Practical lessons on scaling up smallholder-inclusive and sustainable cassava value chains in Africa

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Developing more inclusive and sustainable agricultural value chains at scale is a development priority. The 'Cassava: Adding Value for Africa' project has supported the development of value chains for high quality cassava flour (HQCF) in Ghana, Tanzania, Uganda, Nigeria, and Malawi to improve the incomes and livelihoods of smallholder households, including women. The project focused on three key interventions: 1) ensuring a consistent supply of raw materials; 2) developing viable intermediaries as secondary processors or bulking agents; and 3) driving market demand. Scaling-up experiences are presented, guided by an analysis of drivers (ideas/models, vision and leadership, incentives and accountability), the enabling context (institutions, infrastructure, technology, financial, policy and regulations, partnerships and leverage, social context, environment), and the monitoring, evaluation, and learning process. Lessons for scaling up of similar value chain interventions are presented. These highlight the tension between rapid development of value chains and achieving equity and sustainability goals; the need for holistic approaches to capacity strengthening of diverse value chain actors; the role of strengthening equitable business relationships and networks as a vital element of scaling processes; and how informed engagement with government policy and regulatory issues is key, but often challenging given conflicting pressures on policymakers. The scaling process should be market-led, but the level and type of public sector and civil society investment needs careful consideration by donors, governments, and others, in particular less visible investments in fostering relationships and trust. Addressing uncertainties around smallholder-inclusive value chain development requires adaptive management and facilitation of the scaling process.

Keywords: cassava, value chain, smallholder, scaling, Africa

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DEVELOPING MORE SMALLHOLDER-INCLUSIVE and sustainable agricultural value chains at scale is a development priority. This paper presents new practical lessons from a development programme in five African countries (Ghana, Nigeria, Uganda, Tanzania, and Malawi), which seeks to build smallholder-inclusive cassava value chains.

Cassava in sub-Saharan Africa

Cassava is an important staple crop in sub-Saharan Africa (SSA). Most cassava is produced on smallholder farms with family labour using hand tools and without use of external inputs. Across SSA, cassava is mainly used for human consumption. Cassava is Africa's second most important food staple in terms of calories consumed per capita and is a major source of calories for roughly two out of every five Africans (IFAD/ FAO, 2005; Rosenthal and Ort, 2012).

Traditionally cassava was seen as a food security crop, but production has expanded rapidly in SSA in response to increasing demand (rapidly expanding and urbanizing population), particularly in Ghana and Nigeria (Nweke, 2004), and supply factors (higher yielding varieties, post-harvest technologies, and switching to cassava in areas of high land pressure) (IFAD/ FAO, 2005; Fermont et al, 2008). The area planted to cassava increased almost threefold in Ghana and Nigeria from 1961 to 1999. IFAD/ FAO (2005) argue that one of the key factors influencing the expansion of the cassava area was the availability of improved processing equipment. Processing reduces bulkiness of fresh cassava roots by removing water, resulting in improved storability and lower transport costs to urban market centres.

While many have considered cassava an inferior food crop (IFAD/ FAO, 2005), this situation varies with location (e.g. cassava is more widely consumed in West Africa than East and southern Africa) and is rapidly changing. Domestic food production and/or food imports will have to increase to meet the growing and changing food demand due to population growth, urbanization, and – although poverty levels remain high – growing middle classes (UN, 2013; AfDB, 2011; Chandy et al., 2013). Global food concerns in the light of climate and other changes are renewing the urgent challenge facing African nations to increase domestic and regional food production. Alongside this trend, in addition to traditional food uses (Westby, 2002), cassava is also being considered as a raw material for a wide range of food and non-food industrial uses.

Smallholder-inclusive staple food value chains in sub-Saharan Africa

Smallholder farms in SSA number around 33 million, represent 80 per cent of farms in the region, and contribute up to 90 per cent of food production in some SSA countries (Wiggins and Keats, 2013). Developing smallholder agriculture can be effective in reducing poverty and hunger in low-income countries, particularly in the short to medium term, but sustainable access to markets is needed (Wiggins and Keats, 2013), as well as the ability to engage and benefit from market access (Barrett, 2008; Seville et al., 2010).

The majority of smallholder households in SSA are net deficit in food production terms and only a minority sell food staples in an average year (Hazell and Poulton, 2007). Most poor farmers are not linked to markets (Wiggins and Keats, 2013) or deal with markets (buying inputs and selling produce) in small amounts (Wiggins and Keats, 2014). In the case of staple food grain producers in eastern and southern Africa, a relatively small share of households sell food grains and many of those selling are still net purchasers over the year. Farmers must have access to productive technologies and adequate private and public goods in order to produce a marketable surplus. Those with access to appropriate assets and infrastructure, together with suitable incentives, typically engage in markets, while those lacking one or more of those three elements generally do not (Barrett, 2008). Disincentives for SSA root crop producers result from extremely disconnected value chains, infrastructural constraints, and policymakers paying little attention to these commodities (Angelucci et al., 2013). In contrast to high value export crops (an option for only a minority of smallholders), for staple crops there seem to be few private initiatives that address the lack of smallholder access to domestic and regional markets (Wiggins and Keats, 2013).

There is an ongoing debate concerning the nature and extent of public interventions and the role of the private sector in agricultural development. A neo-classical economic view emphasizes the role of market forces as the main mechanism for efficient resource allocation and considers public sector intervention as having price-distorting effects. This view was strongly advocated by the World Bank and the International Monetary Fund (IMF) (the Washington Consensus) in Africa through structural adjustment programmes and radical reforms in agriculture that were centred on privatizing production and delivery of services and restricting governments to legislative and regulatory roles and delivering core public sector goods and services. However, for countries in which markets are yet to emerge or are underdeveloped and frequently fail, applying the Washington Consensus policies produced mixed social and economic results (Chang, 2009). The realities of the developing world include market failures, capability constraints, and risk management issues (Smith, 2009).

Following agricultural market liberalization in SSA, private traders have taken up opportunities to purchase output from producers, although this varies geographically, while private sector provision of pre-harvest services has been more limited. Incentives for investment in service provision for food crops have been much weaker than for export cash crops. Private investment in crop storage has been low, contributing to increased price volatility post-liberalization (Poulton et al., 2010; Poulton and Macartney, 2012).

The reasons for these outcomes are contested. Some argue that states have not fully withdrawn from many markets and this discourages private investment. Others emphasize the impact of low public investment in basic infrastructure on private investment in agricultural marketing. Some commentators point to the lack of important institutions required to support efficient private markets. Finally, coordination issues have been identified as a key area to address 'low level equilibrium traps' constraining agricultural production and marketing activities (Poulton and Macartney, 2012).

