C:AVA

Cassava: Adding Value for Africa

Driving demand for cassava in Tanzania: the next steps

Draft report

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May 2012

UNIVERSITY of GREENWICH | Natural Resources Institute

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List of acronyms and abbreviations

BMGF	Bill and Melinda Gates Foundation
C:AVA	Cassava: Adding Value for Africa
CFC	Common Fund for Commodities
CIAT	International Center for Tropical Agriculture
CIF	Cost, Insurance and Freight
DSM	Dar es Salaam
EPZ	Export Processing Zone
GDP	Gross Domestic Product
GLCI	Great Lakes Cassava Initiative
GoT	Government of Tanzania
HQCF	High Quality Cassava Flour
IITA	International Institute of Tropical Agriculture
MoA	Ministry of Agriculture, Food and Cooperatives
MITM	Ministry of Industry and Trade and Markets, Tanzania
NGO	Non-Government Organisation
NRI	Natural Resources Institute
TBS	Tanzania Bureau of Standard
TFDA	Tanzania Food and Drugs Authority
TFNC	Tanzania Food and Nutrition Centre
USP	Unique Selling Proposition
VPG	Village Processing Groups

Exchange rate (April 2012): 1 US$ = 1,590 TSh (Tanzanian Shillings)

Acknowledgements

The Team would like to thank both the Tanzanian Food and Nutrition Centre (TFNC) in Dar es Salaam and the Tanzanian Food and Drug Authority (TFDA) in Mwanza for assisting us with logistics and information.

This study is an output from a research project funded by the Bill and Melinda Gates Foundation (BMGF) for the benefit of developing countries. The views expressed in this paper are those of the authors and do not necessarily reflect the views or policies of BMGF.

Executive summary

Recent advances in the field of cassava processing, including work in Tanzania by the Bill and Malinda Gates Foundation (BMGF) 'Cassava: Adding Value for Africa' (C:AVA) project have demonstrated that rural poverty can be addressed by upgrading value chains for new cassava products such as High Quality Cassava Flour (HQCF). This report revisits the value chains for cassava and cassava products in Tanzania and aims to develop new ideas for future interventions based on an up to date picture of the key and emerging demand drivers.

The field work was carried out by a Team from the Natural Resources Institute (NRI), United Kingdom, and the Tanzanian Food and Nutrition Centre (TFNC). The field work was completed between 15th and 27th April 2012 and included a comprehensive review of the state of the art, field interviews with key informants and a short workshop with cassava breeders.

Cassava production in Tanzania is estimated at 7 million metric tonnes (mt) per annum. It is mainly a subsistence crop where 84% of its total production is used for human food, making it second after maize in importance as food crop. The remaining amount is for other uses such as animal feed, alcohol brewing and starch production.

Cassava is identified as one of the emerging market oriented commodities that could contribute to improve the livelihood of small holder farmers in the country. Commercialization of higher-value cassava products is already happening at small scale with HQCF being the main product traded. At least 319 mt of HQCF were produced in 2011 compared to 100 mt in 2010 under two projects currently implemented in collaboration with TFNC: 'Cassava: Adding Value for Africa'(C:AVA) funded by BMGF and 'Small Scale Cassava Processing and Vertical Integration of the Cassava Sub-sector in East and Southern Africa, Phase II' funded by the Common Fund for Commodities(CFC).

There is clear evidence of market failure emerging in the 'new' HQCF sector. Existing HQCF producers are practicing price discrimination between markets and sub-sectors. As a result, some sectors are being under-supplied or are over-paying. This is a symptom of an emerging cassava processing sector in Tanzania that has not yet reached sufficient scale to begin to meet demand and consolidate.

The issue of competition between the long-established traditional domestic value chains (such as the ones for fresh cassava roots and traditionally processed products from rural to urban areas) in Tanzania and the new processed cassava sub-sector has, to date, not been well documented. Currently, fresh cassava sells in Dar es Salaam (DSM) wholesale market at about 50 – 120 TSh/kg making this a possible attractive alternative to processing. More research is needed to clarify where the competition between fresh sales, traditional and new processing

might occur so that these regions can be avoided in future cassava processing plans (e.g. where new cassava products are likely to be uncompetitive).

On the demand side, the Team has identified an estimated potential long-term requirement for between 530,000 mt and 640,000 mt of cassava root equivalent, which could increase to 570,000 mt – 720,000 mt if the Government of Tanzania (GoT) made cassava inclusion in bread and biscuits mandatory through its on-going Presidential Cassava Initiative. Quite a lot of this requirement will come from two proposed starch factories based around large core-farms. However, we estimate that 55-70% of this opportunity would be available to small-scale producers (300-410,000 mt without the Presidential Cassava Initiative and 340 – 490,000 with).

Two products identified by the Team show genuine promise for growth. These are HQCF, if larger quantities of reliable supplies are ensured, possibly by including the introduction of larger scale operations, and development of an improved dried cassava chip product based on traditional 'makopa' and targeted at specific sectors such as the fast growing animal feed industry.

The economic, social and environmental viability of different scales, locations and technologies, and different scaling-up strategies, need to be considered in greater depth. We recommend further, more detailed economic, social and environmental viability research before decisions are made on the way scale is derived.

The analysis highlights the under-supply of Tanzania's wheat and maize milling markets with HQCF. In particular we have identified potential for:

- Replacement of wheat flour at household level (70-80% of wheat flour consumption in Tanzania = 11-25,000 mt/year HQCF).

- Replacement of wheat flour in commercial bread and biscuits (7-15,000 mt/year HQCF).

- An additional demand of between 40 - 80,000 mt/year of HQCF is envisaged annually if GoT makes inclusion in industrial processing mandatory. This is less than in other countries where mandatory replacement has been tried because of the scale of home-baking in Tanzania.

In the small-scale milling sector the Team thinks that the potential to promote HQCF as a blended product in 'ugali' (stiff porridge traditionally prepared with maize flour) has not been fully developed. We believe that a well organised marketing and promotion campaign could create a demand for around 12,500 mt of HQCF for blending with maize flour in ugali preparation.

