries production sector. Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly to have an idea about the percentage spent in innovation. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	State Agriculture Funding	30%	Analysis of funding by the state of Minas Gerias Source: http://www.transparencia.mg.gov.br/despesa-estado/despesa/despesa-funcoes/2011/01-01-2011/31-12-2011/1227/2516/2219/11794/49535
	Ministry of Education	100%	Estimate by the consultants: The data from transparency portal was analyzed for the latest year. Source: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	2. Budget line item-wise split of funding in innovation in agriculture by value-chains (moderate)		

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Ministry of Agriculture, Livestock and Supply Units with direct link	Crops: 8%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 92%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Brazilian Agricultural Research Corporation	Crops: 52%; Livestock, dairy, & poultry: 11%; Fisheries & aquaculture: 4%; Novel foods: 0%; Cross-cutting: 33%; N/A: 0%	EMBRAPA funding based on information provided by Bruno Brasil of EMBRAPA. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas https://www.embrapa.br/
	National Supply Company	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 0%; N/A: 100%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Coffee Economy Defense Fund	Crops: 100%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 0%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Ministry of Economy - Units with direct link	Crops: 88%; Livestock, dairy, & poultry: 2%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 10%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas

Section	Extrapolation made	Percentage or Multiplier used	Justification
	São Francisco and Parnaíba Valleys Development Company	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 65%; Novel foods: 0%; Cross-cutting: 35%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	National Department of Works Against Drought	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 100%; Novel foods: 0%; Cross-cutting: 0%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Ministry of Regional Development - Units with direct link	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 0%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Amazon Development Superintendence	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 100%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Midwest Development Superintendence	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 100%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Northeast Development Superintendence	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0%; Novel foods: 0%; Cross-cutting: 100%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Ministry of Fisheries and Aquaculture - Units with direct link	Crops: 8%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 100%; Novel foods: 0%; Cross-cutting: 0%; N/A: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across value chain. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	State Agriculture Funding	Crops: 0%; Livestock, dairy, & poultry: 0%; Fisheries & aquaculture: 0% ; Novel foods: 0%; Cross-cutting: 95%; N/A: 5%	Analysis of funding by the state of Minas Gerias Source: http://www.transparencia.mg.gov.br/despesa-estado/despesa/despesa-funcoes/2011/01-01-2011/31-12-2011/1227/2516/2219/11794/49535
	Ministry of Education	Crops: 52%; Livestock, dairy, & poultry: 11%; Fisheries & aquaculture: 4%; Novel foods: 0%; Cross-cutting: 33%; N/A: 0%	Assumed same split as EMBRAPA due to lack of data
	3. Percentage split of funding in agriculture basis various innovation area (moderate)		
	Ministry of Agriculture, Livestock and Supply - Units with direct link	Science & Tech: 5% Product Development: 0% Marketing extension / Behaviour Change: 10% Institutional / Infra (incl operations): 84% Policies: 1% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Brazilian Agricultural Research Corporation	Science & Tech: 100% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Also, analysis is done from the EMBRAPA funding based on information provided by Bruno Brasil of EMBRAPA. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas https://www.embrapa.br/
	National Supply Company	Science & Tech: 0% Product Development: 40% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 15% Financing/subsidies: 0% General admin: 45%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Coffee Economy Defense Fund	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Ministry of Economy - Units with direct link	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 100% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	São Francisco and Parnaíba Valleys Development Company	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 100% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas

Section	Extrapolation made	Percentage or Multiplier used	Justification
	National Department of Works Against Drought	Science & Tech: 100% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Ministry of Regional Development - Units with direct link	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Amazon Development Superintendence	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 100% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Midwest Development Superintendence	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	Northeast Development Superintendence	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 100% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Ministry of Fisheries and Aquaculture - Units with direct link	Science & Tech: 30% Product Development: 20% Marketing extension / Behaviour Change: 20% Institutional / Infra (incl operations): 20% Policies: 10% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	State Agriculture Funding	Science & Tech: 60% Product Development: 0% Marketing extension / Behaviour Change: 30% Institutional / Infra (incl operations): 10% Policies: 0% Financing/subsidies: 0% General admin: 0%	Analysis of funding by the state of Minas Gerais Source: http://www.transparencia.mg.gov.br/despesa-estado/despesa/despesa-funcoes/2011/01-01-2011/31-12-2011/1227/2516/2219/11794/49535
	Ministry of Education	Science & Tech: 100% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Brazil from the portal transparencia is analysed and tagged broadly for the year of 2019 to have an idea about the percentage split across innovation area. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	2. Percentage split of total ag funding and innovation in agriculture basis funding organisations, funding recipients, funding instruments, spatial scale, holding size, and innovation stage (for all line items except EMBRAPA)	Refer the assumptions sheet for Brazil in the government funding excels.	Estimate made by the consultants basis the secondary research and analysis of the budgetary line items (refer detailed methodology above and the excel for government funding for the detailed links) Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
	3. SAI matrix (strict, moderate and broad): a matrix with value across innovation area and value chain.	N/A	--