The conceptual and empirical evidence on smallholder market participation, with a focus on staple food grains in eastern and southern Africa, suggests that interventions aimed at facilitating smallholder organization, reducing the costs of intermarket commerce, and improving poorer households' access to improved technologies and productive assets are central to stimulating smallholder market participation and escape from semi-subsistence poverty traps (Barrett, 2008). Appropriate institutions and endowments are needed as well as 'getting the prices right' in order to induce market-based development (Barrett, 2008).

Public support may be necessary to encourage private investment and innovation in agriculture. Market failures (i.e. a situation where market forces fail to allocate resources efficiently or result in a net social welfare loss) justify a public intervention. For example, enterprises may not have the information or experience necessary to invest without undue risk. Such risks are often especially high to innovators. Public agencies might share some of the high transaction costs and associated risks constraining private sector activity. However, key influences on private investment in agricultural supply chains are the existence of an enabling rural investment climate and rural public goods (Wiggins and Keats, 2014). While a sharing of transaction costs and risks could partly compensate for high costs due to the lack of an enabling environment, it is unlikely to stimulate greater private investment where unpredictable state policies are discouraging investment (Poulton and Macartney, 2012). As well as market failure, there may be government or state failure (Poulton and Macartney, 2012) which may also justify public support to private enterprise (Wiggins and Keats, 2014).

'Cassava: Adding Value for Africa': description of the interventions

Smallholders producing cassava in SSA have restricted market access for their produce, not least because roots are perishable, bulky, and expensive to transport. High quality cassava flour (HQCF) has multiple market outlets for food and industrial uses and is a new opportunity for smallholder farmers and processors. Less capital equipment investment is needed than, for example, starch; it builds on existing processing knowledge. Processing of cassava roots to HQCF involves peeling, washing, grating, pressing, disintegration, sifting, drying, milling, screening, packaging, and storage.

Cassava is traditionally grown by large numbers of smallholders; each farmer usually cultivates less than 2 ha. Meanwhile, emerging markets for HQCF make orders and expect deliveries of consistent quality product in large quantities from systems that are not currently set up to accommodate a large number of suppliers. The key challenge to linking cassava farmers to the large markets for HQCF, therefore, is aggregation and facilitation of delivery of HQCF to factories through a value chain originating from many smallholders combined with meeting quality standards.

There are a number of ways to overcome this challenge and the preferred option will vary from one country or region to another. Where value chains are relatively well established (like Nigeria and Ghana), the introduction of artificial

dryers capable of processing 1–3 metric tonnes of HQCF/day (single shift) could help to locate intermediary processing closer to the sources of fresh cassava roots and/or provide intermediate aggregation and transportation services, in addition to maintaining an acceptable quality of products delivered to the end use market. Where the value chain is relatively new and the technology gap is more difficult to overcome in the short run, the services of aggregation of high quality cassava grits (grated, pressed, and sun-dried, but not milled) will have to be provided by an entity such as a farmers' association or an entrepreneur, who could also provide a milling service. This is because grits can be more easily collected from a large number of farmer-processors for bulking and the quality parameters for grits are more easily maintained than for flour. A further option is for community-level processors to target smaller, more localized markets such as rural or small town bakers.

The 'Cassava: Adding Value for Africa' project (C:AVA; http://cava.nri.org/) has developed value chains for HQCF in Ghana, Tanzania, Uganda, Nigeria, and Malawi (phase 1, 2008–14). Funded by the Bill & Melinda Gates Foundation (the Foundation), the project aims to improve the livelihoods and incomes of smallholder households as direct beneficiaries, including women and disadvantaged groups. It promotes the use of HQCF as a versatile raw material for which diverse markets exist. Three key value chain strategies form the basis of C:AVA, namely: 1) ensuring a consistent supply of raw materials; 2) developing viable intermediaries who can act as secondary processors or bulking agents in value chains; and 3) driving market demand and building market share (in, for example, bakery industry, components of traditional foods, or plywood/paperboard applications).

C:AVA has made multi-point interventions in the value chain, which differ by location and time. Project country offices based in universities and other research centres have played the key role of facilitation of the value chain. Partnerships have been essential to progress.

Interventions with smallholder farmers have focused on improving root supply. This has included working with community groups to build capacity in cassava root production (agronomy training, introducing new high-yield cassava varieties) and business and organization management training and mentoring.

Interventions with processors to improve quantity and quality of HQCF produced has involved: support at community level and various sized enterprises on HQCF processing; introducing new processing technologies or improving existing ones; and business and organization management training and mentoring.

A third set of interventions has been at the market level including identifying potential new markets for HQCF and providing business and technical support to make a case for using HQCF.

Capacity strengthening of diverse service providers has been an important part of this process. This was a key consideration with respect to sustainability of the value chains being developed.

C:AVA has facilitated the development of HQCF uses and value chains supplying a range of markets including: wheat replacement for flour millers, biscuit manufacturers, and local bakeries; in plywood and paperboard manufacturing, replacing

wheat flour and maize starch, respectively; and novel traditional products e.g. instant *fufu*; and domestic use of cassava flour. There are two main types of drying processes in HQCF value chains: artificial drying using flash dryers or bin dryers and sun drying. While there is an overall broad project approach, within each country there have been varied strategies and experiences reflecting different contexts.

This paper presents reflections of C:AVA's scaling-up experience to date and implications for similar value chain development interventions; that is, value chains based on a staple food crop – particularly cassava – supplying domestic or regional markets in SSA.

Method

Our working definition of scaling up draws on the definitions of Hartmann and Linn (2008) and IIRR (2000). Hartmann and Linn (2008) define scaling up as 'expanding, replicating, adapting and sustaining successful policies, programs or projects in geographic space and over time to reach a greater number of rural poor'. IIRR (2000) presents the following definition: 'Scaling up brings more quality benefits to more people over a wider geographical area, more quickly, more equitably, and more lastingly.' In this paper we will include the following dimensions: the expansion and adaptation of cassava value chains over time and space; the number of target beneficiaries reached; and the quality, equity, and sustainability of benefits.

To draw practical lessons from across the project in different countries, a study was undertaken which aimed to: 1) clarify what has/is being scaled up; 2) analyse pathways to scale and impact and the approaches used; 3) identify key drivers and enabling/constraining factors; and 4) identify lessons for scaling up and scaling out of similar smallholder-inclusive value chains.

