European Commission

VCA4D
VALUE CHAIN ANALYSIS FOR DEVELOPMENT

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Maize value chain analysis in Zambia

Value chain analyses assist in informing policy dialogue and investment operations. They help the understanding of how agricultural development fits within market dynamics. They permit an assessment of the value chains' impact on smallholders, businesses, society and environment.

The European Commission has developed a standardised methodological framework for analysis (https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-/wiki/1-vca4d-methodology). It aims to understand to what extent the value chain allows for inclusive growth and whether it is both socially and environmentally sustainable.

The value chain context

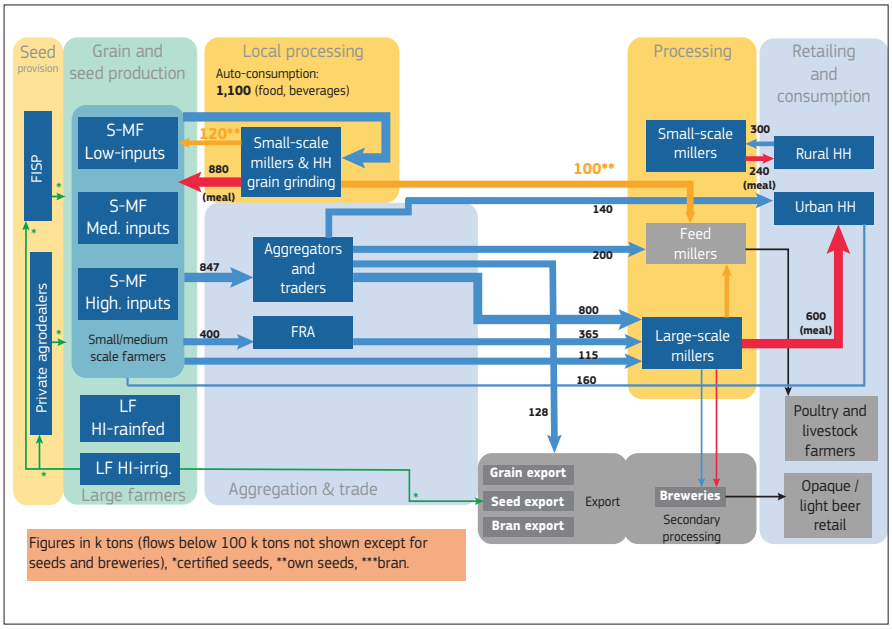
Maize is the national staple food in Zambia, providing about 60% of the country's caloric requirements. This production comes mainly from small-scale farms and is almost entirely rain-fed.

With good rainfall and the sustained provision of government subsidies on both the production and marketing side, the country has usually produced maize surpluses for the last two decades. However, production shortfalls due to severe climate shocks led to food crises in some years (Figure 2). Crop failures exposed maize to price spikes and volatility, putting strain on both consumers and producers, and leading to temporary export bans during food shortages to favour national consumption.

The yield of small-scale maize producers is low and averages 2 t per ha. Increased maize production is mostly attributed to an increase of the area under cultivation (from 750,000 ha to 1.5 million ha between 2001 and 2015).

The European Union intervention

The Zambian policy encourages private investments to improve the productivity of small-scale farmers and their capacity to deal with climatic and price shocks. This is reflected in the "Vision 2030" Government strategy, the National Climate Change Policy and the National Food and Nutrition Strategic Plan, all launched in 2017.



In the 11th EDF, the European Union (EU) aligned to the Government's vision of promoting small-scale farming. On the one side, the EU supports business-oriented smallholder farmers to graduate from low productive subsistence agriculture towards more diversified and market-oriented farming. On the other side, it works with private investors to engage small-scale maize producers through contract farming arrangements to integrate them in the value chain (VC) in a sustainable and inclusive way. This is done through collaboration with the Africa Agriculture and Trade Investment Fund (AATIF), a KfW initiated investment fund.