Section	Extrapolation made	Percentage or Multiplier used	Justification
	4. Brazil State Funding	Refer to the Brazil assumptions sheet in the government funding excels for detailed information	The percentages of funding by states out of the total government funding is based on differences between general government funding and central government funding for Agriculture in Brazil sourced form FAO stat. Since 2019 values are not available, the value is extrapolated using an average of the previous three years. For detailed values across years and scenarios, please refer to the 'Brazil assumptions' sheet in the government funding excels. Source: FAO.Stat data on General government and Central government funding
	5. EMBRAPA's percentage split of total ag funding and innovation in agriculture basis funding organisations, funding recipients, funding instruments, spatial scale, holding size, and innovation stage	--	Analysis is done from the EMBRAPA funding based on information provided by Bruno Brasil of EMBRAPA. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas https://www.embrapa.br/
	6. Brazil budget data (2010-2013)	Simple CAGR	Estimate by the consultants: Extrapolation for the years where the data is not available in the portal transparencia was done basis the CAGR of the 6 years from 2014-2019. Source Link: http://www.portaltransparencia.gov.br/despesas/lista-consultas
Government funding: Kenya	**1. Budget line-item wise split of total funding in innovation in agriculture (moderate):**		
	I.1. Payments to the agents in the food and agriculture sector	100%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	I.2. General support to the food and agriculture sector	100%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Ministry of Agriculture, Livestock, Fisheries and Irrigation	100%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Ministry of Environment and Forestry	5%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Ministry of Water and Sanitation	50%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Ministry of Lands and Physical Planning	100%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	State Department for Public Service and Youth	5%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	State Department for East African Communities	10%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	State Department for Regional and Northern Corridor Development (Ag related)	100%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	State Department for Correctional Services (Ag related)	100%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	State Department for University Education (Ag related)	100%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	State Department for Environment and State Department for Natural Resources (2018)	10%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	State Department for Water Services (2018)	10%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	2. Funding in agriculture by value-chains		

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Crops & plants	31%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent by value-chain. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Livestock, dairy, & poultry	10%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent by value-chain. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Fisheries & aquaculture	3%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent by value-chain. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Novel foods	0%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent by value-chain. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Cross-cutting	56%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent by value-chain. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	N/A	0%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent by value-chain. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	3. Funding in agriculture by innovation area and value chain matrix		