To examine the C:AVA scaling-up process we used a conceptual framework (Figure 1) that was adapted from a generic value chain scaling-up framework developed by Hartmann et al. (2013) and Linn (2012). To scale up cassava value chains to benefit a larger number of smallholder farming families requires an alignment between various drivers and enabling or constraining factors within the overall value chain system and context within which it is based. While implementing an intervention, a learning process involving some form of monitoring and evaluation (M&E) is needed to inform the scaling-up pathway so it can be adapted in light of the lessons learnt.

Drivers push the scaling-up process forward, and Linn (2012) identifies the following elements: ideas and models that have worked at a small scale or have been promoted successfully elsewhere; vision and leadership which has recognized that the scaling up of an idea is necessary, desirable, and feasible; external catalysts such as political and economic crises or pressure from outside actors (donors, NGOs, and so forth) which may drive the scaling-up process forward; and incentives and accountability for results which are needed to drive actors and institutions.

The key steps in the study method were as follows:

- A review of C:AVA documentation to gather information on the project in each country, including changes in strategy and the evolution of the value chains being

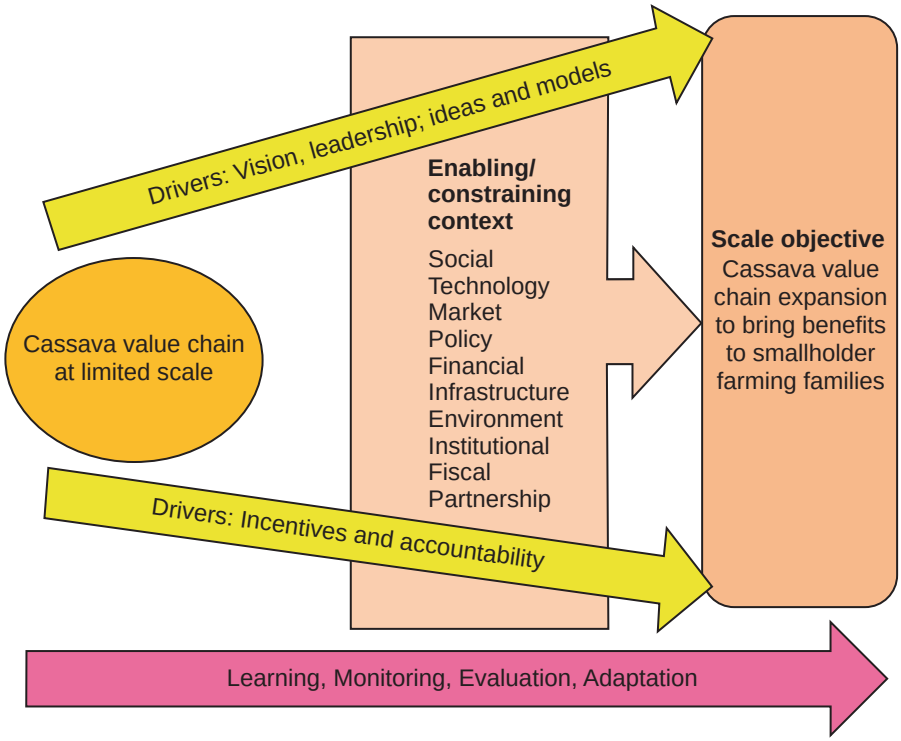


Figure 1 Scaling up cassava value chains: pathways, drivers, and enabling and constraining factors
Source: Adapted from Hartmann et al. (2013) and Linn (2012)

developed. Project documentation included: the original project proposal; value chain, gender, and situation analysis scoping studies in each country; annual and quarterly country progress reports; project annual reports; annual meeting presentations; and monitoring and learning reports. This information was used to map out C:AVA scaling process/pathways to scale for each country.

- Interviews with C:AVA personnel to identify drivers, enablers, and constraining influences in each country and for the project as a whole. The study facilitation team interviewed: the overall project managers (two, based in Nigeria and UK), country managers (five, based in Ghana, Nigeria, Uganda, Tanzania, and Malawi), subject specialists who also had a country focus (four, based in UK and Nigeria), and one M&E specialist (based in UK). A checklist based on the conceptual framework (Figure 1) was used to ascertain for each country: the overall project evolution (scaling strategies, value chains being supported, actual C:AVA activities, target groups); key drivers and key enhancing/constraining factors; and the M&E and learning processes. The information collected was recorded in summary tables for each country.
- Participatory analysis by country managers and coordinators of the relative importance and influence of the drivers and enabling or constraining influences

identified. Country teams were asked to: 1) verify the summary tables making corrections and adding any key omissions; 2) prioritize, as high, medium, or low, the listed drivers and factors (enablers or constraints) in terms of their influence on scaling-up process for HQCF value chains to bring benefits to smallholders and other target groups for their respective countries to date; and 3) identify which of these drivers and factors (enabling or constraining) are still key influences for future scaling of HQCF value chains to bring benefits to smallholders and other target groups.

- The results were shared for validation in a C:AVA team meeting, including the programme officer from the Foundation.
- A project working paper was prepared, which contributed to the development of a C:AVA phase II.

In the following sections we present the findings of the study according to the conceptual framework above, drawing on experiences from across the five project countries, starting with the scale objective for the C:AVA project, then the drivers, followed by the enabling/constraining context. Finally, we identify lessons and draw out conclusions emerging from the analysis.

Scale objective

The original project objective in relation to scaling was based on bringing income benefits to 90,000 smallholder families. This objective was refined in country strategy workshops following a number of initial project studies (value chains, scoping studies, gender situational analysis, and baseline surveys). These studies identified the diversity within the broad category of 'smallholder', which informed project planning in a general sense, but did not result in specifically targeted interventions for different types of smallholder.

Figure 2 outlines the broad situation regarding different types of cassava farmers and how they may engage in new cassava value chains. Larger, better resourced, male members of rural communities are typically in a better position to respond to, and manage the risks offered by, new commercial opportunities. Significant support will be needed for women and less well-resourced members of rural communities, many of whom are food insecure, to benefit from new cassava value chain development. Enterprises may also need help to source from these target groups. In Nigeria, for example, only 45 per cent of the female-headed households working with C:AVA had more than one hectare of farmland, compared to 87 per cent of male-headed households (Figure 3).