Figure 1: Mains actors and flows in the maize value chain in Zambia (2018)

Grey boxes - actors excluded from maize VCA scope. S-MF: small & medium-scale farmers, LF: large-scale farmers, HI: high intensity, HH: households, DMMU: Disaster Management and Mitigation Unit, FISP: Farmer Input Support Programme, FRA: Food Reserve Agency

Functional analysis

Flows of maize

After a steady growth in production during the 2000s, **the country has now reached self-sufficiency** in maize with a **production of 2 to 3.5 million t** and has even some surplus to export (Figure 2). There is a diversity of maize products available for the market (Figures 1 and 3). Nevertheless, **85-90% of the production is used for food**, Zambians being among the largest consumers of maize (around 150 kg/head/year) in Africa. Nearly half of this production is home-consumed in rural and peri urban areas and half is processed by industries into maize meal for household use.

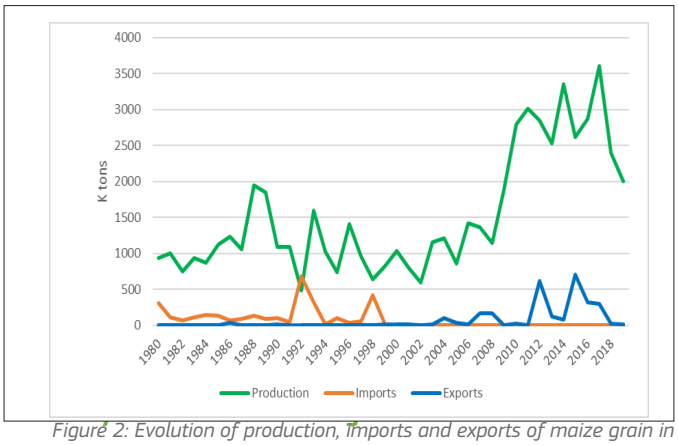


Figure 2: Evolution of production, imports and exports of maize grain in Zambia

Source: CFS, CSO, FAO

Each type of maize producer (Figure 1) has **differing strategies, constraints and opportunities**. Large-scale farms are mostly involved in the maize VC for seeds production and for self-supplying grain to the poultry, pig and dairy sectors; this strategy of vertical integration adds value and secures outlets. Large-scale production of maize grain for sale to millers can be challenging due to price uncertainty and restrictive policies as export bans. Small and medium-scale farmers growing maize for sale using higher levels of external inputs face similar market risks but also agro climatic variability. Risks are higher in remote areas where prices are lower and the maize grain market is not well developed. Financial risks are lower for small-scale farmers using medium levels of external inputs.

Risks in maize trade and milling

Maize trading can be risky particularly for the large-scale traders involved in storage. The risks are increased by the uncertainties about the government's regulation on maize exports and floor prices for each season. Smaller traders and aggregators have lower storage costs and reduce their risks by operating on a fast turnaround time between buying and re-selling at smallish margins.

Maize grain milling is generally done by large-scale enterprises. They take **small risks** as they are downstream in the VC and access subsidised grain. Partly due to the lower risks, there has been significant capital investors in this sector. Small-scale millers operate in peri-urban and rural areas and have a different customer base from commercial millers. Their returns on capital are low due to the seasonal fluctuation in demand, high energy costs, and competition in some areas where there are many small-scale mill owners.

Governance of the value chain

Coordination processes for maize marketing are characterized by spot market relations between small/medium farmers and traders. There is almost no contract farming for maize, and cooperatives organised by the public administration for small-scale farmers are not involved in maize marketing.

The governance of the VC has a long record of government involvement, given the strategic importance of maize to national food security.

Around half of small-scale farmers benefit from subsidised supplies of fertilizer and hybrid seed, lowering their production costs, through the **Farmer Input Support Programme (FISP)**. Small-scale farmers using low levels of external inputs on maize do not benefit from subsidies, and face a higher risk of food insecurity.

The **Food Reserve Agency (FRA)** is the government's maize trading arm which competes with private traders for the purchase of grain. Most of the grain purchased by FRA is held as a strategic food reserve and released to commercial millers below the market price, with the aim of evening out seasonal peaks in maize meal costs for urban consumers. The FRA provides a guaranteed market for surpluses of small-scale farmers in remote areas, where private traders are generally less active. The combined effect of FISP and FRA has encouraged maize production, providing a platform for small-holder agricultural commercialisation in remote areas. However, these policies are also costly for the public finances.