The Tanzanian animal feed sub-sector is growing rapidly. An estimated demand of 40 – 45,000 mt/year (160 – 180,000 mt/year of fresh cassava root) is estimated. Using HQCF in this sector is not economically viable, but supplying

higher quality cassava chips ('improved' makopa) probably would be. Conditions conducive to inclusion of cassava in animal feed include:

- High transport costs making local feed production economic in areas where livestock husbandry is undertaken.
- Sources of cheap animal protein are available (e.g. un-utilised lake shrimp).
- Scale economies might be available in areas where large quantities of cassava are produced (e.g. the Lake Region).
- New transport infrastructure (e.g. roads) reduces transport costs and could make profitable sales of 'improved' cassava chips to the area around Dar es Salaam where livestock industry is growing at steady pace.
- Recent investment in pelleting equipment makes cassava use more acceptable.
- Seasonality and price volatility of maize.

In the beer sector, the Team found no plans for clear beer production using cassava. However, a small but possibly valuable opportunity exists in the local traditional beer sector. This market would need 2,500 – 3,000 mt/year of 'improved' makopa to meet current demand.

Several other minor sources of demand were identified and have real promise but need more research. These include:

- The fast expanding paper and packaging sector.
- Users of imported maize syrup (sweet and beverage manufacturers).

Currently, using cassava in the textile and building materials sector in Tanzania does not look promising, but this should be reviewed as conditions in these sectors are dynamic.

Key success factors for meeting the needs of the identified cassava demand drivers are:

- Production scale – each source of demand needs a minimum guaranteed quantity of supply before committing to using cassava.

- Quality – being able to differentiate quality and price between areas of demand will be important to successfully growing the processed cassava sector.

- Improved production efficiency – meeting new cassava demands with existing productive capacity will require key production constraints to be overcome including resolving issues of disease, improved distribution and adoption of improved planting material and increasing farm unit productivity.

The Tanzanian plant breeding plan has, to date, largely focussed on farmer identified traits, including high dry matter, disease resistance and drought

resistance. Potential exists for a more market-driven client-oriented cassava breeding approach. Any gain in protein content, for example, would greatly enhance the economics of using cassava in animal feed.

Working on the basis of a conservative 350,000 mt/year demand for fresh cassava identified during the mission and an estimated per farmer production of 15mt/year and a typical farm size of 1 ha allocated to cassava production per household, a project that reaches at least 25,000 small-scale producers is envisaged. This would benefit producers of fresh cassava roots, intermediary processors (including village processing groups), cassava products end-users and other actors in the chain (such as traders and transporters).

In sum, the Team have located a number of exciting possible cassava demand drivers in Tanzania based in several geographical regions of the country. Expanding cassava processing in the Lake Region looks particularly interesting. In this light, we have made a number of recommendations for additional targeted sub-sector feasibility studies which should confirm this analysis and work toward developing a sector and demand-driven specific series of cassava development plans.

1. Introduction and background

The purpose of this report was to revisit the understanding of the Tanzanian market for cassava and cassava products building on the findings of other studies (such as Posthumus et al., 2009; MMA 2007 and 2008; Promar Consulting, 2011). Terms of Reference of the mission are provided at Annex I. In summary, the aim of the mission was to review current and prior efforts on developing cassava value chains in Tanzania, identify options for future investments in cassava value chains beyond HQCF. A list of persons met and interviewed by the Team is provided at Annex II. Field work was completed between 15th and 27th April 2012.

This report was prepared by a Team consisting of Ben Bennett, Diego Naziri, Grace Mahende and Elifantio Towo.

Cassava is an increasingly important crop in Tanzania: it is the second most important food crop after maize in terms of production volume and per capita consumption, supporting the livelihood of 37% of farmers in rural areas. The majority of the poorest farmers (59%) are reported to grow the crop for food.

Cassava production in 2010/2011 in Tanzania was estimated at 1,548,841 mt grain equivalent (see Table 1).

Table 1 - Cassava production trend 2000/2001 to 2010/2011

Year	(Tonnes - Grain Equivalent)
2000/01	1,445,457
2001/02	1,725,380
2002/03	1,320,698
2003/04	1,480,196
2004/05	1,846,387
2005/06	2,052,767
2006/07	1,732,978
2007/08	1,797,453
2008/09	1,972,148
2009/10	1,464,056
2010/11	1,548,841

Source: Ministry of Agriculture Food and Cooperatives.
Note: data do not include Zanzibar.

Cassava is widely grown in all farming systems in Tanzania due to its adaptability to various soils and agro-ecological conditions. The main cassava producing areas in Tanzania are the Lake Victoria zone (Mwanza, Mara, Kagera