Drivers

Vision and leadership/Ideas and models

C:AVA is a key driver of smallholder-inclusive HQCF value chains development in all five countries. In Nigeria and Ghana there are also a number of other important

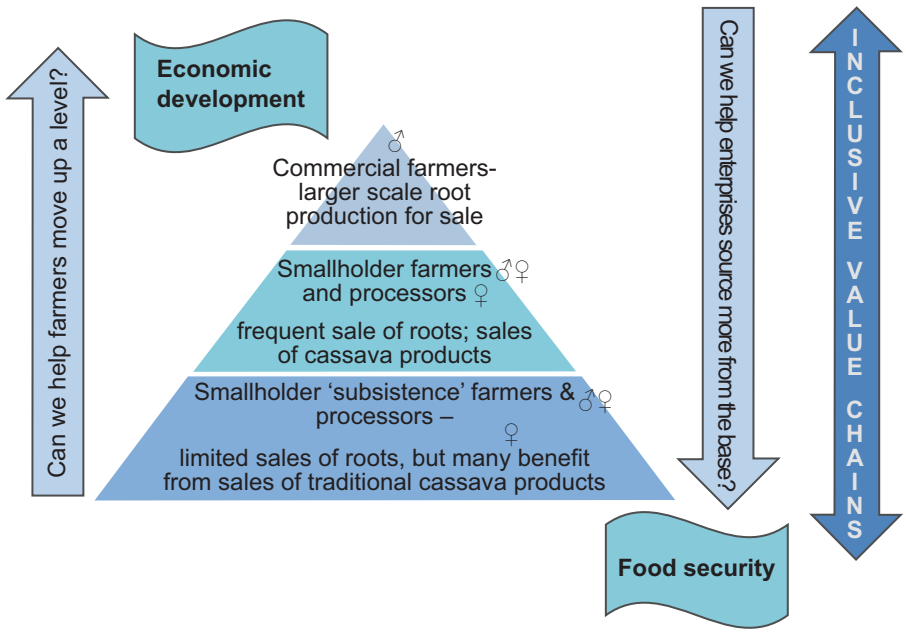
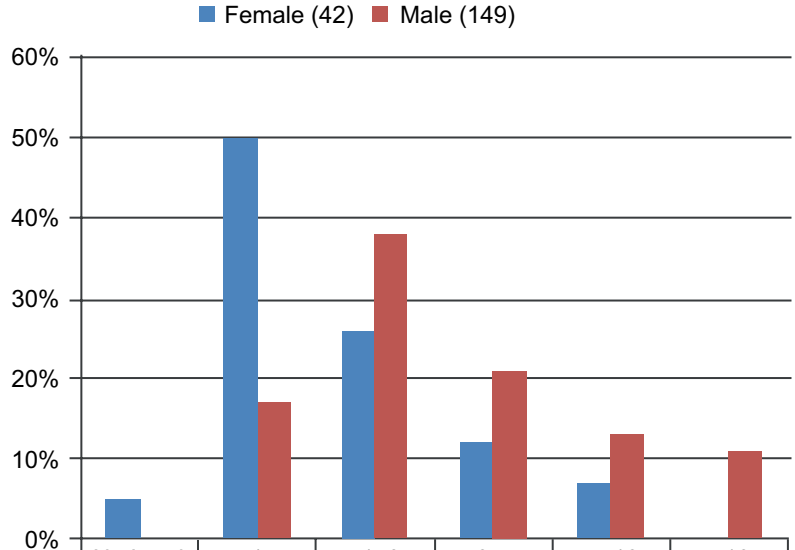


Figure 2 How can different smallholder farmers or processors be included in cassava value chains?
Source: Adapted from Seville et al. (2010) and Woodhill (2012) cited in Hartman et al. (2013)



	No Land	≤1	>1–3	>3–5	>5–10	>10
Female (42)	5%	50%	26%	12%	7%	0%
Male (149)	0%	17%	38%	21%	13%	11%

Figure 3 Farm size (ha) by gender of heads of households working with C:AVA in Nigeria
Source: Data from C:AVA Impact Study in Nigeria

cassava value chain policy and programme interventions. The overall vision of C:AVA – of smallholder households benefiting from improvements in HQCF value chains – has been sustained during the project. Equitable distribution of benefits and women's empowerment were also part of the original vision, as emphasized in the Foundation's Gender Impact Strategy for Agricultural Development (2008). The overall strategy was to build on and upscale pilot initiatives through support to intermediaries as a means of aggregating produce and linking smallholders to end users. Specifically, the project proposed that smallholder farmers sell cassava roots, grits (grated, pressed, and dried, but not milled), and wet cake (grated and pressed), directly or via village processors, to intermediaries for onward sale to end users in cassava value chains based on HQCF. The focus was on substitution for imported wheat flour by HQCF in the baking industry and improvement of traditionally processed cassava products for urban markets.

Flexibility in project management and ongoing support along the value chains has allowed diverse value chain models to emerge. Country-level trajectories have varied from the initial C:AVA strategic vision through an iterative process, initiated in the country strategy workshops. A variety of 'value chain models' have emerged in the various countries in response to different contextual constraints and opportunities (Table 1). This involved investments, often invisible to those outside the process, in problem solving iteration, learning by doing, and mentoring. The project focused on a range of different types and scale of intermediaries, using sun drying and artificial drying in different countries. Mid-term, in 2010, there was a switch in emphasis and resource

Table 1 Emerging HQCF value chain models

Emerging HQCF value chains	*Ghana*	*Nigeria*	*Malawi*	*Tanzania*	*Uganda*
Farmer-processor groups to small local end users			√	√	√
Farmer-processor groups to large urban end users				√	
Farmer-processor associations to local small end users			√		√
Farmer-processor associations to large urban end users					√
Small enterprises (sun drying) to local small end users	√		√	√	
Small enterprises (sun drying) to large urban end users	√			√	
Small enterprises (bin drying) to small local end users	√				
Small enterprises (bin drying) to large urban end users	√				
Medium/large enterprises (flash drying) to large urban end users	√[1]	√	√		

Note: [1]Currently understood to be producing industrial grade cassava flour.

allocation to improving the artificial drying capacity and fuel efficiency of intermediaries in Nigeria in order to increase the scale of HQCF production and numbers of smallholders supplying roots. There were also renewed efforts to identify diverse end markets.

Champions of smallholder-inclusive value chains are emerging. There are examples of private sector players who are helping to drive the value chains to achieve scaling up. A large company in Malawi has stated that they want to support smallholders and the director of a Tanzanian small- or medium-scale enterprise (SME) is a potential role model for small-scale (female) entrepreneurs to enter the value chain. It is likely that in several countries, scaling up will involve a wider identification of such potential entrepreneurs.

Different models for linking farmer (processor) organizations to buyers in cassava value chains are emerging, with differing challenges and opportunities in terms of scaling up (see Table 2). These relate to dimensions such as the criteria for participation, formal and informal contractual arrangements, responsibilities of different parties, provision of resources, access to market information, continuity and building trust, and the nature of and exposure to risk.

