Policy and Public Investment Prioritisation through Value Chain Analysis (PPVC)

In most developing countries, the formulation of sound economic policies that establish a framework and enabling environment for agricultural transformation and inclusive economic growth is high on the agenda. However, appropriate and effective public policies and investments require strategies that are targeted and recognise budgetary constraints. To this end, many governments develop national agricultural investment plans (NAIPs) or strategic reforms that outline the Ministry of Agriculture's policy and investment priorities. While these initiatives are a positive step towards formalising the process of priority-setting and budgeting, they can often lead to long lists of policy ambitions and substantial increases in proposed levels of public agricultural expenditure.

Against this backdrop, the Bill and Melinda Gates Foundation (BMGF) is supporting a replicable, market-led, evidence-driven Policy Prioritisation through Value Chain Analysis (PPVC) project. The project is implemented by the Bureau for Food and Agricultural Policy (BFAP) in partnership with the Alliance for a Green Revolution in Africa (AGRA), the International Policy Research Institute (IFPRI), and in-country think tanks. The PPVC approach was developed by BFAP and IFPRI during a pilot project in Tanzania in 2017 and 2018 that was executed in collaboration with Sokoine University of Agriculture, Morogoro, Tanzania. The approach was developed to (1) identify value chains that can increase incomes, ensure food and nutrition security, attain higher agricultural GDP growth, create jobs and employment and other outcomes related to inclusive agricultural transformation (IAT); and (2) prioritise and implement policies and public investments for upgrading the identified value chains. The initiative is set up to follow a demand driven approach in relation to the identification and prioritisation of policy options, and upon the explicit request from national governments and other relevant stakeholders, and focuses on capacity building of in-country think-tanks. The project has been implemented in Tanzania, Kenya, and the first set of outputs have been developed for Ethiopia and Nigeria.

This project does not replace the national plans or any ongoing value chain and policy prioritisation activities, but rather augments the process by providing a unique combination of empirical tools within a market-led approach. The broad activities or interventions to be delivered by the Project include:

- **Market-led analysis to identify value chain priorities.** On-the-ground value chain mapping, and partial and computable general equilibrium modeling to generate a market outlook and identify and assess priority value chains that align to national strategies and that have the potential to drive IAT.
- **Policy and public investment reform identification, prioritisation and design.** Articulation and sequencing of policy and public investment reforms for upgrading each prioritised value chain.
- **Technical assistance on implementation of reforms.** Provision of ongoing technical assistance to governments on the implementation of policy and public investment recommendations, as

follow-up support for ensuring that recommendations are implemented after technical findings are presented.

Broadly, the PPVC approach covers two key aspects, which can run concurrently, each with multiple phases. The first aspect relates to **cross-cutting sectoral priorities** and the second is focussed on **value chain specific priorities**. Under the various phases, the approach combines a number of qualitative and quantitative assessments. Figure 1 presents the overall framework where a combination of market-led and economy-wide outcomes inform the selection and analysis of priority value chains and cross-cutting policies and investments that are most effective at driving sustainable inclusive agricultural transformation.