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Crops & plants	Science & Tech: 1% Product Development: 0% Marketing extension / Behaviour Change: 60% Institutional / Infra (incl operations): 34% Policies: 5% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Livestock, dairy, & poultry	Science & Tech: 40% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 60% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Fisheries & aquaculture	Science & Tech: 14% Product Development: 10% Marketing extension / Behaviour Change: 15% Institutional / Infra (incl operations): 27% Policies: 3% Financing/subsidies: 0% General admin: 5%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	Novel foods	Science & Tech: 0% Product Development: 0% Marketing extension / Behaviour Change: 0% Institutional / Infra (incl operations): 0% Policies: 0% Financing/subsidies: 0% General admin: 0%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Cross-cutting	Science & Tech: 5% Product Development: 0% Marketing extension / Behaviour Change: 5% Institutional / Infra (incl operations): 85% Policies: 0% Financing/subsidies: 0% General admin: 5%	Estimate by the consultants: The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
	4. SAI matrix (strict, moderate and broad): a matrix with value across innovation area and value chain.	N/A	--
	5. Percentage split of total ag funding and innovation in agriculture basis value chain and innovation area, funding organisations, funding recipients, funding instruments, spatial scale, holding size, and innovation stage	Refer Kenya assumptions sheet of the government funding excels for detailed information on the percentage values taken	Estimate by the consultants: Rough percentages were taken based on programmes allocated to the ministry/state department in the Kenyan government documents. The detailed dataset for Kenya through the budget documents of 2018-19 is analysed and tagged broadly to have an idea about the percentage spent in agriculture. Source: https://www.treasury.go.ke/budget-statement-2018-19.html
Government Funding: Other Global South countries	**1. Growth rates (moderate)**		
	% Change in agricultural government funding YOY for extrapolation where data is missing	2%	Average CAGR for govt agricultural funding from 2010 - 2017 where data is available (sourced form FAO.Stat)
	% Change in agricultural value added YOY for extrapolation in years where data is missing	2%	Average CAGR for agricultural value added from 2010 - 2017 where data is available (sourced form FAO.Stat)
	Adjustment factor on FAO.Stat/IFPRI govt funding data to account for other agricultural funding not classified as agriculture in the databases	1.10	Mark up of India agricultural funding over FAO.Stat stated number for 2010-2017 is 1.17. Rounded down in order to make a conservative estimate
	2. Non-R&D funding by % of govt funding (2010-2019)	1-5%	Based on non-R&D funding by China, India, Brazil, and Kenya

Section	Extrapolation made	Percentage or Multiplier used	Justification
	3. SAI funding (moderate) **SAI funding (strict)**	n/a	-
Private Corporations	1. Percentage of R&D funding considered as innovation	100%	Estimation by consultants based on understanding of annual reports
	1. Percentage of marketing related funding considered as focused innovation	Depends on category: Farm Mechanization: 80% Fertilizers: 50% Crops and Pesticides: 70% Commodity Processing Operations (where core): 40% Animal Genetics: 100% Animal Health: 80% Animal Nutrition: 70% Meat Processors: 20% Seafood Processing: 15%	Consultant estimation based on various expert interviews of executives in the private companies
	2. Adjustment factor for category-wise industry extrapolation of innovation funding	Farm Mechanization: 0.802 Fertilizers: 1.500 Crops and Pesticides: 1.042 Commodity Processing Operations (where core) : 0.918 Animal Genetics: 1.042 Animal Health: 1.042 Animal Nutrition: 1.042 Meat Processors: 0.917 Seafood Processing: 0.917	Consultant's estimation based on review of secondary research and analysis of EU2500 database.
	3. Assumed share of Global South	Depends on company analysed (refer to excel sheet 'Company related assumptions')	The table for the assumed share of the Global South includes the assumed share of innovation funding directed towards the Global South for a given company. Geographical sales data from annual reports of sampled companies has been used as a proxy in most cases to estimate this. Source: Annual reports of sampled companies
	4. Assumed share of revenue spent on R&D	Refer to excel sheet 'Company related assumptions' for company wise assumptions	This includes assumptions regarding the R&D funding by a company as percentage of total revenue, in case of companies where R&D funding has not been reported or not been reported in the desired format. These assumptions are used to estimate the R&D related innovation funding for sampled companies. The company related assumptions sheet of the private corporations excel can be referred for further deep dive. Source: Annual reports of sampled companies

