

Cassava, the 21st century crop for smallholders?

Exploring innovations along the livelihood-value chain nexus in Malawi

Klaus Droppelmann, Peggy Günther, Franziska Kamm, Ulrike Rippke, Carolin Voigt, Bartosz Walenda



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Preface

For more than 55 years, the Centre for Rural Development at the Humboldt-Universität zu Berlin has trained 20 post graduates annually to become professionals equipped with excellent knowledge and skills in the field of German and international development cooperation.

Three-month empirical research projects conducted in cooperation with German or international development agencies form an integral part of this one-year course. Participants work in interdisciplinary teams supervised by experienced team leaders and carry out innovative, future-oriented research on development problems that prevail on the ground on a local or national scale. This strengthens global knowledge and provides partner organisations in the host country with strategies and tools. Here, it is vital to involve a wide range of actors in a process which includes surveys and consultations at the household, expert and policy levels.

Most studies are linked to rural (or urban) development themes and have a socio-economic focus, such as the enhancement of agricultural livelihoods or the design of regimes to manage natural resources sustainably. Up to now our partner countries have either been developing or transformation countries, and occasionally fragile states. In the future, however, studies will also be conducted in the global north, since the Sustainable Development Goals (SDGs) are a global concern. New methodologies have been introduced in some studies, e.g., production of handbooks or guidelines. Further priorities are evaluations, impact analysis and participatory planning. In these cases, the respective host country serves as a test region.

Throughout the years, SLE has carried out more than 200 cooperation projects in over 90 countries. The results are published in this series.

The present study on agricultural innovations in cassava value chains in Malawi was carried out in cooperation with IITA and GIZ in Lilongwe, Malawi and GIZ BEAF in Bonn, Germany.

We wish you a stimulating read.

Yours sincerely,

Prof. Dr. Bernhard Grimm
Dean of the Faculty of Life Sciences
Humboldt-Universität zu Berlin

Dr. Susanne Neubert
Director of the Centre for Rural
Development (SLE)

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Abbreviations

AIS	Agricultural Innovation Systems
ASWAp	Agricultural Sector Wide Approach
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
C:AVA	Cassava: Adding Value for Africa
CA	Conservation agriculture
CBSD	Cassava Brown Streak Disease
CG	Cassava-growing households
CGIAR	Consultative Group on International Agricultural Research
CMD	Cassava Mosaic Disease
CMRTE	Chinangwa ndi Mbatata Roots and Tuber Enterprise
CSA	Climate-smart agriculture
DAES	Department of Agricultural Extension Services
DARS	Department of Agricultural Research Services
EPA	Extension Planning Area
F	Financial capital
FAO	Food and Agriculture Organization of the United Nations
FEWSNET	Famine Early Warning Systems Network
FGD	Focus group discussion
FISP	Farm Input Subsidy Programme
FO	Farmer organisation
FUM	Farmers Union of Malawi
GAP	Good Agricultural Practices
GIAE	Green Innovations Centres for the Agriculture and Food Sector
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GoM	Government of Malawi
HCN	Hydrogen cyanide
HH	Household
HQCF	High-quality cassava flour
ICT	Information and Communication Technology
IITA	International Institute of Tropical Agriculture
LLW	Lilongwe rural
LUANAR	Lilongwe University for Agriculture and Natural Resources
MIERA	More Income and Employment in Rural Areas in Malawi

MK	Malawi Kwacha
MoAIWD	Ministry of Agriculture, Irrigation and Water Development
MoITT	Ministry of Industry, Trade and Tourism
MS	Malawi Standard
NASFAM	National Smallholder Farmers' Association of Malawi
NCG	Non-cassava-growing households
NCPA	National Cassava Processor Association
NGO	Non-governmental organisation
NKK	Nkhotakota District
RTCDT	Roots and Tuber Crops Development Trust
SWOT	Strengths, weaknesses, opportunities and threats
TLC	Total Land Care
VC	Value chain
WHO	World Health Organization

Executive summary

Cassava is the second-most important staple food crop after maize in Malawi. The availability of different varieties of cassava allow for both commercial use and household consumption of cassava to hedge against food insecurity. Malawi is prone to drought due to climate change vulnerability, poor agricultural practices and high population growth making cassava, a drought-resistant crop, an attractive option.

Although the policy focus has shifted from sole reliance on maize and tobacco toward a crop-diversification strategy, cassava receives little attention from the Malawian government. Within the cassava value chain, production is dominated by smallholder farmers who struggle to increase their yields for individual consumption and marketing. Agricultural innovations designed by our partners, GIZ-Malawi and the International Institute of Tropical Agriculture (IITA), aim to address some of these limiting factors. However, these innovations have seen low rates of adoption among smallholders. In consequence, the high demand for cassava by industrial processors has not yet been satisfied and a mismatch between supply and demand for cassava products persists. Nevertheless, high expectations for the crop exist.

This study sets out to answer the question of whether cassava is, indeed, the 21st century crop for smallholders. The focus lies on smallholder production systems in Nkhosokota District on the shores of Lake Malawi and in the rural vicinity of Lilongwe, the capital city. A nexus between the household asset endowments of smallholder farmers and their participation in the value chain was examined to identify root causes of the supply-demand mismatch and to formulate recommendations for effective value chain development. A partial value chain analysis has been conducted to account for the participation of smallholders in the value chain. We chose a structural analysis over an economic analysis, as prices are highly volatile in the informal markets of Malawi and notoriously difficult to solicit from actors. Since the responsibility for the production of food and cash crops falls broadly along gender lines within a household, gender aspects take a central role in our research. All our instruments included gender differentiated elements.

Methodology

We used information from expert interviews (n=31) to establish whether an enabling environment for cassava exists and how agricultural innovations have been designed and disseminated. Through household interviews (n=58) consisting of a partial livelihood analysis and a scenario game, we examined in what way

smallholders' asset endowment – physical, financial, social, natural and human capital – influences their decision making. Focus group discussions with farmer organisations (n=4, 51 participants) helped shed light on the function and challenges of self-organised producer and processor groups. The results of our data collection have been discussed and verified in two validation workshops with a total of 25 experts present.

Traditional cassava growing areas are located at the lakeshore and in the south of Malawi, where predominantly bitter cassava varieties (containing a higher content of the precursor of the neurotoxin cyanide) are cultivated. More recent production areas have evolved around urban areas such as Lilongwe, Zomba and Blantyre where sweet varieties (with negligible contents of cyanogenic glucosides) are grown. These different varieties have different uses and marketing channels within the value chain:

- Home consumption: Cassava is produced, processed and consumed within the household. Predominantly bitter varieties, but sweet varieties are also possible. A prominent example is Nkhotakota District.
- Farm gate sale: After production, farmers sell the fresh produce at the farm gate. It is then either transported to the urban fresh market or to a processing facility.
- Own transport: Farmers are responsible for transport themselves, usually to the nearest processing plant or market.

Sweet cassava is regarded primarily as a cash crop and is usually marketed raw in urban markets where it is consumed on the spot as a fresh snack. Around Lilongwe, a highly organised informal market has emerged for sweet cassava. While this allows cassava farmers in peri-urban areas to commercialise and earn an income, prices are usually dictated by the buyers and high market entry barriers exist for individual vendors and smallholders.

Bitter varieties are commonly processed at the household or cooperative level into *kondowole* (fermented cassava flour) and eaten as the staple dish *nsima*. Only a very small portion of the annual harvest finds its way into commercial use. While all varieties can be used, bitter ones are preferred for processing. Beyond cassava flour, industrial-grade, high-quality cassava flour (HQCF) can replace wheat or corn flour in baked goods. Cassava starch can be converted into glucose syrup for use in the brewery industry or as a glue extender in cardboard and plywood manufacturing. It is also increasingly popular as an energy source in livestock and fish

feeds. Also, waste material from cassava processing can be used for bio-ethanol production.

Results

However, while the high demand for cassava certainly is a pull-factor for production increase, smallholders cannot simply increase their market sales without compromising their food security. Even though crop production is the mainstay of smallholders' livelihoods and their most important source of income, smallholder households currently produce just enough to satisfy their basic needs or a small surplus for marketing commercially. Our partial livelihood analysis has shown that smallholders face several production constraints because of the low levels of physical, financial, social, natural and human capital within their households. Considerable regional differences in access to these resources exist with families in Nkhotakota identifying small arable land holdings and extremely restricted access to finance and credit as constraints to production expansion. To overcome financial struggles, smallholders usually rely on their extended family, wage-labour employment or food- or cash-for-work initiatives. An additional regional difference observed is that smallholders in Lilongwe rural predominantly produce for the market, while households in Nkhotakota use cassava primarily as a staple crop for home consumption.

In most surveyed households, decision-making is done jointly across genders. Female-headed households are usually single-headed and lack workforce and time to foster social relations. Also, their arable land sizes are smaller compared to male-headed households where both spouses are prevalent.

In the scenario game, both spouses in the household (n=93) were offered hypothetical options and incentives to produce cassava, acquire planting material and market and process their harvest individually or communally. Both spouses in cassava growing households wish to adopt new and improved cassava varieties, indicate willingness to pay for them and prefer to engage in individual farm-gate sales, but also express interest in teaming up for bulking or joining a processing association. Hence, the vast majority of smallholders show a willingness to participate more actively in the cassava value chain and to adopt innovations that enable them to do so. For non-cassava-growers, free access to high-quality planting material, business training and the opportunity to sell at farm gate would motivate them to (re-)start growing cassava. The negative effects of climate change resulting in failing maize harvests were pointed out as the strongest encouragement to (re-)commence cassava cultivation.

Contrary to the eagerness smallholder farmers expressed to commercialise their cassava production numerous expert interviews revealed that they essentially lack an enabling environment to participate successfully in the value chain. The Malawian cassava value chain consists of a multitude of actors who still prefer to pursue very singular interests instead of working toward a common vision. This is further hampered by an incoherent legal environment. A fully-mandated, multi-stakeholder platform for the coordination of value chain development in the form of the Roots and Tuber Crops Development Trust exists; however, it is not yet operating at its desired capacity due to financial and structural constraints and it struggles to effectively coordinate the divergent agendas of individual actors in the cassava value chain.

The government extension service is generally not geared toward cassava. It is ill-equipped and understaffed, especially with female extension workers who would be better suited to address the needs of female farmers. The formal seed supply system is organised by the Ministry of Agriculture, Irrigation and Water Development's Department of Agricultural Research Services (DARS) with support from IITA. Yet, once new and clean planting material has been developed, seed multiplication appears to be poorly organised and due protocol is frequently ignored. Moreover, access to clean and/or improved planting material is difficult for farmers due to its limited dissemination. Consequently, the seed supply system relies on communal sharing of planting material, but since no effective quality control exists, the spread of diseases is likely. The nascent seed market is not yet commercially self-sustaining. It is artificial and unreliable in that its driving force is the demand from development agencies, including government, donor organisations and NGOs, who support seed multipliers and, at times, indiscriminately buy planting material from them to distribute it for free for promotional purposes or as part of large-scale humanitarian relief interventions. This may be an excellent business opportunity in a bad agricultural year, but in the long term, it undermines the development of a commercially self-sustaining market based on demand for quality planting material from cassava growers.

Agricultural innovations have been introduced to address such shortcomings; however, these innovations neglect the circular and consultative learning process required by the Agricultural Innovation Systems approach. Innovations were introduced following a top-down approach. Active participation of smallholders as main beneficiaries was limited. For example, the development of improved cassava varieties, championed by IITA and certified by DARS, followed a research-centred approach which was met with limited success (limited adoption) because smallholder preferences regarding taste and cooking quality were not sufficiently

considered as relevant factors. This has reinforced recycling of seeds, as farmers chose to rely on traditional varieties. In cases where improved varieties have reached farmers, they are outdated as of today and some have lost their disease resistance.

Our results confirm earlier findings of a significant mismatch between supply and demand. Smallholder farmers are willing, but not able, to increase their cassava production, while the industry is unable to source cassava-based products in sufficient quality and quantity. Taking this as our starting point, we looked at possible steps to close this gap. We concentrated on two key areas and identified entry points for each.

Recommendations

The first area that we identified as key to the development of the value chain is mechanisms to increase cassava supply into the market since many farmers state a great willingness to commercialise, but are unable to succeed on their own. Here we distinguished three main entry points:

- Entry point: Seed and production system
 - Improve access to clean and improved planting material
 - Reduce recycling and uncontrolled distribution of uncertified planting material
 - Include farmers' quality preferences through a participatory approach facilitating their active participation in the development process of new improved varieties and
 - Improve smallholders' productivity through promoting Good Agricultural Practices
- Entry point: Extension service
 - Support through the extension service
 - Entry point: Farmer organisations
 - Strengthen capacities of farmer organisations involved in seed multiplication and processing

Secondly, we identified value chain coordination and governance as key in closing the gap between supply and demand in the cassava sector. The cassava value chain is quite complex and its actors need to be supported to achieve the desired supply push. Consequently, we see these additional entry points:

- Entry point: Roots and Tuber Crops Development Trust
 - Formulate a common vision for all actors and stakeholders in the cassava value chain
- Entry point: Government
 - Support the Malawian government's efforts to meet smallholders' financial and information needs

For both key areas, we matched each entry point with recommendations, both for short- and long-term action. We believe the implementation of these recommendations by our partners will help close the gap between supply and demand in the cassava value chain.

While we are convinced that cassava is a suitable crop for smallholders in the 21st century, it is not a silver bullet either. Smallholder participation in the cassava value chain as part of a diversified crop portfolio is a valuable, complementary strategy for smallholder farmers as long as commercialisation efforts do not compromise household food security.

Zusammenfassung

Maniok ist nach Mais das zweitwichtigste Grundnahrungsmittel Malawis. Die Verfügbarkeit verschiedener Manioksorten ermöglicht sowohl den kommerziellen Gebrauch, als auch den Konsum von Maniok auf Haushaltsebene, um sich gegen Ernährungsunsicherheit abzusichern. Aufgrund der Vulnerabilität Malawis gegenüber dem Klimawandel, schlechter landwirtschaftlicher Praktiken und der hohen Besiedlungsdichte stellt Maniok als anspruchslose und dürretolerante Pflanze eine attraktive Option für Kleinbauern dar.

Obwohl sich der politische Fokus von einer alleinigen Konzentration auf Mais und Tabak hin zu einer Strategie der Diversifizierung der Anbaukulturen verlagert hat, erfährt Maniok weiterhin wenig Aufmerksamkeit seitens der malawischen Regierung. In Malawi wird Maniok vorrangig von Kleinbauern angebaut, die jedoch Schwierigkeiten haben, ihre Erträge für den individuellen Verbrauch sowie den Verkauf zu steigern. Die von unseren Partnern GIZ-Malawi und dem *International Institute of Tropical Agriculture* (IITA) entwickelten landwirtschaftlichen Innovationen, beispielsweise ertragreichere Sorten, zielen darauf ab diese einschränkenden Faktoren abzubauen. Allerdings sind diese Innovationen bislang nur von wenigen Kleinbauern angenommen worden. Somit wird die hohe Nachfrage der lokalen Industrie nach Maniok als Rohstoff bisher nicht gedeckt – es besteht weiterhin eine große Diskrepanz zwischen Angebot und Nachfrage. Nichtsdestotrotz wird der Pflanze ein großes Potential für die Armutsbekämpfung zugemessen.

Diese Studie beantwortet folgende Fragestellung: Ist Maniok tatsächlich die Kulturpflanze des 21. Jahrhunderts für Kleinbauern? Unser Fokus liegt auf kleinbäuerlichen Produktionssystemen im Distrikt Nkhotakota am Ufer des Malawisees und in der ländlichen Umgebung von Lilongwe, der Hauptstadt Malawis. Wir untersuchen den Zusammenhang zwischen der Kapitalausstattung kleinbäuerlicher Haushalte und ihrer Beteiligung an der Maniok-Wertschöpfungskette, um die Ursachen der Diskrepanz zwischen Angebot und Nachfrage zu identifizieren und Empfehlungen für eine effektivere Entwicklung der Wertschöpfungskette zu formulieren. Die Beteiligung der Kleinbauern untersuchen wir durch eine partielle Wertschöpfungskettenanalyse. Wir bevorzugen eine strukturelle gegenüber einer ökonomischen Analyse, da Preise in informellen Märkten höchst volatil sind und im Rahmen unserer Studie nicht sinnvoll erhoben werden können. Weiterhin spielen in unserer Forschung Genderaspekte eine zentrale Rolle, da die Verantwortlichkeiten für die Ernährung der Familie und der Erwirtschaftung des Familienein-

kommens traditionell stark nach Geschlechtern getrennt ist. Daher enthalten alle unsere Instrumente genderdifferenzierte Elemente.

Methodik

Informationen aus Experteninterviews (n = 31) geben Aufschluss darüber, ob ein förderliches Umfeld für Maniokkommerzialisierung besteht und wie landwirtschaftliche Innovationen konzipiert und verbreitet wurden. Anhand von Haushaltsbefragungen (n = 58), die aus einer partiellen *Livelihood*-Analyse und einem auf Zukunftsszenarien gestützten Entscheidungsspiel bestehen, untersuchen wir, auf welche Weise die Kapitalausstattung kleinbäuerlicher Haushalte in Bezug auf physisches, finanzielles, soziales, natürliches und Humankapital ihre Entscheidungsfindung beeinflusst. In vier Fokusgruppendifkussionen mit insgesamt 51 Teilnehmern analysieren wir die Funktionsweise von selbstorganisierten Erzeuger- und Verarbeitungsorganisationen und identifizieren deren wesentliche Herausforderungen. Die Ergebnisse der Datenerhebung wurden insgesamt 25 Experten in zwei verschiedenen Veranstaltungen zur kritischen Diskussion vorgestellt.

Traditionelle Maniok-Anbaugebiete befinden sich entlang des Malawisees und im Süden des Landes. Hier werden vorwiegend bittere Sorten angebaut, die sich durch einen höheren Anteil an Vorstufen des Neurotoxins Cyanid auszeichnen. In jüngerer Zeit haben sich Anbaugebiete im Umland der städtischen Zentren von Lilongwe, Zomba und Blantyre entwickelt, wo vermehrt süße Sorten (mit vernachlässigbaren Gehalten an Blausäureglykosiden) angebaut werden. Die verschiedenen Sorten haben unterschiedliche Nutzungs- und Vermarktungswege innerhalb der Wertschöpfungskette:

- **Eigenverbrauch:** Maniok wird in kleinbäuerlichen Haushalten produziert, verarbeitet und verzehrt. Hierfür finden vorwiegend bittere Sorten Verwendung. Ein Beispiel für ein traditionelles Anbaugebiet ist der Distrikt Nkhotakota.
- **Ab-Hof-Verkauf:** Nach der Produktion verkaufen die Bauern die frischen Maniokknollen direkt von ihrem Betrieb. Diese werden dann von Zwischenhändlern entweder zu urbanen Märkten oder zu einer Verarbeitungsanlage transportiert.
- **Eigener Transport:** Die Landwirte sind selbst für den Transport verantwortlich, üblicherweise zur nächsten Verarbeitungsanlage oder zum nächstgelegenen Markt.

Süßer Maniok wird in städtischen Märkten normalerweise roh verkauft, wo er teilweise direkt als unverarbeiteter Snack konsumiert wird. Rund um Lilongwe hat sich ein gut organisierter informeller Markt für süßen Maniok entwickelt. Während dies den Maniok-Bauern ermöglicht, ihren Anbau zu kommerzialisieren und

Einkommen zu erwirtschaften, werden die Preise von den Käufern diktiert, und es bestehen hohe Eintrittsbarrieren für Kleinbauern, die als individuelle Verkäufer in den Markt einsteigen wollen.

Bittere Sorten werden üblicherweise auf Haushalts- oder Genossenschaftsniveau zu *Kondowole* (fermentiertes Maniokmehl) verarbeitet und als Grundnahrungsmittel *Nsima*, einer Art festem Brei, konsumiert. Nur ein geringer Teil der jährlichen Ernte wird vermarktet. Während dafür alle Sorten verwendet werden können, werden bittere für die Verarbeitung bevorzugt, da sie ertragreicher sind. Zudem kann hochwertiges Maniokmehl, genannt HQCF (*High Quality Cassava Flour*), in der Back- und Futtermittelindustrie Weizen- oder Maismehl ersetzen. Maniokstärke kann zu Glukosesirup weiterverarbeitet werden und findet vielfältige Anwendungen in der Papier-, Kleber- und Getränkeindustrie. Als energiereiches Futtermittel erfreut es sich zunehmender Beliebtheit in der Tier- und Fischfutterindustrie. Zusätzlich können Abfallstoffe aus der Maniokverarbeitung für die Produktion von Bioethanol verwendet werden.

Ergebnisse

Die hohe Nachfrage nach Maniok bietet einen starken Anreiz für die Produktionssteigerung. Jedoch können Kleinbauern ihre Marktverkäufe nicht erhöhen ohne ihre Ernährungssicherheit zu gefährden. Obwohl Pflanzenproduktion die Hauptstütze des Lebensunterhalts der Kleinbauern und die wichtigste Einkommensquelle darstellt, reicht die derzeitige Produktionsmenge gerade aus um die eignen Grundbedürfnisse der Kleinbäuerinnen und -bauern zu befriedigen. Nur gelegentliche Überschüsse werden kommerziell vermarktet. Unsere partielle *Livelihood*-Analyse zeigt, dass Kleinbauern aufgrund des geringen Niveaus an physischem, finanziellem, sozialem, natürlichem und Humankapital in ihren Haushalten mit mehreren Produktionsbeschränkungen konfrontiert sind. Es besteht ein erheblicher regionaler Unterschied um den Zugang zu diesen Ressourcen. Familien in Nkhotakota leiden besonders unter kleinen Ackerflächen und eingeschränktem Zugang zu Finanzmitteln sowie Krediten. Um finanzielle Schwierigkeiten zu überwinden, sind Kleinbauern häufig auf ihre Großfamilie, Lohnarbeit oder humanitäre Hilfe angewiesen. Ein weiterer regionaler Unterschied ist, dass Kleinbauern in Lilongwe überwiegend für den Markt produzieren, während Haushalte in Nkhotakota Maniok hauptsächlich als Grundnahrungsmittel für den Eigenbedarf anbauen.

In den meisten der von uns befragten Haushalten werden Entscheidungen gemeinsam von den Ehepartnern getroffen. Frauengeführte Haushalte sind in der Regel alleinstehend und es fehlt ihnen in der Folge an Arbeitskraft für die Feldar-

beit sowie an Zeit, um weitreichende soziale Netzwerke zu unterhalten. Auch sind ihre Ackerflächen kleiner als bei Haushalten mit männlicher Haushaltsführung, in denen so gut wie immer beide Ehepartner vorhanden sind.

In unserem auf Szenarien basierenden Entscheidungsspiel wurden beiden Ehepartnern eines Haushaltes (n = 93) getrennt voneinander hypothetische Optionen und Anreize angeboten. Diese beziehen sich auf den Anbau von Maniok, den Erwerb von Pflanzgut sowie Vermarktungs- und Verarbeitungsmöglichkeiten für ihre Ernte. Unsere Ergebnisse zeigen, dass in Maniok-anbauenden Haushalten beide Ehepartner Interesse an der Nutzung von verbesserten Manioksorten haben, bereit sind für verbessertes Pflanzgut zu zahlen und Ab-Hof-Verkäufe bevorzugen. Zugleich besteht Interesse, die Ernte gemeinschaftlich weiterzuverarbeiten, um ein höheres Einkommen zu erzielen. Die überwiegende Mehrheit der Kleinbauern ist somit bereit, sich aktiver an der Maniok-Wertschöpfungskette zu beteiligen und Innovationen anzunehmen, wenn ihnen dies ermöglicht wird. Kleinbauern, die derzeit kein Maniok anbauen, zeigen Bereitschaft den Anbau (wieder)aufzunehmen, wenn ihnen verbessertes Pflanzgut, sowie Fortbildungsmaßnahmen zugänglich gemacht würden und sie ihre Ernte Ab-Hof verkaufen könnten. Negative Auswirkungen des Klimawandels, die in der Vergangenheit schon zu Missernten im Maisanbau geführt haben, stellen ebenfalls eine Motivation für den Maniokanbau dar.

Im Gegensatz zu der Bereitschaft der Kleinbauern, ihre Maniokernte zu vermarkten, ergeben zahlreiche Experteninterviews, dass ihnen ein förderliches Umfeld fehlt, um erfolgreich an der Wertschöpfungskette teilnehmen zu können. Die malawische Maniok-Wertschöpfungskette besteht aus einer Vielzahl von Akteuren, die immer noch in hohem Maße ihren Partikularinteressen nachgehen, anstatt auf eine gemeinsame Vision hinzuarbeiten. Dies wird durch ein inkohärentes rechtliches Umfeld erschwert. Es besteht zwar eine Plattform zur Koordination der Wertschöpfungskettenentwicklung in Form des *Roots and Tuber Crops Development Trust*, die das offizielle Mandat hat alle Akteure in der Wertschöpfungskette zu koordinieren und zu repräsentieren, aber aufgrund finanzieller und struktureller Schwierigkeiten ist sie dazu nicht in der Lage.

Der staatliche landwirtschaftliche Beratungsdienst ist nicht auf Maniok ausgerichtet. Er ist ungenügend ausgestattet und insbesondere mit weiblichen Beraterinnen unterbesetzt, die besser auf die Bedürfnisse von weiblichen Landwirten eingehen könnten. Das formelle Saatgutwesen wird vom *Department of Agricultural Research Services (DARS)*, des Ministeriums für Landwirtschaft, Bewässerung und Wasserentwicklung mit Unterstützung von IITA organisiert. Die Verbreitung und

Vermehrung von verbessertem Pflanzmaterial ist jedoch schlecht organisiert und bestehende Vorschriften werden häufig ignoriert. Der Zugang zu verbessertem Pflanzmaterial für Landwirte ist aufgrund seiner begrenzten Verbreitung schwierig. Folglich sind Kleinbauern darauf angewiesen Pflanzmaterial selbst herzustellen und untereinander auszutauschen. Da dabei keine wirksame Qualitätskontrolle existiert, kommt es häufig zur Ausbreitung von Krankheiten. Der noch im Aufbau befindliche Pflanzgutmarkt ist nicht kommerziell nachhaltig. Er wird als künstlich und unzuverlässig beschrieben, da seine treibende Kraft die Nachfrage von Entwicklungsinstitutionen ist, einschließlich der Regierung, Geberorganisationen und Nichtregierungsorganisationen. Sie unterstützen Multiplikatoren von Pflanzgut und kaufen teilweise wahllos Pflanzmaterial ab, um es als Teil von großangelegten humanitären Maßnahmen oder zur Anwerbung von Neuanbauern kostenlos zu verteilen. Dies mag zwar eine hervorragende Geschäftsmöglichkeit in einem sonst schwachen landwirtschaftlichen Erntejahr sein, untergräbt jedoch langfristig die Entwicklung eines sich selbsttragenden Marktes.

Um all diesen Mängeln entgegenzuwirken, wurden landwirtschaftliche Innovationen entwickelt. Diese Innovationen vernachlässigen jedoch den zirkulären Lernprozess, der vom Ansatz der landwirtschaftlichen Innovationssysteme (*Agricultural Innovations Systems Approach*) gefordert wird. Bisherige Innovationen wurden überwiegend nach einem Angebotsansatz eingeführt, der die aktive Beteiligung von Kleinbauern als Hauptbegünstigten größtenteils ignoriert. So verfolgt die Züchtung verbesserter Manioksorten, als eine der wichtigsten Innovationen, von Wissenschaftlern festgelegte Züchtungsziele. Neue Sorten fanden in der Folge nur begrenzte Akzeptanz unter Kleinbauern, da sie ihre Präferenzen hinsichtlich Geschmack und Kochqualität nicht ausreichend berücksichtigten. Dies hat das Recycling von Pflanzgut verstärkt, da Landwirte weiterhin ihre traditionellen Sorten anbauen. Diejenigen Sorten, die die Landwirte erreicht haben, müssen mittlerweile als veraltet angesehen werden, da einige schon ihre Krankheitsresistenz verloren haben.

Die Ergebnisse unserer Studie bestätigen eine signifikante Diskrepanz zwischen Angebot und Nachfrage. Kleinbauern sind zwar bereit, aber nicht in der Lage, ihre Maniokproduktion zu steigern, während die Industrie Maniok nicht in ausreichender Qualität und Menge beziehen kann. Davon ausgehend fokussieren wir zwei Schlüsselbereiche und identifizieren jeweils potentielle Einstiegspunkte.

Empfehlungen

Der erste Bereich, den wir als Schlüssel für die Entwicklung der Wertschöpfungskette identifiziert haben, betrifft Mechanismen zur Verbesserung der Markt-

versorgung mit Maniok. Viele Landwirte zeigen eine hohe Kommerzialisierungsbereitschaft, können aber alleine nicht erfolgreich sein. Hier unterscheiden wir drei Haupteinstiegsunkte:

- Einstiegsunkt: Pflanzgut und Produktionssystem
 - Verbesserung des Zugangs zu sauberem und verbessertem Pflanzmaterial
 - Reduzierung der Pflanzgutwiederverwendung und der unkontrollierten Verteilung von nicht zertifiziertem Pflanzmaterial
 - Einbeziehung der Qualitätspräferenzen der Landwirte durch einen partizipativen Ansatz, der ihre aktive Teilnahme am Entwicklungsprozess neuer Sorten ermöglicht
 - Verbesserung der Produktivität der Kleinbauern durch Förderung guter landwirtschaftlicher Praktiken
- Einstiegsunkt: Unterstützung durch den offiziellen landwirtschaftlichen Beratungsdienst
- Einstiegsunkt: Stärkung der Kapazitäten von Bauernorganisationen, die an der Vermehrung von Pflanzgut und der Verarbeitung von Maniok beteiligt sind

Als zweiten Bereich haben wir die Koordinierung der Wertschöpfungskette und deren Koordination als Schwachstelle im Maniok-Sektor identifiziert. Die Maniok-Wertschöpfungskette ist komplex und ihre Akteure müssen unterstützt werden, um die Lücke zwischen Angebot und Nachfrage zu schließen. Wir sehen diese zusätzlichen Einstiegsunkte:

- Einstiegsunkt: Formulierung einer gemeinsamen Vision für alle Akteure in der Maniok-Wertschöpfungskette
- Einstiegsunkt: Unterstützung der Bemühungen der malawischen Regierung Kleinbauern verbesserten Zugang zu Informationen und landwirtschaftlichen Produktionskrediten zu verschaffen

Für beide Schlüsselbereiche haben wir zu den jeweiligen Einstiegsunkten Empfehlungen für kurz- und langfristige Maßnahmen entwickelt.

Wir sind davon überzeugt, dass Maniok eine geeignete Nutzpflanze für Kleinbauern des 21. Jahrhundert, aber dennoch keine Wunderwaffe ist. Maniokanbau, als Teil eines diversifizierten landwirtschaftlichen Portfolios, stellt eine wertvolle Strategie für Kleinbauern dar, solange Kommerzialisierungsbemühungen die Ernährungssicherheit kleinbäuerlicher Haushalte nicht in Gefahr bringen.

1 Introduction

1.1 Cassava's relevance and potential worldwide and in Malawi

Cassava (*Manihot esculenta*) is, at present, the fourth-most important food crop in the world. It is grown for its large, starch-filled roots which contain nearly the maximum theoretical concentration of starch on a dry weight basis among food crops. Demand for cassava from the starch industry in southeast Asia and food markets in Africa have made cassava the fastest growing crop worldwide, in terms of relative production. Cassava is grown in over one hundred countries on an area of close to 25 million hectares. The worldwide production is estimated to be around 268 million tons. Most of this is produced by some six million small-holders, which is one of the reasons for average yields being far below potential (GCP21, 2018).

Cassava, as a crop, has several strengths, but also some weaknesses. A brief overview of its main features is presented in the Figure 1.

Strengths	<ul style="list-style-type: none"> ▪ Reasonable yields under poor soil conditions and low-input management ▪ Responds well to mineral fertiliser ▪ Tolerates extreme and erratic rainfall ▪ Flexible planting and harvesting 	<ul style="list-style-type: none"> ▪ Perishable planting material ▪ Short shelf life of roots ▪ Bulky commodity, high volume/ low value ▪ Labour intense production (weeding, harvesting, processing) 	Weaknesses
Opportunities	<ul style="list-style-type: none"> ▪ Multi-purpose crop (root starch, nutrient-dense leaves, fuel wood) ▪ Substitute for wheat flour in the bakery industry ▪ Gluten-free ▪ Climate change adaptation 	<ul style="list-style-type: none"> ▪ Toxicity (cyanogenic glucosides and aflatoxin) ▪ Susceptible to pests and diseases ▪ Lack of support to the value chain as compared to support given to other crops 	Threats

Figure 1: Cassava value chain SWOT analysis

Source: Own compilation.

Cassava is considered to have a huge potential for alleviating rural poverty and contributing to national economic development. It is well-known for producing

2 Introduction

reasonable yields under marginal conditions such as poor soils, drought and extreme rainfall with little to no external inputs and under poor husbandry. It is among the few crops projected to not be adversely affected by global warming. Being a multi-purpose crop, the former “food of the poor” is believed to be able to respond to the priorities of developing countries, to trends in the global economy and to the challenge of climate change (Howeler, NeBambi, & Graeme, 2013).

Agriculture is the backbone of Malawi’s economy, employing 64 % of the work force (GoM-MoAIWD, 2016). With a growing population, food security remains a major challenge for the country. Cassava is the second-most important staple food crop after maize. It is grown traditionally along the lakeshore where bitter cultivars are predominant, but also in other areas where sweet cultivars are increasingly popular (Rusike et al., 2010).

While erratic rainfall has had adverse effects on maize productivity in most parts of Malawi, cassava production has increased steadily over the past decades – both the area under cassava as well as the average productivity of the crop (Schöning & Mkumbira, 2007). In Malawi, cassava is almost entirely grown by smallholders cultivating less than two hectares of land. As both a staple food and cash crop and being flexible over a range of planting and harvesting times, cassava offers them a reliable and flexible livelihood strategy (Sandifolo, 2016).