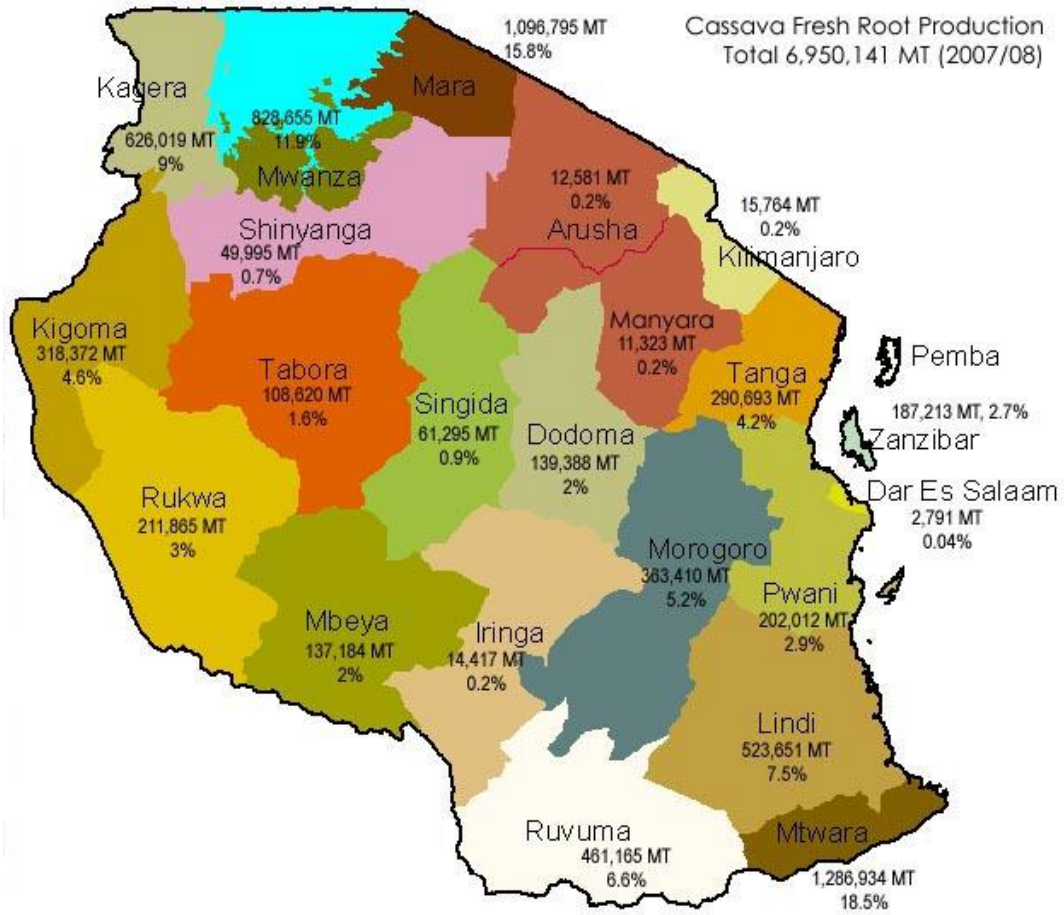
and Shinyanga regions), the Southern zone (Lindi and Mtwara regions and Tunduru district in Ruvuma region), the Eastern zone (Morogoro, Tanga, Coast, Dar es Salaam) and Zanzibar (Pemba and Unguja islands). Table 2 and Figure 1 show the cassava production in Tanzania by zones and regions, respectively.

Table 2 -Cassava production by zones of Tanzania

Zone	Proportion of national cassava fresh root production (%)	Per household annual cassava fresh root production (mt)
Lake	37.43	1.65
Southern	26.05	3.74
Eastern	12.36	0.56
Southern Highlands	11.86	0.64
Western	6.14	0.80
Central	2.89	0.34
Zanzibar	2.69	1.01
Northern	0.57	0.05

Note: based on 2007/08 Cassava fresh root production and 2002 Population Census data

Figure 1 - Regional production of fresh cassava roots (mt), and percentage of national production of Tanzania in 2007/2008



Several initiatives are supporting the development of the cassava value chain in Tanzania. For instance, presently two projects are being implemented in collaboration with TNFC in order to opening new market opportunities for processed cassava: 'Cassava: Adding Value for Africa' (C:AVA) funded by BMGF and 'Small Scale Cassava Processing and Vertical Integration of the Cassava Sub-sector in East and Southern Africa, Phase II' funded by the Common Fund for Commodities (CFC). Both projects promote the production and commercialization of High Quality Cassava Flour (HQCF), an 'improved' quality cassava flour with low cyanide levels based on grating fresh cassava at village level, removing water by pressing to make 'grits' and supplying these dried 'grits' to small flour mills who grind to produce a non-fermented, clean, white HQCF. This HQCF can be used as a food directly or blended with other foods as a replacement for other sources of carbohydrate or starch such as maize and wheat flour. So far, a small amount (reported as 319 tonnes) of HQCF has been used by biscuit manufacturing firms and bakeries as replacement of wheat flour. Smaller volumes have been used as ingredients for snacks.

The C:AVA project, led by NRI, supports the development of value chains for HQCF in Ghana, Tanzania, Uganda, Nigeria and Malawi to improve the livelihoods and incomes of at least 70,000 smallholder households. The project focuses on three key intervention points in the value chain: a) ensuring a consistent supply of raw materials; b) developing viable intermediaries acting as secondary processors or bulking agents in value chains; and c) driving market demand and building market share (in, for example, bakery industry, components of traditional foods or plywood/paperboard applications). Progress by C:AVA in Tanzania was achieved through the development of 18 Village Processing Groups (VPG's) and three processing intermediaries in four districts of the Southern zone (Mtwara region). The overall amount of HQCF produced increased from 4 mt in 2009 to 72 mt in 2010 up to 207 mt in 2011.

The 'Small Scale Cassava Processing and Vertical Integration of the Cassava Sub-sector in East and Southern Africa, Phase II' Project is funded by CFC and managed by the International Institute of Tropical Agriculture (IITA) Tanzania. Phase II of the project, launched in February 2010 and operating in Tanzania, Zambia and Madagascar, broadly aims at developing the income generating potential of cassava by capitalising on the existing, but unexploited, profitable market opportunities for cassava processed products identified by Phase I of the project (implemented between 2003 and 2007). In particular it promotes market-oriented and sustainable cassava production methods, dissemination of appropriate and more efficient higher-scale processing techniques for HQCF production, and vigorous market expansion approaches. In Tanzania it is implemented in the Pwani region, Coast zone, where four intermediate processing centres for HQCF production have been established. They are supplied by either their own cassava plantations or out-grower schemes. Furthermore the involvement of large farmers has been pursued by the project. An amount of 28 mt and 112 mt of HQCF have been produced in 2010 and 2011, respectively, under the auspices of the CFC project.