Section	Extrapolation made	Percentage or Multiplier used	Justification
	5. Assumed share of revenue spent on marketing	refer to excel sheet 'Company related assumptions' for company wise assumptions	Includes assumptions regarding the marketing/adoption funding as percentage of total revenue. These assumptions are used to estimate the marketing related innovation funding for sampled companies. Source: annual reports of sampled companies
	5. Split by innovation area	refer to excel sheet 'Company related assumptions' for company wise assumptions	Includes company-wise assumptions regarding the different innovation areas the company focuses on, and the year-by-year split across these. While the split for sampled companies is entered manually (using segment revenue data as proxy), this share is derived from the sampled company estimates when extrapolating for the non-sampled companies. The company related assumptions sheet of the private corporations excel can be referred for further deep dive. This is calculated based on information provided in annual reports
	6. Extrapolation of industry size numbers where data is missing	refer to excel sheet 'Category assumptions' for category wise assumptions	Industry reports such as the ones in the following links were used to assume overall revenue/category size as well as CAGRs that were used to extrapolate for certain years. Refer to the excel sheet for a complete list of sources. Sample source links: https://www.grandviewresearch.com/industry-analysis/commercial-seeds-market https://www.futurewiseresearch.com/healthcare-market-research/Animal-Genetics-Market/3367
	7. SAI assumptions by each innovation type	Refer to excel for exact mapping	Tagging has been done by going through annual reports of companies to check 'sustainability' related language. This has been done at the level of 'innovation types' i.e. a single assumption has been made for seed development and biotech. However, manual adjustments have been made for certain companies based on their specific annual reports. For example, Bayer and Monsanto was adjusted based on what was mentioned on their annual reports. Examples of annual reports referred to: http://release.ace.bayer.com/sites/default/files/bayer-ag-annual-report-2019_9.pdf https://www.syngenta.com/sites/syngenta/files/company/Syngenta_SBR19.pdf https://www.yara.com/siteassets/investors/057-reports-and-presentations/annual-reports/2019/yara-annual-report-2019-web.pdf/
Institutional Investors	1. % of PE funding towards agriculture	0.6% - 1%	~2% for India discounted for a Global value Source: https://economictimes.indiatimes.com/news/economy/finance/private-equity-vc-investments-hit-record-high-of-48-billion-in-2019-report/articleshow/74190932.cms?from=mdr). Assumed a discounted 1% globally.
	2. Global PE funding in Agriculture (2019)	Simple CAGR	2019 value is extrapolated using data for last 3 years. Source: https://www.mckinsey.com/~/media/McKinsey/Industries/Private%20Equity%20and%20Principal%20Investors/Our%20Insights/Private%20markets%20come%20of%20age/Private-markets-come-of-age-McKinsey-Global-Private-Markets-Review-2019-vF.ashx

Section	Extrapolation made	Percentage or Multiplier used	Justification
	3. Global VC investments in agriculture	Simple CAGR	Values for 2010 and 2011 extrapolated using growth rates in the ag investor report. Source: https://research.agfunder.com/2015/AgFunder-AgTech-Investing-Report-2015.pdf
	4. % towards Global South of the total PE/ VC investments	10%	Statista calculated it to be around 17%, so a conservative estimate of 10% is taken. Value has been validated by experts in the PE/VC sector such as Hemendra Mathur, and Hans Tracy (Principal, Solum Partners) Link: https://research.agfunder.com/2015/AgFunder-AgTech-Investing-Report-2015.pdf
	5. SAI/Impact intention values by each innovation type	Refer to excel for assumptions by each innovation type	Estimation by consultants based on read of companies under each innovation type and validated/edited through expert calls (e.g. Hans Tracy, Solum Partners)
	6. Extrapolation of trends by each tag to overall PE/VC funding value	Multiplier used:1	Trends of companies in Tracxn were assumed to be representative of the overall PE/VC funding in the Global South
Private Philanthropy	**1. Percentages in innovation:**		
	Agrarian reform	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural co-operatives	0%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural development	0%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural education/training	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural extension	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural financial services	0%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural inputs	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural loans to entrepreneurs	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural land resources	50%	Estimate by consultants based on secondary research on the description of the activities included under this category

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Agricultural policy and administrative management	0%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural research	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural services	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Agricultural water resources	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Food crop production	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Industrial crops/export crops	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Livestock	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Livestock/veterinary services	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Plant and post-harvest protection and pest control	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Forestry development	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Forestry education/training	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Forestry policy and administrative management	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Fishery development	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Fishery education/training	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	Fishery research	100%	Estimate by consultants based on secondary research on the description of the activities included under this category