1.2 Problem statement and research needs

Staple crops with low-input requirements, such as cassava, are being promoted for market development due to their accessibility for underprivileged smallholder farmers (Forsythe, Kaitano, & Martin, 2010). Cassava is believed to offer considerable potential for commercialisation, either to supply local markets with fresh cassava or to provide raw material for further processing and utilisation in industries such as bakeries, packaging and breweries. Kambewa and Nyembe (2008) estimated the demand for raw cassava in Malawi to exceed its supply, emphasising its possibility for commercial use. Its anticipated potential to increase income, employment and food security is acknowledged by the United Nations, researchers, supporting agencies (like non-governmental organizations and foundations) and bilateral cooperating partners. Among others, GIZ and International Institute of Tropical Agriculture (IITA) developed innovations along the cassava value chain (VC) to realise this potential. These innovations include the promotion of using improved planting material, especially higher yielding, pest- and disease-resistant and -tolerant varieties, improved crop management practices as well as

facilitating the self-organisation of smallholders in farmer associations which serve as entry points for innovations.

Despite these efforts to promote cassava, a mismatch between supply and demand persists. The Malawian cassava VC is still poorly developed with a low percentage of value addition to its products (IITA Malawi, 2017). Industrial demand for cassava products is also affected by price volatility in local maize as well as international wheat markets. Both commodities can be substituted with cassava. Therefore, cassava prices on local markets also vary considerably, contributing to boom and bust cycles which make reliable production of high volume and quality a challenge. When smallholders manage to produce any surplus, they struggle to find a market for it due to the poor infrastructure network in rural areas. This leaves the newly established industry lacking raw material for its processing capacities. Consequently, the potential for cassava commercialisation remains underexploited as smallholders are not able or not willing to participate effectively in the cassava VC. Reasons may include factors such as

- limited access to inputs (especially planting material),
- inadequate infrastructure (e.g. markets, transport facilities, credit options),
- insufficient information (e.g. extension services, market prices),
- inefficient VC governance overall and
- more attractive alternative sources of income.

Subsequently, cassava is still perceived as a food crop for hunger periods rather than a cash crop, grown alongside other crops for subsistence and only optionally being used as a secondary source of income (IITA Malawi, 2017).

Innovations to enhance the commercialisation of cassava have not achieved their anticipated impact, so far. It is not clear why smallholder farmers have not incorporated the innovations into their livelihood strategy and whether the problem lies in the innovation design, in the method of dissemination, or elsewhere. For this reason, our study focuses on smallholders' livelihoods and cassava's role within them. The main research question we aim to answer is: What innovations are required by smallholder farmers to enable them to participate more successfully in cassava value chains and what are the most effective ways to introduce and disseminate these innovations?

2 Analytical and conceptual framework

2.1 Research design

In order to enable smallholders to participate effectively in selected cassava VC channels, the objective of the study is to develop recommendations for improving existing innovations and identifying entry points for new innovations. Smallholders' ability and willingness to do so is governed by their environment as well as their household's asset endowment and their preferences with regard to livelihood activities. By gaining a deeper understanding of smallholders' asset endowments and exploring their decision-making processes, we aim to reveal pre-conditions and factors that lead to the adoption, rejection or disadoption of innovations.

As cassava can be both a food and a cash crop, traditional gender roles are attached to it. While it is commonly the wife's responsibility to put food on the table, it is a husband's duty to earn income. This can lead to goal conflicts around the utilisation of cassava. Narratives in the literature equate commercialisation of cassava with benefits for women; however, little is known about how female farmers engage in cassava farming commercially and the livelihood outcomes from this, particularly given the importance of cassava for food security (Forsythe, Kaitano, & Martin, 2010). Hence, we conducted a gender-differentiated analysis of the decision-making process that leads to participation in the cassava VC.

The results of our study may help practitioners to improve the design, dissemination and facilitation of innovations along the cassava VC in Malawi. Therefore, the study aims to contribute to improve smallholders' livelihoods by enhancing food security and increasing income.

We generated the following outputs:

- a partial VC analysis in two study areas with focus on supply;
- a partial livelihood analysis, focusing on the asset endowment of selected households within those two areas;
- a gender-differentiated analysis of decision-making processes with regard to the production, commercialisation and processing of cassava and
- an investigation of existing innovations along the cassava VC, including how they were developed, disseminated/introduced and utilised by the target population.

6 Analytical and conceptual framework

Further details of the project design, including our activities, can be found in Annex 1.

2.2 Guiding research questions

According to the above-stated research objectives, we provide answers to the following guiding research questions:

- Does an enabling environment for cassava utilisation exist?
- What framework conditions are required to allow smallholder farmers to participate in the cassava VC more effectively?
- How is cassava utilised by smallholder farming households: as a staple food crop or cash crop or both?
- Are smallholder farmers capable and willing to participate in the cassava VC from the perspective of their individual livelihood systems?
- Where and how do smallholder farmers participate in the cassava VC in the study areas?
- What is the impact of cassava commercialisation in terms of household income generation and food security?
- What are the gender differences of household decision-making and livelihood strategies regarding cassava?
- What innovations are required to allow smallholder farmers to participate in the cassava VC more effectively?
- How would innovations need to be designed and disseminated in order to facilitate their integration into smallholder farmers' livelihood systems?
- Where are entry points for innovations along the cassava VC?

2.3 Conceptual framework

2.3.1 Livelihood-value chain nexus

The value chain approach is an economic and growth-based approach to development. In recent years, development agencies employed this approach to achieve pro-poor development goals, focusing on social inclusion as well as ecological sustainability to complement the strong economic focus of classical approaches. It aims to increase the competitiveness of a VC and add value along its

different stages: input provision, production, processing, transport, retailing and consumption (GIZ, 2016). It classically focuses on one commodity, in our case cassava. The participation in a VC usually requires a certain degree of specialisation from farmers in order to generate reasonable income (Sheck, Donovan, & Stoian, 2013).

On the contrary, the cultivation of a crop, for example, cassava, represents only one among several activities to generate income within smallholder households who have to cope with scarce resources and limited assets, in general. Hence, their livelihoods are complex and their activities to generate income are diverse in order to minimise the risk of failure in one particular subsystem. As smallholders strive to optimise their whole livelihood system rather than one particular subsystem, they negate the specialisation required by farmers to successfully participate in a value chain (DFID, 1999; Scoones, 1998; Sheck, Donovan, & Stoian, 2013).

As a result, value chain development approaches recently started to consider smallholders' livelihood systems more carefully (GIZ, 2016). To account for this, we combine both approaches, resulting in our livelihood-value chain nexus. Hence, this research carries out both a partial livelihood analysis and a partial value chain analysis focusing on the supply-side of the cassava VC. The livelihood-value chain nexus describes the combination of both concepts (see Figure 2).

The study applies the partial livelihood analysis in order to shed light on the role cassava plays within smallholders' living situations in both study areas (Lilongwe rural and Nkhotakota District). In particular, we focus on the household's asset endowment and its income generation activities (Scoones, 1998). The asset endowment of a household is the foundation for smallholders' ability to participate in a particular VC. It is composed of five types of capital: human, social, natural, physical and financial capital.

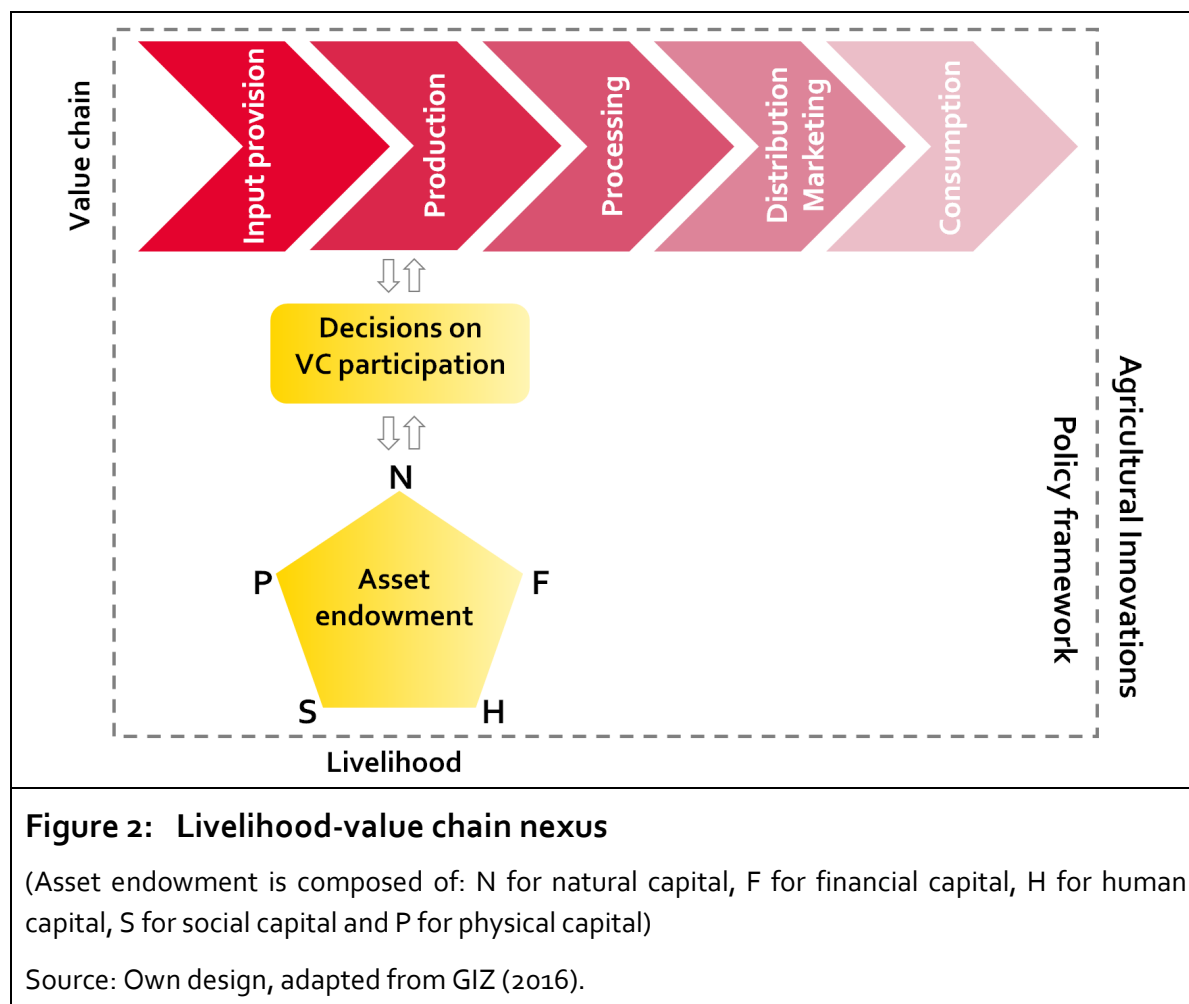
Our partial value chain analysis includes:

- stakeholder mapping;
- partial economic analysis (e.g., availability of input factors, prices);
- partial environmental analysis and
- gender analysis of income generation and food security.

The final decision to engage in a VC, such as cassava, is a complex process of evaluating competing activities to maximise the livelihood security of all household members. Innovations need to be designed and disseminated in a way that supports these decision-making processes. Following Sheck, Donovan, & Stoian

8 Analytical and conceptual framework

(2013), using a nexus approach will enable us to shed light on the complex challenges of smallholders and to identify entry points for holistic innovations.



2.3.2 Agricultural innovations

Agricultural innovations form a central element of our research on the livelihood-value chain nexus. We apply the Agricultural Innovation Systems (AIS) approach and define innovations in a non-technocratic, interdisciplinary and system-based manner. The VC and the AIS approach are complementary and share several developmental objectives like poverty alleviation, income generation, food security, agricultural and rural development and economic growth. In other words, both approaches are constructed to solve real world problems on a local level. The widely adopted AIS approach (Dolinska & D'Aquino, 2016) emerged due to the ineffectiveness of the traditional, linear model of technology transfer which failed to increase sustainable food production in the Global South. The AIS approach is a departure from research-centred and top-down strategies. It recognises that the

use of technology and/or information depends not only on its availability, but more so on the ability of different actors to adopt and adapt it to their specific needs (Cohen & Levinthal, 1990).

An AIS constitutes a network of actors and organisations that forms a flexible framework. Within the AIS approach, innovations emerge from the interaction between actors (individuals, organisations and institutions) who take part in the production, exchange and utilisation of knowledge. It incorporates actors like non-governmental organisations (NGOs), research institutions, governmental actors, farmers, as well as the private sector and focuses on the relationships and interactive learning processes between these actors (Dolinska & d'Aquino, 2016). The approach relies upon individual and collective absorptive capacity to transform knowledge into a beneficial social or economic agricultural activity. Within an AIS, an innovation is marked by the following features (Spielman, Ekboir, & Davis, 2009):

- Innovation is the use of knowledge in response to social or economic needs and opportunities.
- Innovation serves to address constraints and problems.
- Innovation involves the use of new as well as existing knowledge.
- Actors can be individuals, organisations and institutions.
- Innovation is a continuous process.

Innovations can occur anywhere along the VC and apply to the micro-, meso- and macro-level. There are product innovations, process innovations, institutional/organisational innovations and service-delivery innovations. Hence, innovation possibilities in VCs are diverse and can relate, for example, to input supply, production organisation or policy and regulatory issues (Anandajayasekaram & Berhanu, 2009). This holistic nature of the AIS makes it an ideal vehicle to support the value chain development process. In combination with the sustainable livelihood approach, it recognises smallholders' living realities as well as their priorities and needs.

3 Methodology

The results of this study are based on empirical research. An explorative, qualitative approach was chosen to provide an in-depth analysis of smallholders' decision-making processes in regard to their participation and innovations in cassava value chains in Lilongwe rural and Nkhotakota District. The research instruments for data collection were implemented in four main research phases and were structured as described in the work schedule (see Annex 2).

3.1 Methods of data collection

Data collection was conducted using a combination of qualitative research methods:

- semi-structured expert interviews,
- focus group discussions and
- semi-structured household questionnaires.

The combination of methods is complementary and allows for the cross-validation of information. During field research, we conducted a total of 58 household interviews (93 single-respondent interviews within the households), 4 focus group discussions (with a total of 51 participants), 31 expert interviews and 2 results-validation workshops (with a total of 25 participants), applying the following approach.

3.1.1 Expert interviews

Expert interviews were conducted following customised interview guidelines to deepen knowledge and gain new information on

- the role and potential of cassava for income generation and food and nutrition security;
- the functioning and governance of the cassava VC;
- gender aspects and dynamics along the cassava VC;
- reasons and solutions for the mismatch between demand and supply;
- limitations of existing and missing innovations within the cassava VC;
- existing innovations, the conceptual framework and entry points for future innovations and
- the enabling environment and policy context for cassava production.

12 Methodology

Key experts from the public sector, donor organisations, research-cooperation partners, NGOs, academia and the private sector were identified by snowball sampling and are listed in Annex 3.

3.1.2 Focus groups discussions

During focus group discussions (FGDs) we gathered information on production such as planting material and farming methods, processing, commercialisation, market access and self-organisation from the following farmer organisations (FO).

- Chigonthi Cassava Agroprocessing and Marketing Cooperative Society Ltd. in Lilongwe rural: cassava (bitter) cooperative, producing for a local processing unit.
- Mkazimasika Cassava Cooperative in Nkhotakota District: cassava (predominantly bitter varieties) cooperative and multiplication of planting material, producing for a local processing unit, production and marketing of *kondowole* (see Table 4 for a description).
- Mlira Club in Lilongwe rural: cassava (sweet) cooperative, production for farm-gate sale; vendors and middlemen of cassava (to capture marketing aspects).

More details about these FOs can be found in Annex 4. Additionally, we included two cassava cooperatives and one processing cooperative from an area in Zomba District where cassava commercialisation, especially processing of bitter varieties, is advanced.

- Chinangwa ndi Mbatata Roots and Tuber Enterprise (CMRTE) in Zomba: processing of cassava into flour and High Quality Cassava Flour (HQCF) for the local market.
- Nasawa Cooperative in Zomba: production of bitter cassava for Universal Industries Ltd.
- Dzaone Cassava Cooperative in Zomba: production of bitter cassava for Universal Industries Ltd.

Box 1: Focus Group Discussion

**Facilitator
C. Dzindichoke
moderating a
focus group dis-
cussion with fe-
male members
of a farmer or-
ganisation**

Photo: P. Günther

As laid out in the FGD guidelines (see Annex 5), important research topics were the motivation, purpose and vision of the FO as well as the role of agricultural innovations for farmers within the FOs. Further, information on the functioning of FOs and future strategies was collected; members of the cooperatives were first asked to discuss the activities they are engaged in within the cassava VC. In a second step, a problem analysis was conducted; participants were asked about challenges that the FO faces. In all FDGs but one, this step was conducted in gender-segregated groups to enable women and men to speak freely and to see if both groups perceive challenges differently. Finally, possible solutions for the most-important challenges were identified and discussed by the participants.

3.1.3 Household interviews

During the household interviews, two data collection instruments were used in two consecutive sessions (see Annex 6):

- Session 1: Semi-standardised questionnaire on the general household endowment
- Session 2: Two versions of a scenario game
 - a version for cassava-growing households
 - a version for non-cassava-growing households

In session 1, the household head was asked to establish the general endowment of the household with regard to social, physical, human, financial and natural capital and the current importance and use (home consumption or cash crop) of their cultivated crops. In the case of single-headed households, this interview

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was conducted with one person only. In other cases, both spouses were asked to be present during the interview, if that was possible.

In session 2, spouses were interviewed separately. In a scenario game, respondents were presented with a set of options designed for cassava-growers or non-cassava-growers to study gender-differentiated preferences and decision-making mechanisms for participation in cassava VCs. More details on this method can be found in Chapter 7 alongside results.

Box 2: Scenario game during a household interview



Field interviewer
E. Ngwira conducting
the scenario game

Photo: C. Voigt

3.1.4 Validation workshops

Two validation workshops with a total of 25 participants were conducted in Zomba and Lilongwe to validate the findings from data collection, to discuss our interpretations and to raise open questions.

3.2 Research units and sampling

The main research units during data collection were smallholder farmer households, cooperatives, farmer groups and operators of community-level processing units. Additionally, entrepreneurs, value chain supporters and innovation promoters from state, private and civil-society sectors were part of data collection too.

The selection of households builds on the sampling population of the representative random sample in the IITA Baseline Survey Report (IITA Malawi, 2017)

which included over 751 households throughout Malawi, thereof 245 households in Lilongwe District and 58 in Nkhotakota District. The sampling frame of the IITA baseline survey was used for the regional clusters of Lilongwe rural (LLW) and Nkhotakota District (NKK). Table 1 describes the sampling strategy for case selection in our study. Our research design builds on a small-N research sample.

Sampling stage	Sampling unit	Criteria
1	Regional cluster: Nkhotakota and Lilongwe (rural)	Type of cassava utilisation in the region: Predominantly bitter (NKK) or sweet (LLW) cassava varieties
2	Sub-regional cluster: Extension Planning Area (EPA)	Random selection according to IITA baseline sample
3	Smallholder households	<ul style="list-style-type: none"> ▪ Gender of head of household ▪ Years of schooling ▪ Farm holding size ▪ Area under cassava ▪ Cultivation of cassava ▪ Contact with improved cassava varieties

Source: Own compilation.

In the first stage of sampling we decided on two regional clusters. The choice of regional clusters reflects differences in the cassava varieties grown, cassava utilisation and marketing. Nkhotakota District is situated at Malawi's central lakeshore. It is a traditional growing area for bitter cassava varieties. Here, cassava is predominantly used for home consumption and access to commercial markets is limited. Smallholder farmers in Lilongwe rural have adopted sweet cassava varieties only recently. They supply urban markets with unprocessed roots for immediate consumption. A detailed profile of the study regions can be found in Chapter 5.

A selection of sub-regional clusters (Extension Planning Areas (EPA) within the two study districts) was conducted randomly from the IITA baseline survey sample. To ensure diversity in selected households and to help identify typical and deviant cases, we used purposive sampling techniques (Gerring, 2007) across household characteristics, such as the number of household members, the household head's number of years of schooling, farm holding size, area under cassava and

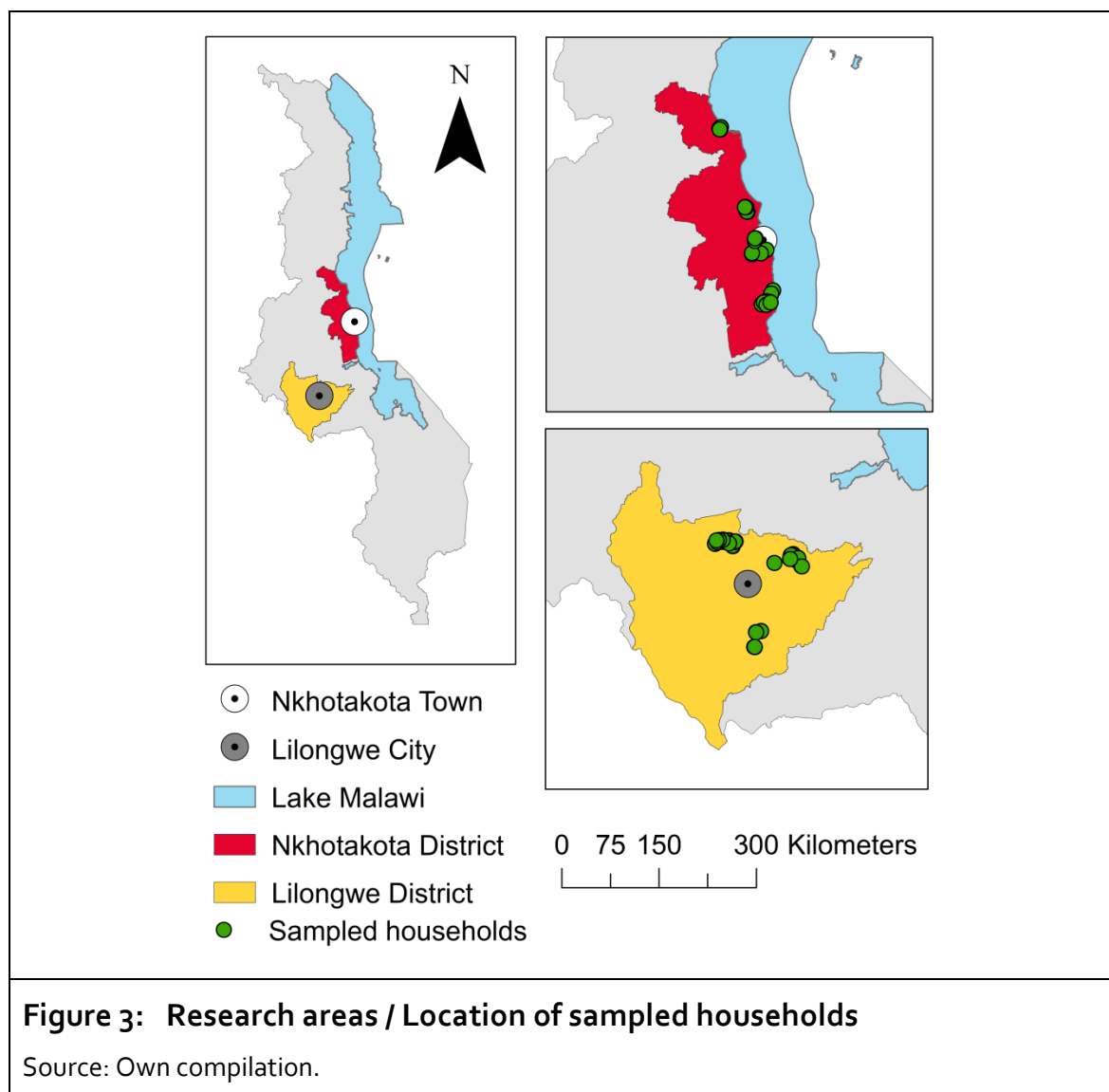
membership in a farmer organisation. During the inception phase, sampling criteria were agreed upon and validated with the support of local experts and cooperation partners. We then grouped the selected households into different categories (Table 2).

Sampling category / District	NKK	LLW
Male-headed, non-cassava-growing HH	0	6
Female-headed, non-cassava-growing HH	1	2
Male-headed, cassava-growing, innovation-non-adopting HH	6	4
Female-headed, cassava-growing, innovation-non-adopting HH	3	3
Male-headed, cassava-growing, innovation-adopting HH	15	12
Female-headed, cassava-growing, innovation-adopting HH	5	1
Total (n)	30	28

Source: Own data.

Compared to the IITA baseline survey sample, we oversampled female-headed households (in LLW, we had 21 % of female-headed households in our sample vs. 10 % in the IITA baseline survey sample and in Nkhotakota 30 % vs. 15 %, respectively). We did this to allow for a gender-differentiated analysis of household asset endowments and qualitative statements of the interview respondents. Similarly, non-cassava-growers in Lilongwe rural and innovation adopters in both districts were oversampled to generate additional information on cassava cultivation and the adoption of improved cassava varieties. Other differences between the IITA's 2015/16 sample and our 2017 sample are due to a change in farming practices, changes in the household composition and the adoption or discontinued use of innovations.

The location of the interviewed households can be seen in the map in Figure 3 below.



3.3 Data documentation and approach to analysis

Data was documented using Android-based tablets and CPro/CSEntry for data collection and management. MaxQDA was used to process data generated in expert interviews and focus group discussions. The data obtained through household interviews was processed and organised with SPSS Statistics software. In addition, exemplary qualitative statements from all three data collection methods were summarised and included in the presentation of results.

A codified matrix was used to calculate household asset endowment including financial, social, physical, human and natural capital for each sampled household (see coding matrix in Annex 7) in Microsoft EXCEL (see Table 3).

Table 3: Scoring attributes according to different forms of capital in household's asset endowments

Type of capital	Indicator	Attributes
Natural	Land allocation	<ul style="list-style-type: none"> ▪ Total area under cultivation ▪ Area cultivated in relation to area uncultivated
	Irrigation	<ul style="list-style-type: none"> ▪ Irrigation technology
	Sustainable natural resource management	<ul style="list-style-type: none"> ▪ Measures against soil degradation
	Livestock	<ul style="list-style-type: none"> ▪ Type of animals and livestock size
Human	Education	<ul style="list-style-type: none"> ▪ Formal education ▪ Agricultural experiences and farming practices
	Labour force	<ul style="list-style-type: none"> ▪ Workforce according to HH size ▪ Working HH members ▪ Labour bond by homebased care
Social	Household structure	<ul style="list-style-type: none"> ▪ Decision-making process
	Community integration	<ul style="list-style-type: none"> ▪ Relation to village authority ▪ Group membership ▪ Active participation ▪ Benefits from social interactions/activities
Financial	Labour supply	<ul style="list-style-type: none"> ▪ Affordability of hired labour
	Financial resilience	<ul style="list-style-type: none"> ▪ Access to credit ▪ Costs of living ▪ Satisfaction with financial situation ▪ Means to overcome financial struggles
Physical	Standard of living	<ul style="list-style-type: none"> ▪ Housing quality ▪ Sources of energy ▪ Water, sanitation and hygiene
	Production equipment	<ul style="list-style-type: none"> ▪ Variety and quantity of agricultural tools
	Consumer durables	<ul style="list-style-type: none"> ▪ Availability and quantity of motorcycle, bicycle, cell phone, radio
Source: Own data.		

4 The agriculture and cassava sectors in Malawi

The cassava value chain is impacted by many framework conditions. The following chapter establishes the demographic and socio-economic background, the administrative and political landscape, typical cassava products (see Box 4) and food safety concerns with cassava as well as consumer preferences. Further, the context of GIZ/IITA agricultural innovations in the cassava VC is presented, which influence household gender dynamics, production patterns and the commercial potential.

4.1 Demography and socio-economic background

The population of Malawi (at 17.7 million in 2016) grew at a rate of 3.1 % between 2010 and 2016. It is expected to double by 2050, which will lead to an even higher population density (currently 188 per km²) (UN data, 2017). Only around 16.3 % of Malawians live in urban areas, but these centres grow faster (3.4 % between 1998 and 2008) than the rest of the country (Droppelmann, Makuwira, & Kumwenda, 2012). So far, the two biggest cities, Lilongwe and Blantyre, have accommodated three quarters of this growth (The World Bank Group, 2016). The trends are limited by relatively high living costs in urban compared to rural areas.

Malawi's rank for human development is 170 out of 188 countries, placing it in the low human development category. 53.7 % of the population is described as multi-dimensionally poor nationwide (23.2 % in urban areas); a further 29.2 % is vulnerable to poverty (OPHI, 2016). The standard of living is mostly impacted by limited availability of electricity (4 % of rural population vs. 50 % of urban population have access), drinking water, sanitation and cooking fuel. National HIV prevalence was 9.2 % of the adult population aged 15 to 49 years in 2016 and contributes further to vulnerability (UNAIDS, 2017).

Food security remains an important political issue and despite "significant improvement in the food security situation in Malawi"(UNICEF, 2007), the hunger situation is reported as serious and an estimated one-third of Malawians are believed to have struggled to meet their minimum food requirements in 2016/2017 (IFPRI, 2016). This has a particularly strong negative impact on child health; nearly 4 in 10 (37 %) children under five in Malawi are stunted. Stunting is an indication of chronic undernutrition. In addition, 12 % of children are underweight, or too thin for their age (NSO & ICF, 2017).

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Agriculture is the backbone of the country's economy, as half of the country's economically-active workforce is employed in the sector. 33 % of the national GDP is generated in agriculture (70 % thereof by smallholders) and the sector accounts for approximately 80 % of export earnings (The World Bank Group, 2016).

4.2 Policy and administrative landscape

The Government of Malawi (GoM) has been intensely intervening in the agricultural sector in the form of a fertiliser subsidy programme called FISP (Farm Input Subsidy Program) since 2005/06. It has directed the lion's share of public agricultural expenditures (on average, 64 % of Ministry of Agriculture, Irrigation and Water Development's (MoAIWD) and 9 % of the government's budget between 2006 and 2013) almost exclusively to inputs for maize farmers, thereby preventing investment in other prospective crops. FISP is believed to have reached 80 % of all smallholder farmers in 2010/11. Moreover, FISP has been complemented by additional measures such as maize export bans during food crises (The World Bank Group, 2016).

The 2016 National Agricultural Policy puts an emphasis on the diversification of crop production and marketing. The second Malawi Growth and Development Strategy stresses the need for creating income opportunities in rural growth centres and slowing down rapid urbanisation due to rural-urban migration (GoM-MoAIWD, 2016; The World Bank Group, 2016). The Malawi Agricultural Sector Wide Approach (ASWAp) 2011-2015, sets out financing priorities for agricultural productivity and diversification to raise rural income levels.

Regulations in the cassava sector

Only recently, cassava has been listed as a priority crop within Malawi's crop diversification strategy and its potential for diversified use in non-food sectors has been recognised; for example, substituting imported wheat flour with high-quality cassava flour (HQCF) in bakery products. While an upswing in cassava production is expected, there are no standing budget lines to support the cassava sector and funds are only released ad hoc in emergency situations. Cassava keeps its role as a "fall-back" crop in case of droughts or failing maize harvests and remains an "orphan crop" left to promote itself. The overarching policy principle remains maize self-sufficiency and support to the fertiliser industry (GoM, 2011).

The Seed Act, last revised in 1996 and currently under prolonged consultation with the GoM for a new amendment, regulates the seed system. So far, it contains general regulation for seeds, but nothing for cassava in particular. The current re-

vision has included multiple-stakeholder consultations and it is expected that the seed system for vegetatively-propagated crops will be formalised as part of the revision. This might lead to the introduction of seed certificates and control visits and entail penalties for the distribution of non-certified cassava cuttings to counter the proliferation of compromised planting material for cassava and other crops. Unfortunately, this draft is not accessible to the public.

No specific laws and policies for regulating the fresh and processed cassava trade are in place and no policy for the horticultural sector exists (under which roots and tuber crops are grouped together by the MoAIWD). A minimum farm-gate price for cassava was introduced in 2008/09 by the government to protect producers and ensure that they receive at least cost-recovery prices from buyers. At the moment, this minimum price is MK 30 per kg (less than the equivalent of 4 Euro cents); however, evidence from household interviews and literature shows that this minimum price is underestimated and not binding. As a result, buyers still dictate prices at the farm gate and national markets for cassava are essentially self-regulated and self-organised.

The industry also lacks clear policy guidance (Haggblade et al., 2012). For example, industrial processing and marketing of cassava products rely on standards for cassava and maize starch for the textile industry (MS 704:2004¹) and standards for edible products only exist for cassava flour (MS 349:2002). Consequently, quality control of the whole range of cassava produce is not assured and the Malawi Bureau of Standards is not in a position to certify HQCF and its producers.

Supporting policies

The agricultural extension service is guided by the Extension Policy of 2000 which was operationalised only in 2004. It focuses on pluralistic (government, NGO and private extension actors), demand-driven (catering to farmers' demands) and decentralised extension services to achieve food security and reduce poverty by elevating subsistence smallholder farming to commercial, profit-oriented agribusiness production. Numerous assessments of the policy indicate that despite progressive provisions of the policy, its operationalisation lags behind and its implementation is incomplete (Ragasa, Mazunda & Kadzamira, 2015).

While agricultural cooperatives operate based on a law from 1998 and a regulation from 2002 within a sound framework, their economic activity is impeded by macroeconomic instability. Due to unpredictable markets and high price volatility,

1 These codes stand for Malawi Standards (MS) plus a serial number and year of publication.

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organised and individual smallholders struggle to participate effectively in many VCs. This leads to side-selling by producers, even if contract farming arrangements are concluded. Contract enforcement and abidance are weak as all parties try to avoid risks and commitments (Borda-Rodriguez & Vicari, 2014).

Innovations are understood as an important approach for transformation. Agricultural innovations are designed and implemented by governmental and research institutions under the auspices of the Department of Agricultural Research Services (DARS). In its narrative, the National Agricultural Policy takes a systemic approach to innovations, yet when it comes to interventions the focus is firmly set on technical innovations, first-and-foremost for agricultural mechanisation, irrigation, and seed varieties.