Incentives and accountability

Commercial incentives vary greatly among the different countries, value chain models, and over time. Incentives and commercial motivation for private sector investment in

Table 2 Organizational models of smallholder production and examples in C:AVA countries

Model	*Driver of organization*	*Rationale*	*C:AVA country cassava examples*
Producer-driven (association)	Producers, when formed into groups such as associations or cooperatives	Access new markets Obtain higher market price Stabilize and secure market position	Producer associations and cooperatives in Uganda (and in Malawi)
Buyer-driven	Processors Retailers Traders, wholesalers, and other traditional market actors	Assure supply Increase supply volumes Supply more discerning customers – meeting market niches and interests	SME out-growers, Ghana
Facilitator-driven	NGOs and other support agencies National and local governments	'Make markets work for the poor' Regional and local development	Community processing groups in Tanzania, Ghana, Malawi (and Nigeria prior to 2010)
Integrated supply chain	Lead firms Supermarkets Multinationals	New and higher value market Low prices for good quality Market monopolies	Some interest is emerging

Source: Based on Miller (2011)

value chains (and hence scaling up) are affected by prices, access to credit, quality, and volumes. Commercial and other incentives along the value chain can change dramatically over time. Profitability of HQCF production and the attractiveness of HQCF in relation to alternatives/substitutes vary seasonally and from year to year, depending on the fluctuating prices for cassava roots, wheat, and fuel costs for artificial drying. The project invested to improve incentives and profitability, in order to improve cassava productivity of farmers; to increase efficiency and reduction of intermediary processors' costs; and to develop awareness of product attributes among end users. There has been little investment so far by the private sector in improving profitability along the chain. Interest has been reported by some companies in buying from smallholder farmers/processors for reasons beyond short-term commercial interests, such as corporate social responsibility and encouraging brand loyalty.

Competitiveness of HQCF compared to alternative raw materials is a key driver for end users. HQCF was competitively priced in relation to imported wheat and maize starch prices in Malawi and Uganda. Malawi also had foreign exchange shortages, which further contributed to interest among large enterprises to invest in HQCF value chains. In other countries, HQCF was less competitive compared with alternative raw materials (mainly wheat flour), but interest in HQCF and other cassava-based products has increased in all countries nevertheless. A growing middle class provides opportunities for sales of quality products utilizing HQCF, such as composite flour and instant *fufu*.

Motivating farmers in the short term without fostering dependency, while working towards longer-term value chain benefits is a challenge. Farmers and community-level processors are motivated by prospects for income generation and livelihood security. Better-off farmers are in a position to respond on the basis of their existing assets. The limited capacity at start up and limited working capital of asset-poor farmers, combined with small margins on sales, can be a major disincentive to their participation, but the provision of support to build capacity and fast track implementation risks creating dependency.

Enabling and constraining context

Institutional context: the entire value chain

Developing sustainable smallholder-inclusive value chains is a long-term process involving the entire chain. Ongoing support to the chain actors, as well as the linkages between them, has been necessary to build value chains in each country. This required investments by C:AVA in value chain relationships, addressing problems and identifying opportunities in the value chain. Such investments may not be highly visible to donors or other actors seeking to facilitate value chain creation or strengthening, but they are crucial for success.

Value chain actors sharing a similar business ethos are likely to find it easier to do business together and linking these actors offers greater likelihood of sustainable chains. Mutual

understanding of expectations, business norms and practices, capacity, and needs among the suppliers and buyers along the value chain is crucial. There are examples of enterprises whose managers have experience of working with smallholder suppliers, together with knowledge of what smallholders need in terms of advice and inputs. In these circumstances there is less need for external support and greater likelihood of a sustainable value chain. C:AVA has facilitated links between actors in value chains – providing a space for improved understanding and negotiation to take place.

Increased demand for cassava needs to be carefully balanced with increased supplies of cassava roots. Improved varieties and crop husbandry can rapidly lead to increased yields. It is necessary to avoid a cassava glut, but it is equally important not to completely cut investments in cassava production to avoid shortages that may cause the value chain to collapse. This matching of supply and demand is a critical balancing act which may be addressed by, for example, involving cassava producers of various scales of operation, and regular feedback of market intelligence on price movements and production costs. Another aspect of the imbalance between supply and demand is seasonality of production (see Environmental context). Increased demand for cassava for alternative uses reduces the supply for the HQCF value chain and, unless production increases, results in higher prices. The competition for cassava roots for alternative cassava value chains exists in all countries, but is particularly challenging in Ghana and Nigeria, and has also been the case in periods of food shortages at regional level influencing Uganda and parts of Malawi.

Institutional context: farmers/processors

Skills in business management, group dynamics, leadership, and accountability at farmer-processor organizations are key to successful participation in value chains. The lack of these skills in farmer-processor groups was a constraining factor in each country. Stronger farmer-processor organizations possessing such skills have benefited most from the new HQCF value chains. Project support encouraging networks of farmer-processor groups and intermediaries for information sharing were seen as positive.

Constraining factors at farmer level can be overcome with technical support and organizational capacity building. At farmer level, a number of factors were said to be constraining scaling up of HQCF value chains, including smallholder farmers' lack of access to improved planting materials or seed systems, inability to respond to the spread of cassava diseases, and side-selling of cassava to other markets. More structural issues such as access to land and gender inequalities were not raised in the interviews yet may have had a significant impact on farmers' ability to participate and benefit from HQCF value chain development.

Prior investments in institutional development provide a launch pad for integrating smallholder farmers into value chains. Where there has been success in working with farmer cooperatives/associations that can manage cassava processing and marketing operations, as in Uganda, there had been significant *prior* investment by donors and NGOs in institutional development. C:AVA has successfully built upon this previous investment in organizational farmer development in Uganda. In southern Tanzania

and Malawi, there had also been some previous investment in organizational development through the formation of community processing groups.

Institutional context: intermediaries

Smaller enterprises have shown more interest in entering the HQCF value chain than larger organizations. There are different types and scales of intermediaries associated with different value chains (Table 1) and operating with different technologies. There has been interest shown by larger enterprises, but generally – outside of Nigeria – they have not invested in artificial drying as anticipated. Smaller entrepreneurs are joining value chains in Tanzania and Malawi, using sun-drying technology for which entry costs are much lower.

Procurement of cassava roots exclusively from smallholder farmers can involve significant risks for medium- and large-scale processors. Intermediary processors face challenges (high costs of logistics, coordination of purchases, side-selling in contract farming, etc.) when they procure cassava roots from smallholder farmers only. Spreading procurement of cassava roots from different types of cassava growers (e.g. of different scales) reduces the risk for medium- to large-scale processors who require a consistent and reliable root supply (see Table 3). One of the future strategies identified was the potential for engaging smallholder farmers in contract farming, in order to improve their access to inputs and technical advice, and their ability to provide a reliable supply, including by joining forces with large-scale farmers.