As a result of these two projects and previous initiatives that have been implemented in Tanzania since the beginning of the 2000s, the production of HQCF has steadily increased. In 2004, only eight mechanized small-scale cassava processing units were in operation. Nowadays, the total number of these processing units is estimated at 150, mainly located in the Southern (Mtwara region) and Coast zones (Pwani region). While the overall installed theoretical production capacity of graters is estimated at around 90,000 mt/year, most of these units are not processing regularly. The production of HQCF is limited by several factors including insufficient supply of quality grits, insufficient pressing capacity and poor linkages with a still underdeveloped market.

Having proven that cassava end-users have potential to drive demand for fresh and processed cassava, and therefore generate income for both intermediary processors and cassava producers capable of producing a surplus - benefiting from new cassava production practices, management regimes and improved planting materials - the question is: do demand drivers exist for a substantially increased cassava supply in Tanzania? This report attempts to answer this question.

2. Methodology

The following methodology was adopted to address the Terms of Reference. A re-assessment of the available literature was conducted to ensure that all new research on the value chain for cassava in Tanzania since the previous study was located.

A brief workshop was held in the Natural Resources Institute (NRI) with key informants from the Cassava: Adding Value for Africa (C:AVA) project. This workshop focused on clarifying the value chain for cassava and cassava products and identifying the recent changes, including those resulting from the increased availability of High Quality Cassava Flour (HQCF) in Tanzania. Several sectors of interest were identified.

A Team was established consisting of two Market Economists from NRI, the C:AVA Country Representative and a Food Technologist from TFNC (who is also Coordinator of the CFC–funded cassava project).

The strategy consisted of identifying, in a systematic manner, the opportunities and constraints of cassava-based products for each target sector and sub-sector. In order to assess the demand for these products in the different value chains, it was necessary to identify the suitable cassava products (meeting the required technical specifications), the amount and way the buyer would like it delivered, the price the buyer would be ready to pay and whether this price is attractive to cover the additional costs for processing and transporting the product.

In Tanzania, the Team developed a list of questions to apply to the firms and sectors identified during the workshop (see Annex III). Industries in three areas of Tanzania were visited by the Team: Dar es Salaam, Arusha and Mwanza.

Besides assessing the current and potential demand for cassava-based products and new opportunities for investments, the Team was also asked to identify the needs of cassava demand drivers and potential lead buyers in terms of specific and distinctive traits and qualities searched in raw and processed cassava and to understand the suitability of currently available cassava varieties in Tanzania. In order to address this, the Team, on the one hand, discussed the issue with existing and potential lead buyers and, on the other hand, held a workshop and invited some key-cassava breeders to attend. The findings of the discussion are presented in the report, a list of participants is at Annex IV and the workshop outline is at Annex V.

3. Cassava demand drivers

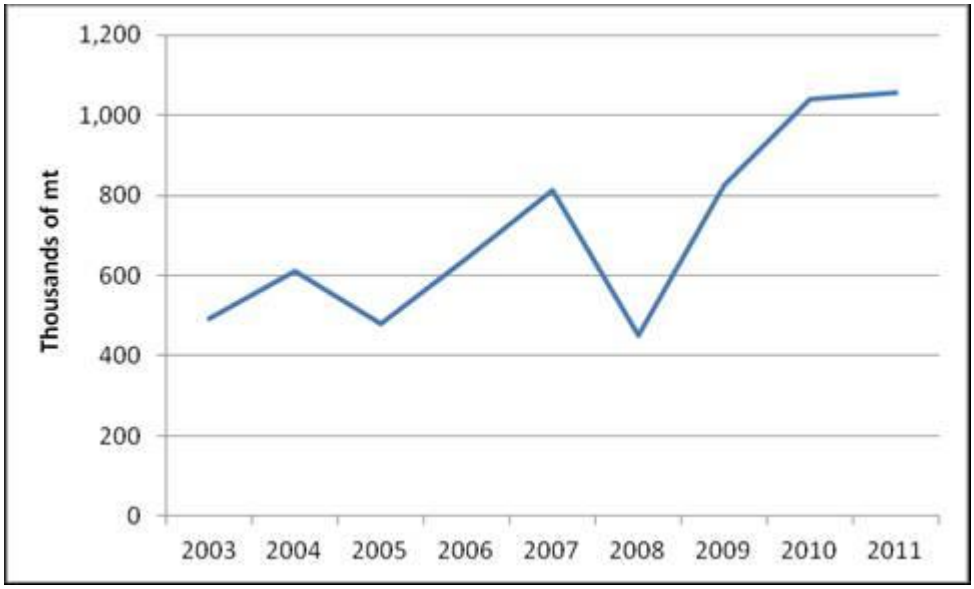
This section addresses the question "which sectors in Tanzania will drive future demand for cassava?" This is done through sector and sub-sector analysis of the different existing and potential value chains for cassava and cassava-based products. For each sector a brief description is offered from the available information, which in some cases is rather poor. The authors were surprised how difficult it was to get industry level information in Tanzania with both government and industry players often with very limited awareness of the universe of actors in their sector. For instance, at the enterprise level of analysis, few actors could answer the question "what is your market share?"

3.1 Milling sector

3.1.1 Large scale milling sector

Large mills focus on and have the monopoly of the production of wheat flour. Almost all wheat grain is imported and, as shown in Figure 2, imports are increasing at a steady pace (with the exception of year 2008 characterized by very high international prices of cereals). Recent statistics estimate the import of wheat during 2010 and 2011 at above 1 million mt, mostly from USA, Argentina, Russia and Australia. Import of wheat flour is not allowed. The CIF value for the 2011 import is reported at around TSh 620 billion (US$ 390 million). Once milled, the branded flour is sold to wholesalers or directly to retailers, bakeries and biscuit manufacturers.

Figure 2 – Import of wheat grain, 2003-2011



Source: Tanzania Revenue Authority.

We could identify three main categories of flour:

1. Home-baking flour: it is usually sold to wholesalers or directly to retailers (especially supermarkets). It is produced with soft or medium-soft grain. Upon discussion with managers of large scale mills, the market share of this category was roughly estimated at 70-80 percent.