4.3 Gender

Although women account for a significant share of the agricultural labour force, they are typically disadvantaged, having less access to land, labour, agricultural inputs and extension services. This limits their productivity as well as their adoption of innovations (Ragasa, Aberman & Mingote, 2017).

The association of cassava as a “woman’s crop” is derived from its low market value as a traditional staple crop, along with its low input requirements. Research demonstrates male farmers are associated with cash crops, while female farmers are associated with subsistence crops of low economic value. Malawi reveals especially highly gendered patterns of access to inputs. Family-based agriculture in Malawi is under male authority, even in matrilineal areas; however, division of labour is less visible at the production level, as male and female farmers usually work together on shared plots. Although women undertake more weeding while men undertake more land preparation, they were found to assist each other when needed. Still, women primarily process cassava for household consumption, while men produce cassava primarily for sale. Malawian men mainly sell fresh roots from sweet varieties, while women sell processed cassava products from bitter varieties. Women are found to participate gainfully in commercial cassava opportunities while maintaining, if not increasing, food security; however, the extent is highly dependent on gender norms and household relations (Forsythe, Posthumus, & Martin, 2016).

4.4 Cassava perception and products

Cassava has many nicknames: the poor man's crop, poverty fighter, a women's crop, the 21st century crop, the orphan crop. In Malawi, cassava is treated like a back-up crop that is relied on during crisis and rather a second choice of policy makers. Even though this perception is slowly changing, no mainstreaming happens. Consequently, the government extension service does not acknowledge cassava as a major crop. In contrast to that, its promotion is very much donor driven.

Box 3: Cassava seeds and varieties

Cassava is a vegetatively-propagated crop. Under traditional cultivation, planting material² for the next growing season is retained by farmers themselves. This is an advantage in terms of the availability and affordability of the input; however, it brings a higher susceptibility to diseases, which can build up over a few generations then spread with the planting material if the farmer is not aware of the need to screen it. Thus, continuous breeding of varieties is necessary.

Cassava varieties are commonly distinguished as sweet and bitter cultivars, according to the content of cyanogenic glucosides within their cells. Sweet varieties contain less cyanogenic glucosides than bitter ones. Processing (like soaking, fermenting, grating and/or drying) breaks down the toxic components before it is safe for consumption.

Breeding in Malawi is done by IITA in collaboration with DARS. To date, the private sector has not shown interest in cassava breeding. The current focus of breeding efforts is to increase the yield potential and to increase resistance or tolerance to viral diseases, such as Cassava Mosaic Disease (CMD), Cassava Brown Streak Disease (CBSD) and Cassava Bacterial Blight.



Improved variety and a bundle of planting material



Cassava seeds

Photos: P. Günther

² The terms seed and planting material are used as synonyms in Malawi. The botanically correct term for cassava "seeds" used by farmers is "planting material". Botanical seeds are only found in cassava breeding programmes.

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For many Malawian households, cassava is quite a popular crop, as it requires little input. Especially along the lakeshore and in southern Malawi, smallholders have long-term experience with it as a staple food crop. Around urban centres, cassava is an attractive cash crop, but in rural areas the price is usually much lower or there is no market at all. Recently, the perception of cassava in Malawi is changing from that of a sole food crop to one of a possible cash crop (Forsythe, Posthumus, & Martin, 2016).

4.4.1 Cassava products and nutritional aspects

As a multi-purpose crop, every bit of the cassava can be used. The leaves are a highly-valuable source of proteins, minerals and vitamins (Montagnac, Davis, & Tanumihardjo, 2009) and are consumed as a relish, called *chigwada*. Yet, their consumption is not sufficiently encouraged. Additionally, cassava stems can be used as fuel wood.

The main utilisation of cassava is focussed on its roots, containing mainly starch, which are pure carbohydrates. In their raw form, they contain some vitamins. From a dietary perspective, half of human carbohydrate intake should be from tubers, the other half grains, such as maize.

Typical products made from cassava in Malawi are found in Table 4. In general, once cassava is processed into flour or starch, options are limitless, but here we focus on those cassava products attainable for smallholders. Downstream applications of cassava starch, like glue extender for the plywood industry, are not the focus of our study.

Table 4: Typical cassava products in Malawi		
Product	Processing	Use
Traditional use of (semi-)bitter varieties		
<i>Kondowole</i>	Traditional processing of cassava into fermented flour.	In Nkhotakota, for example, <i>kondowole</i> is eaten as the staple dish <i>nsima</i> .
<i>Makaka/Mtandaza</i>	Sun-dried tubers are milled into non- to semi-fermented flour that is of lower quality than cassava flour.	In the Shire Highlands, e.g. Zomba, <i>nsima</i> is prepared from <i>makaka</i> flour.
Non-traditional use of sweet and bitter varieties		
Fresh roots	At the point of consumption, sweet cassava is peeled, washed, and chewed raw or cut into pieces and boiled.	It is a popular snack and substitute for bread in urban areas like Lilongwe.
Cassava flour	Fresh roots are peeled, washed, grated, pressed, sun-dried and, later, milled into flour.	Available in local markets and supermarkets, it has wide application. It is frequently used to substitute HQCF despite its lower quality.
High-quality cassava flour	HQCF is industrial-grade cassava flour (repeated processing steps) containing over 90 % starch.	HQCF can replace wheat or corn flour and starch in baked goods like bread and biscuits.
Starch	Cassava starch is of even higher purity than HQCF which requires additional sedimentation. It serves as the base for a variety of uses.	Starch can be used for glucose syrup for breweries, glue extender in cardboard and plywood manufacturing or livestock and fish feed.
Cassava peel/waste products	Products made from cassava by-products are bio-ethanol and cassava bricks.	One example is a Norwegian funded project in NKK experimented with bio-ethanol from cassava.
Source: Kambewa (2010); Kleih et al. (2013); Moyo (2017).		

Box 4: Cassava products



Makaka (sun-dried tubers)



Fermented cassava flour



High-quality cassava flour



Cassava briquettes made from residues

Photos: P. Günther

4.4.2 Food safety of cassava products: Cyanogenic glucosides and aflatoxins

Food safety is a critical issue in cassava, as all plant parts contain the cyanogenic glucosides linamarin and lotaustralin which are converted into cyanide in the digestive system. These toxins must be properly handled during processing to prevent ingestion of unsafe levels of cyanide, which can result in loss of sight, paralysis and even death. They are converted to hydrogen cyanide (HCN) and later lose toxicity in the presence of linamarase, a naturally occurring enzyme in cassava. According to the World Health Organization and the Food and Agriculture Organization of the United Nations (FAO), the safe threshold is 10 ppm (Tacos et al., 2010). Sweet cultivars contain only 20 mg of HCN per kg of fresh tubers, while bitter ones may produce more than 50 times as much (Hair, 1995).

For *makaka* preparation, whole tubers are sun-dried. Depending on environmental conditions, this can take a long time and may lead to incomplete breakdown of cyanide components. As bitter and sweet varieties are mixed, it becomes even more difficult to be certain about cyanide content. According to Cassava: Adding Value for Africa (C:AVA), HQCF contains a maximum of 4 ppm, thus being safe for human consumption; however, according to an expert in the MoAIWD, the Malawi Bureau of Standards is not able to certify HQCF, as its quality remains questionable and too variable. At the time of writing, no *makaka* producer is certified. Hence, HQCF struggles to qualify as a substitute for safe and certified wheat flour.

Other important factors are bacterial contamination and aflatoxin. Mold growth is of special concern when fermenting processes are used or when the root does not dried out in a timely fashion (Bennett et al., 2016).

We found anecdotal evidence of farmers and processors taking shortcuts during the drying cycle, using *makaka* instead of single-variety cassava roots for processing to flour. Such malpractice does not positively influence consumer perceptions about cassava or the development of its VC.

4.5 Approach to innovations by our cooperation partners

The German Federal Ministry for Economic Cooperation and Development's (BMZ) and GIZ's special initiative "Eine Welt ohne Hunger" (One World without Hunger) focuses on green innovations in the agricultural sector. As part of that initiative, 14 Green Innovation Centres for the Agriculture and Food Sector (GIAE) have been established worldwide with a strong focus on African countries. Collaboration with existing research institutes, knowledge hubs, agricultural schools and

the private sector is an important pillar of the GIAE. The main objectives of the programme are income generation for smallholders, employment and improved regional food supply through agricultural innovations. The innovation approach is realised by focusing on the whole VC of targeted crops. The BMZ and GIZ follow a rather broad definition of innovations. Innovations are defined as changes in routines, which can be of technical or organisational nature. Examples are improved varieties or mechanisation, but also new forms of organisation and cooperation as well as promotion of services (e.g. extension service, trainings). Another important aspect is the facilitation of knowledge exchange and information among stakeholders (GIZ, 2015).

4.5.1 GIZ Malawi

One of these innovation centres is located in Malawi, a priority partner country for German international development cooperation. GIZ has been working in Malawi for more than 30 years and has maintained an office in Lilongwe since 1998. Currently, there are three focal areas for the German-Malawian cooperation: education, health and private sector development in rural areas. The latter includes the programmes "More Income and Employment in Rural Areas of Malawi" (MIERA) and GIAE-Malawi, both of which work on several VCs (groundnut, sunflower, soybean and cassava) and were direct collaboration partners for our study. The timeframes and budgets of these two different programmes are

- GIAE-Malawi's duration is from 11/2014 to 09/2021; the budget is 11.5 million Euros (+ 4.3 million Euros from the European Union).
- MIERA's duration is from 02/2015 to 01/2019; the budget is 10 million Euros.

Both programmes focus on different parts of the VC: GIAE-Malawi focuses on the supply side with farmer organisations (FOs) as entry points through which GIZ wants to reach smallholders as main beneficiaries. Secondary entry points in all promoted VCs are specific input providers, primary traders and processors. The general focus of GIAE-Malawi lies on sustainability and climate change; therefore, an agro-ecological approach is used as an innovation for all target crops.

MIERA has a stronger business focus than GIAE and looks mainly at the ability of the VC to enhance value addition. The major objective is to include micro-, small- and medium-scale enterprises (MSMEs) and smallholder farmers into inclusive business and new marketing models. The entry points for this programme are actors from the private sector. Because we placed the focus of our study on the participation of smallholders in the VC, we worked more closely with the GIAE-Malawi programme.

The following innovations for cassava are on the agenda of GIAE-Malawi:

1. Dissemination of higher-yielding and virus-tolerant varieties for industrial processing and home consumption.
2. Improved farming systems: agro-ecology, conservation agriculture (CA) and climate-smart agriculture (CSA).
3. Crop-specific good agricultural practices (GAP).
4. Food security.
5. Improved service provision for agri-business: bulk purchase of inputs by FOs and improved post-harvest handling.
6. Agri-finance solutions.
7. Adaptive, low-input mechanisation including processing facilities and efficient, low-input drying technologies.

The dissemination of improved varieties is the only innovation which applies solely for cassava, the remaining innovations (2-7) are also implemented in the other three target VCs. According to information provided by interview partners, the strongest focus lies on the dissemination of improved varieties. Furthermore, processing and drying technologies and the dissemination of GAP are of high importance. The remaining innovations listed above (2, 4-6) seem to be of minor importance for GIAE's support to the cassava VC.

On the governmental level, GIZ collaborates mainly with the Ministry of Industry and Trade (MoITT) and to a minor extent with the Ministry of Agriculture, Irrigation and Water Development (MoAIWD). In the non-governmental sector, GIZ works with several partners to promote these innovations in the cassava VC, the most important ones are the International Institute of Tropical Agriculture (IITA), which was a direct collaboration partner of our study, and Cassava: Adding Value for Africa (C:AVA).

4.5.2 International Institute of Tropical Agriculture

IITA is an Africa-based international research institution which forms part of the 16 international centres supported by the Consultative Group on International Agricultural Research (CGIAR). It was founded in 1967 and came to Malawi in 1987 at the request of the Southern Africa Centre for Cooperation in Agricultural Research and Training. IITA has an international CGIAR mandate for the improvement of banana and plantain, cassava, cowpea, maize, soybean and yam. The research themes include crop improvement, social sciences and agri-business de-

velopment, integrated pest management and natural resource management. Its involvement in the cassava research started in 1994 and initially concentrated on developing and promoting varieties for food security. From 1999 on, IITA shifted its focus to demand-driven research with an emphasis on private-sector/ industrial-end-user participation, income generation and food security.

Box 5: DARS and IITA research stations in Chitedze



C. Moyo of IITA in the cassava test plots



Dr. W. Makumba of DARS in the greenhouse

Photos: U. Rippke,
B. Walenda

At the moment, IITA has two projects on cassava in Malawi: one on germplasm development and another on value addition for commercialisation (with GIZ-GIAE). However, in their cooperation with GIZ, IITA's efforts are now concentrated on the improvement and multiplication of cassava planting material, disease and pest tolerances and resistances. IITA is now breeding both bitter and sweet varieties, but former research activities were limited to the bitter varieties to improve food security as a drought- and hunger-relief measure. The current traits of improved varieties pursued by IITA are listed below:

- disease and pest tolerance and resistance (against CMD, CBSD, cassava bacterial blight, cassava mealy bug and cassava green mite),
- high yield potential,
- low cyanogenic glucosides content (low and medium bitter varieties),
- multipurpose varieties (for food security and commercialisation purposes at the same time),
- orange/yellow fleshed cassava (which is rich in Vitamin A).

Twelve improved cassava varieties have been released by DARS for distribution to farmers: nine bitter or slightly bitter varieties and three sweet varieties (see Table 5). According to IITA, the bitter varieties *Sauti* and *Sagonja* are the most popular varieties among farmers, particularly along the lakeshore. However, the rate of adoption of these varieties was below expectation. It is suspected that farmers' preferences like cooking qualities and taste were not sufficiently taken into consideration in the past. Although farmers were consulted in the plant breeding process, consultations happened at a rather late stage and, hence, allowed farmers to choose between presented options, but not impact the early stages of the selection process of plant traits.

Table 5: Improved cassava varieties released in Malawi

Variety	Year of release	Sweet or bitter
<i>Silira</i>	1999	Bitter
<i>Maunjili</i>	1999	Bitter
<i>Mkondezi</i>	1999	Bitter
<i>Sauti</i>	2002	Bitter
<i>Yazaso</i>	2002	Bitter
<i>Mlora</i>	2008	Bitter
<i>Phoso</i>	2008	Bitter
<i>Sagonja</i>	2009	Slightly bitter
<i>Chiombola</i>	2009	Slightly bitter
<i>Kalawe</i>	2011	Sweet
<i>Mphale</i>	2011	Sweet
<i>Chamandanda</i>	2011	Sweet

Source: Information provided by IITA Malawi.

One of the core objectives of GIZ and IITA in collaboration with DARS is the establishment of a commercially-oriented dissemination system for improved planting material (see Figure 4 below). According to this model, IITA and DARS are responsible for the development and certification of improved varieties at research stations in Chitedze, Bvumbwe and Makoka. They also have to guarantee the generation of basic seed from tissue culture. Selected FOs and private seed multipliers are tasked to ensure the multiplication of clean planting material in secondary and tertiary nurseries. The micro-level distribution of planting material to smallholder farmers should be facilitated by FOs. So far, the seed distribution model is still a work in progress.

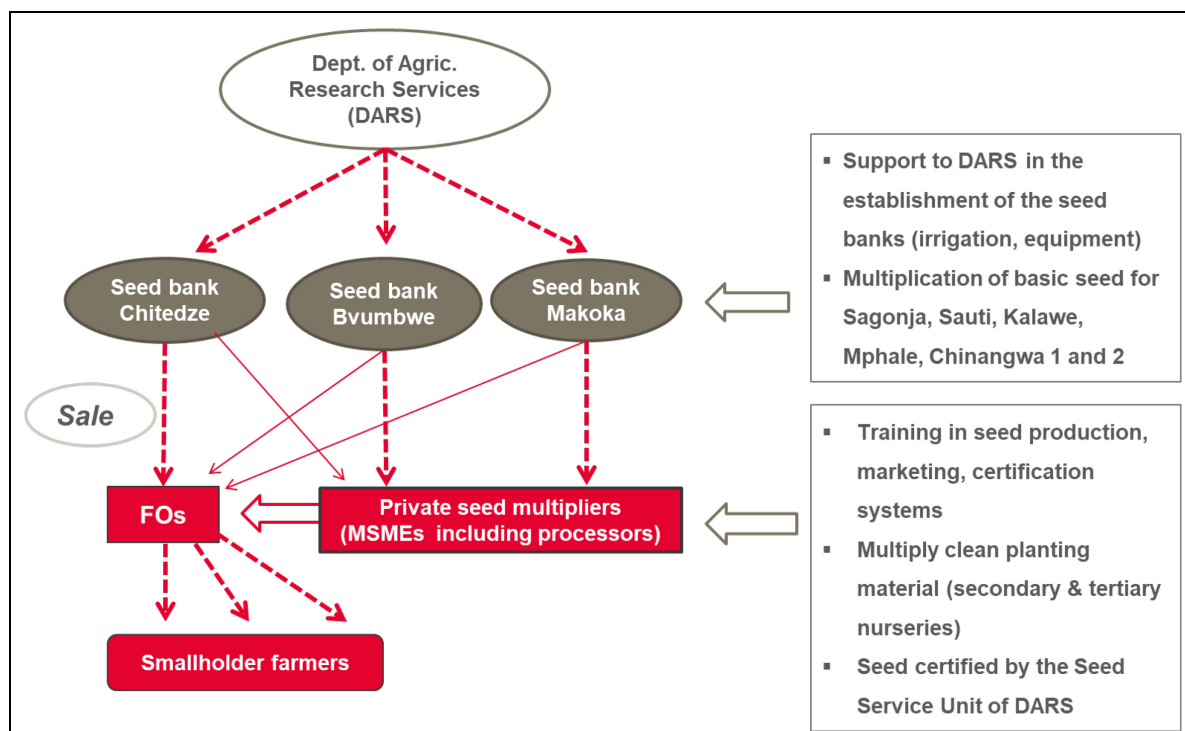


Figure 4: Model for the distribution of improved cassava planting material

Source: GIAE-Malawi (2017).

4.5.3 Cassava: Adding Value for Africa

C:AVA is a project that initially aimed at creating sustainable HQCF value chains, thereby improving the livelihoods and incomes of smallholder households and micro-, small- and medium-scale enterprises. It was founded by the Bill and Melinda Gates Foundation and is an implementation partner of GIZ. In Malawi, C:AVA started in 2009 in reaction to the coupling of government's very high cassava production estimates and problematic market access. In Phase I, the HQCF VC was established, developing products of the crop for industrial use. Also, modern drying technologies were introduced. Now in Phase II, more diversified uses of cassava, like glucose, livestock feed, etc are targeted. Additionally, C:AVA supports free-of-charge information and communication technology (ICT) service for cassava cultivation information (see Box 6 below).

The overall objective of C:AVA is to increase income through good market access and private-sector investment.

Therefore, the key intervention areas of C:AVA are:

- enhancing smallholders' productivity to improve profitability of cassava sales by improved varieties and pull of market demand,
- distributing improved planting material (provided partly by IITA) as well as setting up irrigation facilities for seed multiplication,
- processing of cassava in pilot plants to add value and link farmers to markets for enhanced commercialisation of cassava,
- promoting HQCF production for diverse industrial uses and
- training extension workers on cassava, particularly on GAP.

The work of C:AVA is concentrated in the southern part of the country where Universal Industries Ltd., a key partner of C:AVA, is situated. Universal Industries Ltd. is a major player for cassava utilisation in the private sector. GIZ works in close collaboration with both IITA and C:AVA and also trains their staff on Good Agricultural Practices (GAP) through a Training of Trainers approach. This staff then trains parts of the extension service and selected lead farmers who serve as multipliers to train farmers.

Box 6: ICT tools for cassava farmers

For three years already, a project called “New Alliance ICT Challenge” has supplied information on crops to extension service workers and smallholders. Via the free mobile phone service number 321 operated by the Agricultural Extension Officers Platform, information on common beans, pigeon peas, cowpeas, sweet potatoes, cassava³, rice and maize is supplied.

The information on cassava (delivered by C:AVA) covers topics like climate and soil requirements, land preparation, selection of planting material and varieties, planting, weeding, pest and disease control, harvesting, processing, storage and utilisation. The mobile service provider Airtel has a total of 3.5 mobile phone subscribers in Malawi, it is claimed that half of them used the service at least once.



Similarly, the CGIAR Research Program on Roots, Tubers and Bananas developed an app for cassava⁴ that uses artificial intelligence to diagnose diseases. It is currently field tested in Tanzania. As smallholders often have difficulties identifying CBSD and CMD, the free app may help them screen their fields for these abundant viral diseases. The app is combined with SMS services to send alerts to smallholder farmers.

Cassava brown streak disease (CBSD) symptoms

Photo: K. Droppelmann

³ In Malawi, dial 321, then press 9 for English, then 5 for cassava

⁴ <http://www.rtb.cgiar.org/blog/2017/09/28>

5 Smallholder livelihoods in the study areas

This chapter introduces the study areas of Lilongwe rural and Nkhotakota District which are situated in Malawi's Central Region. First, the district's general characteristics are presented. Next, the average asset endowments of smallholder households are described and, finally, the most important findings on smallholders' potential to participate effectively in cassava VCs are given.

5.1 Lilongwe rural

Lilongwe rural is positioned in the western part of the Central Region at the national boundary with Mozambique. Table 6 below provides general information about the study area.

Table 6: General characteristics of the study area: Lilongwe rural	
Size of study area	5,431 km ²
Total population	1,340,373 people
Annual precipitation	500 - 1,200 mm
Main rainy season	November - March
Temperature range	Min. 8 ° C in winter – max. 32 ° C in summer
Vegetation	Arable plain covered with grassland, shrubs
Soils	Relatively fertile sandy loams
Economic activities	Crop production and livestock (to a minor degree), sales of baked goods, firewood collection and sales, brick production
Important crops	Maize (staple crop), tobacco (cash crop), cassava, soybeans, groundnuts, sweet potatoes (staple and cash crop)
Role of cassava	Cultivation of sweet cassava variety for unprocessed consumption at urban markets (bitter varieties for processing are by far less common)
Food intake	Starchy grains, vegetables and fat on a daily basis, starchy roots and legumes several times per week up to a daily basis, fish and/or eggs once per week, fruits and milk products only occasionally or rarely, meat either once per week or never
Limitations for cassava commercialisation	Lacking means of transport; average travel time to markets 2 hours (walking)
Additional livelihood challenges	Dry spells, soil degradation, crop pests/diseases (army worm, cassava mosaic virus, termites, and weevils), chronic livestock diseases, livestock theft as a serious problem
Source: Own data and FEWSNET (2016), IITA Malawi (2017), NSO (2008).	

The agricultural season starts with the onset of rainfall in November, when farmers plant maize and cassava. The time from November to February is the most intense agricultural labour period. Maize harvests start in March (green harvest) and peaks in May. Sweet cassava varieties are harvested flexibly from April to July, according to demand for the fresh and unprocessed root. Bitter varieties for further processing are also grown, but to a minor extent. Most cassava is stored underground for twelve months or longer after harvesting. Starting in November, food stocks from previous harvests have usually been consumed and commodity prices, especially for the staple food crop maize, pick up (see Figure 5).

Lilongwe rural	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Rainy season												
Cassava	Planting				Weeding	Harvest				Land prep.		
Maize	Sowing		Weeding		Green Harvest		Harvest	Land preparation				
Labour peak												
Food prices		High						Low				
Lean season												

Figure 5: Agricultural calendar for Lilongwe rural

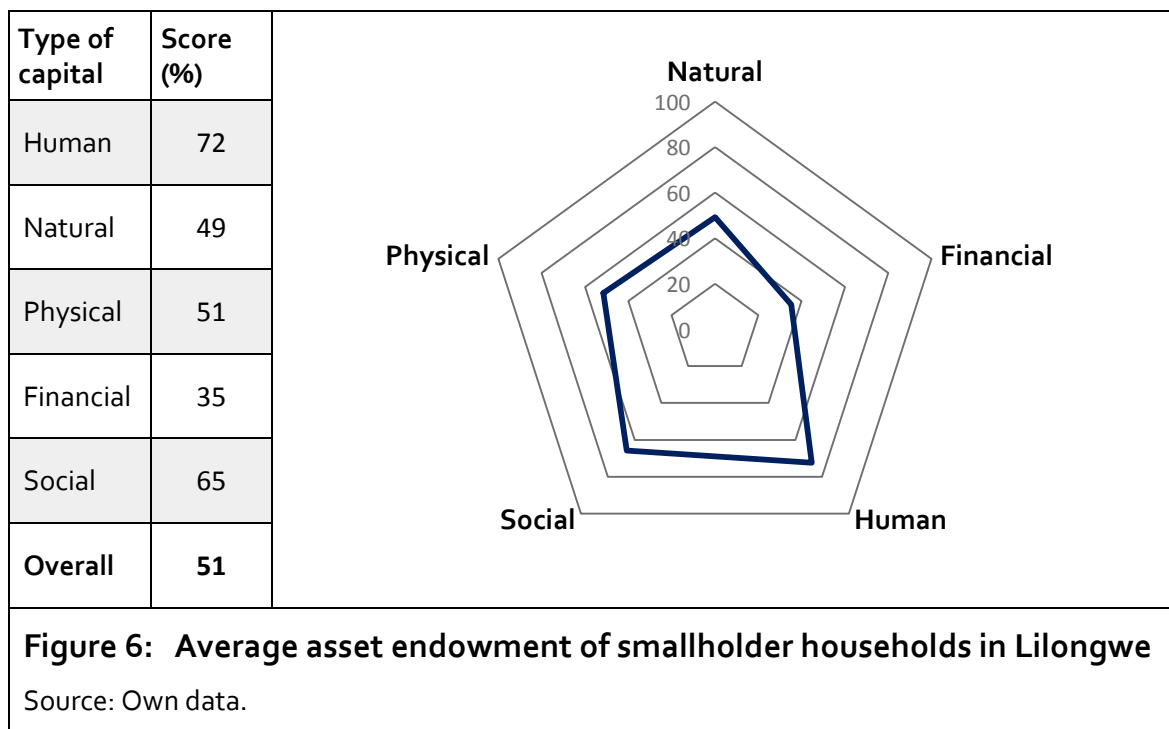
Source: Adapted from FEWSNET (2016).

Smallholder households in Lilongwe rural depend on crop production primarily for food security, but it is also their most important income-generation source. Cassava is not grown traditionally in this area and plays a minor role as a food crop compared to maize, which is the most important crop in Lilongwe rural. However, on average, smallholders generate one-fifth of their households' income through the commercialisation of cassava in this area (IITA Malawi, 2017). The cultivation of sweet cassava varieties for unprocessed consumption at the market in Lilongwe represents one of the most lucrative cash crops for smallholder farmers (FEWSNET, 2016; IITA Malawi, 2017).

Despite the potential for surplus production in years of good rainfall, most smallholder producers face limitations. The majority of households do not have the means to transport their produce to markets. As the average travel time to markets is two hours by walking, most farmers market cassava through farm-gate sales (IITA Malawi, 2017).

5.1.1 Household characteristics and average asset endowment

Figure 6 shows the average asset endowment for 28 smallholder households sampled in Lilongwe rural in the form of an asset pentagon. This pentagon shows the five types of capital (human, natural, physical, social and financial). Overall, smallholder households score 51 % which hints at a limited productive potential due to several constraints described below (see Figure 6).



Human capital

The average household size is 6.1 members, of which 4.8 are able to work on a regular basis. The majority of respondents state that one member of the household has finished at least primary school. Additionally, in one-third of all households, at least one person has finished secondary school. On average, smallholders have 21 years of experience with farming practices, but only 9 specific to cassava. The cultivation of cassava is relatively new. More than half of all respondents state that they have grown cassava for five years or less. Smallholders are aware of soil degradation issues and almost every household takes simple measures against it (applying fertiliser, leaving residues in the field, planting trees or making ridges). As a result, smallholders in this sample score 72 % in regard to their human capital, which is a reflection of their sound knowledge and reasonable work force to contribute labour and participate effectively in the cassava VC.

Natural capital

Smallholders in our sample cultivate an average area of 1.79 ha. The majority of smallholders' arable land is allocated to maize, followed by cassava, soybeans, tobacco and groundnuts (see Table 7). The cultivation of groundnuts is popular among smallholder households, whereas tobacco (cultivated within four households) and cabbage (within one household) are less commonly cultivated. All interviewed farmers practice rain-fed agriculture and use watering cans for irrigation. Almost all households keep livestock. The majority of households keep less than 10 small livestock such as chicken, goats or pigs. Beef cattle are rare, but sometimes kept by smallholder households in Lilongwe rural. In total, farmers' natural capital is 49 % which shows that smallholders cope with scarce natural resources and this limits their potential to produce surplus.

Crop	Cultivated area per HH (ha)	HH (n = 20)
Maize	0.92	27
Cassava	0.51	17
Groundnuts	0.50	19
Soybeans	0.50	9
Tobacco	0.46	4
Cabbage	0.37	1

Source: Own data.

Physical capital

Smallholders' physical capital scores 51 % and their standard of living is very basic. The following characteristics were observed:

- Source of energy for light: Electricity (batteries, solar power, etc.) (80 %) and candles (20 %);
- Source of energy for cooking: Open fire;
- Housing: Grass-thatch roofing, solid brick walls, unsealed floor;
- Sanitation: Own pit toilet (usually not shared with other households) and
- Water: Borehole providing clean drinking water less than 30 minute walk away

Agricultural tools and consumer durables are scarce. Most households own and use a hoe for cultivation; some also own machetes (*panga* knives), axes or sickles. Only half of the sampled households own a spade and only four households in the sample own an oxcart. Almost all households surveyed have their own cell phone and many have their own bicycle, but only half have a radio. One household has a motorcycle, which is exceptional.

Table 8 summarises smallholders' average general household characteristics.

Household structure	Natural resource base	Personal assets
<ul style="list-style-type: none"> ▪ Age of household head: 47 years ▪ Household members: 6.1 ▪ Labour force: 4.8 ▪ Education: Primary school ▪ Years farming: 21 ▪ Years cultivating cassava: 9 	<ul style="list-style-type: none"> ▪ Total arable land: 1.79 ha ▪ Most important crops: Maize, cassava, soybeans, groundnuts ▪ Average field size: Maize: 0.92 ha Cassava: 0.51 ha ▪ Small livestock (chicken, goats, pigs) 	<ul style="list-style-type: none"> ▪ Agricultural tools: Hoes, machete, axe, sickle, spade, watering can ▪ Consumer durables: Cell phone, bicycle, radio
Source: Own data.		

Financial capital

On average, smallholders in this sample score only 35 % in regard to their financial capital, which is the lowest figure in this asset endowment; hence, smallholders face the biggest constraints here. The vast majority of smallholders state that they are unable to meet their daily costs of living. Further, they report that they had to overcome financial struggles in the last year by doing *ganyu* labour⁵, utilising saving groups, engaging in food- or cash-for-work initiatives or by selling their household assets. In Lilongwe rural, almost 90 % of interviewed households have access to micro-credit. More than half of all respondents are unsatisfied with their financial situation; their reasons for financial dissatisfaction include low prices for agricultural products, inability to cover daily needs, poverty and planning insecurity. As smallholders' financial capital is truly deprived, the household liveli-

5 The word '*ganyu*' is widely used in Malawi to describe a range of short-term rural labour relationships, the most common of which is piecework weeding or ridging on the fields of other smallholders, or on agricultural estates.

hood security is fragile, especially when harvests fail and income from cropping is marginal. Cassava commercialisation in the cassava VC for sweet varieties requires a certain degree of specialisation in the household's livelihood portfolio which could pose a risk to already fragile households. Hence, this strategy should be assessed carefully.

Social capital

Smallholders' social capital in Lilongwe rural scores 65 % due to their high community integration and involvement in group-based economic activities (80 %). Nine households belong to agricultural groups (three specific to cassava) and seven belong to saving groups. In addition to this, the majority of smallholders participate actively in the groups' economic activities. In half of all cases, farmers report to benefit from their group integration. In Lilongwe rural, smallholders' sound communal organisation may constitute a potential for collective marketing of cassava.

5.1.2 Income generation and the role of cassava

Cropping is the most important income source for smallholders in Lilongwe rural. They ranked maize the most important crop for their livelihood. It is grown primarily for home consumption and only surplus production may be sold into the market. Groundnuts, cassava and soybeans are popular cash crops among smallholders, but are only perceived to be of minor importance in comparison to maize. Table 9 highlights that smallholders in Lilongwe rural place more importance on a crop that will be consumed within the home rather than one cultivated for commercial purposes.

In Lilongwe rural, cassava has only recently started to be grown, but its cultivation already represents an important livelihood activity. This allows smallholders to generate income and diversify their crop portfolio and, therefore, benefit the sustainability of their overall livelihood system.

Apart from cropping, sources of household income include *ganyu* labour, as the second-most important source of income, followed by livestock keeping and petty trade. Remittances are an income source for only a minority of households. The most crucial household expenditures reported by smallholders are on food, followed by agricultural inputs and supplies, clothes, soap and school fees.

First crop	No. of HH (n=28)	Cash crop only	More cash crop than home consumption	Cash crop equal to home consumption	More home consumption than cash crop	Home consumption only
Maize	21			1	11	9
Cassava	4	2	2			
Tobacco	2	2				
Cabbage	1	1				
Second crop						
Groundnuts	12	2	6	1	2	1
Cassava	10	3	5	1	1	
Maize	4		1	1	2	
Soybeans	2	1	1			
Source: Own data.						