Section	Extrapolation made	Percentage or Multiplier used	Justification
	Fishing policy and administrative management	100%	Estimate by consultants based on secondary research on the description of the activities included under this category
	2. GDP deflator	Varies as a function of year	USA values of GDP deflators and exchange rates have been taken since most international philanthropies are based in the USA
	3. Extrapolation for 2019	Refer to excel for exact values	Change in BMGF's funding towards agriculture from 2018 to 2019 taken as a proxy for philanthropic funding. Proportions by tags of the last 3 years used arrive at break-down for 2019
Bilateral/ Multilaterals	**1. Percentages in innovation:**	Refer excel for assumptions by each purpose name, similar to philanthropies above	Estimate by consultants basis the secondary research on the description of the activities included under this category GDP Deflators sourced from world bank database (https://data.worldbank.org/indicator/NY.GDP.DEFL.ZS)
	2. GDP deflator	Refer to excel for exact values	GDP deflator of donor country used to adjust for inflation GDP Deflators sourced from world bank database (https://data.worldbank.org/indicator/NY.GDP.DEFL.ZS)
	3. Extrapolation for 2019	Refer to excel for exact values	We use a Exponential Smoothing (ETS) algorithm (inbuilt excel function) to forecast bilateral/multilateral funding in 2019. We then use 2018 proportions for each tag and allocate this to 2019.
	4. Removing overlap with government budgets	Refer to excel for exact mapping	We used the recipient name in the OECD.Stat database to determine the funding going to governments. This funding was removed from the overall values since they are likely to be counted in the government budgets/estimation.

5. List of Experts Consulted

Table 12. List of Experts Consulted.

S No.	Expert Name	Title	Organization	Expertise area
1	A B Chakravarthy	Lead	SAATHI	PE/ VC
2	Alberto Milan	Sustainable Finance, CCAFS	CGIAR	Case studies
3	Aly-Khan Jamal	Partner	Dalberg	Internal validation
4	Ammad Bahalim	Program Officer	Bill & Melinda Gates Foundation	Philanthropy/ Foundation
5	Arindom Datta	Executive Director, Rural and Development Banking	RaboBank	DFIs
6	Avinash Mishra	Investment Director	Global Innovation Fund	DFIs
7	Balakrishnan Madhavan Kutty	Rural Development Specialist	The World Bank	Bi-lateral/ multi-lateral
8	Bernard Hennies	CSO	Toyota Tsuho Group (NovaAgri)	Brazil; Private Corporations
9	Bernhard Kowatsch	Head	UN World Food Programme Innovation Accelerator	Bi-lateral/ multi-lateral
10	Beryl Agengo	Digital Agriculture Specialist	World Bank	Bi-lateral/ multi-lateral
11	Calum Turvey	Professor	Cornell University	Government - China
12	Cheng Cheng	Director	AGRA	Bi-lateral/ multi-lateral
13	Chris Cochran	Founder and Advisor	Good Food Advisors	Private Corporations
14	Christian Witt	Senior Program Officer, Soil Health	BMGF	Philanthropy/ Foundation
15	Enjiang Cheng	Program Officer	Ford Foundation	Philanthropy/ Foundation; China
16	Girish Aivalli	CEO	USAID Saathi	PE/ VC
17	Hans Tracy	Principal	Solum Partners	PE/ VC
18	Hemendra Mathur	Venture Partner	Bharat Innovation Fund	PE/ VC
19	Henrik Franklin	Lead Portfolio Advisor, East and Southern Africa	IFAD	Bi-lateral/ multi-lateral
20	Jack Liu	Professor	CAAS	Government - China
21	Jerry Glover	Senior Sustainable Agriculture Advisor	USAID	Bi-lateral/ multi-lateral
22	Jesse Baver	Partner	Dalberg	Internal validation
23	Kouessi Kodjo	Internal Office of Evaluation	IFAD	Bi-lateral/ multi-lateral
24	Kusi Hornberger	Partner	Dalberg	Internal validation
25	Luciana Pereira	Program Manager, Sustainable Raw materials	Laudes Foundation	Philanthropy; Foundation
26	Marcos Paya	SPM	Dalberg	Internal validation
27	Mariano Beillard	Foreign Service Officer/ Economist	USDA	Bi-lateral/ multi-lateral
28	Mauricio Antonio Lopes	Senior Researcher (Formerly Director)	Embrapa	Government - Brazil
29	Meera Mishra	Country Coordinator, India	IFAD	Bi-lateral/ multi-lateral
30	Mengzhen Kang	Researcher	CAAS	Government-China
31	Michael Tsan	Consultant	Dalberg	Internal validation
32	Philip Pardey	Professor	University of Minnesota	Government - China
33	Rhode Ahlonsou	SPM	Dalberg	Internal validation
34	Roger Feng	Professor	Pacific Wealth Partners	PE/ VC
35	Roshini Prakash	Knowledge Director	AVPN Asia	PE/ VC; Philanthropy/ Foundation
36	Sanjeeta D.C. Agarwal	Project Manager, Natural Resource Management	KfW	DFIs
37	Sara Eckhouse	Executive Director	Foodshot Global	Private Corporations