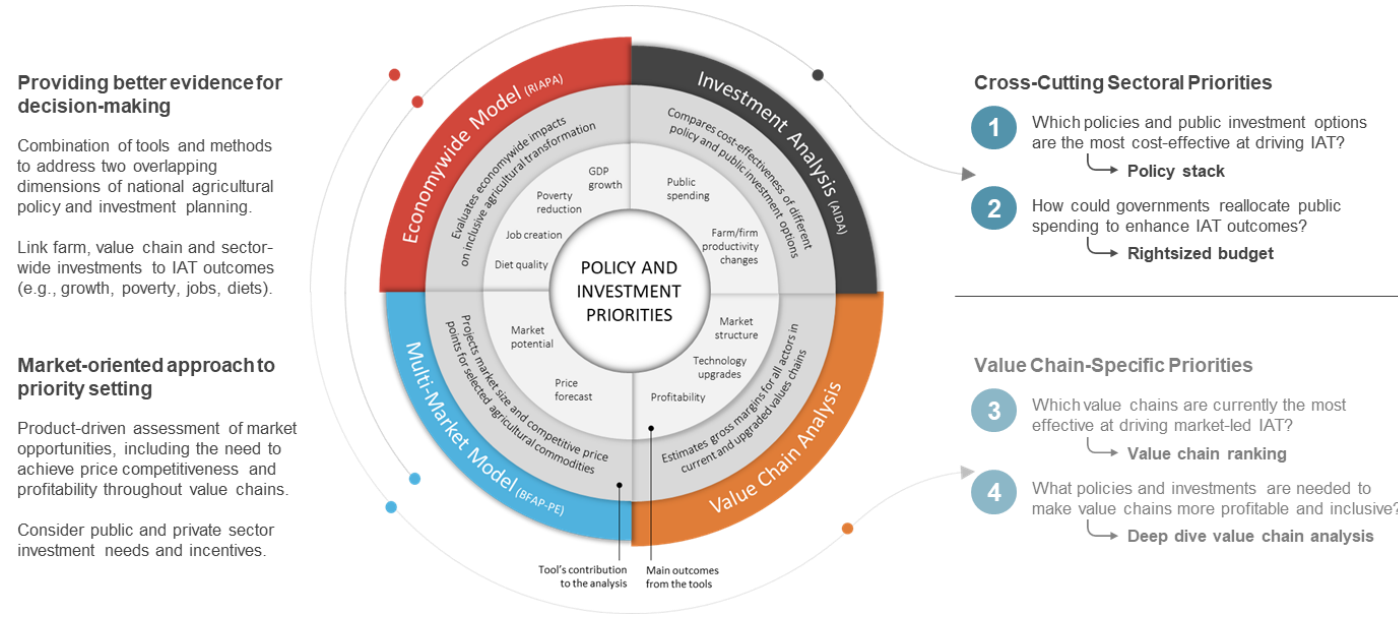

Figure 1: Overview of the tools utilised in the PPVC approach.

1. Cross Cutting Sectoral Priorities

The cross cutting sectoral priorities is an investment analysis conducted by IFPRI using the RIAPA-AIDA framework. It comprises two phases designed to compare the cost effectiveness of various relevant policy and public investment options. It considers the quantum of government expenditure, as well as the farm and firm level productivity gains that the expenditure is expected to unlock. The first phase develops a policy stack, based on the cost effectiveness of various options in driving inclusive agricultural transformation (IAT). The second phase develops a rightsized budget, which considers expenditure constrains and therefore reallocates public expenditure in order to optimise and enhance IAT outcomes.

AIDA requires information on investment impacts, unit costs and public spending. Econometric analysis of farm and household survey data is first conducted to analyze household-level investment impacts. This is combined with information from secondary sources, including monitoring and impact evaluation (M&E) studies of past investments and programs, and/or from spatial crop and infrastructure modeling. AIDA then decomposes and analyzes government budgets using public expenditure data, and projects future changes in spending allocations and investment impacts. This information is fed into RIAPA, which analyzes the economywide impacts of AIDA's investment spending forecast, alongside changes in market and macroeconomic policies. Finally, RIAPA's microsimulation module estimates household-level poverty and dietary impacts differentiated by gender.

The estimates of the returns to different investments is then used to prioritize the allocation of public spending given resource constraints (i.e., budget rightsizing). This is an iterative process in which investment impacts and returns are re-estimated over time, allowing the prioritized budget to evolve over the planning period in response to changes in investment outcomes and costs.

2. Value Chain Specific Priorities

Value Chain Specific Priorities involve research undertaken by BFAP, IFPRI and in-country think tanks with AGRA facilitating discussions with key in-country stakeholders. The analytical work also comprises two phases, designed to prioritise specific value chains to maximise impact on IAT outcomes, as well as specific actions within these value chains to ignite inclusive growth.