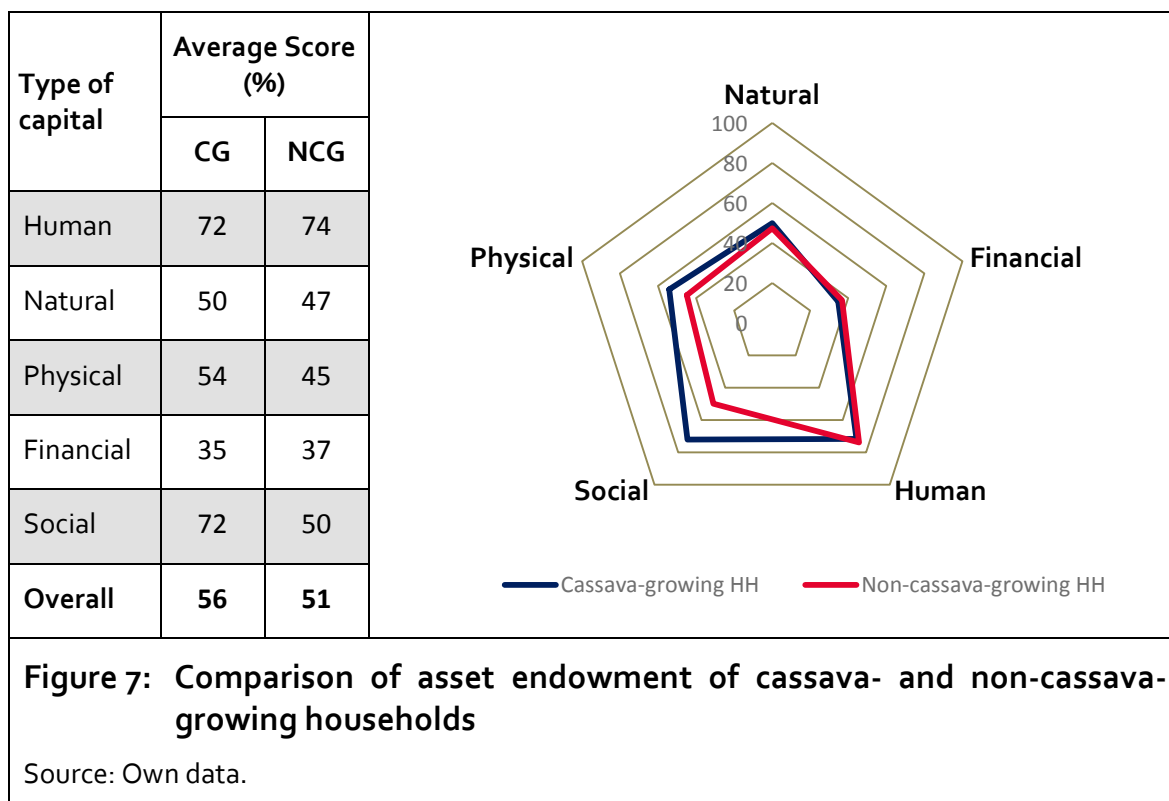
5.1.3 Cassava-growing and non-cassava-growing households in Lilongwe rural

In total, 49 cassava-growing households (CG) and 9 non-cassava-growing households (NCG) were sampled in both Lilongwe and Nkhhotakota districts. Of these, eight NCG are situated in Lilongwe rural and only one in Nkhhotakota. The comparison of the asset endowments between both groups does not show a strong difference in overall scores; however, there are slight variations in their natural, physical, and social capital (see Figure 7).

Cassava-growing households in Lilongwe rural cultivate more arable land on average (2.1 ha) compared to non-cassava-growing households (1.1 ha). Besides their better access to arable land, they also show a higher standard of living: they are better equipped with agricultural tools (both diversity and quantity), consumer durables (cell phones and radios) and have slightly better housing than NCG.

These advantages may be explained by the CG's closer relation to the village chief, their stronger orientation towards commercialisation and their stronger involvement in economic group activities.

4.2 Smallholder livelihoods in the study areas



Taking into account that the vast majority of all farmers in both study areas receive their land through family relations, the closer relations CG appear to have with the local elite may help them to access more land. When farmers' total arable land area increases, they can cultivate a second crop in addition to maize. In this situation, smallholders in Lilongwe rural tend to either cultivate cassava or groundnuts. Figures show that smallholders who decided to grow cassava utilise it mostly as a cash crop. This may benefit the households of cassava-growers and their overall standard of living as well as their ability to purchase agricultural equipment. Beyond this, CG' social capital is higher compared to NCG. They show a stronger communal organisation in economic group activities and are more active within these groups.

5.2 Nkhotakota District

Nkhotakota District is the northernmost district in the Central Region and is situated along the western lakeshore of Lake Malawi. It borders the Northern Region Districts of Mzimba and Nkhata Bay and borders Salima District to the south.

Table 10 gives an overview of the general characteristics of the study area in Nkhotakota.

Size of study area	4,259 km ²
Total population	330,321 people
Annual precipitation	1,200 - 1,600 mm
Main rainy season	November – March
Temperature range	Min. 15 ° in winter – max. 39 ° C in summer
Vegetation	Grassland, forests, bush scrub
Soils	Relatively fertile, sandy to clay loams
Economic activities	Crop production, fishery and livestock
Important crops	Cassava (staple crop), maize, rice, sweet potatoes, tobacco and soybeans (staple crop and cash crop)
Role of cassava	Traditional growing area of bitter, mostly traditional cassava varieties, which are processed into cassava flour for preparation of the staple food <i>nsima</i>
Food intake	Starchy roots, vegetables and starchy grains on a daily basis, fish several times during the week up to a daily basis, fruits up to several times per week as well as legumes but to a smaller extent, milk products and meat occasionally or rarely, eggs once per week or never
Limitations for cassava commercialisation	Lacking means of transport, average travelling time to market is 8 hours (walking), insufficient linkages to urban markets and urban-based processing industry
Additional livelihood challenges	Dry spells, floods, crop pests and diseases (cassava mosaic virus, cassava brown streak virus, cassava green mite, termites, grasshoppers) and livestock diseases
Source: Own data and FEWSNET (2016), IITA Malawi (2017), NSO (2008).	

Figure 8 illustrates that the agricultural season starts with the onset of rainfall in November and the planting of maize and rice. At the same time, the harvest of cassava begins making November the most labour-intensive month. Whereas maize and rice are harvested during the dry season from April on, most of the cassava is harvested during the rainy season. This practice is strategic, because it allows farmers to immediately start planting again before the end of the rainy season. From December to March, commodity prices for maize and rice rise as households run out of their staple reserves. Here, cassava can complement smallholders' food security, because it is harvested flexibly from November to March. From June to August, commodity prices drop again. Due to the high water table in the proximity of the shore of Lake Malawi and *dambo* areas (i.e. seasonal wet-

44 Smallholder livelihoods in the study areas

lands), planting can take place flexibly throughout the year. For this reason, we have not indicated planting time on Figure 8 below.

Nkhotakota	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Rainy season												
Cassava	Harvest											
Maize	Land prep.	Sowing	Weeding	Green-	Harvest						Land prep.	
Rice	Land prep.	Planting		Weeding	Harvest						Land prep.	
Labour peak												
Food prices		High						Low				
Lean season												

Figure 8: Agricultural calendar for Nkhotakota

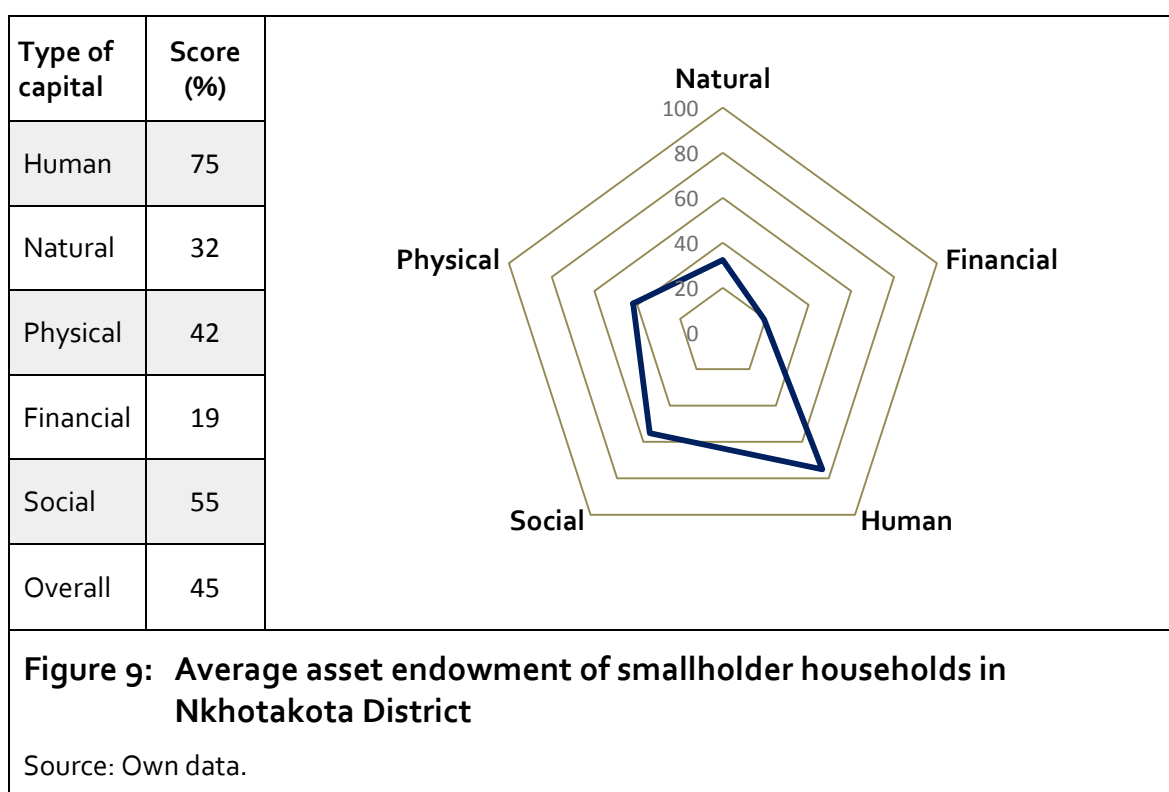
Source: Own data and adapted from FEWSNET (2016).

Crop production, fishery and livestock are the major sources of income in this study area. Crop production is an important livelihood strategy and contributes half of smallholders' annual income (IITA Malawi, 2017). Unlike Lilongwe rural, Nkhotakota is a traditional growing area for bitter varieties of cassava and these varieties are used as a traditional food security crop. For this reason, cassava is perceived by smallholders as their most important crop, followed by maize. Both crops are mainly used for home consumption. Households in Nkhotakota appear to an advantage in food security, because they can balance the year with a mix of cultivating maize and cassava (FEWSNET, 2016).

Two major constraints limit the commercialisation of crops. First, the average travel time to markets by walking is 8 hours and, second, head- and back-load are the most common modes of transporting goods, as smallholders often have no motorised vehicles or bicycles. Insufficient linkages to urban markets and urban-based industrial processing facilities hinder the growth of cassava as a cash crop (IITA Malawi, 2017); however, there is a cottage processing industry at village level.

5.2.1 Household characteristics and asset endowment

Figure 9 shows the average asset endowment of all smallholder households in our sample (n=30) in relation to the five types of capital (human, natural, physical, social and financial capital). On average, a smallholder’s asset endowment is 45 % which is lower than for farmers sampled in Lilongwe rural.



Human capital

Smallholders’ human capital scores are relatively high at 75 %. The average household size in Nkhotakota is slightly higher than in Lilongwe rural with 7.0 members, but this does not result in a much higher work force, which is 5.3 members compared to households in Lilongwe rural. In regard to formal education, the majority of respondents mentioned that at least one person within the household finished primary school. Within nine households, the highest academic degree is secondary school, which is slightly higher than in Lilongwe rural. In terms of agricultural experience, on average, smallholders in Nkhotakota have practiced farming for 28 years and have cultivated cassava for 24 years, which is much longer than in Lilongwe rural. This shows that cassava is traditionally grown in this area. Farmers’ agricultural knowledge does not differ substantially from Lilongwe rural.

Natural capital

Smallholders' natural capital in Nkhotakota scores only 32 %, which is low. Smallholders' average arable landholding in Nkhotakota is one hectare, which is about half of that in Lilongwe rural. Cassava is perceived by smallholders in Nkhotakota to be their most important staple crop and they allocate the majority of their arable land to it, followed by maize and rice (see Table 11). Sweet potatoes, tobacco and soybeans are grown by very few farmers in our sample. Sweet potatoes and soybeans are grown on a relatively small area of 0.2 hectares, whereas tobacco is cultivated on a comparably large field of 0.4 hectares (see Table 11). Respondents hint at a decrease in cultivated land due to lack of availability of inputs, shortcomings in financial capital or a decrease in work force. Uncultivated areas are much more common in NKK than in LLW as a result of this and the abundance of rocky terrain and waterlogged soils. Livestock herd sizes are smaller and less diverse than in LLW. Not a single household in our sample keeps cattle. Relying mostly on fish as a source of protein, smallholders usually keep only a few chickens and sometimes also goats.

Table 11: Average land allocation of smallholders' most important crops planted in Nkhotakota District

Crop	Cultivated area per HH (ha)	HH (n=30)
Cassava	0.53	29
Maize	0.40	25
Rice	0.31	21
Sweet potato	0.20	3
Tobacco	0.40	1
Soybeans	0.20	1

Source: Own data.

Physical capital

Smallholders' standard of living in NKK is very basic and, in many aspects, comparable to the situation in LLW, except for the accessibility of clean water sources which are more difficult to access and take more time to reach in NKK. On average, households score 42 % in regard to their physical capital. The following characteristics were found:

- Source of energy for light: Electricity (batteries, solar power, etc.)
- Source of energy for cooking: Open fire
- Housing: Grass-thatch roofing, solid brick walls, unsealed floor
- Sanitation: Own pit toilets (not shared among other households)
- Water: Access to clean source of drinking water is likely more than 30 minutes

Agricultural tools and consumer durables are very basic as well, but in comparison to LLW, they are even less diverse and fewer in quantity. An average smallholder mainly uses hoes, a *panga* knife and an axe as basic farm equipment. There are no watering cans, carts or wheelbarrows. A cell phone is available in 75 % of all households. Radios are uncommon. Only five households have their own bicycle. As an exception, one respondent has a motorcycle.

Table 12 below gives an overview of smallholders' general household characteristics, the natural resource base and personal assets in the Nkhotakota study area.

Table 12: Household characteristics in Nkhotakota District		
Household structure	Natural resource base	Personal assets
<ul style="list-style-type: none"> ▪ Age of household head: 50 years ▪ Household members: 7.0 ▪ Labour force: 5.3 ▪ Education: Primary school ▪ Years farming: 28 ▪ Years cultivating cassava: 24 	<ul style="list-style-type: none"> ▪ Total arable land: 1 ha ▪ Most important crops: Cassava, maize, rice ▪ Average field size: Cassava: 0.53 ha Maize: 0.40 ha ▪ No cattle ▪ Small livestock (chicken, few goats) 	<ul style="list-style-type: none"> ▪ Agricultural tools: hoes, panga knife, axe ▪ Consumer durables: Cell phone
Source: Own data.		

Financial capital

Almost all smallholders struggle to cover their costs of living and had to overcome financial challenges in the last year, which were mostly solved by cash- or food-for-work initiatives, *ganyu* labour or informal means (extended family or remittances). One-sixth of all sampled households in this area sold their own assets to overcome financial struggle. The majority of respondents are dissatisfied with their financial situation as they are unable meet their households' basic needs, cannot afford farm supplies and/or cannot generate sufficient income from agriculture to cover their production costs. A major challenge in Nkhotakota is the

poor access to micro-credit facilities. This results in very low overall financial capital of 19 % among smallholders in Nkhotakota.

Social capital

Smallholders' social capital in Nkhotakota scores 55 % on average, which is 10 % lower than Lilongwe rural. The majority of respondents are members of various groups: almost half of the respondents belong to a farming group with one group specific to cassava, five respondents belong to a village-based saving group and an additional five mentioned church. Slightly more than half of all respondents stated they receive benefits from group membership; however, they are less active within their groups and receive less benefit from their group membership than smallholders in Lilongwe rural. Hence, smallholders in Nkhotakota may be more motivated by the need for social cohesion when forming communal group structures, rather than the benefits of economic activities, which motivates smallholders in Lilongwe rural.

5.2.2 Income generation and the role of cassava

Similar to the situation in Lilongwe rural, cropping is the most important source of income for smallholders in Nkhotakota. Dissimilarly, farmers' most important crop for their livelihood is cassava, followed by maize, both of which are used primarily for home consumption and only to a minor extent for commercialisation (see Table 13).

First crop	No. of HH (n=30)	Cash crop only	More cash crop than home consumption	Cash crop equal to home consumption	More home consumption than cash crop	Home consumption only
Cassava	25				3	22
Maize	4					4
Rice	1					1
Second crop						
Maize	16				3	13
Rice	7	1	3		2	1
Cassava	2			1		1
Sweet potato	1				1	
Tobacco	1	1				

Source: Own data.

For many households in Nkhotakota, a second source of income besides cropping is unavailable. *Ganyu* labour is mentioned by some as a possible alternative source of income and three households used livestock as an income source. Unusual for the lakeshore area, fishery was only mentioned by one household, probably due to lack of a market. Petty trade, firewood collection and charcoal, art and handicraft, as well as remittances are sources of income, but to a minor degree. Crucial expenditures within smallholder households in Nkhotakota are food, followed by clothes, agricultural inputs and farm supply, soap and school fees.

5.3 Adopters and non-adopters of improved cassava varieties

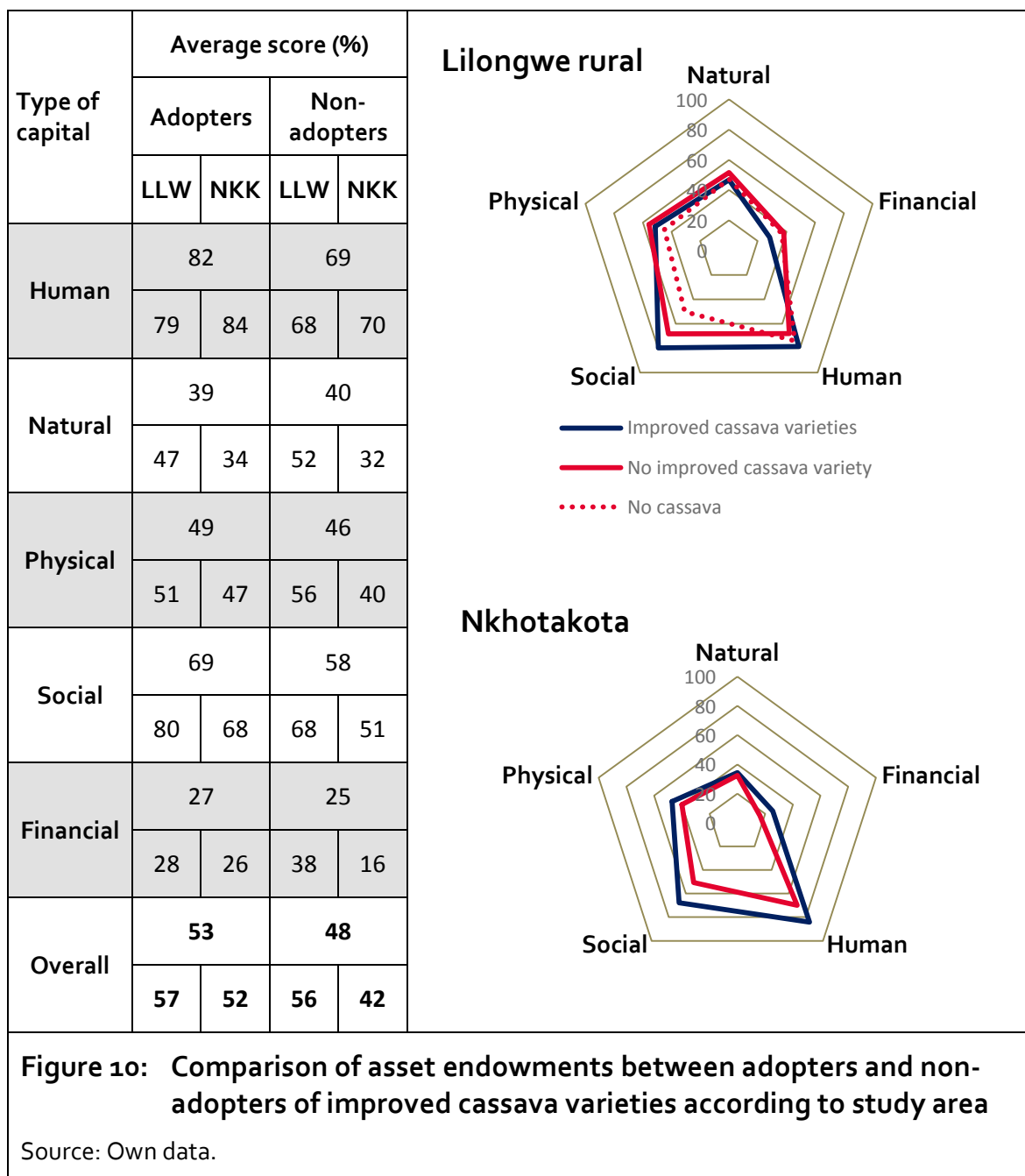
Among the 49 cassava-farming households sampled in both regions, 32 households had contact with improved cassava varieties. Currently, 17 of the 32 households (53 %) cultivate those improved cassava varieties (adopters), 7 households in Lilongwe rural and 10 households in Nkhotakota. Thus, only about one-third of all sampled households who cultivate cassava use improved varieties and slightly more than half of the households who had contact with improved varieties kept cultivating them. A comparison between adopters and non-adopters shows that among all cassava-growing households, those who cultivate improved varieties exhibit a slightly higher overall asset endowment (see Figure 10).

Detailed analysis of the five types of capital across the study areas also shows that the endowments of adopters are different for those living in Lilongwe rural and those in Nkhotakota District.

Lilongwe rural

Adopters' natural, physical and financial capital tend to be lower compared to non-adopters in LLW by -5 %, -5 % and -10 %, respectively. No female single-headed household cultivates improved cassava varieties. Among all cassava-growing households in this area, the ones who cultivate improved varieties

- are all unable to cover their daily cost of living;
- are less satisfied with their financial situation than non-adopters;
- are unlikely to access micro-credits through a bank and
- report less access to formal means to overcome financial struggle (family relations, informal systems, saving groups, etc.)



In comparison, non-adopters exhibit a higher productive potential based on their comparably higher natural, physical and financial capital within the household. A closer look at the crops cultivated by non-adopting households shows that they are more likely to cultivate other cash crops, such as tobacco and tend to have more diversified crop portfolios. Hence, they do not rely on cassava and do not take additional efforts to optimise this particular subsystem of their livelihoods. Adopters have a more fragile livelihood system and may be more eager to cultivate improved varieties which are more tolerant to crop pests and diseases. As adopters only started to cultivate cassava recently, whereas non-adopters

show an average of five more years of experience farming cassava, the cultivation of improved varieties may well be an attempt to overcome their lower productive potential to maintain their livelihoods.

Adopters score higher in regard to their human capital; for example, in formal education. Similar to non-adopters, all adopters partake in economic group activities, but they are much more active. Hence, the high scores in social capital among LLW farmers are highly influenced by adopter households, who favour communal economic activities. Possibly, farmers who are organised in groups are more likely to access improved cassava varieties in this case.

Nkhotakota

In Nkhotakota, each type of capital scores higher within households which cultivate improved cassava varieties. Adopters score 11 % higher, on average, than non-adopters. In this sample, there are two female single-headed households who cultivate improved cassava varieties. Among all cassava-growing households in this area, the ones who cultivate improved varieties

- have 30 % more arable land than non-adopters (1.21 ha vs. 0.80 ha),
- have 8+ years more cassava farming experience,
- have a higher level of formal education,
- have better access to credit through village-based saving groups,
- have stronger group integration and higher levels of activity and enjoy more benefits,
- have higher standards of living in respect to housing and
- are better equipped with agricultural tools and consumer durables.

Adopter households in NKK cultivate a larger area and hence, they might be more likely to cultivate an improved cassava variety alongside their traditional one in order to hedge their production risks. As a result, they are more likely to produce surplus, which they can sell after they meet their home consumption needs and taste preferences. This may create a positive impact on each household's overall standard of living. However, this is only one possible theory to explain adopters' higher asset endowment respective of their productive potential. This situation clearly needs further research.

The above analysis shows that the cultivation of improved cassava varieties is a valuable strategy for households with smaller asset endowments to address their asset disadvantage and maintain their livelihoods. At least in Lilongwe, rural female single-headed households are not likely to cultivate improved varieties. For

this reason, in Chapter 5.4, we will look closer at female single-headed households and their livelihoods in both study areas.

5.4 Female single-headed and male-headed households

15 interviews were conducted in female-headed households, of which 13 households are single-headed: 6 in LLW and 7 in NKK. There were two female-headed households, whose head stated to have joint decision-making and hence were excluded from this analysis. Furthermore, in order to score correctly, we do not consider the household-structure attribute “decision-making” here, as this attribute refers to a joint or separate decision-making process of two spouses. Figure 11 shows the adapted scores of both groups. The gender-differentiated analysis shows that female single-headed households generally exhibit a smaller asset endowment (see Figure 11). We were not able to identify any male single-headed households in the IITA baseline sample.

When compared with male (double-)headed households, female single-headed households, on average, cope with the following disadvantages:

- Arable land size is smaller, especially in Nkhotakota.
- Lower level of formal education, especially in Lilongwe rural.
- In Nkhotakota, women are less integrated and less active in economic group activities and receive fewer benefits from them.
- In Nkhotakota, women are less closely related to the village chief.

The scores in Figure 11 show that the difference between female single-headed and male-headed households is smaller than the difference across study areas; that is, regional differences appear to weigh stronger than gender differences. Nonetheless, female single-headed households in NKK cope with the smallest asset endowments of all groups and, for this reason, should receive additional attention. Here, the cultivation of improved cassava varieties may be a viable strategy to improve their livelihoods through a crop which requires fewer inputs. Taking into account the lower productive potential of female single-headed households in Nkhotakota, it may be advisable to support their increased participation in and capacity for economic group activities, for example in cassava processing.

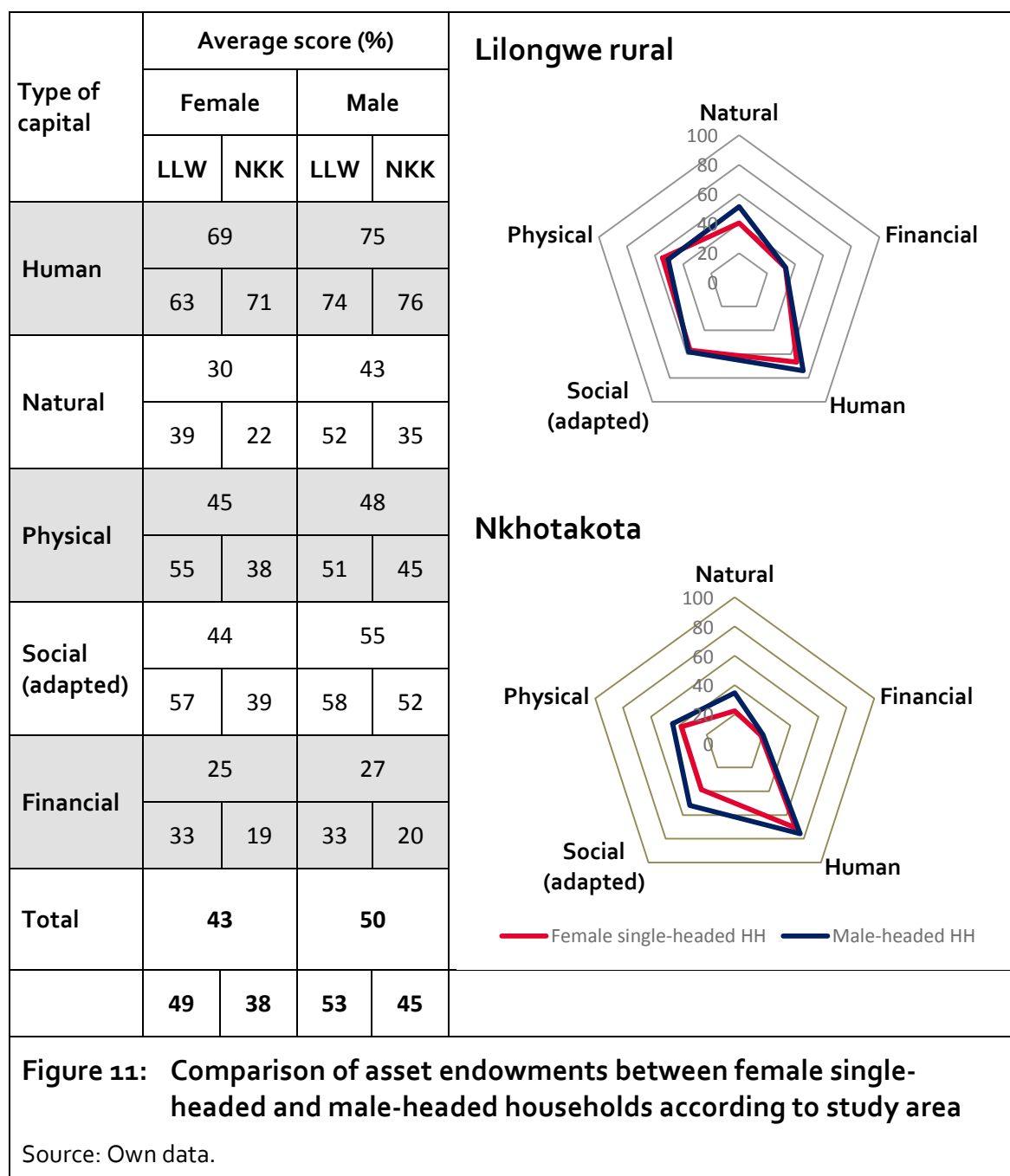


Figure 11: Comparison of asset endowments between female single-headed and male-headed households according to study area

Source: Own data.

Even though female single-headed households face more constraints than male-headed households, exceptional cases exist in both study areas where women find strategies to enhance their livelihoods and generate income despite the fact that they farm on a comparably smaller area. In Lilongwe rural, one farmer who heads a female single-headed household and who does not farm cassava scores extraordinarily high in regard to her financial capital. This woman cultivates a small area, but with tobacco. She is a member of an agricultural group which is facilitated by the National Smallholder Farmers' Association of Malawi (NASFAM).

5.5 Households' productive potential and value chain participation

Overall, smallholders face several constraints due to their low asset endowments. The low natural, physical and financial capital scores, especially, limit smallholders' productive potential and their chance to participate in the cassava VC effectively without putting their livelihoods at risk. At the moment, smallholders hardly produce enough surplus to cover their households' basic needs, even though agricultural production is their most important source of income.

Whereas smallholders in LLW are already growing cassava as a cash crop, households in NKK use cassava primarily for home consumption. NKK farmers may also benefit from commercialisation of their cassava crop as opportunities for collective marketing exist via their already cohesive social organisation. Existing farmer groups in the area, are likely to generate more economic benefits when they improve their operational organisation.

In regard to gender, the above comparison shows that regional differences between LLW and NKK have a stronger influence on smallholders' asset endowment than the sex of the head of the household. The differences which appear in the scoring patterns between genders may also occur due to the fact that female-headed households are single-headed and rather refer to the household's limited workforce. However, the analysis of individual asset endowments shows that exceptions among female-headed household exist. Nonetheless, women in Nkhota-kota have to cope with the smallest endowments among the whole sample and may not be able to participate more gainfully in the VC without further support.

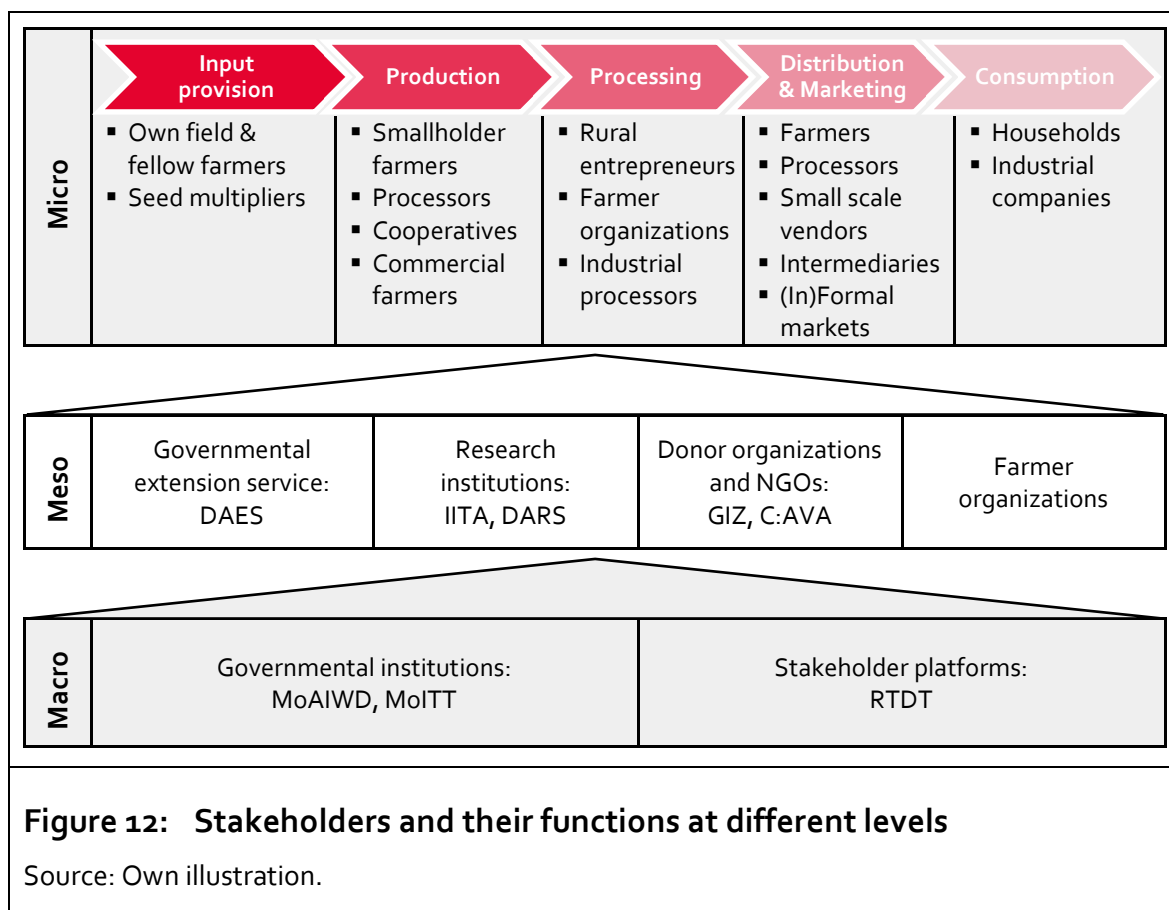
Beyond individual household characteristics which influence the production of cassava, smallholders' economic environment limits their sustainable participation in the cassava VC. Especially in NKK, smallholders' financial capital is low because their access to finance and credit is a major challenge. Smallholder farmers rely on informal family relations, *ganyu* labour or food- or cash-for-work initiatives to overcome their financial struggles. Because transport infrastructures remain weak, no reliable markets for cassava exist and access to planting material and farm inputs remains limited; therefore, an increase in production capacities at the household level will only generate limited improvement in smallholders' livelihoods.