38	Sara Mbago-Bhunu	Regional Director, East and Southern Africa	IFAD	Bi-lateral/ multi-lateral
39	Srivalli Krishnan	SMP- Global Development	BMGF	Philanthropy/ Foundations
40	Subhadeep Sanyal	Principal	Omnivore Partners	PE/ VC
41	Valérie Hernando-Presse	Global CMO	Danone	Private Corporations
42	Vinay Vutukuru	Senior Agriculture and Rural Development Specialist	World Bank	Bi-lateral/ multi-lateral
43	Yicong Luo	Research Analyst	CGIAR	Client validation; Government - China
44	Yumei Zhang	IFPRI - Beijing Non-Staff Fellow	CGIAR	Client validation; Government - China

Annex 1: Data file descriptions

Data files can be downloaded from: https://wle.cgiar.org/cosai/innovation-investment-study

Data file	Description
Government spending	Model developed to estimate the domestic agriculture spend, agriculture innovation spend and sustainable agriculture intensification spend, by governments in the Global South and between 2010–2019. As data on adoption of innovations, institutional innovations and non-R&D spends do not exist for most governments, the model used a bottom-up approach that analyzed budget and expenditure line items of governments (where data was available) and made assumptions where necessary to tag these spends (where data was not available). Bottom-up tagging effort was targeted to optimize for time and resource investment. This was done by focusing on four countries: China, Brazil, India and Kenya, which contribute to around 90%+ of agriculture spends in the Global South.
Government extrapolations	Summary of government expenditure in agriculture (excluding China, Brazil, India and Kenya), sourced from FAOstat, IFPRI SPEED, Dalberg Analysis, and Pardey et al.
Private corporations	Model developed to estimate the agriculture innovation spend and sustainable agriculture intensification spend by private corporations between 2010–2019 focused towards the Global South. These estimates are based on bottom-up research conducted for selected companies and extrapolation of the findings to the ecosystem. This was done by focusing on around 20+ private companies, which were the largest and likely most innovative companies within their respective domains. Checks in form of proxy metrics were built into the model to enable validation for boosting accuracy and maintaining rigor. In addition, a scenario-based approach was taken to provide a range for the investment estimates, which involve varying assumptions regarding the proportion of marketing/adoption spend considered as innovation.
Institutional investors	Model developed to estimate investments in agriculture innovation and sustainable agriculture intensification by institutional investors (private equity/venture capital [PE/VC]) between 2010–2019 focused towards the Global South. The estimation was done using a combination of top-down estimation and bottom-up tagging. The top-down estimation was done using the AgFunder investment reports to estimate the total investment figure by institutional investors going to the Global South between 2010–2019. Top-down estimation also included estimates regarding sustainable agriculture intensification investments. Bottom-up tagging was done using the Tracxn database to identify the investment trends that may be applicable to the top-down estimates. These trends have been superimposed on the top-down estimate to get an overall estimate and analysis of how PE/VC money is flowing in agriculture.
Bilateral and multilateral	Model developed to estimate the bilateral and multilateral funding for agriculture innovation spend and sustainable agriculture intensification spend between 2010–2019 focused towards the Global South. As nearly

	all bilateral and multilateral funding for programs is focused on either basic research or adoption of innovations and new practices in the Global South, the model includes all expenditure that can be classified as creating or driving adoption of new agricultural technologies and new practices. The model used the OECDstat CRS database. This database includes aid investments made by non-OECD companies.
Private philanthropy	Model using the OECDstat database such as finance type (instrument type), donor recipient, donor name, and recipient name to tag investments against private philanthropy. Domestic philanthropic investments have been excluded from this analysis.
Consolidated sheet	Brings all data together in a high-level view, including three estimate scenarios around innovation spends and sustainable agriculture intensification.

CoSAI
Commission on
Sustainable
Agriculture
Intensification

The Commission on Sustainable Agriculture Intensification (CoSAI) brings together 21 Commissioners to influence public and private support to innovation in order to rapidly scale up sustainable agricultural intensification (SAI) in the Global South.

For CoSAI, innovation means the development and uptake of new ways of doing things – in policy, social institutions and finance, as well as in science and technology.

Contact us: wle-cosaisecretariat@cgiar.org

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