Practical knowledge and skills combined with business skills are needed for successful participation in value chains. Potential intermediaries need exposure to information on the opportunities presented by HQCF processing and trading and the opportunity to learn the business through exchange visits, access to advice and/or mentoring, hands-on practice, etc. In Tanzania, an accessible learning site at a parastatal

Table 3 Types of intermediary, sources of supply, and risks to intermediaries

Intermediary	*Source of supply*	*Nature of risk*
Medium – large enterprises (flash drying)	Buy on open market Source from own farms Contract/outgrower schemes Farmer groups (roots)	Source markets may be at a distance Undersupply of roots results in operation below capacity, which reduces income to repay investment loans; may jeopardize ability to meet contracts Weather conditions affect root production Side-selling in contract arrangements
Small enterprises bin/sun drying	Buy on open market Source from own farms Farmer processing groups (roots and/or grits)	Undersupply of roots results in operation below capacity and reduced income to repay investment loans Weather conditions affect production (and processing)
Farmers associations	Members of association use own roots, purchase from other members or from farmers in locality	Equipment often received as grant, therefore less commercial pressure to operate to capacity Weather conditions affect production and processing

responsible for small-scale industry development enabled a local entrepreneur to try out HQCF processing in a practical way and led to significant investment.

Institutional context: end users

Awareness-raising among potential end users of HQCF creates interest, but their decision making depends on their capacity (technical knowledge, equipment and skills). C:AVA was successful in raising awareness with end users such as local bakers, agri-food companies, and paperboard manufacturers, through workshops, media, personal visits, etc. However, the end user's decision on whether to use HQCF appears to be highly dependent on the capacity of their organization. For example, a paperboard manufacturer in Uganda who had hands-on technical knowledge was provided with a sample of HQCF and made a rapid decision to start using it, with little or no further project support. In contrast, a paperboard manufacturer in Malawi implemented joint trials with C:AVA personnel over a period of time in order to make an assessment of the suitability of HQCF.

There are few examples of provision of services by end users to other actors in the HQCF value chain, although in other sectors, end users have engaged in providing inputs, credit, and advice to their suppliers (e.g. breweries supporting sorghum producers in Uganda; Wiggins and Keats, 2014). An example for HQCF is an agro-processing company in Dar es Salaam that is providing credit to a community processing group in Mtwara that supplies it with grits.

Institutional context: service providers

There are different ways for strengthening farmer and processor capacity, involving private, NGO, and public sectors. Private sector-led approaches can provide strong motivation and resources, enterprise management skills, and a guaranteed market. NGOs often have well-motivated staff, strong accountability structures, an ethos of farmer empowerment and gender inclusivity, and are used to targeting more vulnerable groups. The public sector has the advantage of continuity of presence and technical skills and policy linkages.

Service providers require capacity building in value chain development, business management, and farmer organizational strengthening. Service providers have played an important role in all countries, but the experience has been mixed, depending upon their capacities. In Tanzania and Nigeria, for example, the service providers felt a sense of ownership and continued to provide services despite the ending of their contracts. But understanding and expertise in value chain development and business management is often limited among local NGOs (e.g. Ghana, Uganda) and government agricultural extension organizations; strengthening the capacity of the service providers in business management requires time and resources.

Relationships between service providers need to be strengthened to enhance knowledge sharing, learning, and ownership. In some countries (e.g. Tanzania, Nigeria, Ghana), the relationships between service providers have been strengthened; they see

themselves as a team taking ownership of cassava development activities. This network of service providers provides opportunities to replicate and scale-out the C:AVA intervention. In other countries (e.g. Malawi), service providers tend to work in isolation, which hampers sharing of information and knowledge.

Infrastructural context

Infrastructural challenges (roads, electricity, and water supplies) are important constraints to cassava value chains. Access to suitable roads was a key constraint across all countries. Access to reliable/affordable electricity was ranked as a highly important constraint in Nigeria and Uganda. Water supply is a significant constraint for processing in Nigeria and Tanzania and to a certain extent in Uganda. Many of the infrastructural constraints are unlikely to change without significant public investment, but it is an important issue for consideration in siting new processing facilities, as well as establishing where there can be a reliable supply of cassava.

Mobile phone technology facilitates trade of cassava products in rural areas. Mobile phone coverage was said to be a highly important enabling factor in Tanzania and Uganda to facilitate trade (by sending or receiving orders and payments).

Technological context

Efficient technology is key to making cassava processing profitable, but requires technological innovation and capacity building of local equipment fabricators. C:AVA made available improved equipment for sun drying, and has demonstrated that efficiencies can be obtained for smallholders. In Nigeria, major improvements have been made in energy efficiency and conversion to renewable energy resources in flash-drying technology.

C:AVA investments in improved processing technology and strengthening the capacity of fabricators in different countries have been positive and provide significant opportunities for South–South learning. Too often it has been assumed in the past that it is sufficient to hand out processing equipment without regard for dependency issues, sustainability, or the technical advice and maintenance inputs required. The capacity of local equipment fabricators to maintain and manufacture processing equipment was a challenge in all C:AVA countries. Strengthening capacity among suppliers of equipment is necessary to produce quality processing equipment and also to provide support for installation and maintenance.

Sun-drying technology is suitable for smallholders and starting SMEs but poses logistical challenges for scaling up HQCF production. Producing high volumes of HQCF based on sun drying is challenging, particularly in West Africa, but also to some extent in Tanzania and Malawi; limiting factors vary but may include climate, lack of drying space, limited capacity for collective action, and poor infrastructure. Production of high volumes of HQCF of consistent quality through sun drying requires strong quality management systems and coordination of processing activities. Farmer-processors often lack such logistical skills. However, it is a relatively low-cost

(and low-risk) technology suitable for smallholders and starting SMEs who enter the HQCF value chain and target buyers that can accommodate small quantities.

Financial context

Working and investment capital for intermediaries and processors is a constraining factor and requires more engagement from industrial end users. The experiment with a loan portfolio guarantee fund in Ghana was not very successful as the banks did not provide loans to the intermediaries at lower interest rates, despite receiving a C:AVA guarantee. There are few examples of credit being made available to farmers and processors from actors higher up the value chain.

Policy and regulatory context

The policy and regulatory environment in the five C:AVA countries has not been strongly conducive to cassava value chain development. In Malawi, the government's fertilizer subsidy programme for maize, for food security reasons, has encouraged farmers to shift from cassava to maize, resulting in reduced production. In Nigeria a specific policy on HQCF inclusion in wheat flour was reversed and subsequently reintroduced following changes in government. This instability created an unpredictable environment for investment in cassava development. C:AVA staff played a big role in advocacy, contributing to presidential initiatives on cassava involving heads of state of Nigeria and Malawi.