2. Special baking flour: it is mainly sold directly to bakeries. It is produced by blending hard and soft grain. Its market share was estimated at 10-20 percent.

3. Speciality flour: this flour is used for the preparation of biscuits, wafers, cakes, hosts and ice-creams. Its market share was estimated at 5-10 percent.

Four major large scale mills were visited by the Team.

At first sight, the inclusion of HQCF at mill level might seem the simplest solution for the creation of a tremendous demand of processed cassava. For instance Posthumus et al. (2009) estimate a potential annual demand of HQCF at 55,000-62,000 mt assuming a 10% substitution rate. Abass (2007) presents much the same figures (75,000 mt/year). By adoption a similar approach, at current production level, the potential annual demand of HQCF could be estimated at over 78,000 mt. However, our analysis reveals that more caution is required.

The current gross production cost of wheat flour in a mill located in DSM and Arusha is estimated at TSh 700,000 and TSh 770,000 per tonne respectively (see tables 3 and 4). This difference is mainly due to transport cost. While mills in DSM collect bulk grain in the local port, the ones in Arusha incur considerably higher costs for transporting the grain (bagged) from Mombasa, Kenya. The mills are currently benefiting from a suspension of the 10% import duty. It was mentioned that this is a temporary measure introduced to partially offset the recent peaks in international wheat price. Assuming this measure will come to an end the gross production costs for the two locations will raise to 760,000 and 830,000 per tonne, respectively.

According to our analysis (Table 3), for the most optimistic scenario, a 10% substitution would allow a mill located in DSM to reduce its flour production costs by 1.5% and to increase its margin by 6.8%. In the worst scenario (higher HQCF price and duty-free import of wheat grain) the production costs would increase by 1.4% and the profit would decrease by 4.3%.

For a mill located in Arusha the figures are not dissimilar (Table 4). In the best case scenario the production cost would decrease by 1.6% and the margin would increase by 5.8%. In the worst case scenario the production cost would increase by 0.2% and the margin would narrow by 0.8%.

Table 3: Profitability analysis of 10% cassava inclusion in wheat flour at mill level in DSM

Item	US$/t	TSh/t
Fob price of wheat (HRW No2: Wheat Gulf) April 2012	272.0	432,480
Freight	41.0	65,190
Insurance (0.3% of Fob)	0.8	1,297
CIF wheat grain in DSM	**313.8**	**498,967**
Current import duty (0% of CIF)	0.0	0
Usual import duty (10% of CIF)	31.4	49,897
Port handling charges	7.0	11,130
Storage cost in port	4.5	7,155
Clearance	2.0	3,180
Bagging cost in the port	0.0	0
Transport from port to mill gate	1.5	2,385
DDP wheat grain at mill gate (duty free)	**328.8**	**522,817**
DDP Wheat grain at mill gate (10% import duty)	**360.2**	**572,714**
Cost of raw material in flour (duty free)	421.6	670,279
Cost of raw material in flour (10% import duty)	461.8	734,249
Milling cost		29,282
Gross production cost of flour (duty free) = Break even for HQCF		**699,561**
Gross production cost of flour (10% import duty) = Break even for HQCF		**763,531**
Packaging cost		19,965
Wages		2,662
Operating and administrative expenses		6,655
Transport cost in DSM		10,000
Total production cost of flour (duty free)		**738,843**
Total production cost of flour (10% import duty)		**802,813**
Selling price (48,500 TSh/sack 50 kg)		**970,000**
Margin (duty free)		**231,157**
Margin (10% import duty)		**167,187**
Price of HQCF (delivered in DSM from Mtwara)		**650,000**
Difference price HQCF/Gross prod. cost wheat flour (duty free)	-7.1%	-49,561
Difference price HQCF/Gross prod. cost wheat flour (10% import duty)	-14.9%	-113,531
Difference total prod. cost flour at 10% inclusion (duty free)	-0.7%	-4,956
Difference total prod. cost flour at 10% inclusion (10% import duty)	-1.5%	-11,353
Difference in margin at 10% inclusion (duty free)	2.1%	4,956
Difference in margin at 10% inclusion (10% import duty)	6.8%	11,353
Price of HQCF (delivered in DSM from Mtwara)		**800,000**
Difference price HQCF/Gross prod. cost wheat flour (duty free)	14.4%	100,439
Difference price HQCF/Gross prod. cost wheat flour (10% import duty)	4.8%	36,469
Difference total prod. cost flour at 10% inclusion (duty free)	1.4%	10,044
Difference total prod. cost flour at 10% inclusion (10% import duty)	0.5%	3,647
Difference in margin at 10% inclusion (duty free)	-4.3%	-10,044
Difference in margin at 10% inclusion (10% import duty)	-2.2%	-3,647

Source: calculated from data provided during interviews

Table 4: Profitability analysis of 10% cassava inclusion in wheat flour at mill level in Arusha