2.1 Value Chain Ranking

The first phase of the value chain specific priorities is the development of a ranking report. The ranking exercise considers current policy initiatives and therefore typically, but not exclusively, starts with a shortlist of value chains identified in existing policy documents such as the National Agricultural Investment Plans. The value chains included in this short list is then ranked based on a selection of quantitative indicators, informed by historic data and the modelling framework, related to market led potential, inclusiveness, transformation and a qualitative scan of the value chains that considers four key elements for each chain: (1) The current and potential investment level of each value chain; (2) the scalability of a value chain taking account of potential in regional markets and in downstream or complementary value chains; (3) the existing level of policy support; and 4) Agro-ecological resource potential related to the specific chain. Table 1 provides a summary list of indicators

Table 1: Summary of Value Chain Ranking Indicators

Indicator Category	**Indicator Sub-Category**	**Indicator Name / Description**	**Analytical Framework**
Market-led potential	Market Potential	Potential for intensification	BFAP Africa PE Model
		Domestic consumption growth	BFAP Africa PE Model
		Regional Export Potential	Historic Data
	Competitiveness	Relative Trade Advantage (RTA)	Historic Data
		Input cost to use ratio	Historic Data
Inclusiveness		Poverty Reduction	RIAPA CGE Model
		Agri-food System Employment	RIAPA CGE Model
Transformation		Agri-food system growth	RIAPA CGE Model
		Diet Quality	RIAPA CGE Model
Value Chain Scan	Qualitative Feedback in country	Level of Policy Support	Qualitative Ranking through Stakeholder Engagement
		Private sector investment levels	
		Scalability and interlinkages with additional value chains	
		Agro-econological Resource Base	

The various indicators are combined using a Garrett Ranking technique. The indicators inform a ranking outcome for each category. These can be regarded as orders of merit assigned to value chains through the indicators. Orders of merit are transformed into units of scores by converting orders of merit to percentage positions and converting percentage positions to scores using the Garrett table (Garrett & Woodworth, 1985). Finally, scores are added for each factor (value chains in our case) and divided by the total number of indices used. The final ranking of value chains is assigned according mean scores: highest mean score ranking first and lowest mean score ranking last.

Value chain selection is informed by the ranking, but occurs in collaboration with stakeholders and policy makers in country. In the various countries where the approach has been rolled out to date, the ranking was a key consideration in choosing relevant value chains, but the choice was also informed by urgency and need for actions from policy makers. Consequently, while higher ranking value chains have been chosen, it has not simply come down to choosing the highest ranking value chains for deep dive analysis.

2.2 Value Chain Deep Dive

The deep dives provide an in depth analysis of specific value chains and follows the initial selection process. Essentially, it aims to inform which policies and investments are needed to unlock improved profitability, inclusivity, efficiency and therefore growth from these value chains. The value chain deep dive process proceeds sequentially as follows:

- Firstly, it aims to establish the current state, as well as the baseline, or "business as usual" outlook for the specific subsector. This provides an overview of historic and expected supply and demand trends (including trade flow and prices), identifies critical stakeholders throughout the value chain, and establishes associated market shares, operational costs, capacities and constraints. This all informs a summary of major challenges and constraints faced by the various value chain actors.
- Secondly, it defines an "ideal or improved state" for the value chain, in which key bottlenecks and constraints are addressed using specific levers of change, including but not limited to value chain investments (public and private) and policy levers. In order to reach the ideal state, a combination of investments and policies are formulated at specific nodes of the value chain aimed at unlocking more value out of the market system and to boost the level of participation/inclusiveness.
- Thirdly, the impacts of the changes are quantified in three ways.
    - Changes are translated to gross margin impacts at the various nodes of the value chain.
    - The impact of interventions is modelled over a medium-term horizon (10 years), using BFAP's multi-market partial equilibrium model, which informs the projected product flow through the value chain.
    - The broader economic and socioeconomic impacts of improved margins and expanded production is simulated using the economy-wide RIAPA general equilibrium model.