C:AVA Uganda was instrumental in suggesting the standards and specifications for seven cassava products, including HQCF, which were legally approved and gazetted by the East Africa Community. This provides longer-term opportunities for scaling up, although in the shorter term, despite project support for farmer-processor associations to meet requirements, the Uganda National Bureau of Standards did not issue certifications. This created a (temporary) block on HQCF supplies to biscuit manufacturers.

Partnerships and leverage

Experiences with partnerships with other organizations have been mixed, but are important to support value chains successfully. NGOs with similar missions and target groups are potential agents to achieve scaling. C:AVA's relationship with NGOs (those already working with the project and others) contributed to the scaling process. Although the public sector often lacks the means to contribute to scaling up, government policies can influence value chain development. Partnerships with NGOs and the public sector have been beneficial in all countries, but a lack of partnerships with financial institutions was noted.

Leverage can be a key aspect of a scaling process and C:AVA is just starting to show some success. The World Bank defines the basic concept of leverage as: 'the ability of a public financial commitment to mobilise some larger multiple of private capital for

investment in a specific project or undertaking' (Griffiths, 2012). However, others consider the mobilization of resources from any sector as leverage.

In Malawi, a large domestic private company invested in a flash drier facility following a range of project interventions to encourage investment (provision of planting material, a soft loan, a study tour to Nigeria to see flash driers, business plan development, links to the paperboard market, and other associated information). In southern Tanzania, a small-scale female entrepreneur built a small processing centre in a village and planted a large area of cassava. C:AVA provided hands-on experience through a parastatal processing centre, supplied a grater and press and made linkages to markets in Dar es Salaam. In Tanzania, District Agricultural Development Plan funds have been used to support community processing groups. In Malawi, lessons from C:AVA helped source support from government and NGO partners to reach more beneficiaries.

Social and cultural context

Cultural patterns in food consumption can pose either a challenge or an opportunity to new cassava value chains. In Ghana and Nigeria, most consumers prefer traditional cassava products (e.g. garri, *fufu*) and local processors are less interested in the less profitable HQCF. In Uganda, on the other hand, consumers are interested in cassava-based products and traditional value chains are less well developed, creating an opportunity for HQCF inclusion in food products. Companies can capitalize on this interest by promoting local and patriotic products that include cassava as an ingredient. This is more than a corporate social responsibility issue – it can be a good example of a business case facilitating a positive development impact.

Cassava value addition can empower women, but gender-related obstacles to women's participation need to be addressed promptly and adequately. Cassava value addition was identified as a promising intervention, which aligned with the priorities of the Foundation to support women's empowerment. C:AVA has brought benefits to women, particularly through the added value created in sun-dried HQCF value chains. In order to scale up and reach more women, sustainable mechanisms will be necessary to improve women's access to equipment, finance, and to support their participation in sun-drying value chains.

Environmental context

Environmental issues are largely constraining. Limited access to water, climate and climate change issues, and the environmental impact of waste water from processing (the latter noted in Ghana, Nigeria, and Malawi) were all noted as constraining factors to cassava processing.

Seasonality is an important consideration in the supply of cassava roots and sun drying processing. Most cassava roots are harvested during the wet season in West Africa when the moist ground makes harvesting easier and in the dry season in East/southern

Africa. This, together with the demand to make other cassava-based products, results in considerable variation in availability and price of roots over the year.

Monitoring, evaluation, and learning

Cross-country learning, although limited, was considered valuable by participants. Cross-country lesson learning with Nigeria has been beneficial for C:AVA Malawi and Malawian investors. Fabricators of processing equipment from Uganda, Tanzania, and Malawi attended a training event in Malawi run by a Nigerian fabricator. Learning occurred among country managers at annual meetings. More cross-country learning between different actors would have been beneficial.

Lessons learned by C:AVA

1. There is a potential tension between the *rapid* development of cassava value chains and the realization of benefits to smallholders, addressing gender disparities and sustainability.
   - Scaling-up objectives should clearly articulate the target groups and nature of the benefits and be at the core of intervention strategy.
   - Scaling up requires the commercial 'pull' of end user markets (as stressed by Campbell, 2010), but crucially they must be aligned with interventions that give a 'push' to smallholders, as argued by others such as Barrett (2008) and Seville et al. (2010).
   - Longer-term horizons and an adaptive problem solving approach are needed (consistent with Wiggins and Keats, 2013) in building capacity along the entire value chain and aligning the key elements of these complex systems.
2. Smallholders are not a homogeneous group and face different risks, challenges, and opportunities.
   - Understanding of and engagement with the rural communities with whom interventions are working is critical. Country-level typologies of smallholders based on their resources and market access (see Figure 2) help in the development of interventions and the assessment of impact. Although not a novel point (see for example Seville et al., 2010; Donavan et al., 2015), it does need to be emphasized if the position of stated target groups is to be improved.
3. *Scaling-up strategies need to be informed by local and national stakeholders and context, but draw on cross-country learning.* There is no one simple model for scaling up value chains, but a diversity of 'value chain models' relating to local and national contexts. Circumstances matter (Wiggins and Keats, 2014; Donavan et al., 2015; Smith, 2009). These imply different scaling strategies, including leverage, partnerships, capacity building, etc. Flexibility to adapt the strategy and resources in the light of changes in policy (donor and government) and market conditions, among others, is key in the scaling process.
   - Ensure scaling-up strategies are developed through a participatory stakeholder planning process. The views of smallholder men and women, as well as

other actors, are needed to identify their interest, their views on business, economic, and social viability, and their capacity strengthening needs.
- Stakeholder inclusive mechanisms for adapting the strategy in the light of changing circumstances need to be established.