6 Value chain analysis

The following chapter analyses the cassava value chain with a focus on structural factors and, when possible, aspects of a partial economic analysis are presented. We start the chapter by introducing VC actors and their functions and describe cassava marketing channels. We then present an environmental analysis which describes the relationship between environmental aspects like climate change and the cassava VC. Challenges and missing links along the VC are explained in the following section. Lastly, we evaluate existing innovations. Parts of a social analysis has already been presented in Chapter 5.

6.1 Value chain actors and their functions

On the micro level, actors participate directly in cassava VC at various stages. In addition to these actors, value chain support-service providers conduct general investment or preparatory activities which benefit all or at least several VC actors simultaneously and thereby create collective good for all VC actors (GIZ, 2016). These support-service providers are active on a meso- or macro- level and their work often influences several stages of the cassava VC simultaneously. Actors on the macro-level usually have a more regulatory and governing function, while actors at the meso-level are mostly engaged in direct support activities. Figure 12 provides a general overview.



6.1.1 Input provision

There are four groups of actors who can provide farmers with planting material. Firstly, it can be sourced locally, as farmers recycle planting material from their own field after harvesting the roots or from the fields of fellow farmers as direct VC participants. This is the most common practice in Malawi.

Secondly, the government provides planting material to farmers through certified multiplication farmers and as part of recovery programmes in case of droughts and floods (usually with support from relief organisations) to hedge against anticipated maize shortages. This is the second most important source of planting material.

Thirdly, some FO and rural entrepreneurs sell cassava seeds as their main business; their certification is desirable by government, but not necessarily enforced. Also, NASFAM supports cassava under a Climate-Smart-Agriculture project on agricultural diversification with a seed programme which provides improved planting material.

Fourthly, donor-funded projects (like GIZ and C:AVA) and non-profit organisations distribute free or highly-subsidised seeds to farmer organisations and pay for the transport and seeds themselves.

Department of Agricultural Research Services (DARS)

The Department of Agricultural Research Services is part of MoAIWD. Its mission is to conduct agricultural research and provide advisory and regulatory services on all crops and livestock except tobacco, tea and sugar cane (which are considered so-called “estate crops”, because larger, commercial farmers grow them). The Seed Services Unit within DARS is charged with the testing and certification of seed and with the registration of farmers and companies producing certified seed. DARS operates 18 research stations located in various agro-ecological zones throughout Malawi, targeting different commodity groups and services. Regarding cassava, DARS is the only mandated body for multiplication and lab testing of improved varieties of cassava planting material, which have been developed by IITA. To disseminate its technologies, DARS collaborates with extension service providers and seed multiplication farmers to enable adoption and utilisation among smallholder farmers.

Another important actor focussing on cassava research is the International Institute of Tropical Agriculture, introduced in section 4.5.

6.1.2 Production

The main producers of cassava are small-scale farmers, cultivating cassava on small plots as part of their diverse livelihood activities. Some rural and industrial processors also produce cassava on their own to ensure a minimum supply of raw cassava for their processing units. Their hectareage ranges from a few hectares to several hundreds. Additionally, there are a limited number of commercial farmers with larger hectareage under cassava.

Communal ownership of fields at the village level is also common. These fields are managed collectively and profits shared at the end of the season. Through formalisation, these cassava-growing communities become farmer organisations.

Farmer clubs, producing groups, clusters, associations and cooperatives are common forms of FOs in Malawi. They differ mainly in their number of members and their legal form of registration. There is no register of how many farmer organisations exist in total in Malawi and how many are involved in the cassava sector. C:AVA works on behalf of GIZ-MIERA with a total of 20 cassava-producing groups which consist, in total, of 189 farmer clubs. There are two main umbrella organisations which unite farmers and farmer organisation on a large scale: The

Farmers Union of Malawi (FUM) and NASFAM. As an umbrella organisation for agricultural policy lobbying, FUM's mandate is to provide an interface between their affiliated farmer organisations and other actors and constituencies in the cassava sector. In total, it represents 256 FOs. NASFAM is by far the largest FO in Malawi and a member of FUM. Its membership includes about 100 000 signed-up smallholders. It has a smallholder development-oriented branch and a commercial oriented branch, which takes it beyond the scope of only a farmer organisation and thus additionally assumes the role of a support agency. This dual function positions NASFAM as a key player with respect to the coordination of the smallholder community but also the representation of their interests at the sectoral level in multi-stakeholder coordination platforms.

For our research, we conducted focus group discussions with six farmer organisations that are involved in cassava production and/or processing. The Chigonthi Cassava Agroprocessing and Marketing Cooperative Society Ltd. as well as the Mlira Club are located in Lilongwe rural and the Mkazimasika Cassava Cooperative is located near the town of Nkhotakota. The three remaining FOs are located in the rural areas of Zomba: Chinangwa ndi Mbatata Roots and Tuber Enterprise CMRTE, Nasawa Cassava Cooperative and Dzaone Cassava Cooperative. Commercialisation of bitter varieties is advanced in this area, compared to Nkhotakota, and thus we thought it advisable to draw on farmers' experiences. As depicted in Annex 4, most of the FOs mention improvement of livelihood and food security as the main purpose of their organisation. The benefits are mainly improved access to markets and to inputs (planting material) and extension service.

6.1.3 Processing

There are three main actors who process raw cassava: rural entrepreneurs, farmer organisations and industrial processors. Industrial processors take responsibility for bulking the cassava and transporting it to their processing unit (PU). Most small-scale rural entrepreneurs do not have the means to collect their raw material and rely on individual farmers and FOs in their vicinity to supply them.

We talked with two local processors, who had been given processing units by donor projects under the understanding that they provide a market for smallholder farmers in their respective areas: Mr. Masimbe in Lilongwe rural and Mr. Chisi in Nkhotakota District (see Box 7). Both receive their raw cassava, at least partly, from the cooperatives we talked to in the FGDs (Chigonthi in LLW and Mkazimasika in NKK). In addition, they cultivate cassava. Both rural entrepreneurs employ around 10 workers each while processing the cassava.

Mr. Masimbe was already an experienced cassava farmer when he was selected and supported by the Malawi Entrepreneur Development Trust (MEDI) in 2010 to receive training on starch processing in Brazil. There, he also learnt about the Brazilian way of cultivating cassava (see Box 11), which he passed on to fellow farmers in Lilongwe rural. In 2015, he learnt with C:AVA how to produce HQCF and starch.

Box 7: Small-scale cassava processing units



Cassava grater (right) and diesel generator (left) in a rural processing unit



Sedimentation basin for cassava starch production in a rural processing unit

Photos: K. Droppelmann, U. Rippke

Mr. Chisi participated in a joint project by the FAO, Total Land Care (TLC) and IITA. The project aimed at mobilising farmers to grow more cassava. After completing the training successfully, he was provided with a processing unit to produce HQCF. Farmers of the Mkazimasika cooperative were supposed to supply him with raw cassava. He is also a member of the cooperative, which started three years ago when a cluster of various farmer organisations united into a cooperative. Mr. Chisi cultivates bitter cassava on 4 ha and he runs a hardware shop, hence he was identified for his business skills. Currently, he receives support from GIZ and C:AVA.

Some farmer organisations focus on processing raw cassava as a group. One example in Zomba District is CMRTE, a FO that participated in our FGD. Industrial processors exist especially in the southern part of Malawi (Zomba, Blantyre), for example, Universal Industries Ltd.

6.1.4 Distribution and marketing

In general, distribution and transport of cassava are major challenges because of the limited time frame available to transport this highly perishability good. Since cassava is a high-volume, low-value product, transport becomes a major cost. Compared to other countries in the region, travel time to cities is relatively short in Malawi (Droppelmann, Makuwira, & Kumwenda, 2012); however, due to the poor conditions of rural roads, transporters are reluctant to service areas away from tarred roads.

Farmers can transport their raw cassava to a processing plant or a market themselves. Popular options are by head-load, bicycle or oxcart. There are gender differences, since only women transport cassava on their head, while most men use bicycles. Most farmers do not own a motorised vehicle and the costs of renting one exceeds their income level. Therefore, transport is labour-intensive and slow.

Because of these challenges, a much more popular option for farmers is to sell the raw cassava at the farm gate, in which case an intermediary takes over and is responsible for harvest, transport and retailing. Especially for sweet varieties, small-scale vendors are involved in this step. They buy and resell the raw cassava on the street and in informal markets themselves or to another intermediary closer to city-centre markets. These intermediaries bulk cassava from different vendors and transport the cassava further, often with a motorised vehicle. The cassava is then distributed to retail points. These may include mobile or roadside retailers, formal and informal vegetable markets, even supermarkets (see Box 8).

Box 8: Small-scale vending of sweet cassava in Lilongwe city**Hawkers at the Lilongwe City market****Mobile hawker in residential areas**

Photos: P. Günther, B. Walenda

If industrial processors are involved in transport, they buy raw cassava at the farm gate and organise motorised collection, but a certain minimum quantity of raw cassava must be pick up to make this profitable. After processing, these big players often sell their products directly to industrial consumers.

6.1.5 Consumption

Individual consumers use cassava products as a fresh snack or to prepare *nsima*, the staple food. Higher value cassava products like HQCF and starch are used as raw material in bakery, confectionary, brewery, packaging, plywood and livestock and fish feed industries.

6.1.6 Support actors

Ministry of Agriculture Irrigation and Water Development

MoAIWD's mission is to promote agricultural productivity and sustainable management of land resources to achieve food security, increased incomes and ensure sustainable socio-economic growth. It formulates policies and priorities for the agriculture sector to create an enabling environment for agricultural activity in Malawi. It is supported by specialised departments, such as DARS, DAES and the Department of Crop Development. Cassava itself is quite oddly grouped under horticulture crops.

Ministry of Industry, Trade and Tourism

The Ministry of Trade, Industry and Tourism registers businesses, therein agricultural cooperatives, issues export licences and aims to create an enabling environment for private sector initiatives in Malawi.

Department of Crop Development

The Department of Crop Development translates policy priorities into extension messages for DAES. It develops training modules for extension officers on the ground, who operate below district level, based on technologies approved and released by DARS.

Department of Agricultural Extension Services (DAES)

The Department of Agricultural Extension Service within MoAIWD is mandated to serve as a link between agricultural research and farmers. The governmental extension service, the only service operating nation-wide, dates to the 1950s and was established by the colonial government of Malawi (Nyasaland) following severe droughts and famines. The service is organised in eight Agricultural Development Divisions (ADD) based on agro-ecological zones and more than 200 Extension Planning Areas (EPA), each overseen by an Agricultural Extension Development Coordinator (AEDC). Further, EPAs are divided into a total of 2,880 sections, each serviced (in theory) by an Agricultural Extension Development Officer (AEDO), "*who is the frontline extension officer and the one to translate agriculture messages to the farmer*" (Kamangira, 2016).

A total of approximately 2,900 extension workers are deployed in the EPAs and interact with farmers on the field level. Approximately 2,300 have adequate diplomas. Additionally, about 800 extension workers are funded and employed through NGOs, donors and private sector seed companies.

Roots and Tuber Crops Development Trust (RTCDT)

The RTCDT is a legally established trust led by a non-executive board and supported by a Secretariat. It comprises entrepreneurs, commercial farmers and representatives from various NGOs, donors (IrishAid, GIZ), international organisations (FAO, IITA), the MoAIWD through DAES and DARS and the universities of Malawi (formerly, Chancellor and Bunda colleges) as active players in the cassava sector. Although FUM, NASFAM and the recently formed National Cassava Processing Association (NCPA) are members of the RTCDT, smallholder participation was described to us as very limited.

International Organisations, NGOs and relief organisations

Below we provide brief summaries of key actors and their activities in Malawi.

The FAO's project "Strengthening linkages between small actors and buyers in the Roots and Tubers sector in Africa⁶" focuses on the cassava value chain. The project supports policymakers and institutions that are important to the sector. The project's focus is on developing inclusive business models throughout the cassava VC and on strengthening access to financial services and climate change risk management tools.

World Food Program provides humanitarian relief operation in short- and medium-term emergency situations. In the case of cassava, it occasionally provides planting material.

The European Union promotes cassava and all legumes through its project "Farm Income Diversification Project". It also supports small scale processing of cassava into HQCF with a regional focus in Nkhata Bay.

TLC's project "Enhancing Food Security in cassava based farming systems in Malawi and Zambia⁷" has a focus on production, value-added processing and marketing. This project operates in LLW and NKK. In Zomba and NKK, TLC promotes improved varieties and a pass-on-system of seeds. Also, post-harvest handling and farming-as-a-business training are provided.

6 <http://www.fao.org/in-action/african-roots-and-tubers/countries/malawi/en/>

7 <http://www.totalandcare.org/Projects/OverviewofTLCProjects/tabid/65/Default.aspx>

The African Development Bank Group plans to set up a factory for processing cassava in NKK to produce flour for biscuits, livestock feed, and other uses as part of the "Smallholder Irrigation and Value Addition Project"⁸.

World Vision runs a support project focussing on cassava production and marketing through RAIPLY Malawi Ltd., a factory using cassava starch for plywood production in Nkhata Bay.

6.2 Cassava marketing channels for food and industry

This chapter focuses on marketing channels for cassava products. Different cassava varieties can be used in various channels, therefore a strict distinction in sweet and bitter VC is not possible. Independent of later stages of the VC, input supply and production are similar for all channels and are therefore presented together. Three marketing channels from the perspective of smallholder farmers exist and are explained below and visualised in Figure 13.

1. Home consumption: Cassava is produced, processed and consumed within the household. This applies predominantly to bitter varieties (especially in NKK), but to some extent also to sweet varieties.
2. Farm-gate sale: After production, farmers sell their fresh produce at the farm gate. Afterward, it is either transported to the urban fresh market (sweet varieties) or to a processing plant.
3. Own Transport: Farmers are responsible for transport, usually, to the next processing plant.

8 <http://www.gafspfund.org/gafspmapcountry/mwi>

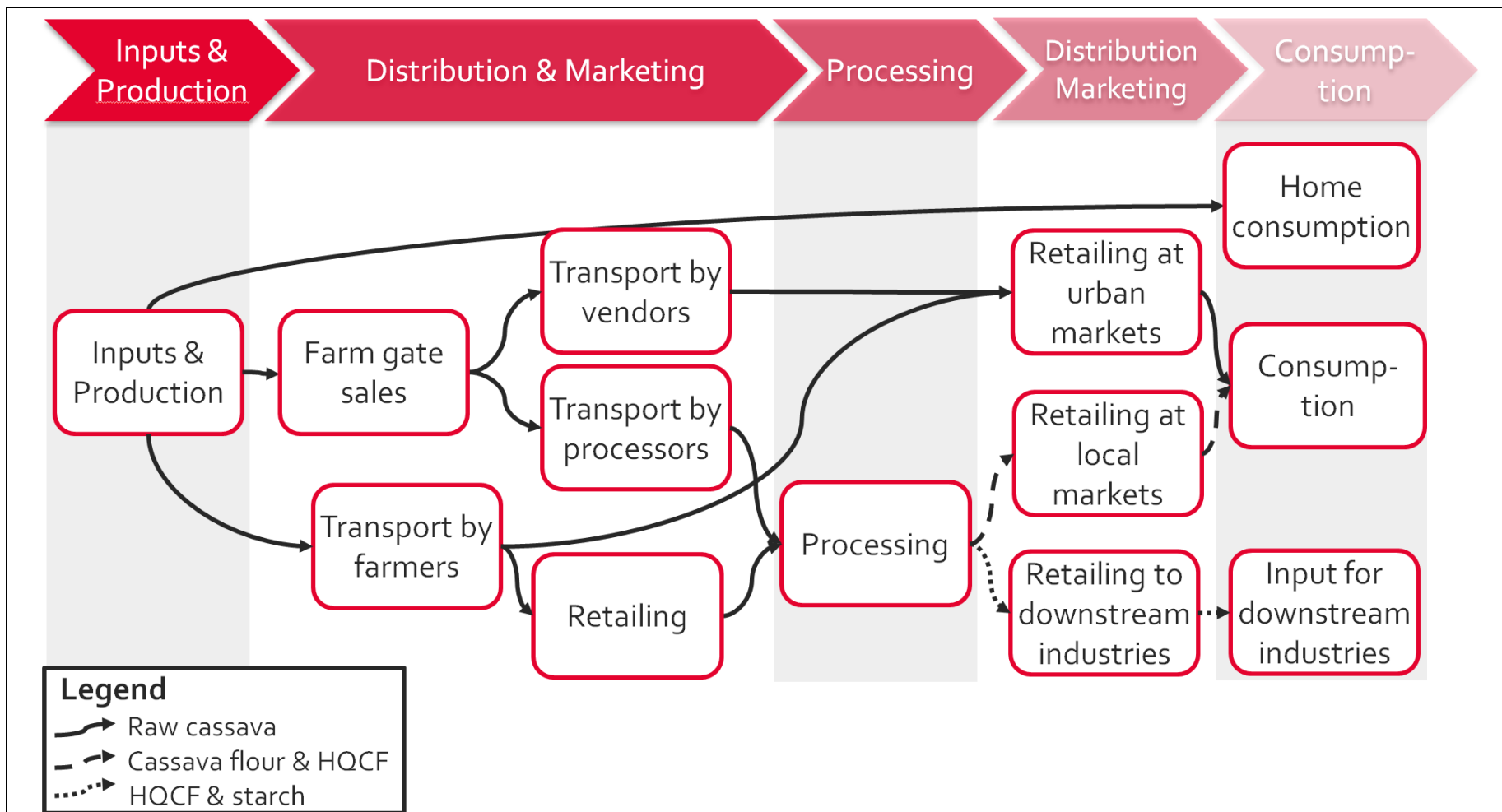


Figure 13: Overview of different cassava value chain channels

Source: Own compilation.

Input supply

The inputs of the cassava VC are provided by four groups of actors, as described in section 6.1.1. For cassava producers, the primary inputs are planting material and labour.

The core problem is the lack of a functioning market for cassava planting material, which is currently described as rudimentary. Planting material is sourced from previous fields or from fellow farmers. Late planting can be caused by a prolonged search for planting material. This is a bottleneck for cassava production, as much of the recycled planting material is potentially diseased and, thus, farmers may risk their production base.

Sweet varieties, mainly *Mbundumali* (*Manyokola*), are grown for the snack market. Most of the planting material is sourced locally with minimal buying. For HQCF and starch production in Nkhotakota, bitter varieties like *Bitilisi* and *Mbawala* are common. In both instances, planting material is accessed locally. Farmers may also receive clean planting material from fellow farmers, but plant in infected fields and thereby spread diseases.

Farmer organisations during our FGD discussed challenges they face along the VC. These are presented in Annex 8. When asked, FOs mentioned access to clean and improved planting material as a main limitation, leading to over-recycling of planting material. Additionally, they cite land shortages for increased production and inability to finance hired labour for cassava production as challenges.

Production

In Malawi, cassava is usually cultivated on ridges, a practice introduced by the British colonial government as a measure against soil erosion on slopes. Starting in November, farmers prepare the fields so that these are ready when the first rains fall. Planting of stem cuttings is best done with the onset of rains (Dec-Jan); however, for home consumption, planting is usually done toward the end of the rainy season as cassava's drought tolerance enables farmers to plant it after all other crops. In Nkhotakota and other lakeshore areas, residual moisture enables farmers to plant throughout the year. Changes in planting methods, for example, reduction of spacing, were introduced by IITA, the agricultural extension service, as well as various donor organisations. Plants are established and become very resilient after about the first six weeks of life; however, weeding and disease screening should be done. In general, cassava production is not very labour intensive, except for weeding and harvesting which is done by hand. Cassava matures

in 6-12 months, depending on the variety. Some traditional varieties can take up to two years to mature.

Irrigation of cassava is not common in Malawi, because it is a drought-tolerant crop that grows well under rainfed agriculture. According to assessments by GIAE, small-scale irrigation does not make sense from an economical perspective. Also, agrochemicals are not typically used on cassava in Malawi. Cassava responds well to fertiliser application, but farmers prefer to apply it to cash crops like tobacco, maize or fruit crops.

At the production stage, farmers and FOs face several challenges:

- theft, particularly of sweet cassava roots;
- damages by termites, mice or livestock and
- diseases and pests.

The peak labour demand in cassava production is during the harvest period. When farmers harvest their crops roughly at the same time (as needed for communal and industrial processing), labour availability can become a severely limiting factor and drive up prices for hired labour. Even under normal conditions, labour for harvesting may account for 15-20 % of cassava production costs. However, at the time of harvest, most farmers lack financial capital to hire labour.

The main cassava production and harvesting seasons occur concurrently between October and February for home consumption. Farmers want to harvest just before and during the rains in order to replant without losing planting material. When harvesting for processing, farmers prefer the later part of the rainy season (March-April) because the roots are heaviest then. Marketing must also occur during this period because of the perishability of the fresh cassava. Cassava processors; however, prefer to purchase freshly harvested cassava in August and September when the ratio of starch to water in the roots is highest. From the smallholder farmers' perspective, those months are too early, since cassava is not yet fully grown and planting material cannot be stored long enough until the next growing cycle. This causes disputes.

The main constraint smallholders face post-harvest is the lack of adequate storage options for both roots and planting materials. Once harvested, the cassava root begins to break down and within 72 hours the crop is considered unusable. Therefore, it must be processed as quickly as possible after harvesting, preferably within 48 hours. In Malawi, cassava is usually stored underground in the field. Cassava flour has a shelf-life of 3 to 6 months (Bennett et al., 2016).

Box 9: Sustainable cultivation methods

Conservation Agriculture is a technology package based on three principles: minimum soil disturbance (e.g. no-till), maximum soil cover (by mulching crop residues or a cover crop) and crop diversification (preferably with legumes). In Malawi, the NGO Total Land Care (TLC) is a key promoter of CA and considered a leader in its adaptation to local conditions. CA is a labour-saving technique when it comes to land preparation, so it is specifically suitable for female farmers. According to TLC, cassava is suitable for CA. Mulching of crop residues is beneficial because termites are a common problem in cassava fields. Termites do not usually attack a healthy living plant in the presence of dead organic matter used as ground cover. Cassava can also be successfully intercropped with legumes like beans and soya. When grown simultaneously with maize, it is likely that competition for light will become a problem. In southern Malawi, intercropping is a traditional practice, especially popular with female farmers (IHS 3, 2012). Intercropping is key to soil fertility restoration and is beneficial to nutrition security at the HH level, especially for poorer HHs.



Plots with crop-residue mulch (left) and freshly ploughed (right)

Photo: P. Günther

An advantage of delaying root harvesting until the rainy season is that stems are kept viable in situ for immediate replanting. Freshly cut stems are more productive as they sprout faster than stored stems (Kambewa, 2010). If tubers are harvested earlier, mature stems are usually stored in bundles of 50 sticks in the shade with their buds facing upwards. If they are kept moist, they may be stored for a maximum of eight weeks; however, the quality of the stems deteriorates as they start drying from the top. This issue discourages many smallholder farmers from engaging in cassava seed multiplication as the crop has to be kept in the field to be ready for sale or has to be properly stored at quite some expense. In general, one hectare of cassava grown for planting material is needed to produce enough planting material to plant up to 10 hectares, as spacing is closer than with the aim to produce roots.

6.2.1 Channel 1: Home consumption

Box 10: Home consumption of cassava in Nkhotakota District



Cassava cultivation on raised planting beds in *Dambo* areas



Sun-drying of cassava to produce *makaka*



A plate of *kondowole nsima*, the everyday dish in Nkhotakota District

Photos: B. Walenda, P. Günther

Cassava plays an important role in households as a food security crop especially along the lakeshore, as confirmed by our household interviewees in NKK (see Table 13). Households can consume cassava boiled or as *nsima* after following a number of steps including soaking, fermenting, drying, grating, milling to *kondowole* (fermented cassava flour), then reconstituting to *nsima*.

Along the northern lakeshore areas (Nkhotakota, Nkhata Bay, Rumphu and Karonga) farmers harvest as need arises, harvesting only enough to meet their household needs for few days. The harvested patch is immediately prepared and replanted. Traditional bitter varieties are most common in the area.

In the Shire Highlands (Mulanje, Zomba, Thyolo, etc.), households process cassava into dried chips (*makaka*) to produce unfermented flour (*mtandaza*). A short drying period may result in partial fermentation inside the cassava chip (see section 4.4). The *mtandaza* flour is mixed with maize flour to prepare *nsima*. For this purpose, cassava is usually harvested in the dry season to take advantage of the sun in the drying process. Both sweet and semi-bitter varieties, mostly traditional, are grown for this purpose.

6.2.2 Channel 2: Farm-gate sales

Many farmers sell their cassava right at the farm gate. If farmers want to sell cassava roots at their farm gate, they need to secure a sale before the harvest because they only have a limited time before the cassava perishes. Farm-gate sales are done by weight or by plot. For farmers, it is more profitable to sell tubers by weight rather than by whole plot, especially if their cassava quality is high and their roots receive good prices per kg.

Traders often prefer to buy entire cassava fields and meet the costs of harvesting and transportation. Before the purchase is made, traders uproot a sample plant and, depending on the size and quality of the roots, suggest a price. The price is agreed upon and the sale is finalised before the rest of the crop is uprooted. Whatever traders leave behind, either due to small sizes or damage during harvesting, is used for household consumption. For farmers using cassava as a cash crop, it appears only realistic to make a real profit, if they have more than half an acre which is then harvested and sold at once. However, for both sides, a lot of uncertainty is involved and only afterward is it possible to evaluate the transaction. Nevertheless, selling by the plot has been described by experts as exploitation of farmers.

Increasingly, business transactions between buyer (usually an industrial processor) and seller (individual farmer or FO) are done using mobile phones. In such

cases specialised transporters collect the produce from farmers' fields or communal bulking points. In some cases, farmers are only paid after the processed cassava is sold by the processing company; therefore, in addition to high uncertainty and lack of transparency, farmers experience a cash-flow crisis while they wait for their cassava to be processed and sold onward.

Prices paid to farmers vary greatly depending on the purchaser, location and time of sale. The minimum price for a kg of raw cassava, as stated by the government of Malawi, is MK 30 per kg. The following examples are presented to illustrate price variation. In 2016, Mr. Masimbe, a rural processor near Lilongwe city, paid MK 40 per kg to farmers who delivered to his factory. In 2017, he wished to pay a farm-gate price of MK 35 per kg in order to meet his collection and transport costs. In the cassava production zone around Zomba, Universal Industries Ltd. paid MK 50 per kg of sweet varieties and MK 40 per kg of bitter varieties in 2016/17. In response to continuous arguments, C:AVA facilitated farmer-buyer meetings for price negotiations in April 2017. After long discussions, C:AVA staff were convinced that farmers don't understand the price structure along the VC correctly; apparently, they compare the price they receive with the final price of cassava products in the end market and are, therefore, not satisfied. However, C:AVA's calculations showed positive profit margins for farmers using conservative estimates. *"Furthermore, it is unlikely that the official minimum price of MK 30 per kg is widely undercut"* to quote V. Sandifolo of C:AVA.

A group of small-scale vendors took part in one of our FGD. They buy sweet varieties and sell them without processing. They describe their challenges with buying cassava from farmers:

- Farmers are unwilling to negotiate an acceptable price.
- Immature cassava harvested too early tastes bitter and it gets rejected at the market.
- After a deal has been negotiated, other vendors from town might come and offer a better price or buy whole fields from the farmer. The farmer then dismisses their previous agreements.
- As most vendors buy cassava per line (ridge) or even per plant, the real harvest might be less than they expected.
- Before they buy, vendors look at the farm management (weeding, planting) to estimate how many roots they can expect.

- The farmer often determines which plants vendors may buy (they are not allowed to choose themselves), so vendors get poorer plants, which means fewer roots for the agreed price.

Following their farm-gate sale, the cassava roots move further along the VC to either retailing in urban markets or to processing. In the following discussion, we describe these processes.

Retailing in urban markets

A major channel in the cassava VC is the fresh market, where cassava is consumed as an unprocessed snack. Around big cities, large proportions of sweet cassava are grown for urban markets, not for home consumption.

Small-scale actors transport sweet cassava from the farm to nearby intermediaries or markets. The mode of transport is often not motorised, with vendors using their own bicycles, oxcarts or head load. Depending on the mode of transport, aggregation takes place at different points. Some small-scale vendors are only responsible for a portion of the transport to a specific location where loads are further bulked before an intermediary takes over. During transport, vendors face several challenges:

- Transport of cassava by head load is heavy; this limits the amount of cassava vendors can sell in a day.
- Sometimes head-load vendors are summoned by customers after the vendor has passed by, but when they return, the customer does not want to pay the suggested price.
- Female vendors report having roots stolen by passersby, because the vendors are unable to defend themselves or chase the thieves.
- A bicycle vendor depends on his bicycle. If it dysfunctions or breaks on the way, the hiring of a new bicycle diminishes profit.

Closer to the city centre, bulking takes place, and cassava is moved from bicycles to lorries. We have anecdotal evidence of vendors driving up to 150 km out of the city to buy fresh cassava; that would be as far as Kasungu or Ntcheu from Lilongwe.

The middlemen, while providing a crucial function of moving the product from farms to retail markets, often engage in uncompetitive behaviour by creating barriers to entry in the markets; for example, they restrict supply by allocating each other alternate product delivery days and limiting the amount of product one can bring to the market (Kambewa & Nyembe, 2008).

Small-scale vendors sell their own cassava during the day and face several challenges:

- Some customers want to taste the cassava and then refuse to buy it.
- The buyer determines the price by taking the root then handing over less money than the vendor was promised.
- If the vendors can't go to the market themselves (due to sickness or other events), they need to send someone else as cassava is perishable. That person may not be trustworthy or may have inadequate knowledge of pricing.
- In the evening, profit is sometimes less than expected. Vendors explain this by the popular belief "that one buyer attracts the money" meaning that they believe some people have the power to transfer money from the vendor's purse to their own unnoticed.
- Unsold cassava from one day cannot be sold much later.
- Fresh cassava competes with sweet potato to some extent; however, the differences in peak seasons reduces competition between the two commodities. While the cassava season runs from August to February, the sweet potato season runs from March to July.

Besides these vendors, intermediaries work together with retailers around Lilongwe. The markets in the city are very well organised. Retailing is organised from the trading centres known as Six Miles and Kawale and are used as the main entry points to Lilongwe from the south. A northern entry point is Area 25.

Urban consumption of sweet cassava and sweet potatoes has grown rapidly in Malawi over the past 15 years. The rise in relative prices for maize and wheat explains this growth in urban cassava consumption as low-income workers seek snack substitutions for *dowe* (grilled maize) and bread products.

Processing

After farm-gate sales, it is also possible to transport the raw cassava to a processing plant. Many processing factories try to organise their own motorised transport, but to make the long trips worthwhile, enough raw product needs to be supplied. Therefore, farmers need to coordinate among themselves and harvest at the same time. This can lead to conflicts, as mentioned above. Lack of transport was a constraint also mentioned by some processors. Mr. Masimbe in Lilongwe, for example, thinks a truck would allow him to collect raw material much faster and thus would also ensure its good condition at the time of arrival at his factory.

Cassava is processed for value addition into flour, HQCF and starch. The process entails many steps starting with grading roots into smaller/thinner, thicker/bigger and damaged roots. Damaged roots are returned to farmers. Smaller roots are washed, peeled and used for products for non-human consumption. Bigger roots are washed and peeled before grating and pressing to remove moisture, followed by drying the pulp and, finally, milling. Cassava pulp can be dried by sun drying or artificial drying. Sun drying is usually carried out by processor groups engaged in seasonal small-scale processing. Artificial drying (or flash drying) is a more advanced technology which rapidly dries by passing hot air through the cassava pulp. This method is used by industrial processors.

Processors' main challenges include lack of financing to purchase technical equipment (flash driers, motorised transport, etc.) and lack of a constant supply of raw cassava. Demand for raw cassava is high, since 3-4 kg of fresh cassava are required to produce 1 kg of HQCF and 5-6 kg of raw cassava for 1 kg of starch. Since insufficient quantities of raw cassava are delivered to them, most processing plants are unable to operate at full capacity. This is a problem even during the harvesting season. At certain times of the year, processing plants sit idle since no raw cassava is available. Processors relying on sun-drying are unable to process cassava during the rainy season, when it is impossible to dry cassava without a flash drier. As the gap between product supply and demand is large, processors prefer to have their own large-scale plantations in close proximity to their plants to ensure minimum supply.

Mr. Masimbe produces starch and HQCF. In his factory, Mr. Masimbe employs ten trained staff during the processing season (April to November) who carry out all functions even in his absence. He pays them MK 15,000 per month. For peeling and other simple work, he employs pieceworkers and pays them MK 200 per 50 kg of cassava peeled. When the factory is in production, he employs 20 casual pieceworkers to carry out one or two processing cycles per week. Each cycle takes two days (day one: grading, washing, peeling; day two: grating and drying for HQCF and additional sedimentation for starch). The final step in processing HQCF is milling which he outsources to local hammer mills. He says he could run a maximum of three cycles per week and easily expand production from his current 2 tons per month to 10 tons a month or even more with his current set up, but there is not enough cassava being grown in the area to support that.