2.3 Quantitative tools utilised in the analysis

The value chain specific analysis relies on a package of empirically-grounded tools designed to answer key questions at different stages of the policy process. These tools include four main components, namely a multi-market model (BFAP); an Integrated Value Information System (IVIS); an economy-wide model (RIAPA-AIDA); and value chain mapping and gross margin analysis. The Integrated Value

Information System provides a platform that integrates global spatial datasets with the empirical output of the other tools. The Value Chain Analysis identifies key actors and products flows and provides gross margins at various points of the chain to inform investment needs and feasibility. The BFAP multi-market partial equilibrium model projects market space and competitive price points for the specific commodities, whereas the RIAPA economywide model evaluates broader economic and socioeconomic impacts on inclusive agricultural transformation. The specific tools are detailed below. While each tool has its own merits, the strength of the PPVC approach rests in the combination, which is ultimately used to assess impact and prioritise actions. The combination of the multi-market PE model, IVIS and value chain analysis enables the identification and costing of public and private investments in agriculture and downstream agro-processing. The value chain analyses adopts a product-driven or market-led approach which extends from local farmers to final consumers or export markets, and the farm component of each value chain is situated within the broader agricultural sector (but not the economy as a whole). IVIS highlights where value chains could potentially be located in a country and the PE model assesses impacts on agricultural production and prices. In turn, RIAPA captures the whole economy, including both agricultural and downstream subsectors, and how these combine to form a country's agri-food system (AFS).

Integrated Value Information System (IVIS)

IVIS was developed to integrate economic, statistical and spatial modelling approaches into a single system designed to answer the kinds of policy and business questions needed to design a feasible public-private investment plan. IVIS is hosted in a secure web-based geographical information system that facilitates better project governance, including real-time monitoring and evaluation using BFAP's economic models and databases.

BFAP Multi Market Partial Equilibrium Model

The multi-market Partial Equilibrium (PE) model utilised in this analysis has been developed by the Bureau for Food and Agricultural Policy over a number of years. After initially starting with an ad hoc combination of country and commodity coverage that emanated from specific research requests for forward looking analysis in the region, the first comprehensive structure for grains and oilseeds in 8 African countries was established in 2012. Over the period 2012-2015, BFAP also introduced the PE modelling methodology to the Regional Network of Agricultural Policy Research Institutes (ReNAPRI) and researchers from in-country think-tanks received training in the application of these analytical tools. This training is repeated and strengthened in countries where the PPVC project is implemented, for example Tanzania and Kenya. Over time, the model has been utilised in various research projects and expanded to the point where it now covers 12 countries, with commodity coverage in each country ranging from 1 to 15. The model typically covers ten to fifteen main commodities, with relevant sectors linked through both competition for resources and input output relationships. For instance, livestock is linked to grains through animal feed and so scenarios that impact the livestock sector spill into grains and vice versa.

The multi market model is a dynamic, recursive partial equilibrium framework, based on balance sheet principles to establish equilibrium, where total supply (production, imports and stocks) must equal total demand (consumption, export and ending stock) for any given product. This approach, together with the analyses of market prices, provides the backbone for detailed market analysis that forms that foundation for the market-led approach of this project. The strengths of the partial equilibrium framework lie in the ability to capture intricate market and policy details, that closely mimic the

situation for specific commodities. This also enables detailed scenario analysis when changes occur in any of the existing variables or relationships.