Item	US$/t	TSh/t
Fob price of wheat (HRW No2: Wheat Gulf) April 2012	-	-
Freight	-	-
Insurance (0.3% of Fob)	-	-
CIF wheat grain in Mombasa	320.0	508,800
Current import duty (0% of CIF)	0.0	0
Usual import duty (10% of CIF)	32.0	50,880
Port handling charges	3.5	5,565
Storage cost in port	1.5	2,385
Clearance	2.0	3,180
Bagging costs in the port	20.0	31,800
Transport from port to mill gate	15.0	23,850
DDP wheat grain at mill gate (duty free)	**362.0**	**575,580**
DDP Wheat grain at mill gate (10% import duty)	**394.0**	**626,460**
Cost of raw material in flour (duty free)	464.1	737,923
Cost of raw material in flour (10% import duty)	505.1	803,154
Milling cost		29,282
Gross production cost of flour (duty free) = Break even for HQCF		**767,205**
Gross production cost of flour (10% import duty) = Break even for HQCF		**832,436**
Packaging cost		19,965
Wages		2,662
Operating and administrative expenses		6,655
Transport cost in Arusha		10,000
Total production cost of flour (duty free)		**806,487**
Total production cost of flour (10% import duty)		**871,718**
Selling price (28,000 TSh/sack 25 kg)		**1,100,000**
Margin (duty free)		**293,513**
Margin (10% import duty)		**228,282**
Price of HQCF (delivered in Arusha from Mtwara)		**700,000**
Difference price HQCF/Gross prod. cost wheat flour (duty free)	-8.8%	-67,205
Difference price HQCF/Gross prod. cost wheat flour (10% import duty)	-15.9%	-132,436
Difference total prod. cost flour at 10% inclusion (duty free)	-0.9%	-6,721
Difference total prod. cost flour at 10% inclusion (10% import duty)	-1.6%	-13,244
Difference in margin at 10% inclusion (duty free)	2.3%	6,721
Difference in margin at 10% inclusion (10% import duty)	5.8%	13,244
Price of HQCF (delivered in Arusha from Mtwara)		**850,000**
Difference price HQCF/Gross prod. cost wheat flour (duty free)	10.8%	82,795
Difference price HQCF/Gross prod. cost wheat flour (10% import duty)	2.1%	17,564
Difference total prod. cost flour at 10% inclusion (duty free)	1.1%	8,279
Difference total prod. cost flour at 10% inclusion (10% import duty)	0.2%	1,756
Difference in margin at 10% inclusion (duty free)	-2.8%	-8,279
Difference in margin at 10% inclusion (10% import duty)	-0.8%	-1,756

Source: calculated from data provided during interviews

These figures should be interpreted with some caution since the situation may rapidly evolve. For instance a devaluation of the local currency would increase the profitability of cassava inclusion. In Figure 2 the recent trend in TSh/US$ exchange rate is shown.

Figure 3 - Recent trend in exchange rate of Tanzanian Shilling vs US$

Source: http://www.xe.com/currencycharts/?from=USD&to=TZS&view=10Y

However, even though such small gains can theoretically represent an incentive for HQCF inclusion (and actually some of the people interviewed have been attracted by this possibility), it is unlikely that any significant changes in current practices may occur in such a competitive sector. In fact, most of the people met showed considerable concern about the inability to market this composite flour as "wheat flour", their traditional core business. This might put their well-established market reputation at risk.[1] There now appears to be insufficient financial incentive to take the risk of voluntarily including HQCF in composite flour. According to some of the managers met during the visits an easier strategy would be to target directly the buyer of their flour (see next sections). In fact, only one large mill in DSM mentioned that they might consider the development and testing of a new product, marketed as composite wheat/cassava flour, provided that significant cost savings would be guaranteed. While this issue would deserve further research (unfortunately the marketing manager was not available at the time of the visit) we prefer not to present this option, given the millers' limited economic benefit from HQCF inclusion, the unknown market acceptability and the likely tiny market share that this product is likely to gain.

A different picture may emerge if the Presidential Cassava Initiative would force mills to include HQCF into wheat flour for industrial processing (special baking flour and speciality flour only), similar to the policy in Nigeria. Assuming a 10% inclusion rate in special baking flour and 25% inclusion rate in speciality flour this might lead to a total annual demand of HQCF by this sub-sector of between

[1]The standard for wheat flour does not allow the milling of any other grain but wheat grain.

17,500 and 35,000 mt (8,000-15,500 mt for inclusion in special baking flour and 9,500-19,500 mt for specialty flour). However the current HQCF production level would be unable to meet this large demand in the short to medium-term.

Table 5 - SWOT analysis for use of cassava products by large-scale mills

Strengths	Weaknesses
• Scale economies • Established brands and market share • Specialist flours for bulk users (caterers, bakers, ice cream, biscuits) • Some cost saving from HQCF inclusion • Transport costs of wheat from port high in Mwanza and Arusha • No special equipment required for blending (just a mixer)	• HQCF inclusion would not allow the product to be marketed as "wheat flour" • Mills concerned that HQCF inclusion might affect their market reputation • A consistent supply of HQCF must be guaranteed • If HQCF inclusion is imposed by GoT the current production would be unable to meet the demand • HQCF can be seen as competing with mills' business in the long run • Levels of inclusion and market acceptance unknown by Tanzanian millers • Technical specifications of cassava inclusion unknown • Companies' concern about HQCF shelf-life • Protein levels in cassava too low – requires blending of more expensive wheat to get to an even protein level • High transport cost of HQCF (e.g., US$31/mt from Mtwara to DSM) • Extra storage costs of additional ingredients • Poor image of cassava (eaten by aged and rural poor) favours competitors and threatens reputation of millers • Wheat mills are concentrated in DSM, not in the main cassava producing zones
Opportunities	Threats
• Large volume of HQCF if GoT will impose HQCF inclusion in wheat flour for industrial uses • Large companies that would have the financial capacity to establish large plants for HQCF if required. • Establishing HQCF production around Tanga can be strategic to supply Arusha • Exchange rate fluctuation – weakening TSh vs US$ would make wheat less attractive • Replacement of wheat in confectionary, bread and biscuit markets • Blended cassava/wheat flour can target niche markets • Regional export – e.g., DRC • EAC Rules of Origin – need 5% local ingredients to supply wheat flour from Tanzania to Rwanda and Burundi	• Decline in international wheat price • Exchange rate fluctuation – strengthening TSh vs US$ would make wheat more attractive • Transport cost of wheat from port low in Dar • Mostly former parastatal companies, poorly dynamic and still strongly relying on GoT intervention to foster innovation and cover R&D costs • The strategic nature of wheat means that interference in the market by government during period of high prices is likely and this uncertainty might put investors off

Three main areas of demand were identified for products containing cassava from the large scale milling sector: a) use in confectionary and bread by

bakeries; b) use in biscuit manufacture, and c) use in flour for home baking. These sectors are now considered separately.