Mr. Chisi reports a similar supply problem and blames farmers' late planting in January and February of 2017. During our FGD, the farmer organisation in NKK

disagreed with him, stating their cassava is ready for harvest, but that Mr. Chisi is not willing to buy it.

Both Mr. Masimbe and Mr. Chisi reported that their processing time is limited to the dry season because they rely on outdoor drying; a rain-proof solar drying installation would allow them to produce throughout the year.

The two processors are the only ones in the areas surrounding them. Hence, rural processors enjoy a monopoly and have a strong influence on farm-gate prices. Compounding this, they frequently pay farmers only after the processed products have been sold. In our interviews, farmers and processors quoted vastly different prices (up to 100 %) paid for raw cassava, with farmers and FOs complaining about low prices and lack of market alternatives.

As many processors are also cassava farmers, their priority is processing their own cassava and buying supplemental cassava from surrounding farmers when needed. This means farmers find it difficult to plan for the quantity, price and time of sale. In order to increase their bargaining power, farmers need to speak with one voice, for example, through a farmer organisation and coordinate their activities. In so doing, processors may not see the need for own production and can concentrate on their core business. Alternatively, FOs can also venture into processing themselves to add value to their produce. For example, Mkazimasika Cooperative is negotiating the option of renting Mr Chisi's processing unit so they can do their own processing.

CMRTE, a registered cooperative promoting community processing in the Zomba region, buys fresh cassava roots and processes them into HQCF to sell at the local market. Their processing is affected by persistent electricity blackouts, since both petrol / diesel engines were replaced with electric ones. Further, they rely on the sun to dry their processed cassava, but lack space to do so. While a large factory exists for drying nearby, cooperative members claim that it is not suitable for their needs. Peeling and pressing of cassava are done by hand and non-motorised simple technology requires the hire of many extra workers and drives up processing costs.

Universal Industries Ltd., the biggest cassava processor in Malawi, has an inclusive business model of a starch and liquid glucose processing factory with its own cassava plantation. As their production is insufficient to meet demand, a public-private venture with C:AVA was established to formally link cash-cropping cassava farmer groups to the company. Universal organised mobile processing units in major growing areas for farmers to complete the first steps of processing (cutting, peeling and grating) and sell value-added products to the company. They use

ICT tools and mobile technology to provide extension/advisory services to their farmers. With financing from C:AVA, Universal set up the first flash drier in the country, able to dry 250-300 kg cassava in an hour, but still lacks raw material to operate at full capacity.

After processing, cassava flour and HQCF are transported to local markets and sold to individual consumers. Processed cassava products (HQCF, starch) are also transported downstream to industrial processing plants, where they are used as an input for other end products.

Table 14 gives an overview of all cassava products commercially available. Note that the annual tonnage of cassava products produced in Malawi is merely around 1000 tons while its potential is estimated at over 100 times the current production. Possible future users of HQCF in Malawi include Carlsberg breweries, Nampak (paper board) and textiles (Mapeto).

End users	Products	Current (per annum)	Potential (per annum)
Universal Industries Ltd.	HQCF for export to Zimbabwe	200 metric tons	24,000 metric tons
Universal, Rab Processors	Biscuits and Composite Flour (HQCF and <i>Makaka</i>)	400 metric tons	3,500 metric tons
Maldeco, Ndatani (occasionally CP Feeds, Transglobe)	Animal feed (HQCF grits as binder)	10-15 metric tons (Maldeco alone) 30 metric tons in total	4,000 metric tons
Raiply	Plywood (<i>makaka</i> flour)	150 metric tons	360 metric tons
Press Corporation Alfred Osusagnya	Ethanol	no data	2.1-2.3 million litres (7 kg cassava per litre)
Kris Off-Set	Paper board (HQCF)	20 metric tons	40 metric tons
Bakeries	Bread, biscuits (HQCF)	15 metric tons	3,500 metric tons
Rural bakeries (local market)	<i>Mandasi</i> doughnuts (HQCF)	100 metric tons	15,000 metric tons
Kapani, Ori	Sausages (Starch, HQCF)	20-25 metric tons	50 metric tons

Source: Data and estimates compiled by C:AVA experts.

The biggest constraint to upscaling industrial cassava processing is the lack of a steady supply of raw material from bitter cassava varieties in Malawi. If the smallholder sector does not manage to overcome its supply constraints in terms of quality and quantity, there is a risk that large-scale producers and processors will step in and, due to their economies of scale, crowd out both smallholders and rural small-scale processors from the market.

6.2.3 Channel 3: Own transport

In addition to home consumption and farm-gate sales, farmers may use a third marketing channel: organising transport to markets themselves. In this scenario, they would remove a middleperson and follow the channels described in section 6.2.2 independently. That is, transporting their cassava to an intermediary closer to the market or to the market themselves, or organising transport for themselves or for the whole village from their fields to the next processing plant. The main advantage they achieve via this channel is a higher price; however, farmers often lack the means of transport or cannot finance it, even if they are members of a FO.

6.3 Environmental analysis

Cassava has a number of agronomic strengths. It readily adapts to agro-ecological conditions and, thus, withstands climatic variations, efficiently utilises the mineral reserves of marginal soils and responds well to inorganic fertiliser application. Its performance, especially its yield, is affected by environmental conditions. During drought, cassava loses its leaves to conserve moisture, then produces new leaves when rains resume. Under such conditions, it can take 18 months or more to produce a crop (Hair, 1995). Although it grows well under heavy rainfall, its growth is stunted and the tubers are susceptible to damage under waterlogged conditions.

6.3.1 The effects of soil degradation and climate change on the cassava value chain

Soils in Malawi are highly degraded by poor agricultural practices such as maize monocropping and crop-residue burning that leads to loss of soil organic carbon and thus soil fertility (Thierfelder et al., 2016). However, no smallholder we spoke to refrained from cultivating land because of soil infertility. Degraded land gets cultivated, as land availability is frequently a limiting production factor. In both sampled regions, most farmers claim to take measures to protect their soil against degradation including, most commonly, contour ridging, mulching and

planting vetiver grass. Some farmers also reported applying manure, practicing crop rotation and planting trees; drainage and Conservation Agriculture (CA) were only mentioned in NKK.

Malawi's vulnerability to climate change is high. Through frequent dry spells and floods in the last decade, anthropogenic climate change is affecting smallholder farmers directly. When asked how they would mitigate rainfall shortages in the future, farmers mentioned several measures: water conservation practices like box ridges and mulching, planting trees in the field, pit planting, weeding, planting early, using early-maturing varieties and diversifying their crops.

Faced with the likely increase in droughts, the vast majority of farmers in both study areas expressed willingness to grow more cassava in the future; to quote one of them: "... because cassava can do well in any condition⁹". In LLW, only 1 of 30 respondents said they would not increase cassava production if a more intense pattern of drought emerges. In NKK, 9 of 48 farmers said they would not intensify cassava production – probably because they already cultivate cassava abundantly.

6.3.2 The negative impact of cassava production on the climate and environment

Opinions on the impacts of cassava growing on soil fertility differ. Some experts say cassava maintains soil fertility when mulching of the leaves is practised, as the roots only contain starch and close to no minerals (which are exported through harvest), while others call it a soil miner. However, it is generally acknowledged that cassavas' deep roots lead to soil loosening. Sustainable cultivation methods (for example, GAP, CA, intercropping – see Box 9) may help ameliorate negative environmental effects of cassava cultivation. Regarding the negative stigma cassava has as a soil miner, it should be kept in mind that the degradation of most soils in Malawi is due to mono-cropping of maize and associated poor land husbandry practices. Hence, cassava is a crop of last resort for a lot of farmers and not the start into a vicious cycle.

As cassava is grown under rainfed conditions, it is very seldom irrigated and, therefore, does not draw heavily from stored water reserves. However, the processing of root to starch requires a lot of water and generates harmful waste.

9 Here, as well as in the following Chapter 7, we used quotes from smallholder farmers that we interviewed to illustrate our findings. The original statements were made in Chichewa, they were recorded, translated and paraphrased into English by our field interviewers .

Sewage from cassava processing plants contains high amounts of cyanide and is not suitable for further use (Bennett et al., 2016).

Regarding the genetic diversity of cassava, its landraces are currently conserved in-situ, especially in traditional growing areas. Nevertheless, so far the research community in Malawi does not recognise traditional varieties as a valuable genetic resource that is worth tapping into.

6.3.3 Cassava value chain contribution to creating a green economy

Cassava can be used as source of renewable energy: cassava fuel briquettes and biogas can be produced from processing residues; for example, a Norwegian project in NKK called “Techno-economic feasibility of de-centralised production of bio-ethanol using wastes from cassava processing” is being piloted in Malawi.

6.4 Problem analysis

6.4.1 Value chain governance

MoAIWD and MoITT shape the cassava sector’s policy framework for small-holder producers, cooperatives and industrial processors. The mandate to coordinate and support the entire cassava sector rests with the Roots and Tuber Crops Development Trust (RTCDDT). It is tasked to coordinate a network of all stakeholder constituencies, with representation from farmer organisations, research, civil society and the public and private sectors, that are active in the cassava sector and to advise and to lobby the government on issues of interest for the sector. The Trust may function as an innovation platform, namely to facilitate circular learning in order to foster the exchange and adoption of innovative practices between its members.

The functioning of the Secretariat is dependent on funds contributed by donors and its members. Since it receives little government support, its full operation is hampered by too little staff and equipment. An additional core obstacle to fulfilling its mandate is the divergent objectives of its individual members; it appears that members prefer to pursue their individual interests by exploiting existing opportunities over contributing to the development and growth of the entire sector.

6.4.2 Extension system

Theoretically, the extension service is supposed to provide an interface between researchers and farmers (see section 6.1.6). On the ground, the extension

service is not able to fulfil this task due to several inefficiencies. It is equipped with insufficient financial and human resources; the extension worker-to-farmer ratio is 1:3000 – far below international recommendations (Kamangira, 2016). Most extension workers do not have motorised transport and sometimes not even a bicycle. Moreover, their work is hampered by poor road and communication infrastructure. The extension service is lacking appropriate offices, computers, training facilities, demonstration plots and test sites. Above all, the general conditions of service discourage good performance. The extension service's participatory and demand-driven approach was designed to empower farmers to express their needs and priorities and to receive targeted messages and tailor-made services. This is far from reality. In fact, most farmers in Malawi do not know about this new extension policy and cannot claim their rights. Additionally, a staggering 86 % of male farmers compared to 13 % female farmers have access to extension services, a highly unequal distribution (Nankhuni, 2017).

Furthermore, the extension service focuses on maize; cassava is not yet a priority for the extension service and is not integrated into national extension programmes. In order to translate extension messages to farmers, extension workers need to be trained on cassava. Cassava and other roots and tubers receive little attention in training curricula at the designated facilities for future extension workers, National Resources College at Lilongwe University for Agriculture and Natural Resources (LUANAR) (public) and Mwimba College of Agriculture (private), to name two prominent ones. Extension staff have to rely on guide books that are outdated and largely ignore cassava. Most information and inputs they receive target legumes and maize. We also observe that there are very few research programmes and classes on cassava at LUANAR. The little knowledge extension staff has about cassava they gained through their own farming background or picked up on the job in cassava growing areas. In this way, some extension workers transformed themselves into veritable, self-taught cassava experts. Specific extension gaps for cassava growers exist in inputs (clean and improved planting material), production (diseases, GAP), commercialisation and marketing.

6.4.3 Seed supply system

Two seed systems exist in Malawi: a communal seed system and a formal system. While the communal system is an important cornerstone in smallholders' farming strategies, no quality control exists and the spread of diseases is likely. The formal system relies on IITA and DARS as main actors, who work towards the participatory inclusion of farmers (see chapter 6.1). However, perceptions about this system vary. While IITA and DARS representatives point out how farmers are

involved in the system and that they are frequently consulted, most other interview partners describe it as basically top-down in its approach.

Governmental and donor-financed distribution of planting material from certified (i.e. released and improved) varieties to seed multipliers at the community level is free of charge. Nevertheless, seed multiplication appears to be poorly coordinated and follows no strict rules; the multiplication strategy exists only in writing and public resources for interventions are only released when maize harvests are severely threatened. This renders it virtually impossible for farmers to familiarise themselves with improved varieties and their qualities, which explains to some extent why farmers prefer to rely on their own traditional seeds. In ad-hoc emergency distributions, which are often supported by NGOs, logistical short-comings can lead to spoilage of certified seed, which are then replaced by planting material from unhealthy sources to satisfy distribution quotas, thereby contributing to the risk of spreading diseases.

The seed market in its current form is viewed as artificial and highly unreliable. Favourable framework conditions for the development of a commercially self-sustainable market are absent and are undermined further when the government, donor organisations and NGOs distribute planting material freely at a large scale during dry spells. Some donor-funded initiatives, like the GIAE programme, try to establish a commercially-oriented seed distribution system. However, commercial planting material is viewed by many farmers as too expensive (with costs around MK 1,500 per bundle of 50 sticks – basically its cost of production) because planting material is otherwise available at no cost from donor-funded projects or as part of relief efforts. Nevertheless, a commercial seed market for cassava planting material would go a long way in overcoming the dilemma farmers face in having to plant at the same time they harvest. Thus, the timing of supply to processing units for optimal processing would be greatly improved.

6.4.4 Missing linkages between value chain actors

Farmers face many challenges in successfully participating in the cassava VC. Their endowment is limited, as well as their access to information on pricing and market opportunities. Small-scale producers don't know their own input costs and have inadequate business skills to determine the price they need to receive to make profit. Even if they were able to make this calculation, they have little power to bargain: when offered a price at a farm-gate sale, many are unsure when the next sale opportunity might arise and take the offered price. Since many farmers lack their own transport opportunities, farmers that wish to sell their cassava have no fall-back option.

Farmers of sweet varieties who wish to capture a large share of the value addition face an additional challenge: market entrance barriers. The highly organised market around city centres has been described as an informal cartel and has led to a distorted market. Information on the cartel is difficult to obtain. Intermediary actors organise themselves into informal structures and limit market access for independent farmers. Commercial retailers set prices and restrict the quantity brought into town. This control has positive effects, since an over-supply would lead to product loss, but at the same time, it is highly prone to protect profit margins and allow rent-seeking behaviour, while farmers still complain about low prices. Concrete profit margins are notoriously difficult to assess due to wide inter- and intra-daily variations in producer and consumer prices. This market power is responsible for comparatively smooth-running marketing channels, but it is unclear how farmers can profit more from these successful businesses.

Farmers selling to a rural processing facility are also at a disadvantage. Often, there is only one potential buyer within a reasonable distance and farmers complain about this dependency. Rural processors are usually part of the community and social cohesion is strong, making it likely for smallholders to impact on rural entrepreneurs once they organise communal action. It is a contradiction that while farmers are unable or unwilling to sell (due to low prices), processors scramble for raw material to meet the high demand from downstream industries. Processing raw bitter cassava to different end products leads to a comparatively long and complex VC, which is more difficult to run smoothly than the sales of raw sweet varieties. Therefore, the real challenge is to organise the supply chain to the processors and, in the process, capture a good price for farmers' raw material. The problem of low prices due to farmers all wanting to harvest at the same time and the resulting irregular supply to processors needs to be solved. Processors face challenges aggregating and transporting cassava roots to factories originating from many smallholders, as well as with meeting quality standards.

After the challenge of acquiring cassava from farmers, problems do not end for processors. Processed cassava products for retailing to individual end-users, like in urban supermarkets, is a relatively new concept in Malawi and demand for that is still low. End users are not yet aware of how to use cassava products like HQCF and cassava flour. Processors expressed dissatisfaction with their current packaging, because HQCF is mainly sold in 50 kg bags which is not attractive to new consumers. They assume, or rather hope, that smaller unit sizes may entice end-users to experiment with a new product.

The main potential market demand for HQCF is as a partial substitute for wheat in the bakery industry and could provide monetary savings on expensive wheat imports. Average customers prefer 100 % wheat-based bread and only a significantly lower price tag for HQCF can convince them to switch. This price difference needs to cover the producers' costs involved in switching. In the case of bread, only a relatively small percentage can be substituted without affecting the properties of the final product. Bread with up to 20 % HQCF inclusion does not significantly differ from bread made from 100 % wheat flour and is unlikely to be detected by the consumer. The problem is, HQCF may be profitable in theory, but unprofitable in practice if consumers refuse to buy HQCF bread without price discounts or if it remains unsold because it does not meet consumers' perceived quality standards. Also, the regional acceptance of cassava is problematic, since it is only a staple food for people at the lakeshore – in other parts of Malawi, it remains a substitute.

6.5 Challenges and shortcomings of innovations

This section gives a comparison of the theoretical approach of Agricultural Innovation Systems (see Chapter 2.4) and the GIZ/IITA innovations in use on the ground. We analyse the concept and design of the GIZ/IITA innovations presented in section 4.5, their dissemination, the collaboration with partners, as well as the adoption of innovations by smallholders.

6.5.1 Concept and design of innovations by GIZ / IITA

The conceptual foundation for innovations in GIZ-GIAE Malawi appears not to be well anchored in the AIS conceptual framework. Expert interviews indicate that the innovations were designed and developed without profound examination of the theoretical background behind agricultural innovations. Further, they were designed in a top-down approach, meaning that they were developed with only minor input from smallholders, as the main beneficiaries and target group. The process of developing and designing innovations included only a few participatory elements and was not primarily demand-driven. It seems that the innovations were developed primarily based on VC analysis. Most of the innovations for the cassava VC also apply to the other three GIZ target crops or VCs. Hence, these innovations do not seem to be crop- or VC-specific; it appears rather like a "one size fits all" approach. The only cassava-specific innovation is improved planting material.

The design of the improved planting material follows a very research-centred approach where researchers define the priorities and the preferred traits are set by the private sector. One example that was often named in this context is the case of the *Sagonja* variety. It was field tested in demonstration trials, but rejected by researchers. Somehow, farmers got hold of planting material and kept using and multiplying it. It turned out that *Sagonja* (meaning: 'the one that doesn't give up easily') is highly appreciated due to its taste and cooking qualities. Another important limitation of the improved varieties commented on by experts, is their higher water demand at the beginning of the growing season (compared to the local varieties). Hence, if the onset of the rainy season is delayed, it might put the crop at higher risk.

Trainings on GAP will presumably start in 2018 as part of the Farmer Business Schools; evaluation of these is, hence, not possible. However, interview partners stated that the corresponding manual for the cassava GAP was developed by external consultants with negligible smallholder consultation; active smallholder consultation, for example, consultation focussing on their needs, did not occur.

Consequently, the concept and design of the GIZ/IITA innovations stands in contrast to the "ideal" innovation (from the AIS perspective) which should include all stakeholders and be developed in a participatory and interdisciplinary way in order to respond to the needs of the beneficiaries. Moreover, we could not find evidence for a circular exchange of knowledge that would involve smallholders in early stages of innovation development or use of grassroots innovations¹⁰ as a starting point. A proper evaluation of the innovations introduced by GIAE-Malawi and/or IITA has not yet taken place. However, the recently published baseline study from IITA (2017) as well as the backstopping mission for GIAE-Malawi offer a good opportunity to start a systematic evaluation of the innovations.

6.5.2 Innovation dissemination

The dissemination and introduction of innovations, particularly for improved planting material, is a major challenge. GIZ relies on its collaborating partner (C:AVA) for the distribution of improved varieties. However, C:AVA is a NGO with limited resources and their work is focused on the southern region of the country. Consequently, they cannot carry out dissemination of planting material on a supra-regional/ large-scale level. At all levels, it remains unclear how functions and

¹⁰ Innovations that come from the smallholders themselves.

responsibilities for the dissemination are defined, this includes governmental and research institutions but also the NGO and donor sector (see also section 6.1).

6.5.3 Collaboration and coordination with partners

Collaboration and coordination with GIZ's partners on the meso-level, that is to say with IITA and C:AVA, were reported to be challenging with regard to the supply of planting material. Particularly in times of prolonged dry seasons, IITA was not able to produce and/or conserve sufficient planting material to deliver it to C:AVA for timely distribution to the farmers. Interview partners concluded that IITA might have been tasked with too many responsibilities including some that were beyond their control. For example, IITA has no access to irrigation facilities to ensure reliable and timely production of sufficient planting material. For this, they must rely on other partners like DARS and DAES.

On the macro-level, GIZ is collaborating with MoITT and MoAIWD; however, it seems that the link to the MoAIWD is very weak. This hampers collaboration with the governmental extension service and reduces opportunity for improved dissemination of innovations at the micro-level. Generally, there seems to be only limited sharing of information and knowledge between partners in the cassava sector, which is a critical bottleneck for successful innovations since these emerge, according to the AIS approach, from the interaction between actors or partners.

6.5.4 Adoption of and access to innovations

The results from the conducted household interviews and FGDs show that farmers are generally very interested in improved varieties, training on GAP and farming as a business and/or commercialisation of (processed) cassava. Although most of the interviewed farmers stated in the scenario games (see section 7.2) that they are willing to pay for improved varieties, it remains questionable if they would be able to do so with their limited financial capital. Moreover, precise knowledge about innovations, for instance, names and characteristics of varieties, are often unknown to farmers and even to the extension workers. Hence, adoption of innovations is already restricted due to difficult access to information on variety characteristics and the planting material itself.

Consequently, the improved varieties, as the most important GIZ/IITA innovation, do not fulfil the criteria of an innovation in the AIS approach. They are rather a technical improvement with limited dissemination, which does not consider the needs of the smallholders sufficiently and, hence, have been adopted to an unsatisfactory extent. Moreover, many of the improved varieties which can be found on the field are already outdated, meaning that they were released more than ten

years ago and might have lost their disease tolerance/resistance (for example, *Sauti*, *Silira* and *Sagonja*).

Box 11: Grassroot innovations: Cassava planting as an example

According to IITA, the standard recommended planting technique for cassava is as follows: Sticks of about 20-30 cm length should be placed two-thirds (15-20 cm) into the soil with their buds facing upwards. The main advantage of this technique is the fast establishment of the plants, which is especially beneficial in terms of competition with weeds and shorter time until harvest. However, during our field research we came across different techniques used by farmers which may constitute grassroot innovations.

In Brazil, Mr. Masimbe learnt about another planting techniques that he calls "Brazilian style". Here, sticks of only 5-10 cm length are placed horizontally 5 cm below the surface of the ground. This is especially advisable for multiplication as more branches emerge from the buds, sprouting underground. In combination with the considerably smaller planting sticks, this leads to a higher multiplication rate. For this technique to be successful, soil moisture in the top soil layer (5-10 cm) has to be sufficient, otherwise the whole stand can be lost.

Members of Mkazimasika Cooperative in NKK use yet another method of planting cassava which combines elements of the two techniques described above and thus can be considered an intermediate form. Sticks of about 15-20 cm length and having 6-8 nodes are placed at a 45 ° angle into the soil, with about three-quarters of the cutting underground. In this way, root formation is stimulated while drying out of the planting stick is less likely under sub-optimal soil moisture conditions.

7 Smallholder participation in cassava value chains

In the following, results from the household interviews conducted in Lilongwe rural (LLW) and Nkhotakota District (NKK) will be discussed. Firstly, cassava smallholders' realities are presented in terms of input, production and marketing. Secondly, cassava and non-cassava-growers' decisions about options to participate in the VC will be discussed.

7.1 Farmers' realities

Input

Of the 58 households interviewed, 9 do not grow cassava at all and another 3 only grow cassava on communal fields within their village; therefore, in the following discussion, the results of 46 cassava-farming households are presented.

Their cassava field size is between 0.1 and 1.2 ha, with an average size of 0.5 ha (median 0.4 ha) with very little difference between our two study areas. It is interesting to note that farmers in LLW farm on a larger area, but have different priorities in their choice of crops and land allocation compared to farmers in NKK.

When asking farmers which inputs they most urgently require, all respondents stated their wish for planting material. The second-most important input factor is labour, since many farmers would like to use both their own labour (89 %) and hired labour (54 %). Fertiliser and pesticides are less important, with only four and seven people referring to them as desirable, in LLW and NKK respectively. Another factor described as beneficial is additional training.

In reality, the inputs farmers have access to are limited. For most, only planting material and their own labour are accessible. While many of the farmers stated their desire to hire labour as additional support, only six of them are able to do so. As expected, they do not use fertiliser or pesticides (with one exception) on their cassava. Regarding inputs, no regional differences exist between farmers in LLW and NKK.

Production: Good Agricultural Practices

All interviewed farmers in LLW know about GAP, while 23 % in NKK do not know about them. As farmers' main source of information on GAP is the extension service, farmers' lack of knowledge can be attributed to lack of extension workers in NKK, as the following quote from a farmer emphasises: *"I never heard [of GAP] as extension workers rarely teach us now."*

When asked which GAP measures cassava farmers apply, a wide range of measures was named including Conservation Agriculture (CA), pit planting, making ridges across the slope, using modern varieties, mulching, planting leguminous crops to add nitrogen to the soil, preparing land in a timely way, correct spacing, applying pesticides when needed, rotating crops, planting vetiver grass, planting by dipping 3 to 4 nodes of the planting material into the soil, frequent and timely weeding to reduce competition between weeds and the crop, leaving maize residues on the soil surface and intercropping.

Marketing

The following discussion on cassava sales uses data collected from only 22 households, since 24 of the interviewed households have no intention of taking part in commercial marketing. The vast majority (17 HH) sell their cassava at the farm gate, 2 HH sell to Mr. Masimbe's processing plant, 1 person sells directly to people in the village, and 2 are new cassava farmers and thus have not yet marketed their product.

Farmers' satisfaction with the price they received for their cassava differs, but most seem dissatisfied with almost 60 % reporting they lack satisfaction or are not at all satisfied. Table 15 shows absolute numbers.

Price satisfaction	LLW	NKK	Total
Very satisfied	2	0	2
Satisfied	4	0	4
Medium satisfaction	2	1	3
Lacking satisfaction	6	3	9
Not at all satisfied	3	1	4
Total	17	5	22

Source: Own data.

As reasons for their dissatisfaction, seven farmers stated high cost of production in comparison to price. This explanation is surprising, since the monetary costs of cassava inputs are usually quite low, especially if farmers use their own planting material and labour. Farmers might consider the cost of resources such as time and labour input. Farmers also stated they feel dissatisfied because they

have no bargaining power and need to accept the prices set by vendors; they perceived these prices to be lower than in past years. Further dissatisfaction results when the price is not determined by a proper scale.

Another reason for their disappointment is the long cultivation period of cassava. Farmers who were satisfied with the prices gave three explanations for that: they set their own price, compared prices with neighbours before accepting sales agreements, and/or entered agreements on communal sales.

Cassava prices change throughout the year and sometimes even during the day due to the perishability of the tuber, so it can be difficult to predict them. Prices also depend on the quality of the product and the variety. In household interviews, respondents gave a wide range of prices and did not use a standard unit of measurement. Interestingly, an objectively high price is not connected with higher price satisfaction, as demonstrated in Table 16.

Table 16: Prices and satisfaction by unit of sale					
	Very satisfied	Satisfied	Medium satisfaction	Lacking satisfaction	Not at all satisfied
Unit of sale	Price in MK				
kg	50 /kg	50 /kg		12 /kg	10-25 /kg
Plant	300 /plant			300 /plant	
Ridge (~50 kg)			4,000 /ridge [equiv. of 80 /kg]		
<i>Thumba</i> ¹¹ (~80 kg)			2,500-9,500 /thumba [equiv. of 31-119 /kg]	8,000-10,000 /thumba [equiv. of 100-125 /kg]	
Oxcart (~1500 kg)		30,000 / oxcart [equiv. of 200 /kg]			
Acre (weight not known)		100,000-200,000 /acre		85,000-400,000 /acre	
Source: Own data.					

¹¹ *Thumba* is the vernacular name for a bag that contains 50 kg of maize. It is commonly used for measurements.

7.2 Cassava farmers' decision making regarding their participation along the value chain

Decision making for smallholder farmers who currently cultivate cassava was assessed by letting them choose from a set of four scenarios which resemble steps in the value chain: 1) production of cassava, 2) input acquisition (referring to planting material), 3) marketing the harvest and 4) communal marketing. For each scenario, a set of two to three options was offered. An overview on the options can be found in Annex 9.

As a scenario game requires a high level of capability in abstract thinking, it may have been difficult for some farmers to imagine the options offered and clearly separate them from their day-to-day activity planning. Thus, their own livelihood reality as well as currently-experienced limitations and challenges may have interfered with truly hypothetical answers. However, we found this approach a suitable tool to assess farmers' intentions and believe that it revealed interesting insights.

7.2.1 Findings for all smallholders

In total, 80 cassava farmers were interviewed, 32 of whom live in Lilongwe rural and 48 in Nkhonkhot District. In Figure 14 below, we present the overall frequencies of the option combinations chosen by farmers. Each scenario represents a different stage in the VC and within those scenarios we asked farmers to choose one of three options presented to them. They can choose between option 1 (non-participation), option 2 (a medium level of participation) and option 3 (a high level of participation) in the VC.

This figure illustrates farmers' aspirations and demonstrates their willingness to actively participate in the VC. The majority of farmers

- would like to try out an improved cassava variety,
- would be willing to pay for planting material after two growing seasons,
- would like to sell their produce (as farm-gate sales or as individuals on the market) and
- would consider teaming up for communal marketing (either by bulking for farm-gate sales or by joining a processing association).

None of the respondents refused the hypothetical participation in all stages of the cassava VC. This shows how eager farmers are to change their *status quo*. However, we need to keep in mind that the results show mere intentions, not planned actions.

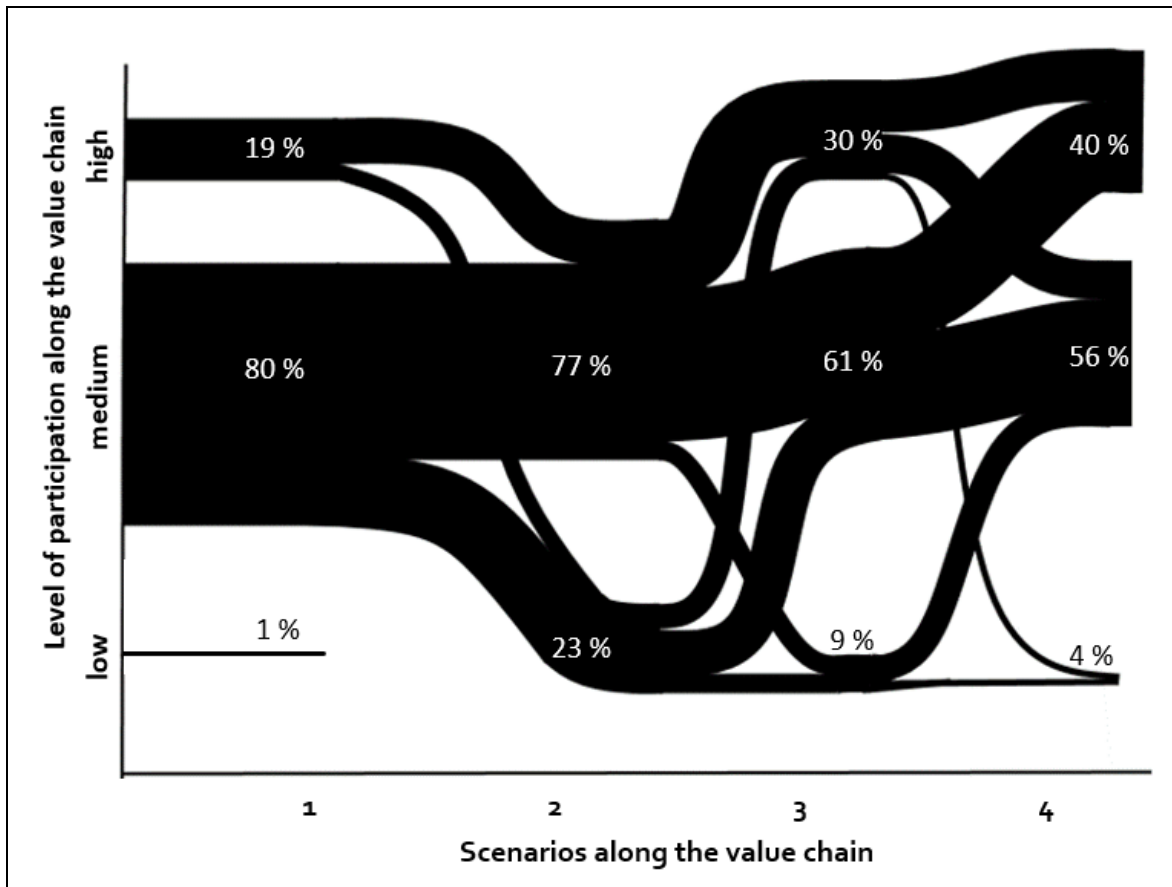


Figure 14: Decisions taken throughout four scenarios by all smallholders
 (Scenarios: 1 Production, 2 Willingness to pay, 3 Commercialisation, 4 Communal marketing)
 Source: Own data.

7.2.2 Comparison of decision making by region

As LLW and NKK cassava growers use cassava for different purposes, we present a regional comparison. Table 17 shows the percentages of the different options taken in each region and in total (for all 80 interviewed farmers).

Scenario	Option	LLW in % (n= 32)	NKK in % (n= 48)	Total in % (n=80)
1. Production	Refuse new variety	0	2	1
	Adopt new variety	78	81	80
	Adopt on half the area	22	17	19
2. Willingness to pay	Not willing to pay	28	19	23
	Willing to pay	72	81	77
3. Commercialisation	No sale of surplus	0	15	9
	Farm-gate sales	72	54	61
	Individual sales at market	28	31	30
4. Communal marketing	No interest in communal marketing	0	6	4
	Team up for bulking	59	54	56
	Join a processing association	41	40	40

Source: Own data.