Model specification is generally based on well accepted structures and specifications of supply and demand, with prices based on a combination of import or export parity, and domestic supply and demand dynamics, depending on the market situation for each commodity. In commodities such as maize, where regional trade dynamics are important, the model also captures trade and pricing relationships within the region in an innovative trade specification detailed in Davids, Meyer and Westhoff (2018). The modelling framework ensures consistency in supply and demand relationships and is able to provide price impacts of alternative scenarios, as well as a dynamic supply and demand response over time.

Parameterisation is based on a combination of econometric estimation and elasticity assumptions based on literature review, theoretical consistency and specialist judgement. The model is calibrated based on historic data, with the period dependant on data availability and consistency. For the bulk of the commodities, the calibration period ranges from 2005 to 2019, but data limitations resulted in a calibration period of 2012 to 2019 for others.

The dependence on historic data, both for estimation and calibration purposes, implies that significant emphasis must be placed on the quality of the historic data feeding into the model. Initial commodity balance sheets were compiled based on a range of secondary data sources. While the official national data provided the starting point for balance sheet compilation, complementary data from the other listed sources provided opportunities for validation and alternatives where required.

IFPRI Economywide RIAPA Model

IFPRI's Rural Investment and Policy Analysis (RIAPA) model is a dynamic economy-wide (or CGE) model that captures the interactions between all producers (sectors) and consumers (households) in the economy. RIAPA separates the Kenyan economy into 86 sectors (half within the agri-food system) and the Kenyan population into 15 household groups (i.e., urban, rural nonfarm, and rural farm, each further divided by per capita expenditure quintile). Producers in each sector combine intermediate inputs (e.g., fertilizers, seeds, fuels) with factor inputs (i.e., land, labour and capital) to produce a level of output, which they either consume within the household or supply to markets where they are combined with imports. Marketed products are either purchased by domestic agents (producers, households, government, investors) or exported to foreign markets. The decision to purchase domestic or imported goods and supply domestic or foreign markets depends on changes in relative prices in these different markets. Producers seeks to maximize profits and consumers seek to maximize utility (e.g., consumption). RIAPA, therefore, provides a comprehensive picture of the workings of the Kenyan economy, while also ensuring that macroeconomic consistency and resource constraints are respected.

Finally, the economy-wide model is linked to a survey-based microsimulation module that tracks changes in household incomes, consumption and poverty. Integrated Household Budget Surveys are used to build the CGE model's social accounting matrix (SAM) as well as the microsimulation module. The SAM captures the structure of the economy using data compiled from the most recent national statistical agency (e.g., national accounts) as well as other international sources, including the IMF (i.e., balance of payments and government financial statistics).

The RIAPA model is used to simulate the effects of expanding farm production within existing agricultural value-chains. Total factor productivity (TFP) growth in the farm component of each value-

chain is accelerated beyond baseline growth rates, such that, in each value-chain scenario, total agricultural GDP is one percent higher in 2028 than it is in the "business-as-usual" baseline scenario. Expanding farm production increases the supply of raw agricultural products to downstream processing activities and generates demand for trade and transport services. Agricultural subsectors differ in size. To achieve the same absolute increase in total agricultural value-added (i.e. GDP), it is necessary for smaller value-chains to expand more rapidly than larger ones. Smaller subsectors need larger productivity gains to match the effects of bigger subsectors. While such rapid growth for these smaller subsectors may be difficult to achieve, targeting the same absolute increase in agricultural GDP permits comparisons across value chain growth scenarios.

Value Chain Analysis

The value chain analysis encompasses the entire deep dive process, combining gross margin assessments, product flow, processing and handling capacity, trading volumes and platforms, partial and general equilibrium modelling frameworks and spatial dimensions. The final outcomes provide a granular view of all products and actors, as well as the economics of the value chain, including operating margins derived from input costs and output and import/export parity prices. A key feature is the development of the potential state, which considers how the value chain could be restructured and optimised to enhance competitiveness, profitability and transformational outcomes. Identifying the potential state of the value chain is made possible by engaging industry specialists and private sector actors with local and international knowledge and expertise.