Confectionary/Bread

The distribution of bakeries in the country varies with the eating habits and growing of the cities and major towns. There are 125 registered bakeries made up of 56% small bakeries, 39.2% micro and 4.8% medium and large bakeries. One third of registered bakeries in the country are located in Dar es Salaam, including two of the six largest. The majority produce bread as a main product.

Table 6 - Registered bakeries in Tanzania in year 2012

		Scale				Total
SN	Region/Location	Micro	Small	Medium	Large	
1	Arusha	1	7	1		9
2	Dar esSalaam	1	40	2		43
3	Dodoma	7				7
4	Iringa	2	1			3
5	Kagera	13				13
6	Kigoma	3	2			5
7	Kilimanjaro	1	5			6
8	Lindi	2				2
9	Manyara	1				1
10	Mara		2			2
11	Mbeya	2	2			4
12	Mtwara	4	1			5
13	Mwanza	1	3		1	5
14	Rukwa	1	1			2
15	Ruvuma	1	1			2
16	Shinyanga	5	2			7
17	Singida	1				1
18	Tabora	3	1			4
19	Tanga		2	1	1	4
	Total	**49**	**70**	**4**	**2**	**125**

Source: Tanzania Food and Drug Authority (TFDA).

This looks like a really good opportunity for cassava, but there is little information available. There seem to be independent bakers, in-store bakers of various kinds (mini-market, petrol station store, supermarket), and some chains in major towns such as DSM and Mwanza.

Following demonstration and promotional initiatives supported by C:AVA, several bakeries in Mtwara (where cost for transporting wheat and wheat flour from DSM is higher) have now diversified their product range by including special bread partially made with HQCF (typically with 10% inclusion rate). The

practice is expanding even though still constrained by the lack of a consistent supply. However the Team was not able to locate any bakeries producing bread with HQCF in the three cities covered by the survey (DSM, Mwanza and Arusha).

Most bakeries work on recipes. The baker buys ingredients from large scale mills or, less frequently, from bakery suppliers and mix up the confectionary and bread for the day. The simplest strategy for getting cassava into these recipes would be to persuade large scale mills to supply composite HQCF/wheat flour. But as noted in the previous section there are several challenges to this approach. An alternative strategy - which is currently being pursued by C:AVA - is to continue targeting the bakeries directly since the standard for bread production allows the inclusion of flour other than wheat flour up to 30%. This sector needs more in-depth study.

In Mwanza there are currently 5 bakeries. A typical bakery uses 300-400 kg of special baking wheat flour a week purchased from one of the large flour mills in DSM. The biggest lines are for white bread sliced loaves and 'scones'.[2] Other lines include brown bread, cup cakes, cookies, mandasi (small fried buns), donuts and birthday cakes. Demand is growing and new bakeries opening all the time.

Assuming the bakeries in Mwanza use 350 kg a week each this means a total current demand for wheat of 91 mt a year, which translates at roughly 9 mt of cassava flour at 10% inclusion rate.

In Arusha the market for bread is growing at a steady pace. Three companies hold 60 to 80 percent of the bread market in the town and surrounding areas: Sunkist, Super Loaf and Family Loaf Ltd. The Team visited one of these companies. The manager estimated that the current market size for bread in Arusha is around four times bigger than 10 years ago. The total market of loaves was estimated at around 100,000 loaves per day (average weight 750 g). Given these assumptions we could estimate the total amount of wheat flour used for bread production in Arusha at 5,000-7,000 mt a year. A 10% inclusion of HQCF would translate in a potential demand of 500-700 mt a year.

The inclusion of HQCF in bread can bring considerable financial benefits to a company located in Arusha since wheat flour is more expensive than around DSM due to the transport cost from the capital (many bakeries seem to prefer flour produced by large mills in DSM rather than the locally produced flour because of higher quality and similar price). A typical delivered price of wheat flour in Arusha is around TSh 56,000 for a 50 kg bag (1,120 TSh/kg) while in DSM the same bag is delivered at TSh 48,500 (970 TSh/kg). By using the same assumption presented in Table 3 and 4 (delivered price of HQCF in Arusha between 700 and 850 TSh/kg and in DSM between 650 and 800 TSh/kg) a bakery in Arusha can save between 2.4% and 3.8% in flour's procurement cost; while between 1.8% and 3.3% if located in DSM. This would result in overall savings of around US$ 6,500 to 10,500 for the smallest of the three companies

[2]A Tanzanian 'scone' is like a sweet bun.

and sevenfold for the largest one. The manager of the company we have visited is very well aware of the possibility to include HQCF (he heard about the initiatives in West Africa) and it is also very confident that bread with HQCF would be very well received by the local market. He would market this product for its distinctiveness and would consider a specific branding strategy to stress his health and nutritional value. However he has never tried due to two main reasons: firstly because of HQCF unavailability in the local market (a part from the well-packed and expensive HQCF in the supermarkets); secondly because he is convinced that he could incur severe problems by blending wheat flour and HQCF for the production of loaves. He needs to be reassured that this is allowed by the current legislation/standard (according to him it would be enough to find some announcements by the MoA, TBS, TFDA, TFNC published at this regard on the newspapers).

In Arusha a small supermarket was also visited. An internal bakery produces bread and other bakery products to be sold within the supermarket or supplied to local retailers. The manager was not aware of the possibility of HQCF inclusion and he would be interested in case this practice would allow some cost savings without affecting its market.

Based on the estimated amount of flour used by the bakeries in Tanzania (78,000-156,000 mt per year) a potential for 7,800 – 15,600 mt per year of HQCF can be expected if in Tanzania all bread was produced with a 10% HQCF inclusion (as in case of imposition by the GoT). More realistically, without GOT intervention, we can expected than 2%, 10% and 30% of bread would be produced with a 10% HQCF in the short, medium and long term, respectively. These assumptions translate in an annual demand of 150-300 mt; 800-1,600 mt and 2,300-4,700 mt of HQCF.