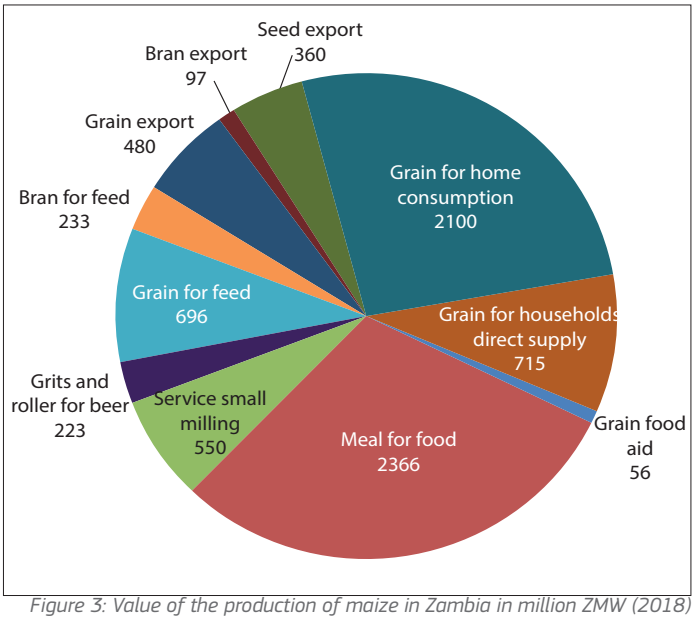


Figure 3: Value of the production of maize in Zambia in million ZMW (2018)

What is the contribution of the value chain to economic growth?

Production and value added

The **value of production of the maize VC was 7.87 billion ZMW (€580 million)** in 2018 (Figure 3). The direct value added is calculated at 3.33 billion ZMW (€245 million) (Figure 4), corresponding to 42% of the value of production. Intermediate consumptions are relatively high and are mainly represented by fertilizers for cultivation and energy for milling. Indirect effects through linkages to upstream activities (mainly transport, maintenance, packaging and electricity) bring a quite important additional indirect value added. Hence, the **total value added of the maize VC for the same year amounts to 5.3 billion ZMW (€390 million)**. The economic contribution of maize VC corresponds to **1.9% of the Zambian GDP**.

Income distribution and beneficiaries of subsidies

The maize VC has a large effect upon income distribution. **Incomes received by farmers, salaried workers, enterprises and financial institutions reached 6.16 billion ZMW (€455 million)** in 2018. This high-income is the result of public **subsidies to the prices of inputs (seeds and fertilizer) and of grain, up to nearly 3 billion ZMW (€221 million)**. Around half of the farmers benefit from input subsidies, with a discount on input prices estimated at 1.4 billion ZMW (€103 million). Seed providers also benefit from incentives to use improved hybrid seeds. For intervention of the FRA on the grain market, the industrial millers receive subsidised supplies of grain for 0.64 billion ZMW (€47 million). Urban consumers indirectly benefit from these subsidies that favour the stabilisation of meal prices and create incomes also for the public system of inputs and grain provision (estimated at 0.9 billion ZMW (€66 million)).

Profitability

Despite a high level of public support, **maize has low profitability for farmers involved in commercial production**. Small and medium-scale farms experience poor efficiency of inputs and low yields. Large-mechanised farms face high costs and they focus on seed production which is more profitable than maize grain. **Downstream actors achieve higher profitability, but they face contrasting situations.** Trading of maize can be highly profitable, but it is exposed to high market volatility, caused by the unpredictability of interventions on grain reserves on the market. Industrial milling is a mature business, with acceptable profitability. Milling appears as a leading business in the maize VC, supported by the public grain reserve as it receives maize released at a subsidized price. Small mills are present countrywise and run often far under their processing capacity, with a revatively low profitability.

Contribution to the balance of trade

The maize VC had a **negative contribution to the balance of trade** in 2018 given the dependency on imported fertilizers for 1.87 billion ZMW (€138 million) and because exports of grain and meal had been restricted to satisfy the supply of domestic market and lower prices. However, Zambia seems to have a potential to develop export to neighbouring countries where demand for maize is fast increasing and grain market prices are generally higher. Its geographic central position in the Southern African region, bordering 6 different maize-consuming countries, is an advantage for Zambia.