Scenario 1 – Production

Regarding the first scenario, the choices of smallholders did not widely differ in the two study regions. Out of 80 respondents, 64 chose to plant the same area with the improved variety to get double the yield (80 %). Another 15 would cultivate only half the area with the new variety (19 %). Only one female respondent from a male-headed household in NKK did not want to use the improved variety, because she has *"no knowledge on this new variety"*. Hence, 99 % would adopt a new improved variety if it was provided to them. A likely explanation is that Malawian farmers are used to the distribution of free agricultural supplies and, since they have no or little other opportunity to access inputs, they readily take what they can get for free.

For those who chose to plant only half their usual area under cassava with the double-yielding variety, their decision would result in maintaining their normal yield. When asked what they would do with the other half of their field, smallholders in LLW stated they would have already satisfied their needs for cassava and would plant a crop with shorter maturity (for example, groundnuts, soya and sweet potatoes). This finding is underlined by one farmer's statement from LLW: *"It's because cassava is mainly used for sale; whereas, other crops can be used for food at home"*.

When asked the same question about what to do with the other half of land, smallholders in NKK stated they would either use the land to grow maize or grow another cassava variety, namely their traditional varieties. Farmers stated they would do so in order to preserve their planting material and to first try the new variety before growing it more extensively. A female farmer stated that she is *"satisfied with the variety usually grown and hence before trying another variety she would try it first on a smaller land."* This is an important fact to recognise when introducing a new variety in a traditional growing area.

Scenario 2 – Willingness to pay

Of all smallholders interviewed, 77 % stated they are willing to pay for a new, disease-free variety after two growing seasons, while 23 % stated they are not willing (or able) to pay. The most common reason they stated for being unwilling to pay was lack of financial capital for farm inputs. Instead of investing in cassava planting material, it is easier to find it for free or recycle their own plants, as the following quote emphasises: *"I may not have money to buy planting materials over and over again, so I may start recycling seed."* All except one farmer had somebody specific in their mind from whom they would get planting material— most frequently they are family relatives, extension officers, neighbours or fellow farmers. NGOs and other actors like GIZ were also named.

The degree of willingness to pay for seed stock varies between regions. Surprisingly, more farmers in NKK stated their willingness to pay for seeds than those in LLW (81 % vs. 72 %). This was surprising because we expected farmers in LLW, who use cassava as a cash crop, to be more willing to pay than those in NKK, who rely on low investments in their cassava crop to meet their home consumption needs. This is even more striking as the average household asset endowment of households in NKK is more financially deprived than those in LLW.

The farmers willing to pay stated a vast range of prices. For a bundle of 50 sticks, the range they suggested was between MK 100 and MK 5,000. The average price was MK 700, and over 90 % were willing to pay MK 1,000 or less. Therefore, the price desired by farmers for a bundle of cassava sticks lies below the current price of MK 1,500 per bundle.

When smallholders who would be willing to pay for seed were asked to name a price at which they would no longer be willing to pay, their answers ranged from as low as MK 200 to MK 6,000, with an average of MK 1,360. Of these, 70 % stated a price below MK 1,500, while 30 % stated MK 1,500 or more as their threshold and should, therefore, be willing to pay the market price of MK 1,500. That means about one-third of all cassava farmers would accept the current market price if

physical access is improved, but the majority of farmers are interested in attaining improved planting materials at subsidised prices.

When recycling planting material, the spread of diseases and pests is more likely than when using certified seeds. Consequently, higher disease pressure must be expected when farmers recycle their seeds. Most farmers stated they would report diseases to extension officers, who should give advice on how to proceed. Some also reported they would undertake measures they were taught by extension service staff, such as uprooting and burning infected plants. Only one farmer thought nothing can be done about cassava diseases.

Scenario 3 – Commercialisation

Of the 80 interviewees, 49 (61 %) chose farm-gate sale as the most suitable use for at least part of their harvest. What hinders them from selling individually (receiving a presumably higher price) was mainly lack of transport and the high costs attached to that. Farmers also mentioned cassava's bulkiness and perishability and the labour and time needed to conduct individual sales. A higher percentage of farmers in LLW chose that option compared to NKK (72 % vs. 54 %), which is likely because they assume a nearby market exists for their predominantly sweet varieties.

Overall, 9 % would not sell their cassava, but keep the surplus produced from improved, double-yielding varieties for themselves or give it to others for free. These respondents highly value cassava for food security and their individual home consumption needs. Interestingly, this option was only chosen by smallholders in NKK (7 of 48), which represents 15 % of them.

The last third, consisting of 23 farmers, chose to transport their produce to the market themselves for a better price. As means of transport, they would use bicycles, oxcarts (own or hired) or head-load. More than half of these farmers described negative experiences (low price, no price-setting power) with farm-gate sales in the past, explaining their willingness to change from that option.

In LLW, all interviewees chose to sell their crop, again emphasising cassava's function as a cash crop. In contrast to that, NKK farmers chose to share the harvest with relatives and friends who are in need of food as cassava is the traditional staple food in NKK. Additionally, the lack of a market for cassava in this region enhances the likeliness of choosing this option, as this quote illustrates: *"It's for home consumption and giving it to others is just to help them which is better than selling it at a give-away price."*

Scenario 4 – Communal marketing

Decisions concerning communal marketing are similar in both regions. In total, 56 % of respondents (59 % in LLW and 54 % in NKK) would team up for bulking of half a ton of good-quality cassava to be collected by a buyer in order to receive a better price, even though only 5 % of them have prior experience with it.

Another 40 % stated their interest in joining a processing association for making cassava flour, thus, adding value to the produce. Most of them were so eager they would be prepared to join right away, demonstrating their strong will to market cassava. The expected outcome from group membership was primarily better prices and market access: *"There is power in unity; hence, higher prices can be achieved if there is collective marketing."* Additionally, knowledge acquisition through peer-to-peer learning was mentioned by several farmers as an important benefit of group membership. However, some smallholders also anticipated challenges such as lack of cooperation and lack of transparency and accountability on financial issues. Others believe that a common agreement on terms and good leadership will help avoid such problems.

Only three farmers in NKK are not interested in teaming up with others, all of those being woman. The reasons they gave include their feelings of inferiority to fellow farmers, fear of lack of cooperation among group members and lack of available markets.

7.2.3 Gendered decisions

Exploring gender dimensions within Malawian smallholder households was an important objective of our study, especially in regard to their decision-making processes. The marriage systems in studied households in LLW and NKK was comparable with ratios of matrilineal to patrilineal being 0.63 for LLW and 0.58 for NKK. In both regions, most decision making is done jointly. Also, more than 85 % of the households anticipate that problems might arise when decision making was without both partners involved. Difficulties that could arise were reported to be lack of unity and conflicting ideas, leading to frustration, disorganisation and misunderstandings. This can eventually bring about failure by overcoming challenges, so *"Their households cannot be fully developed"*.

However, regarding activities and responsibilities we found very traditional gender roles in both regions, irrespective of the marriage system. Typical female responsibilities named include taking care of children and other family members, food selection and preparation, washing clothes and taking care of properties and fetching water and firewood. Some also named taking care of livestock and fi-

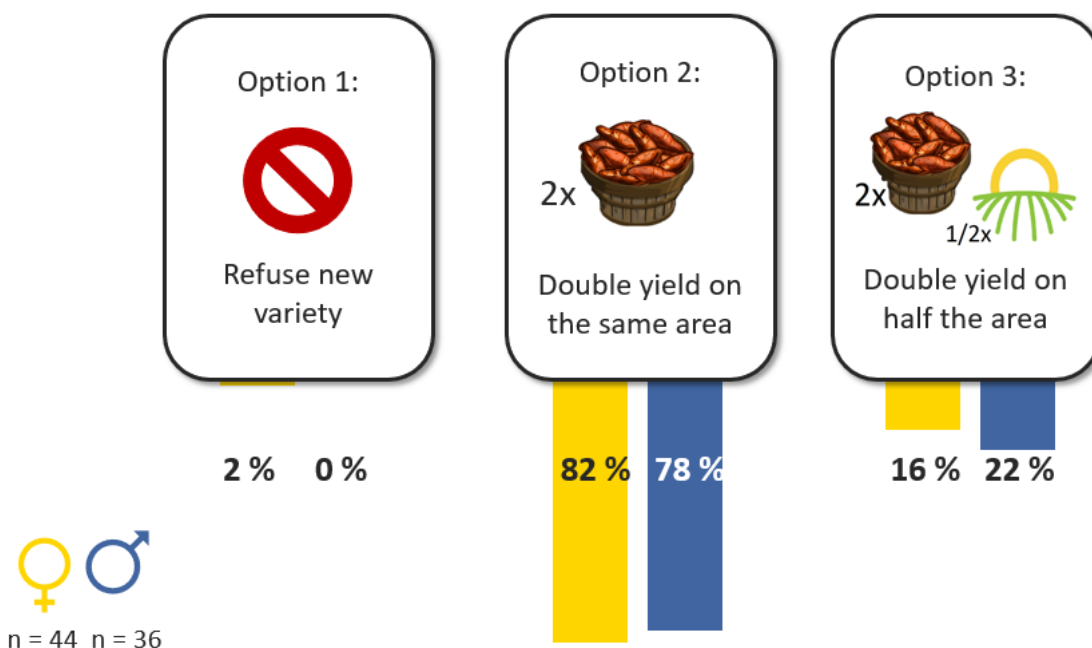
nances. But we also received some responses from men (all three of them from NKK) that reflect a very different understanding of their wife's obligations; i.e. *"being submissive before the husband on decisions"*.

Male responsibilities were mainly related to income generation activities and finances. Buying farm inputs was named a man's responsibility as well as *"making decisions for the family and leading the household; providing solutions to household challenges"*. However, exceptions to these traditional gender roles were also found, for example: *"He mostly just supports the wife on every decision"*. We present these apparently contradictory positions and statements to show that perceptions and aspirations are not always straightforward or consistent in regard to gender roles.

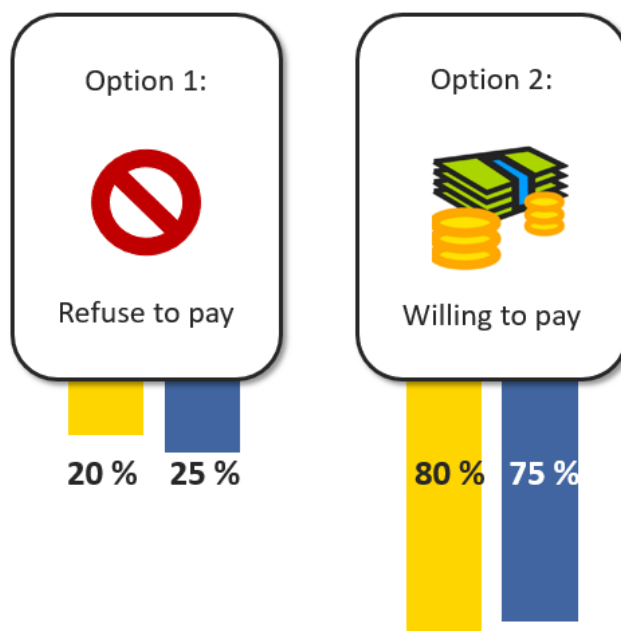
Nevertheless, male and female farmers concurred with each other on most of the choices presented in the scenario game (as can be seen in Figure 15). However, in both regions more diverse combinations of options were chosen by female farmers. Also, within individual scenarios gender differences were not big. For willingness to pay there is no gender difference, thus female farmers are as prepared to make investments into cassava planting material as men. Surprisingly, regarding commercialisation in NKK, even more women than men are willing to take their produce to the market to sell it. We noted no gender difference in the decision to keep cassava or give it away for free. In scenario 4, the option of joining a processing association was more often chosen by males in LLW and females in NKK, while again, no gender difference was found for teaming up for bulking. In total, only three female farmers were not interested in communal marketing, all from NKK.

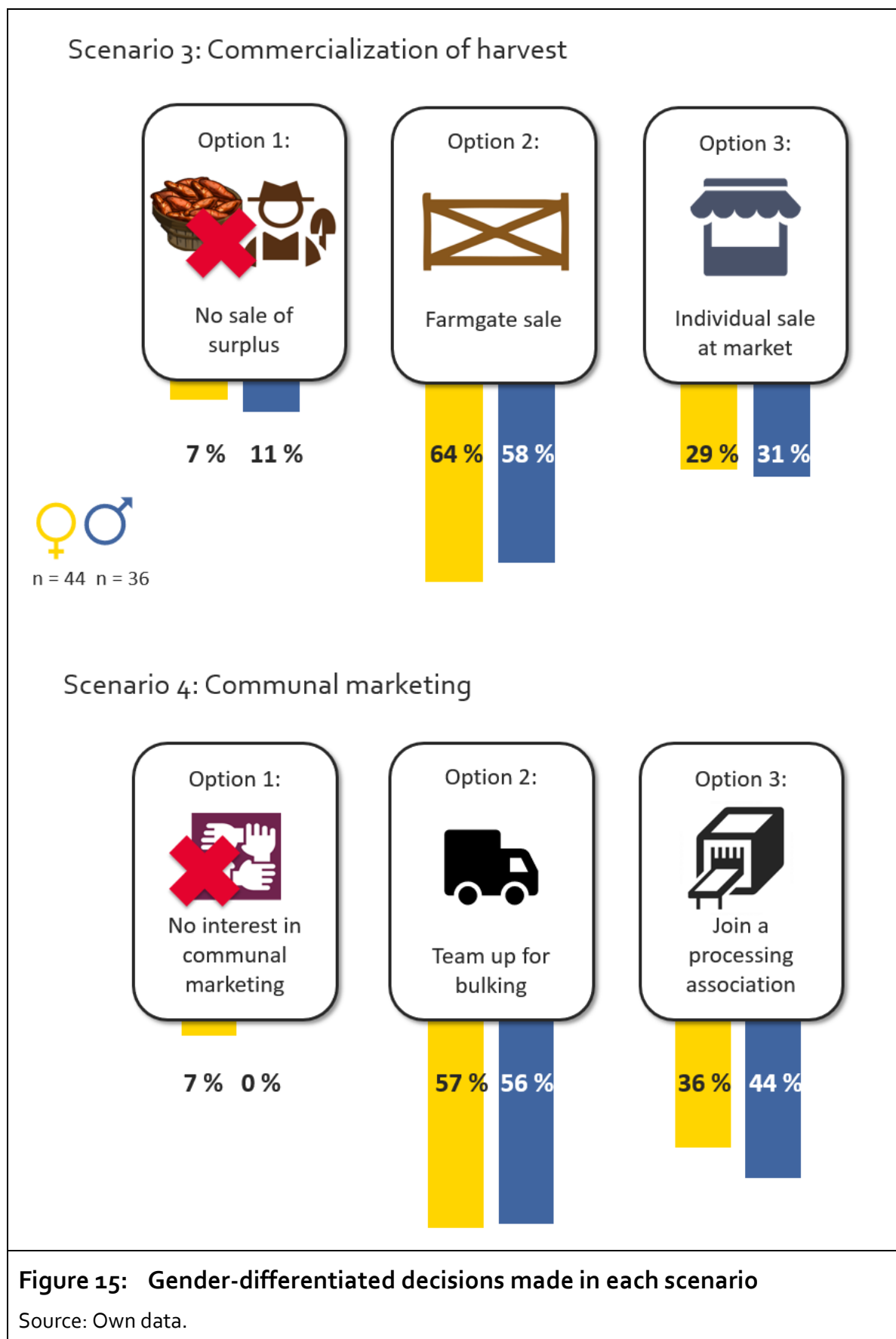
As we aimed at identifying gender differences, spouses were interviewed separately. Thus, they did not have a chance to discuss their choices and make decisions jointly. We found both spouses tend to make similar decisions, with both husband and wife choosing the same options 63 % of the time, indicating they mostly pursue the same goals in their decision-making.

Scenario 1: Adoption of a new improved variety



Scenario 2: Willingness to pay for improved variety





Female single-headed households

Cassava is thought to be a good crop for female single-headed households, as it yields reasonably well under poor husbandry conditions (for example, delayed planting) and peak labour demand does not occur during the maize crop's peak labour season. A total of 13 female single-headed households were interviewed, 6 from LLW and 7 from NKK. Ten of them are growing cassava, three are not. For these HH, we could not discern any common trend or pattern in their decision making.

7.2.4 Adopters' and non-adopters' decision making

Among the total of 80 cassava farmers interviewed in both regions, 25 currently grow improved cassava varieties (adopters) while 55 do not (non-adopters). First, we make a regional comparison and afterward assess their decision-making processes.

Regional comparison

In both of our study areas, 31 % of all farmers were adopters of innovations; 10 are based in Lilongwe rural and 15 in Nkhotakota. Of the non-adopters in LLW, 34 % have not yet been exposed to improved varieties. In NKK, this proportion is somewhat higher: 40 %. We conclude that about half of the farmers who have had contact with improved cassava varieties are still cultivating them, irrespective of the study area. Overall, location does not seem to have a major effect on smallholders' chances of coming into contact with, adopting, or disadopting improved cassava varieties.

Decision making of adopters

Regarding the decisions made within the scenario game, all adopters chose the improved variety, thereby confirming their satisfaction with this innovation. Only 2 of these 25 adopters would refuse to pay for planting material, while the vast majority expressed their willingness to pay. This is remarkable, because adopters in LLW lack financial assets more than non-adopters (see section 5.3). Still, 90 % would invest in cassava planting material, underlining its value to farmers. Only one farmer did not want to sell her harvest; for all others, farm-gate sales or individual sales at the market were equally popular. All farmers currently growing improved varieties are interested in communal marketing: 13 respondents would team up for bulking and another 12 showed interest in joining a processing association.

Decision making of non-adopters

Options chosen by non-adopters (who currently cultivate traditional cassava varieties) are more diverse. For example, one respondent would even reject a freely-available improved variety. Furthermore, about one quarter of these smallholders are not willing to pay for improved planting material. Compared to adopters, more non-adopters did not show any interest in commercialising their harvest. Also, all respondents that are not interested in teaming up were non-adopters.

Generally, farmers who do not grow improved cassava varieties show considerably lower interest in participating in the cassava VC. Hence, either the improved variety fosters the ambition to participate in the cassava VC through a prospectively higher yield or farmers that are more eager to participate actively seek to grow improved varieties.

7.2.5 Non-cassava-growing households

In addition to assessing the decision making of smallholder farmers that already cultivate cassava, we explored incentives and disincentives for farmers who currently do not engage in cassava growing. A total of 13 non-cassava-growers were interviewed. Five of them were male and eight were female, four of whom were females from single-headed households.

Interestingly, all 13 farmers stated they consume cassava as often as several times a week to as infrequently as once per harvest season. Five said they would not increase their consumption if the price lowered, because they do not enjoy the taste and the perishable nature of the cassava root. 9 of 13 have grown cassava in the past, while 4 farmers have no experience with the crop. Their reasons for stopping growing cassava were lack of planting material, the prevalence of disease in their crop, lack of land, destruction by livestock, low market price and labour requirements.

At first, five different incentive options to (re)start growing cassava were offered to the non-cassava-growers (see Annex 10a and Figure 16 below). Three rounds were made, in which the farmers could choose options. Figure 16 shows the distribution of choices. In the first round, farmers could choose three of the options, in the next round only two, and finally only one. In this way, we hoped to discover what their most pressing needs are and in which combination.

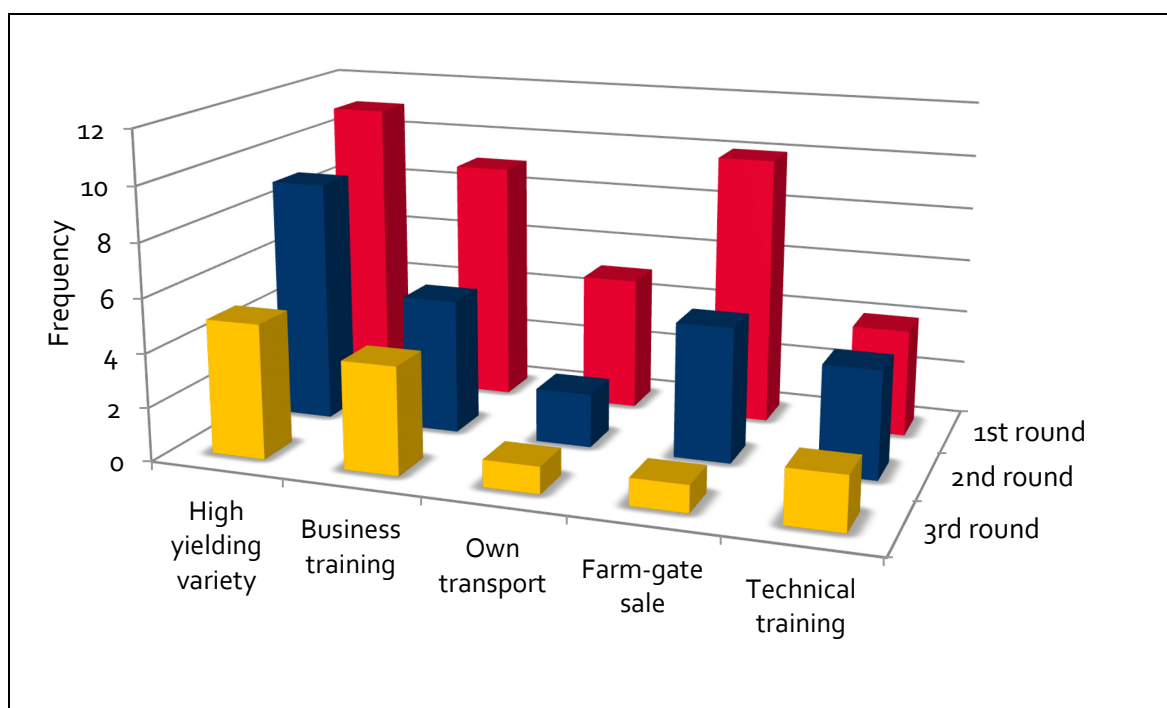


Figure 16: Distribution of choices for non-cassava-growers, over three rounds

Option 1: Free access to a high yielding, disease-free cassava variety.

Option 2: Training on how to run a business based on cassava production.

Option 3: Bicycle provided for free if the farmer starts supplying a processor with cassava.

Option 4: Middleman comes to the farm and collects the harvest for the regular price of the area.

Option 5: Training on better farming techniques that include cassava and reduce labour demand.

Source: Own data.

Most farmers (7 of 13) chose a combination of the options 1, 2 and 4. Thus, combining an improved variety, business training and a convenient market offered the most incentive. An explanation from a farmer's perspective is given in the following quote: *"If it is high yielding, I can be eating and also selling the same product. Business training will mean profits which I can keep in my group savings then use for inputs for a bigger cassava crop next year."*

In general, free access to an improved variety was the most attractive option throughout all three rounds, followed by agri-business training. Reassuringly, this resembles the programmes commonly offered by donors in Malawi. Farm-gate sale was selected frequently. Training on production techniques was chosen by few respondents. A bicycle to transport cassava was the least attractive option, though owning a bike would reduce transport limitations many farmers pointed out as a challenge earlier. A bike requires quite some time and labour to facilitate

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the transport to a processor, which might also be a reason why this option is less desirable. Limiting the number of options that farmers could choose from showed that farmers placed most emphasis on overcoming productivity and business knowledge constraints. Overall, we didn't pick up any gender difference in choosing these incentives.

In a second round, three different (negative) scenarios were presented to non-cassava-growing farmers which might incite them to start growing cassava (see Annex 10b). Nearly all respondents (11 of 13) named changing environmental conditions, namely more dry spells, as their strongest incentive to grow cassava. Hence, farmers are aware of the devastating impact droughts can have on maize and the advantage of cassava during drought events. Changing market conditions for cash crops was only seen as relevant when combined with more dry spells, while a changing policy environment, represented by GoM terminating FISP and advising farmers to grow cassava instead of maize, was mentioned by only one farmer.

8 Lessons learnt and entry points for innovations

In the following, we summarise the most important lessons learnt, identify possible entry points for innovations, and make recommendations. We confirm that the presumed mismatch between supply and demand persists and originates mainly from the production side. We identify main bottlenecks in production as a weak input system, deficient extension service and limited self-organisation of smallholders. Moreover, we found evidence for poor coordination and governance as overarching root causes for important challenges in the cassava VC. These aspects are represented visually in Figure 17 and are subsequently discussed in further detail.

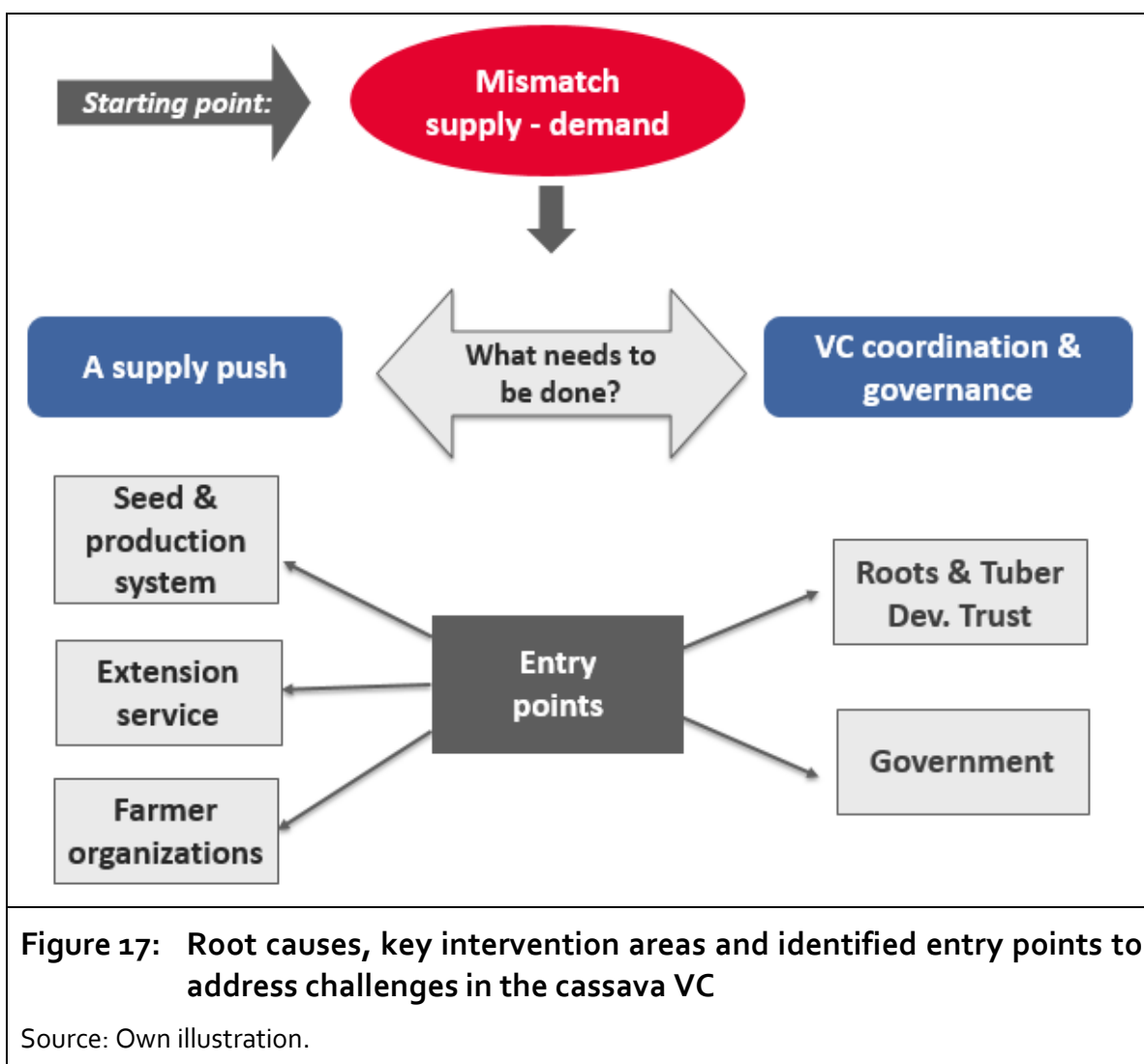


Figure 17: Root causes, key intervention areas and identified entry points to address challenges in the cassava VC

Source: Own illustration.

Background: The mismatch between cassava supply and demand

Apparently, not much has changed over the past decade; our analysis confirms Kambewa and Nyembe's (2008) assessment from the mid-2000s. Current estimates from C:AVA still point to a mismatch between supply and demand. However, some things did change.

In urban centres, attractive markets for sweet cassava varieties developed in a short period of time; here, raw cassava is consumed as a popular snack. One interesting indication of the high demand for and value of raw sweet cassava is its frequent theft from farmers' fields. Due to the high perishability of cassava, the supply chain for the fresh market has to be strongly organised. Anecdotal evidence points to the fact that this coordination is very effectively carried out through a form of a cartel, making market entry for newcomers or attempts to intervene along the supply channel extremely difficult. Hence, the mismatch between supply and demand is less evident or maybe even absent in the case of sweet varieties.

In contrast to this, producers of bitter cassava complain about the lack of markets for their occasional surplus production. Meanwhile, sought-after cassava products (flour, HQCF, starch) do not reach downstream industries in sufficient and reliable quantity and quality. Here, the gap between supply and demand is apparent, but actors struggle to overcome these challenges on their own. Recent expert estimates from C:AVA indicate that the potential demand is far bigger than its current utilisation. Therefore, we need a supply push.

8.1 What is needed for a supply push?

Smallholder farmers express great willingness to commercialise their cassava production and are eager to have a more active role in the various steps along the value chain, specifically in regard to seed multiplication, use of improved varieties to increase their production and communal processing and marketing. Even though the traditional gender roles of women and men persist in Malawian farm households, we found men and women's aspirations regarding VC participation to be the same. However, farmers face substantial challenges which are mainly related to the input and production system, insufficient support from the extension system and challenges in smallholder self-organisation.

8.1.1 Entry point: Seed and production system

Access to and dissemination of seeds

Poor access to sufficient and good-quality planting material of sweet and bitter cassava varieties is a key bottleneck restricting increased production and productivity by smallholders. The access to clean and/or improved planting material is limited due to a sparse network of seed multipliers in the cassava cultivation areas and a narrow time frame in which the planting material can be kept viable. Cassava is propagated vegetatively and requires relatively little financial investment for production, but the planting material is bulky and perishable. Also, the low multiplication rate per plant (only 5-6 planting sticks), makes engagement in commercial seed multiplication less profitable than other crops. The sticks desiccate quickly, resulting in decreased probability of sprouting. Hence multiplication has to be located relatively close to the production sites.

Recommendations

Immediate

- Step up support to existing seed multiplier networks and expand them to a decentralised network by supporting farmer organisations and/or lead farmers as well as support actors like C:AVA.
- Provide training on seed multiplication for FOs and lead farmers to create a multiplier effect.
- Encourage the use of existing ICT services which provide support for identifying diseases.

Short term

- Encourage members of the private sector who practice large-scale cassava production (e.g. Universal Industries Ltd.) to produce clean planting material.
- Routinely update and widely distribute the list of certified seed multiplication farmers via MoAIWD to enable easier access to clean planting material for all stakeholders.

Uncontrolled distribution and recycling of seeds

The production of own planting material bears the risk of over-recycling and is likely to lead to disease outbreaks. Large-scale, uncoordinated and uncontrolled distribution of uncertified planting material during relief interventions also bears the risk of disease spread. Furthermore, it undermines the development of a sustainable private-sector-lead seed multiplication and distribution system.

Recommendations

Short term

- Ban uncertified seed distribution during developmental and humanitarian aid interventions.
- Establish a monitoring system for the entire seed distribution sector which builds on the list of smallholder seed multipliers that MoAIWD maintains. The monitoring system could be one of the responsibilities of the RTCDT and government should provide resources for that.

Medium term

- Ban free seed distribution except for humanitarian relief purposes to support resilience. Preferably, establish a subsidised seed distribution system that does not undermine the commercial seed system but accounts for the financial constraints of smallholders affected by climatic or other calamities.
- Improve and expand the screening of planting material by financing refresher training courses for DAES extension staff; include lead farmers and FOs in this exercise through a participatory extension approach.

Variety development

In the past, the characteristics of improved varieties were primarily determined by researchers. Farmers' preferences, such as taste and cooking qualities, were largely ignored. Usually, farmers are consulted at a late stage, offering them only limited choices during demonstration trials and virtually no opportunity for meaningful input to the breeding process itself. As a consequence, the adoption rates of improved varieties are below their potential. Many of the improved varieties are already outdated as they were released more than 10 years ago. Genetic refreshment of varieties has to be continuous, ideally in 5–7 year cycles.

Recommendations

Short term

- Develop extension messages on the characteristics of improved varieties so that farmers can make an educated choice on variety.
- Develop extension messages on the need for frequent renewal of planting material to avoid the spread of diseases.

Medium to long term

- Design an intervention/programme that uses the DEAS extension staff to reach out to smallholder seed multipliers to a) train them in screening crop

stands for disease symptoms, b) identify popular traditional varieties for genetic improvement and c) use FOs and lead farmers as a platform for subsequent seed demonstration trials.

- In order to improve cassava varieties, support the implementation of a participatory and inclusive process which acknowledges farmers' preferences and needs. Foster a constant and circular exchange between all actors involved (farmers, researchers, NGOs, donors, private sector and government).
- Recognise traditional local varieties (oftentimes preferred by farmers, especially for home consumption) as valuable genetic resources for the breeding programme (by IITA, DARS) and improve these varieties in regard to disease tolerance and yield potential.

Increased productivity

The productivity of cassava smallholders is very low. Besides the difficult access to quality planting material, degraded soils and predominantly poor agricultural practices are the main reasons for the unexploited potential. Good Agricultural Practices (GAP) represent a promising means for smallholders with limited resources to improve soil conditions and productivity. Most farmers (85 % of our sample) have heard about GAP; however, the correct and sustained application remains a challenge due to limited knowledge, guidance and appreciation.

Recommendations

Immediate

- Improve the GIZ Handbook on GAP by including successful practices of innovative farmers, for example the Brazilian way of planting cassava for seed multiplication (see Box 11).

Short to medium term

- Continuously revise and update the GAP Handbook based on feedback from field-level practitioners and smallholder farmers, thereby making good use of their knowledge and experience.
- Start trainings on GAP for FOs and, if possible, include MoAIWD extension workers in the trainings for higher multiplication effects.