4. *Individual and organizational capacity of target beneficiaries needs to be strengthened as they engage in more commercial pre- and post-harvest farming activities*. Strong farmer organizations allow individual smallholder farmers and processors to benefit from value chains through collective action. Farmer organizational capacity building takes time and resources; among the issues are governance, trust, internal communication, transparency, and leadership.
   - Cost-effective approaches for strengthening individual capacity at scale and the potential of different farmer organizations are needed.
   - Resources need to be invested in service providers that have demonstrated practical ability to strengthen farmers' organizational capacity for engagement in value chains. To be more effective, service providers need access to learning networks and best practice on management and governance of farmers' organizations, financial transparency, and resolving challenges of collective action (e.g. Ton, 2010; Francesconi and Wouterse, 2011). Public, private, and NGO sector actors with their associated strengths are needed to secure resources and provide sustainable services.
   - An innovative response is needed to address potential gender-related obstacles to women's participation (e.g. training of female village-based mechanics, peer-to-peer learning, and role models).
5. *A range of institutional arrangements between farmers and actors higher up the value chains emerged* to address the challenge of smallholder capacity to deliver large quantities of roots to large-scale processors. Contract farming and outgrower schemes are subjects of intense debate (Prowse, 2012). They can present advantages and disadvantages to smallholder farmers, depending on the business model, degree of formality, objectives, source of technical assistance, credit, inputs, other partners involved, and minimum land or other resource requirement per participant.
   - Interventions should be informed by recent experiences with different institutional arrangements. This would ensure awareness of the options available and the associated implications in terms of: roles and responsibilities, capacity requirements, likely distribution of benefits, and wider impact in the shorter and longer term.
   - It is important to analyse the conditions in which schemes can work for target groups. Whatever arrangements are in place, they have to work for both farmers and intermediaries. It will be important to monitor closely the potential risks and benefits to smallholder groups.
6. *In decision-making about scaling up value chains it is important to understand the anticipated benefits in terms of both the extent of coverage and degree of individual benefit.* Some value chain models are more smallholder and women friendly than others. For example, large-scale mechanized HQCF processing can create a high demand for cassava roots, potentially bringing benefits

to many smallholders. However, the benefits may be of limited additional value per individual, especially where resources are constrained. Other value chains, targeted to specific groups, e.g. women processors, may make a large difference, changing the trajectory of a household and raising them out of poverty, but for fewer people.

7. *Monitoring, evaluation, and learning systems are required to meet a range of different expectations*. Quantitative modelling is useful for analysis of economic variables and is important for measuring aspects of scale, e.g. inputs, outputs, numbers of beneficiaries, and level of income benefit. Other key aspects in a scaling process require other forms of qualitative and process-orientated monitoring in order to meet the learning objective.
   - *Supporting the scaling up of value chains needs effective learning, communication, and adaptation.* C:AVA has shown the importance of learning from the experience of value chain development and having the flexibility to adapt as circumstances change. This is in agreement with others, such as Wiggins and Keats (2014), who stress the value of loose-coupled management that allows learning. A systematic learning and communication strategy needs to be implemented at different levels for: 1) different participants to access information and engage in shared learning; 2) sharing with potential investors in smallholder-inclusive value chains to encourage take-up of relevant lessons from C:AVA; and 3) engaging with decision-makers influencing the enabling context.
   - More use of ICT and innovative communication approaches would facilitate shared internal learning and enhance communication with external stakeholders.
8. The scalability and sustainability of value chain interventions should be considered against the available financial resources.
   - Financial resources are needed at various points along the value chain (for capital investment, working capital, transport, marketing, etc.). In going to scale, wider access to equipment and finance for its purchase are needed, as well as arrangements for repair and maintenance. Options for finance should be explored for different scales of operation in emerging value chains, e.g. loans, credit from linked value chain actors, joint ownership, and development funds used to purchase equipment, among others.
9. *It is important to recognize the role of relationships and networks for scaling processes*. Developing smallholder-inclusive value chains requires support and investment in developing value chain relationships and aligning key actors and elements. Building relationships and networks along and around the value chain creates trust and develops understanding of interests and clarifies expectations.
   - There should be appropriate levels of investment (financial and skills) in the relationship development aspects of value chain development. The greater the social difference between value chain actors, the greater the investment needed in relationship building.

- The value chain 'models' that are being scaled up need to make explicit to donors and the wider development community, the degree of relationship-building needed to establish effective business arrangements among value chain actors, including the time taken and risks involved.

10. *Partnerships and leverage have been increasingly recognized as a means of taking HQCF value chains to scale.* Partners in different (public, private, and third) sectors bring different interests and resources. In C:AVA there has been emphasis on building informal partnerships with actors along the value chain and, to an extent, partnerships with public sector organizations and NGOs for extending to new geographical areas.
    - Systematically consider, at country and project levels, the enabling opportunities that can be created and constraints that can be addressed through partnerships and leverage.
    - Further analysis is needed of government policy and regulatory issues affecting scaling of cassava value chains in order to guide engagement with policymakers. Working as far up the hierarchy of issues as possible would help to draw attention to more systemic problems and address national conditions (Vorley et al., 2012; Wiggins and Keats, 2014).

Conclusions

Scaling up smallholder-inclusive, resilient agricultural value chains is a priority for many development actors aiming to meet a variety of social, economic, and environmental objectives (e.g. improving rural incomes, local economic development, poverty reduction). Cassava, in particular, is a climate-resilient crop. It is also widely grown by smallholders and there is expanding demand for more and different types of agri-food products in Africa. All of this means that there is significant potential to develop cassava-based value chains in which smallholders participate and benefit.

Value chain development – as opposed to interventions which focus on a particular aspect or aspects of the chain only – may be considered as inherently part of a scaling process. Developing inclusive value chains – such as for HQCF – involves significant uncertainty and risk, not least because it entails decision-making by and functioning linkages between a wide range of actors. Hence, significant investments are needed to support actors along such emerging value chains, which can be very vulnerable to shocks and stresses. Scaling such inclusive value chains involves a process of both aligning and influencing a range of drivers within changing contexts. There is also a need to learn from failures as well as successes in an iterative process. The level and type of investment required for success needs careful consideration by donors, governments, and others working in the field, in particular the less visible investments in fostering relationships and building trust along the value chain.

Although scaling up should be market-led, public sector and civil society interventions are needed to reach more disadvantaged social groups if the effects are to be transformative rather than marginal (e.g. a slightly improved income for better-off producers). These may be direct investments such as co-financing, building

capacity, infrastructure (e.g. roads, energy) or indirect policy levers influencing the agri-food investment environment and value chain governance.

Our experience shows that the tension between the rapid development of cassava value chains and achieving equity and sustainability goals can be challenging. To increase the participation of smallholders, particularly those less well-off, in cassava value chains going to scale, requires a holistic approach to investment in capacity building. This capacity strengthening is needed most probably along the value chain, at individual and organizational levels, although types of support required will vary. Strengthening equitable business relationships and networks is vital for scaling processes that can be sustained over time. Informed engagement with government policy and regulatory issues is also important, but we recognize the challenges involved given the often conflicting pressures on policymakers.

Addressing the uncertainties around smallholder-inclusive value chain development needs *adaptive management and facilitation of the scaling process*. This involves longer timescales in planning and capacity strengthening, challenging of assumptions, strong co-learning and feedback processes to inform decision-making, fostering relationships, and building trust.

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