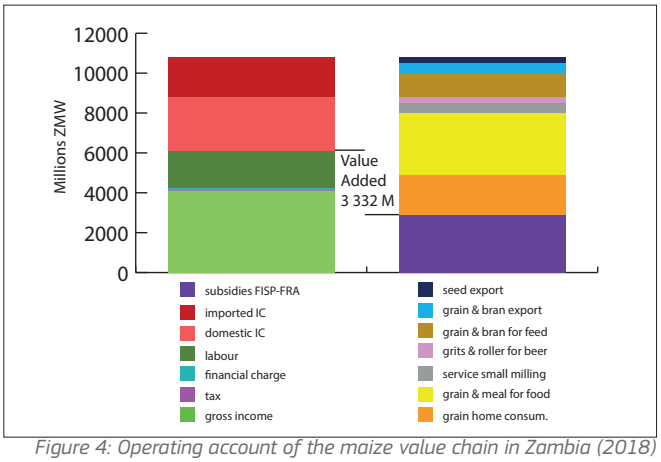


Figure 4: Operating account of the maize value chain in Zambia (2018)

The maize value chain receives more than half of the public funds managed by the Ministry of Agriculture. The efficiency of the subsidies system seems limited as public organizations for inputs supply and grain collection record very high management costs compared to the private sector. The main criticisms to the current maize policy are that (i) there are inequalities between actors that receive subsidy or not; (ii) the low productivity and uncertain sustainability of the smallholders' cropping systems are not addressed.

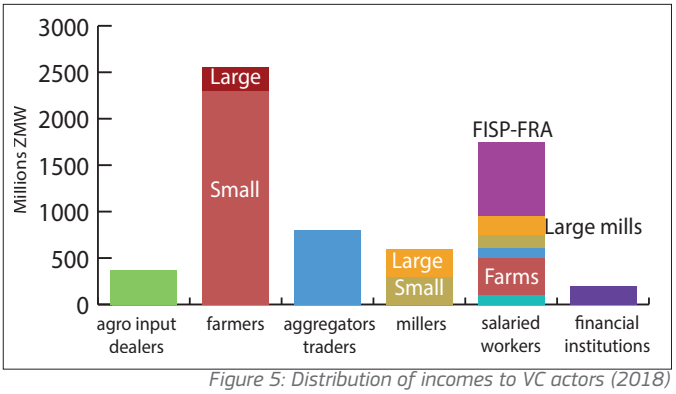


Figure 5: Distribution of incomes to VC actors (2018)

The volume of production subsidies to small-scale farmers has increased, as well as the number of beneficiaries. However, around half of small-scale farmers, including in areas well suited for maize production, are not receiving FISP support. Moreover, in areas less suited for maize production, farmers who do participate in FISP achieve generally lower returns. Hybrid maize seed production is far less inclusive, being restricted to relatively few commercial farming operations with the required infrastructure and an established relationship with seed companies.

Is the economic growth inclusive?

The significant increase in the volume of maize produced since 2000, most of it by small-scale farmers, and the increasing number of actors involved in the various input supply and value addition activities, have provided **increased employment and income generation opportunities both in rural and urban areas** (Figure 5). The increased volume of small-scale activities in agro-input supply and maize trading has provided useful income earning opportunities, particularly for young men in rural areas where paid employment opportunities are scarce.

Small and micro-scale trading provides **significant income for many people unable to compete in formal employment markets** as it does not have educational or skills barriers to entry. The more economically rewarding sides of this trading tend to be seasonal, and also occupied by young men. Women are mostly involved in micro-level processing and trading of maize products which is less seasonal steady and offers much lower income generating opportunities.

Large-scale milling is competitive but the least inclusive activity as it requires significant amounts of capital to enter, high levels of technical and management skills, and significant investments in modern plants and equipment to remain viable long-term. Access to FRA maize quotas is also a factor which affects profitability and is only available to large-scale millers. Small-scale milling requires much less start-up capital, but the returns are also relatively low.

Is the value chain socially sustainable?

The table to the right and figure 6 provide an image of the main social consequences of the VC activities in six strategic domains.