Long term

- To ensure long-term sustainability of training impacts, the initial intensive training sessions should be combined with hands-on guidance, especially when relating to business development, record keeping and accounting. Subsequent

trainings conducted over the long term should focus on hands-off back-stopping to promote self-reliance and create a self-sustaining, circular learning system. Possible key actors are lead farmers within FOs, extension workers and active representatives of smallholder associations (FUM, NASFAM).

8.1.2 Entry point: Extension service

The extension service provides interface between farmers and researchers/policy makers. It is highly demanded and appreciated by smallholders, but poorly educated and equipped to support the development of the cassava sector. Apart from general limitations (mainly understaffing, facilities and mobility), extension workers do not receive cassava-specific training as it is not included in curricula at colleges and universities. Furthermore, the participatory approach outlined in the extension policy is not put into practice and female farmers, in charge of household food security, have very limited access to extension services. It seems that the basic concept of participatory services and their implications is not understood by many extension workers as well as farmers and/or cannot be realised due to limited resources. Consequently, the extension service is not demand-driven and addresses farmer needs from the inherently male-dominated perspective of its extension staff. This offers an easy entry point for supporting the government system to develop appropriate gender-sensitive training material and support training interventions.

Recommendations

Immediate

- Lobby for more employment of female extension staff.
- Promote the use of ICT services, such as the free-of-charge Airtel mobile service number from the Agricultural Extension Officers Platform and applications to identify cassava-related diseases as part of official extension messages (see Box 6).
- Promote cassava as *one part* of a diverse livelihood strategy; move away from single-crop extension messages toward supporting crop rotations and diversified crop portfolios.

Short to medium term

- Promote a focus on drought-resistant crops (including cassava) in LUANAR's study and research programmes for climate adaptation.
- Include training on drought-resistant crops (especially cassava) in curricula for future extension staff at Natural Resources College and Mwimba College of

Agriculture. For these trainings, extension workers that obtained knowledge on cassava from either their experience in cassava growing areas or their own family background should be identified and used as resource persons. This would make use of their valuable experience and create motivation and ownership at the same time.

- Support the development of clear guidelines on how to implement participatory extension services and include them in the curricula of training institutions.
- Promote gender-sensitive delivery of extension services to improve access and utilisation of those services by female smallholders.

8.1.3 Entry point: Farmer organisations

Cassava farmers included in our research showed a high inclination for communal action and supporting each other. However, on the ground, FOs face challenges at all stages of the VC, but particularly in accessing good-quality planting material and reliable markets. FOs, as well as rural entrepreneurs, that are involved in value-adding processing struggle with self-organisation and lack business skills to commercialise their products effectively. This provides a promising entry point for supporting small-scale entrepreneurs and farmer groups in their economic activities.

Recommendations

Immediate and on-going

- Continue the facilitation of self-organisation processes among smallholders. Give particular attention to female single-headed households in Nkhotakota, who were found to be less integrated in social structures.

Short to medium term

- Include cassava FOs and small-scale processors in business skills trainings since both groups report lacking sufficient business skills.
- Organise a series of consultative meetings between FOs and processors to create an understanding of how the VC functions and, thereby, overcome organisational/supply disputes (see Chapter 6.1.1.3).
- FOs and small-scale processors should be mentored or coached in a long-term process providing hands-on assistance. Support interventions should be sequenced into phases, starting with intensive trainings then gradually moving to hands-on coaching/mentoring and finally fusing into a continuous back-

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stopping process. In the long term, these should be facilitated by local institutions like the RTCDT or its newly established affiliate the National Cassava Processing Association (NCPA) rather than external development agencies.

- Facilitate the development of a decentralised network of small-scale processors to overcome challenges that are related to the high perishability of cassava.
- Train and support FOs to semi-process their raw cassava into quality *makaka* or similar products then transport the lighter and less perishable product to the processor.
- Support a marketing strategy for better product placement of cassava and/or cassava products to improve customer awareness and acceptance as well as offer cassava products (e.g. HQCF) in smaller packages to motivate customers to try the product.
- Enable an evaluation system for beneficiaries of trainings to validate if their needs are addressed and to explore options for additional support. This system could also be used to identify grassroots innovations and their innovators, who can serve as multipliers to spread good practices.
- Promote the inclusion of marketing information and opportunities in ICT services to encourage commercially-oriented production of cassava.
- Support the strengthening of coordination amongst FOs and their interaction with other actor groups in the cassava sector.
- Promote knowledge exchange on demand-driven extension service among farmer organisations and cooperatives so that these can claim their right more effectively and motivate extension workers to fulfil their duties.

8.2 What is needed for effective value chain coordination and governance?

The need for coordination increases with the complexity of a VC and with the number of participating and supporting actors. The dual purpose of cassava as a food security crop and as industrial raw material adds a further layer of complexity. Specialisation of farmers into cassava production and seed multiplication is rare. Farmers prefer to harvest the tubers right before the rainy season so they are able to recycle their own planting material. Consequently, situations arise in which there is an oversupply of cassava which suppresses market prices, while most of the time, processors struggle to source raw material. It is poor VC coordination

and governance that hamper the much-needed supply push in Malawi, as weak links in the VC are not addressed properly. The need for organisations representing smallholders and processors (FUM, NASFAM, NCPA) to take a more active role in articulating their members' needs and interests for an effective participation in the cassava sector cannot be overemphasized.

8.2.1 Entry point: Roots and Tuber Crops Development Trust

Stakeholders in the cassava VC do not share a common vision for the sector; instead, singular and short-termed interests prevail. Information is not shared equally for the benefit of all VC actors, especially within the policy sphere and the research community.

Recommendations

Short to medium term

- Encourage, support and strengthen organisations like NCPA, FUM, NASFAM and representatives from women-lead FOs to actively participate and engage with the RTCDT. Although most of them are already members of the General Assembly, their level of involvement needs to be enhanced.
- Enable RTCDT to fulfil its role as a coordinating entity for the identified actors. A first step is strengthening their monitoring and evaluation system to encompass all actors, activities and developments in the sector. A functional monitoring and evaluation system will improve information flows and coordinate processes substantially.
- GIZ and IrishAid, as main supporters of the RTCDT, should provide capacity building and advisory services for the RTCDT and organisations representing smallholders and processors, for example the National Cassava Processor Association.
- Encourage and support the RTCDT to develop a common vision for the development of the entire cassava sector by combining an analytical with a consultative process. VC analysis and VC development need to be closely interlinked processes conducted through a multi-stakeholder platform to strengthen the sense of ownership, work toward a shared vision and exploit potential synergies.
- The revision and publication of the Seed Act should be finalised through a stakeholder dialogue process.

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- The RTCDT should be encouraged and supported in establishing a repository for all relevant studies and reports on cassava and make them easily accessible to the interested public.

8.2.2 Entry point: Government

Cassava does not receive sufficient attention and support from the GoM relative to its vital role as a poverty fighter and food security crop. Public resources are only spent on cassava during food crises and droughts. Its importance and potential for climate-change adaptation in maize-growing districts is not yet fully recognised. Furthermore, while a minimum price for cassava exists, average prices are not collected and access to information for smallholders is limited.

Recommendations

- Encourage GoM to partner with the RTCDT to select key actors and design an implementation strategy for a viable self-sustaining cassava seed distribution system that works toward a public good (i.e. not for profit).
- Conduct a financial needs assessment to establish the financial resource requirements for donor and government interventions in the development of the cassava sector.
- GoM should take responsibility for collecting and disseminating information on cassava price trends and inform smallholders about the existence of minimum prices.

9 Conclusion

Finally, we return to our initial question: Is cassava the 21st century crop for smallholders? We had a look at this question from the perspective of the livelihood-value chain nexus and concluded that cassava is suitable for smallholder farmers who face several constraints in their household assets and resources: cassava requires few inputs to produce reasonable yields under marginal conditions and is more drought tolerant than Malawi's main staple crop, maize. We found that smallholder farmers who cultivate cassava tend to score higher in their overall asset endowment and are likely to receive benefits from the diversification of staple food crops. In addition to this, the majority of smallholder farmers are eager to participate in the cassava VC for income generation.

In order to improve the livelihoods of smallholders participating in the value chain, our recommendations approached the VC from two complementary angles: 1) enhancing smallholder production capacity to generate a supply push and 2) improving governance and coordination along the different stages of the VC to facilitate its efficient functioning. In the absence of a supply push, any commercialisation effort in cassava production is likely to have adverse effects on the food-security status of smallholder households. Sufficient surplus needs to be produced before commercialisation so that smallholder households are not forced to buy back staple food items at high prices during lean periods, as has been documented in the maize sector (Campenhout & Exelle, 2011). We also recommended innovations for better coordination and governance of the cassava VC. We outlined that consultative and participatory processes function best to harmonise interests and create a joint vision. Unlike technical innovations, process innovations require longer timeframes, especially when they are established in a participatory manner.

Cassava is not a silver bullet either. It represents a valuable complementary strategy for smallholder farmers as part of a diversified crop portfolio. Apart from traditional cassava growing areas, like Nkhotakota, maize is the most important staple and receives policy support and strong private sector attention in Malawi. But maize is highly vulnerable to water stress and requires considerable production input which challenges smallholders' efforts to cultivate it in a sustainable manner without putting their livelihoods at risk. This situation is likely to be aggravated when the effects of climatic changes will play out further, increasing the occurrence of dry spells, floods and erratic rainfall patterns. As a result, smallholders will face a higher risk of production with maize in the future. Hence, cassava

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represents a crop that can complement the portfolio of livelihood strategies for income generation and food security among smallholder farmers' households.

One key advantage of maize, compared to cassava, is its high multiplication rate. Since cassava is propagated vegetatively, its planting material is perishable and bulky. This poses challenges for the cassava seed distribution system. All stakeholders and actors along the VC need to coordinate to develop a coherent chain.

Last but not least, the promotion of cassava is also affected by demand. The market for fresh, unprocessed cassava from sweet varieties developed quickly due to changing consumer preferences, which resulted in a growing demand for a cheap snack within cities. Consumer preferences fluctuate strongly. The continuous growth of both the urban population itself and its demand and preferences for food, offers opportunities for further entry points to enhance smallholders' participation along the VC in the future.

10 Bibliography

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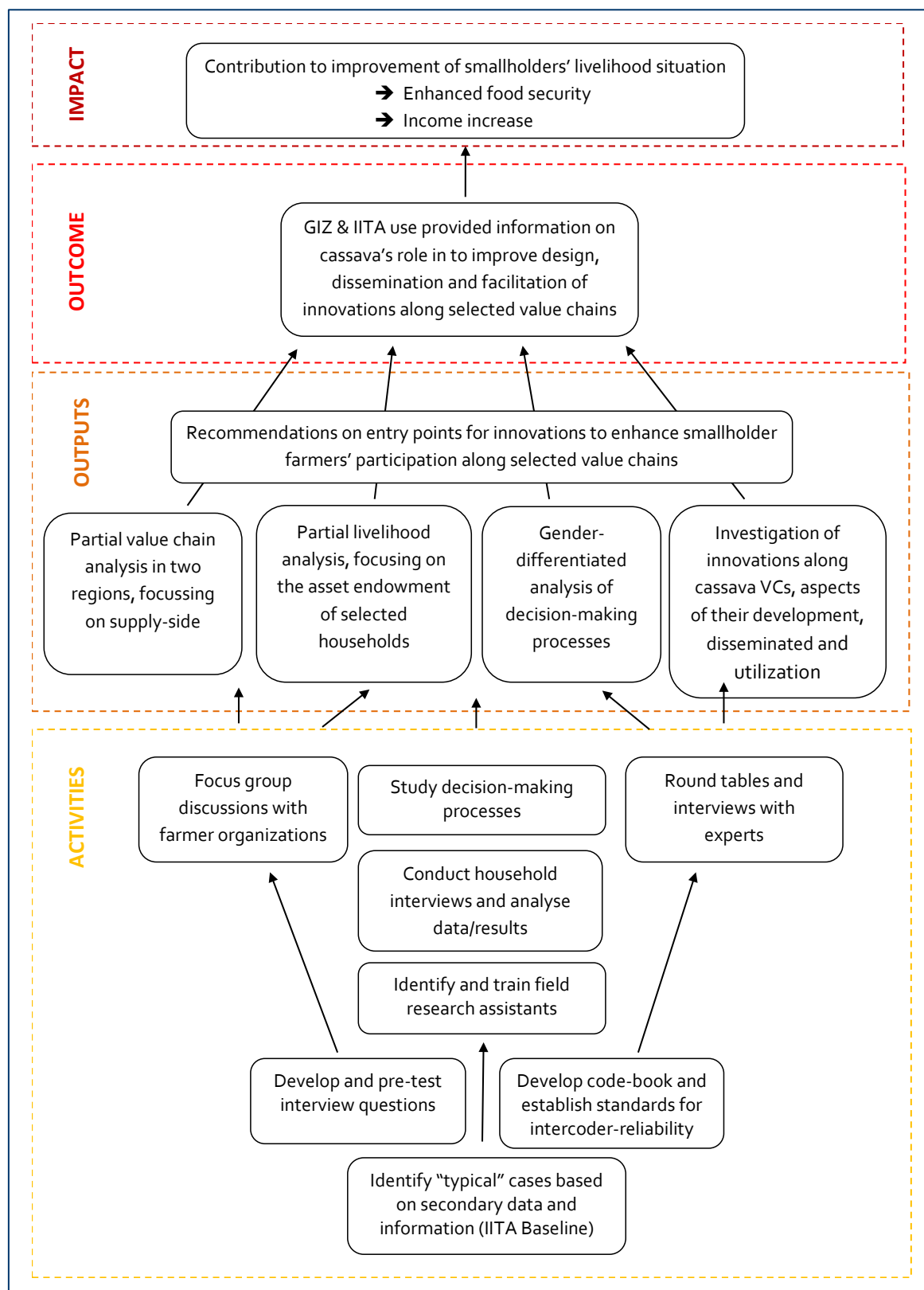
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11 Annex

Annex 1: Research project design



Source: Own compilation.

Annex 2: Work schedule

	Research Activity	17.07	24.07	31.07	07.08	14.08	21.08	28.08	04.09	11.09	18.09	25.09	02.10	09.10	16.10	23.10
Phase I (Berlin)	1st draft of all questionnaires	■	■													
	Finalization of expert interviews															
Phase II (Malawi)	Team arrival in Lilongwe			■												
	Presentation of research concept to GIZ & IITA				■											
	Pre-test and review of expert interviews				■	■										
	Conduct expert interviews				■	■	■					■				
	Pre-test and review of HH questionnaires							■								
	Draft interview guideline															
	Draft codebook									■						
	Discussion of questionnaires with IITA and NAPAS						■	■								
	Recruitment of research assistants for LUANAR					■	■	■								
	Draft research assistants training manual								■							
	Conduct training of research assistants								■							
	Translation of HH questionnaire to Chichewa															
	Pre-test in Lilongwe Rural (Mitundu EPA)															
	Finalisation of HH questionnaires							■	■							
	Draft concept for focus group discussions															
Phase III (Malawi)	Conduct HH questionnaires in LLW Rural (CAPI)								■							
	Conduct HH questionnaires in NKK (CAPI)									■						
	Data entry, cleaning, coding HH questionnaires								■	■	■					
	Conduct focus group discussions															
	Analysis of focus group discussions															
Data entry, cleaning, coding expert interviews											■					
Phase IV (Malawi)	Data analysis								■	■	■	■				
	Report writing												■		■	■
	Editing															
	1st draft report															
	Excursion week													■		
	Review of 1st draft														■	
	Final presentation															■
	Team departure															■

Source: Own compilation.

Annex 3: List of expert interviews

No.	Date	Organisation	Interview Partner	Position
1	17.07.2017	IITA	Pheneas Ntawuruhubga	Breeder Cassava Programme
2	03.08.2017	NAPAS	Flora Janet Nankhuni, PhD	Chief of Party
3	03.08.2017	NAPAS	Joseph Kanyamuka	Policy and Research Analyst
4	04.08.2017	IITA	Arega Alene PhD	Country Representative
5	03.08.2017	NAPAS	Joseph Dzanja	Senior Lecturer LUANAR
6	07.08.2017	NASFAM	Frazer Mataya	Climate Smart Agriculture Programme Coordinator
7	11.08.2017	GIZ	Wilhelm Stolz	Development advisor
8	11.08.2017	FAO	Vincent Kaitano	Consultant
9	11.08.2017	LUANAR	Paul Fatch	Lecturer in Extension and Rural Development
10	14.08.2017	NAPAS	Joseph Kanyamuka	Policy and Research Analyst
11	14.08.2017	MoAIWD	Eviness Nyalugwe	Deputy Director; Crop Development – Horticulture
12	15.08.2017	LUANAR	Alexander R. Phiri, PhD	Head of Department
13	16.08.2017	GIZ	Dr. Volkmar Engelbrecht	Senior Technical Advisor GIAE
14	17.08.2017	GIZ	Zewdy Gebremedhin	Consultant GIAE
15	17.08.2017	C:AVA	Vito Sandifolo	Country Manager
16	17.08.2017	C:AVA	Veronica Grumela	Production Expert
17	17.08.2017	C:AVA	Edmund Mfutso	Business Development Expert
18	18.08.2017	USAID	Stacia Nordin	Nutrition Education Specialist
19	18.08.2017	C:AVA	Patrick Kaliwo	Lead farmer
20	18.08.2017	GIZ	Sekani Kateta	Programme Officier GIAE
21	21.08.2017	TLC	W. Trent Bunderson, PhD	Co-Founder and Executive Director
22	23.08.2017	DARS	Dr. Wilkson Makumba	Director
23	23.08.2017	ACE	Kristian Schach Moller	CEO
24	28.08.2017	GIZ	Moritz Reigl	Intern GIAE
25	01.09.2017	IITA	Chris Moyo	Project Officer Malawi (GIZ Project & breeding programme)
26	01.09.2017	IITA	Linette Chatsika	Monitoring & Evaluation Officer
27	01.09.2017	IITA	Alexander Nganga	Technical Field Officer
28	09.09.2017	-	Masimbe	Owner of a processing unit
29	12.09.2017	-	Chisi	Owner of a processing unit
30	21.09.2017	MoAIWD	Mathias Nkhoma	Asst. Chief Economist, Dept. Crop Development – Hortic.
31	28.09.2017	RTCDT, Mlimi Enterprises	Joseph Jaffu	Vice-Chairman, CEO

Source: Own compilation.

Annex 4: Profiles of the farmer organisations of the Focus group discussions

Name	Chigonthi Cassava Agroprocessing and Marketing Cooperative Society Ltd.	Mlira Club	Mkazimasika Cassava Cooperative	Chinangwa ndi Mbatata Roots and Tuber Enterprise (CMRTE)	Nasawa Cassava Cooperative	Dzaone Cassava Cooperative
District	Lilongwe	Lilongwe	Nkhotakota	Zomba	Zomba	Zomba
Established	2006	2015	2010	no data	2016	2014
Members	54	15	250	no data	36	218
F/ M	34 / 20	7 / 8	150 / 100	no data	8 / 28	153 / 65
Fee in MK	500 yearly	5000 once	500 yearly	500 yearly	5000 yearly	500 yearly
Purpose	Improved livelihood through sale of cassava at profit	Improved livelihoods through better service from ES and access to markets	Taking cassava farming as a business and ensure food security of members	Promote cassava through community processing (buy fresh cassava from smallholders, process into HQCF, sell at rural markets)	Ensure self-reliance of members through production of cassava and other crops	Promote the cassava value chain through community processing of HQCF and sell to rural markets
Benefits	Purchase of inputs at lower prices, relatively higher selling prices	Improved access to markets, farm inputs and ES	Improved access to ES, markets for cassava and additional support	?	Access to training, planting material and markets	Access to market information, community loans and inputs

Source: Own compilation.

Annex 5: Focus Group Discussion guidelines (example)

Introduction	Time
<ul style="list-style-type: none"> ▪ Welcome everybody and give thanks for coming ▪ Explain why we are here (research background) ▪ Give an overview of the schedule and topics 	8:30 – 8:45
Part I: Functioning and activities of the FO	
Functioning of the FO	8:45 – 9:00
<ul style="list-style-type: none"> ▪ What was the motivation to found the FO? ▪ What is the vision of the FO? ▪ What are the benefits of being a member in the FO? ▪ How are benefits shared among members? 	
Activities of the FO	9:00 – 9:30
What do you produce as a group?* Only cassava or also other crops?	
<p><i>Production of cassava:</i></p> <ul style="list-style-type: none"> ▪ What inputs do you need? / Where do you get them from? ▪ Do you use screened seed / improved cassava varieties? ▪ What varieties precisely? <p><i>Seed multiplication:</i></p> <ul style="list-style-type: none"> ▪ What inputs do you need? ▪ Do you use improved cassava varieties? / Which varieties? ▪ Where do you get your seed bundles from? ▪ How do you store/conservate your seeds? / How do you recycle? ▪ How often do you buy new/fresh bundles? ▪ To whom do you sell your seeds? To what price? Do you have price information for cassava seeds? ▪ Who does the screening of your seeds? Do you get support from DARS personnel? 	
How do you produce cassava? *	
<ul style="list-style-type: none"> ▪ Do you know Good Agricultural Practices (GAP)? Which ones? ▪ Do you apply the GAP? Ask for the reason why the do it or don't do it? (e.g. intercropping, mulching, crop rotation, CA) ▪ How do you plant your cassava (e.g. Brazilian style)? ▪ Do you check your cassava for diseases? ▪ Do you produce together? / Do you share tools, land, inputs? ▪ Who does what (gender differences?) ▪ Who does things differently (innovation peers)? What? 	
Harvest*	
<ul style="list-style-type: none"> ▪ Who does the harvesting? ▪ When do you usually harvest and why? ▪ Do you harvest the whole field or do you harvest in parts? 	

Cont. Annex 5: Focus Group Discussion guidelines (example)

<p>Post-harvest Ask openly: What happens after the harvest?</p> <p><i>Selling to local processor</i></p> <ul style="list-style-type: none"> ▪ When do you sell the harvest? How (underground/ harvested)? ▪ What quantities do you sell? Do you have additional surplus? ▪ To what price do you sell? Who determines the price? Do you negotiate? ▪ Who does the transport? Why and how? What are the costs of transport? <p><i>Selling to other actors/ markets</i></p> <ul style="list-style-type: none"> ▪ Do the buyers approach you or do you search buyers/markets? ▪ How do you look for new buyers? ▪ Who does the transport? To what price? <p><i>Production of Kondowole</i></p> <ul style="list-style-type: none"> ▪ When do you harvest? / How much do you produce? ▪ Who does the production? ▪ To whom do you sell it? To what price? Do you negotiate the price? ▪ Who does the transport? To what price? <p><i>Production of Ethanol</i></p> <ul style="list-style-type: none"> ▪ Who had the idea? ▪ How many members are involved? <p>* Ask if they get help/support from external actors</p>	
Break for splitting the group into one men and one women group	9:15 – 9:30
Part II: Analysis of problems and challenges	9:30 – 10:15
<p>➔ Ask for problems and challenges and make lists:</p> <ul style="list-style-type: none"> ▪ For each of the activities (inputs, production, harvest, post-harvest) ▪ For problems/challenges in the functioning of the cooperative <p>➔ Make a collection of all the problems that are mentioned (this can be individual problems and problems for the whole group)</p> <p>Make a “blind and silent” vote: which one of the activities/categories (input, production etc.) are the most challenging?</p> <p>➔ Everybody closes the eyes. Then the facilitators mentions one activity after another. After each activity it is asked who thinks that this is the most challenging activity, if participants want to vote for it, they have to rise their hand.</p> <p>➔ This way we have create a ranking to know which activities are most challenging</p> <p>➔ Afterwards, we discuss the sub-challenges for each activity to become more detail on the challenges and underlying problems</p> <p>➔ Always ask for the root causes of problems: WHY is XY a problem? Please explain....</p>	

Cont. Annex 5: Focus Group Discussion guidelines (example)

Break of 20 min. with refreshments	10:15 – 10:35
Presentation of results of problem analysis	10:35 – 11:10
→ Come together in the big group (men and women) and present the results, let the big group discuss and reflect together	
Part III: Find solutions for the problems	11:10 – 11:45
<ul style="list-style-type: none"> ▪ What is the goal or more desirable situation ▪ What can the group members do themselves to reach this more desirable situation? → If easier/helpful, find solution for parts of the problem ▪ Which assets do they have to get there? → External support can only be one part of the solution! ▪ Which steps could be implemented to solve the problem? ▪ Who would be the persons that would have to take action? 	
Closing of the discussion	11:45 – 12:00
<ul style="list-style-type: none"> ▪ Wrap up of the outcome ▪ Closing remarks, explain what we plan to do with the results ▪ Thank everybody for coming and wish a safe journey back home 	

Source: Own compilation

Annex 6: Instruments used during household interviews

Firstly, we administered a semi-structured questionnaire to the household head of participating households to establish their livelihood situation. We collected information on the characteristics of the household and its resource endowment.

Secondly, we administered semi-structured questionnaires along with a choice experiment / scenario game to both spouses of cassava growing and non-cassava growing households in separate sessions to capture information on their decision-making processes and gender dynamics.

The interview guidelines and instruments are too extensive to be fully inserted here. The instruments are available as online version on the SLE website. (<https://www.sle-berlin.de/index.php/en/publications/sle-overseas-projects>).

Annex 7: Coding matrix for Household Asset Endowment

(exemplary for Natural capital)

Type of capital	Indicator	Attribute	Unit	Category or value			Points				
							max	scored	total score	total	In %
Natural	Land allocation	Total cultivated area	Acres	> 10 acres [2 points]	5-10 acres [1 point]	< 5 acres [0 points]	2 pts max		/ 7 pts	7 pts.	
		Relation cultivated to uncultivated area	Relation	majority cultivated [1 point]	equal amounts [0.5 points]	majority uncultivated [0 points]	1 pts max				
	Irrigation	Irrigation technology	Level	High-technology [1 point]	Low-technology [0.5 points]	None [0 points]	1 pts max				
	SNRM	Measures against soil degradation	Status	Prevalent [1 point]	None [0 points]		1 pts max				
	Livestock	Animals	Species / quantity	Cattle [2 points]	Small livestock with majority chicken and poultry [1 point]	Less than 10 animals of small livestock [0 points]	2 pts max				

Source: Own compilation

Annex 8: Challenges reported in the focus group discussions

Challenges were collected during FGDs with Chigonthi, Mkazimasika, Mlira and Dzaone (before the subsequent ranking). The gender split for the discussion was only implemented in Chigonthi and Mkazimasika, mixed groups' challenges were added to the male column; processors and vendors challenges are not included.

	Male	Female
Seed multiplication	<ul style="list-style-type: none"> ▪ Seed supplier cheat and sell mixed varieties (quality loss) (mentioned 2 times) ▪ Scarcity of planting material (which results in low seed multiplication) ▪ Planting material is attacked by diseases ▪ Insufficient screening of planting material ▪ Contamination of planting material due to mixing of varieties/old planting material ▪ Lack of land for seed multiplication ▪ Climate variability/climate change → droughts as well as excessive rainfall ▪ Negligence to follow GAP during the seed production ▪ Compromised quality of planting material due to long transportation ▪ Poor conservation/management of planting material (drying, bruising, shrinking) ▪ Market/buyer for seed not available (apart from GIZ, C:AVA, government) 	<ul style="list-style-type: none"> ▪ Scarcity of planting material (which results in low seed multiplication) ▪ Late delivery of planting material → loss of quality due to bruises and drying; delay of planting → drying of roots and stems ▪ Unavailability of fertiliser

Cont. Annex 8: Challenges reported in the focus group discussions

	Male	Female
Input	<ul style="list-style-type: none"> ▪ Inability to use hired labour in cassava production due to insufficient financial resources (esp. for weeding) (mentioned 3 times) ▪ Shortage of land for increased cassava production (mentioned 2 times) ▪ Scarcity of improved planting material ▪ Scarcity of sweet variety planting material (highly demanded in the area) ▪ Over recycled planting material → yield decrease (mentioned 2 times) ▪ Insufficient training on seed multiplication, screening for diseases in cassava cuttings ▪ Inability to access chemicals for controlling diseases and pests ▪ Scarcity of potash fertiliser for increased production (was recommended by ES) ▪ Lack of proper farming tools 	<ul style="list-style-type: none"> ▪ Inability to use hired labour in cassava production due to insufficient financial resources (mentioned 2 times) ▪ Inadequate land for cassava planting materials multiplication due to financial constraint ▪ Household food insecurity problems that undermines the ability of household members to efficiently execute field activities ▪ Inability to buy quality planting materials for cassava due to lack of sufficient financial resources
Production	<ul style="list-style-type: none"> ▪ Theft is common for sweet cassava varieties (mentioned 3 times) ▪ Damages due to termites (mentioned 3 times) ▪ Damages by livestock (mentioned 3 times) ▪ Droughts and spell ▪ Uncontrolled fire damages cassava in the field ▪ Diseases (due to mixing varieties) 	<ul style="list-style-type: none"> ▪ Uncontrolled fire and mice damage cassava in the field (mentioned 2 times) ▪ Diseases (mentioned 2 times) ▪ Theft especially for sweet cassava varieties ▪ Damages due to termites ▪ Damages by livestock
Harvest	<ul style="list-style-type: none"> ▪ Insufficient operating capital to hire casual labour for harvesting ▪ Lack of skilled labourers to harvest cassava ▪ High cost of labour, especially when there is high demand at the factory ▪ Harvesting is difficult and time consuming when it has to be done during the dry season ▪ Damage in storage by mice especially for sweet varieties ▪ Rotting of cassava roots more especially when farmers decide to keep cassava in the field for better prices in future ▪ Storage problem due to the perishability nature of cassava 	<ul style="list-style-type: none"> ▪ High costs of labour for harvesting

Cont. Annex 8: Challenges reported in the focus group discussions

	Male	Female
Post-harvest	<ul style="list-style-type: none"> ▪ Unreliable market (mentioned 4 times) → monopolistic market due to processor, dependency on farm gate sale ▪ Low market prices due to monopolistic market (mentioned 3 times) ▪ High transportation costs (mentioned 2 times) ▪ Use of traditional methods for peeling cassava. This method is slow and that it demands a lot time ▪ Unreliable transportation agreements ▪ Insufficient market (apart from processor) (No immediate market is available, sometimes cassava stays in the fields for 2-3 years → quality loss) ▪ Late payment of processor (only after selling the products) ▪ Lack of market information on prices and markets raw cassava ▪ Lack of attention of government and private sector for cassava → no standard measurements for selling cassava; no private sector investment in production of quality seed ▪ No own value addition → dependency on processor for processing their cassava/ no processing facilities available 	<ul style="list-style-type: none"> ▪ High transportation (mentioned 2 times), transport is time consuming (Likoma Island) ▪ Insufficient market (apart from processor, mentioned 2 times). No immediate market is available, sometimes cassava stays in the fields for 2-3 years → quality loss ▪ No racks for drying cassava flour after processing ▪ Marketing → processor only buys small quantities ▪ Late payment of processor ▪ No processing plant was established though training on processing was provided ▪ No own value addition → dependency on processor for processing their cassava
Group functioning	<ul style="list-style-type: none"> ▪ Lack of sufficient operating capital for running affairs of the cooperative (mentioned 2 times) ▪ Low turn up at important meetings (mentioned 2 times) → no recognition of membership benefits, no disposition to pay the weekly fees ▪ Lack of leadership training (mentioned 2 times) (dissatisfaction with the selection of leaders) ▪ Lack of trust among members (mentioned 2 times) ▪ Lack of access to credit ▪ No office for the cooperative ▪ Members change decisions on short notice 	<ul style="list-style-type: none"> ▪ Discouragement of members due to membership fees ▪ Unequal appreciation/undue favouritism of members in certain positions ▪ Some important information is not communicated to wives if husbands are the ones who attend meetings

Source: Own compilation

Annex 9: Scenario Game for Cassava-growers

Scenarios	Option 1	Option 2	Option 3
1. Production	Imagine you have access to a new disease-free cassava variety that is exactly that same as your current one, except that it gives you double the yield and provides good quality planting material.		
	I would not want such a new variety.	I would plant the same area with this new variety to get double the yield.	I would plant a much smaller area with this variety, because I don't need more cassava.
2. Access to inputs	Imagine you have received the planting material for this new disease-free and higher yielding cassava variety for free for the last two seasons, but now you have to pay for it.		
	I will ask someone else for his/her traditional variety, because I can get it for free.	I would be willing to pay for a bundle of planting sticks for the improved and disease-free variety.	
3. Commercialisation	Imagine you have had a good harvest and you can sell part of it.		
	I am not interested in selling cassava. Any surplus I would keep or give to others for free.	I take the price from a buyer who is coming to my farm to pick up the produce.	I transport the produce to the nearest market myself for a much better price.
4. Communal marketing	Imagine you can team up with a few other farmers in your village to work together in order to fetch a better price for your cassava produce.		
	I am not interested in teaming up with others.	I am prepared to team up with others to put 1/2 ton of good quality cassava together in one place for a much better price.	I am interested in joining a processing association to make cassava flour in order to add even more value to my cassava produce.

Source: Own compilation

Annex 10a: Options for non-cassava-growers, underlying incentives

No.	Option	Underlying incentive
1	Free access to a high yielding, disease-free cassava variety.	higher productivity, less land needed
2	Training on how to run a business based on cassava production.	business skills / income generation
3	Bicycle provided for free if the farmer starts supplying a processor with cassava.	overcoming asset limitations
4	Middleman comes to the farm and collects the cassava harvest for the regular price of the area.	access to market / commercialisation
5	Training on better farming techniques that include cassava and reduce labour demand on the farm.	reduction of the labour demand for farming operations

Source: Own compilation

Annex 10b: Scenarios for non-cassava-growers, discentives

No.	Scenario	Underlying motivation for change
1	Due to dry spells maize harvests fail in Malawi in the coming seasons.	changing environmental conditions
2	The Government stops FISP and advises farmers to grow cassava instead of maize.	changing policy environment
3	The prices for all major cash crops drop to half of last year's prices.	changing market conditions

Source: Own compilation

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