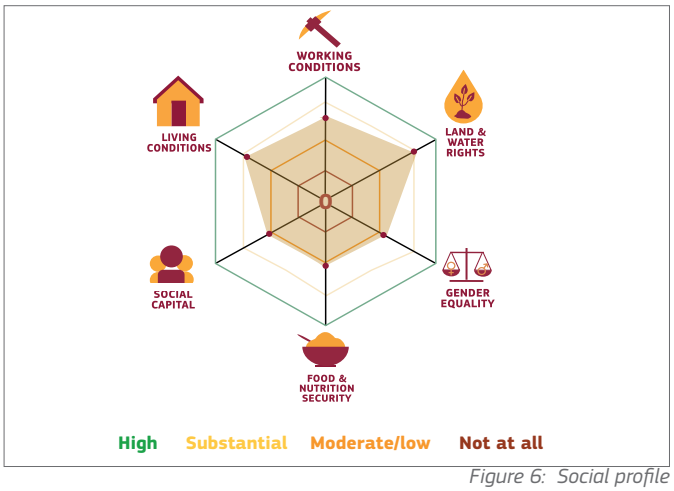


Figure 6: Social profile

Social capital, food and nutrition and gender equality are domains of greatest concern. Small-scale farmers producing maize (for food and for sale) face a range of risks and vulnerabilities. The development of social capital (e.g. through producer cooperatives, and lasting relationships between local input providers, traders and farmers) is weakened at local level by a historically strong dependence on a publicly funded top-down system for supporting maize production and marketing, and the use of maize often as food relief. The result is a "dependency syndrome" culture, rather than fostering a spirit of self-reliance and enterprise. This also plays out at the local level in terms of household food security and nutrition. Poorer households, unable to produce (or retain) enough maize for their own requirements, become dependent on the richer local households for their food supply during the hunger season, exchanging their labour in return for grain. Also, smallholder growing of maize as a cash crop tends to increase gender inequality in male headed households.

Working conditions	• Mainly family labour, supplemented by local hire of neighbours in small-scale production. Commercial farmers provide employment contracts and are signed up to labour legislation in seed production • Large traders and commercial millers mix contracted permanent employees and seasonal employees. Smaller traders, aggregators and small rural mills, often work with family members
Land and water rights	• Increasing land shortages in many traditional producing areas. Longer term land pressure will increase – along with poverty • Established strategy of migration to other areas with clearing of forests for farmers wishing to produce a surplus for sale (high environmental cost)
Gender equality	• Expansion of household production increasing the burden for females (weeding, harvesting and threshing) • Female household members have limited say on how the money from sale of the surplus is used • Prominence and influence of males in grain trading, milling, rural cooperatives and commercial seed growing
Food and nutrition security	• Food insecurity risks for poorer households unable to afford fertilizer or hybrid seed at market prices, and not in receipt of subsidised inputs, due to climate variability, pest and disease challenge and declining soil fertility • Women with young children from poorer households spend significant time away from their homes in search of work and/or food and are not available to provide regular and suitable meals for their children • Rates of under 5-year-old stunting often high in traditional producing areas and in areas where production is on the increase
Social capital	• Low levels of trust between the players in the VC: input suppliers and small-scale farmers (no credit), traders and small-scale producers (no loyalty), millers and traders, producer cooperatives and members, commercial farmers and government • No influence of district cooperatives in the choice of varieties and fertiliser provided through FISP
Living conditions	• Disadvantage of rural producing households in access to health care, education and transport • Good living conditions in commercial farms for employees in terms of housing, water and sanitation, basic health care and primary education

Is the value chain environmentally sustainable?

The environmental analysis was carried out regarding impacts 1) at farm-gate, considering the main typologies of cropping systems and 2) of maize meal production considering a local and an industrial sub-chain.

Impacts at the stages of the value chain

The largest contribution derives from stages associated to grain production (Figure 7). Indeed, most of the impact is generated at farm level from (1) land clearing for maize cultivation and (2) cultivation activities, including combustion of field residues. **Much lower impact is generated at downstream stages, namely transport of grains and milling.**

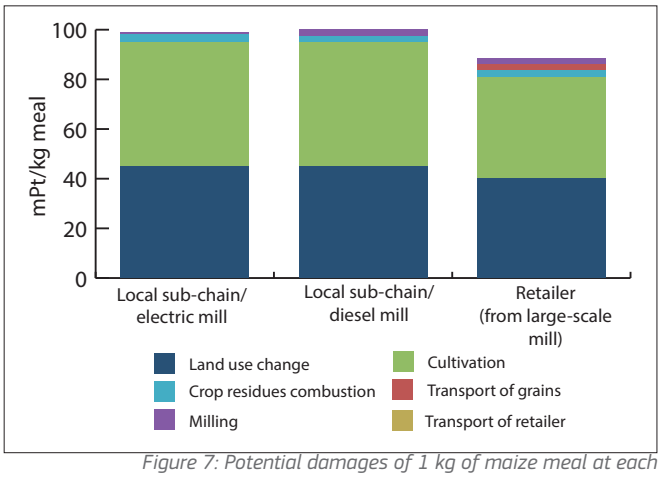


Figure 7: Potential damages of 1 kg of maize meal at each stage of the value chain

Impacts on the areas of protection

The largest impact of the maize VC in Zambia **concerns ecosystem quality** (Figure 8). Ecosystem is mainly **affected by land use, by land use change and by global warming**. Indeed, land use leads to damage to ecosystems due to changes of land cover/land use intensification, leading to soil disturbance and loss of habitat which, in turn leads to potentially disappeared fractions of species. This implies a risk of biodiversity loss. The high rates of agricultural land occupation are associated with the low grain yields that characterize the prevailing cropping systems in Zambia. Although land use change triggered by maize cropland expansion into virgin land does not occur at a high rate, it causes global warming, mainly due to organic carbon loss. Greenhouse Gas (GHG) emissions from other sources (fertilization, mechanical operations, transport, milling) are much lower.

Human health is the second most affected domain, with contributions to the overall impact of the maize VC of around 30% (Figure 8). **The main cause of potential damage to human health is global warming**, which to a large extent is due to cropland expansion into virgin land for maize cultivation. **Smaller contributions** to potential damage to human health **derive from particulate matter formation**, due to production and transport of external inputs. Also crop residue combustion contributes to the formation of particulate matter, along with ammonia emissions due to nitrogen fertilization (in the higher input cropping systems).

There are additional human health hazards associated with herbicide and pesticide application on crops. These risks tend to be localized and may be reversible by mitigation measures following environmental regulations and best environmental management practices. These practices also regard the correct disposal of packaging material contaminated with residues of chemicals. The adoption of such measures needs to be encouraged in Zambia, for instance, through awareness campaigns involving the local leadership, extension services, agri-businesses and agro-dealers.

Resource depletion is the area with the lowest impact even in the cases of higher input cropping systems and of the less efficient milling technologies of small-scale village mills. The contribution to the overall environmental impact of both components of this domain, mineral and fossil resources scarcity, is negligible.

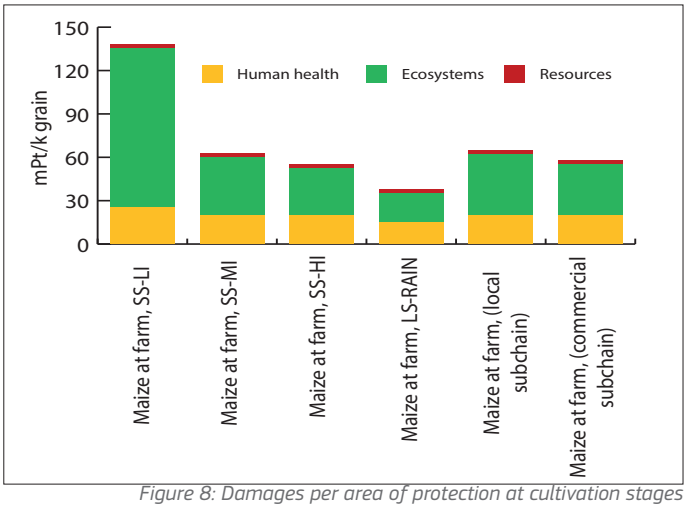


Figure 8: Damages per area of protection at cultivation stages SS = small and medium-scale, LS = large -scale, LI= low intensity, MI= medium intensity, HI= high intensity and mixes of grain from the cropping systems sourcing the local and the commecial sub-chains.

Increasing maize yields would largely influence the environmental profile of the whole value chain by reducing agricultural land occupation and land use change. Improving yields and reducing post-harvest loss would release pressure on land and reduce forest degradation triggered by cropland expansion, which are the main issues that prevent this value chain from being environmentally sustainable. Reducing storage losses can also contribute to significant improvements of the environmental profile of the whole value chain, considering that post-harvest losses have large incidence on the efficiency ratio of output to land area cultivated.

Main findings and recommendations

Main findings

Maize production has recorded a remarkable growth in Zambia driven by food needs and market opportunities. This has been achieved mainly through extension of the cropped area at the expense of virgin land. Despite a history of input subsidies from 1980s, average yields are relatively low (2 t/ha), resulting in low productivity and income for small-scale farmers. Addressing issues related to low yields of small-scale farmers is key to attain a significant improvement of both the economic, social and environmental performance of the maize VC.

Conventional intensification with the package of hybrid seed, mineral fertilizer and herbicide is the main approach promoted by agro-dealers and FISP, but these have likely adverse environmental effects on ecosystems and on human health. Transition to more sustainable cropping practices, as promoted by NGOs and public extension services through conservation farming programmes since the 2000s (minimum tillage, mulching, legume rotation, use of animal manure and herbicides) remains a challenge in terms of uptake. The main constraints are the lack of inputs and equipment, knowledge and markets.

There is scope to address the issue of low yields, improving conventional cropping intensification through adequate crop management for key operations such as fertilization (availability of appropriate fertilizer and timely application), mechanical weeding, crop association (beans with maize). Also, the transition to more environmentally sustainable cropping systems such as those proposed through conservation agriculture (CA) approaches is crucial.

The **main challenges** for the VC are the low productivity and risk of unsustainability of smallholders cropping systems; the human nutritional deficits in rural areas; and the blocking of private or community investment in the VC through inappropriate public intervention.

Recommendations

Several areas of interventions are proposed:

Specific support to upscale conservation agriculture

- Develop, refine and promote CA practices tailored to the local conditions.
- Develop the fabrication of ox-drawn equipment adapted to CA such as tillage tools, rippers, of particular interest to limit herbicide application.
- Develop payments for environmental services to compensate immediate low benefits for farmers and low capacity to wait the delay for soil resource improvement.
- Introduce combinations of different options such as conservation farming and promotion of alternative livelihoods and the harmonization of policies related to forestry, land, agriculture and environment.
- Link fertilisers' subsidies to agroforestry investments on the farm for long-term sustainability in nutrient supply and to build up soil fertility as the basis for sustained yields and improved efficiency of fertiliser response.
- Improve land use planning as climate smart agriculture alone might not avert expansion-led deforestation.
- Improve the screening of agro-ecological and socio-economic constraints and incentives to better understand the low intensity of adoption of CA (zero/minimum tillage and crop rotation).
- Provide robust information at national level in regard to CA and not only conventional cropping systems.

Improving the nutritional status in rural areas

- Study factors which underlie child malnutrition in maize growing areas to inform current nutrition programs.
- Promote orange maize varieties with high lysine and vitamin A.
- Give geographical focus on areas where the prevalence of under 5 stunting or vitamin A deficiency is high.

Policy and institutional perspective to enhance actors' initiative

- Review the FISP program design with a view to achieving more equitable access to subsidised farm inputs by small-scale farmers, with an expanded choice of inputs to reduce the tendency towards maize mono-culture.
- Review the current levels of public expenditure on FISP and FSA to identify cost-saving measures and ensure more public funds for strategic research and extension efforts and encourage private actors to improve the range of services (input supply, grain collection…) for the more commercially oriented small and medium scale farmers.
- In maize growing areas often receiving disaster relief, support initiatives to store maize locally for resale/release during the lean season – reducing dependency on food relief provided from urban centres.

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Agrinatura (http://agrinatura-eu.eu) is the European Alliance of Universities and Research Centers involved in agricultural research and capacity building for development. The information and knowledge produced through the value chain studies are intended to support **the Delegations of the European Union** and their partners in improving policy dialogue, investing in value chains and better understanding the changes linked to their actions. VCA4D uses a systematic methodological framework for analysing value chains in agriculture, livestock, fishery, aquaculture and agroforestry. More information including reports and communication material can be found at: https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-

This document is based on the report "Maize Value Chain Analysis in Zambia" 2022, by Jean-Louis Fusillier (CIRAD), Alistair Sutherland, Ricardo Villani and Antony Chapoto. Only the original report binds the authors.