Table 7 - SWOT analysis for use of cassava products by bakeries

Strengths	Weaknesses
• Market is rapidly growing • Large volumes of wheat flour are used • Inclusion of HQCF at small levels would not impact on product quality • Cassava flour cheaper than wheat • Many baker are open to substitute wheat with HQCF if reasonable economic gain • High transport cost of wheat flour from DSM to other major towns • Market with few large players (for instance in Arusha): easy entry points • Some consumers may be interested in the distinctiveness of bread with HQCF •	• Consumer response to cassava flour inclusion unknown in many zones of the country • Many bakers are unaware of the possibility to use HQCF • Many bakers are concerned that this is not allowed by the legislation • Consistent supply of HQCF should be ensured • HQCF is not available in bulk in some part of the country (e.g., Arusha) • The quality of bread is affected if inclusion rates are higher than 10% (e.g., shorter shelf-life, texture will change, and bread will no longer have its voluminous, rectangular form, which is important for consumers)
Opportunities	Threats
• Cost of wheat flour may rise	• Cost of wheat flour may decrease

• Presidential cassava initiative could legislate for HQCF inclusion • Bakeries would probably prefer to have a "Bakery Quality HQCF" product supplied in separate large bags to retailers	

Biscuits

The sector has experienced tremendous growth in recent years. Two biscuit manufacturers were visited in DSM. These companies may be considered as sisters (same general manager). They represent the third largest biscuit company in the country. The overall combined demand of the two companies is 45 mt of wheat flour per day (even though one of the two companies has been established for less than one year and thus presently operating at just half of its full capacity). One of the two companies has been using HQCF since 2003 (trials) and more regularly since 2008. When HQCF is used an inclusion rate of 25% is common. This translates in a potential current demand of 2,300-3,400 mt per year. They purchase HQCF from Mtwara at around 650 TSh/kg (delivered). If HQCF was supplied regularly, HQCF inclusion may determine annual saving of around US$ 450,000 to 675,000. At this stage, HQCF production in Mtwara is not meeting the demand. They purchased HQCF after a long price negotiation process. In year 2011/12, 55 mt of HQCF have been purchased. The main reasons they are interested in using HQCF is the possibility to reduce the cost of raw material while at the same time supporting local producers. However they have incurred several problems: firstly, the unavailability of large quantities to meet their demand; secondly, the lack of consistency in quantity and quality delivered; thirdly, the need to add more sugar and fat in the recipe. Furthermore the inconsistency in supply determines a need of continuously switching the production process from biscuit with HQCF to biscuit without HQCF and vice versa. This represents an additional burden for the companies and, most importantly, it requires the change of packaging material. The lack of intermediaries able to bulk large quantities of HQCF has been mentioned as an additional problem to be addressed.

A specific opportunity exists in Mwanza where there are two biscuit factories and no current supply of HQCF. One of these companies uses wheat flour ("biscuit flour" which is made from cheaper soft wheat) from DSM for TSh 1,080/kg delivered. They pay TSh 150/kg of this to bring the flour from DSM. At 15% HQCF inclusion they would need 25mt HQCF a month. The existing delivered price of HQCF (and there seems to be some debate about this) seems to be between TSh 600 to 800 a kg. At the current factory gate wheat price and at 15% inclusion, the annual cost savings can be estimated at over US$ 90,000 (Box 1).

Box 1: replacing wheat with HQFC in biscuits in Mwanza: estimation of benefits

Wheat use per year = 2,400mt Replacement cassava at 15% = 360mt Price difference between cassava (700 TSh/kg) and biscuit flour (1,080 TSh/kg) = 380 TSh/kg Total saving = TSh 136,800,000 or approximately US$91,200 per annum

Testing cassava in biscuit factories is relatively straightforward because all use a batch process. A typical batch needs about 200 kg of HQCF. Biscuit producers who have not made product with cassava are nervous about the impact it will have on their products (biscuits should be 'crispy' and not 'hard').

Based on the estimated amount of flour used by the biscuit manufacturers in Tanzania (39,000-78,000 mt per year) a potential for 9,800 – 19,500 mt per year of HQCF can be expected if in Tanzania all biscuits were produced with a 25% HQCF inclusion (as in case of imposition by the GoT). More realistically, without GoT intervention, we can expected that 10%, 25% and 50% of biscuits would be produced with a 25% HQCF in the short, medium and long term, respectively. These assumptions translate in an annual demand of 1,000-2,000 mt; 2,500-5,000 mt and 5,000-10,000 mt of HQCF.

It is recommended, therefore, that biscuit manufacturers be assisted to undertake product and consumer acceptability testing in support of HQCF uptake building on existing work by C:AVA.

Table 8 - SWOT analysis for use of cassava products by biscuit manufacturers

Strengths	Weaknesses
• Biscuit sector growing quickly • Large scale users of wheat flour which could be replaced at 20-30% by HQCF • HQCF already accepted (by at least two companies) • Cassava HQCF cheaper than wheat flour • Transport cost of HQCF to factory compared to wheat (high for Dar but low Mwanza) • May have some taste/structural advantages in biscuits	• Needs assured supply quantities (minimum 5-10mt per consignment) • Irregular supply causes changes to biscuit formulations and thus increases costs (e.g. label) • HQCF use increases fat and sugar costs • There is no existing intermediary to perform arbitrage between HQCF processors and factories
Opportunities	**Threats**
• Increase in world wheat prices • Cassava can be promoted as an ingredient – could be a USP (e.g. for diabetics) • Presidential cassava initiative could legislate % inclusion • Regional market	• Cassava has a less value/status in the minds of consumers that wheat • Falling world wheat prices

Flour for home consumption

As noted earlier, in Tanzania most wheat flour is used at household level for the preparation of traditional dishes such a 'chapatti' and 'mandasi'. Several organizations, including TNFC, Sokoine University of Agriculture, the Small Industries Development Organization (SIDO) and the MoA have been organizing demonstration of blending HQCF and wheat flour at food, agriculture and trade fairs for years.

According to the information gathered, consumers appreciate the use of blended flours and, due to these promotional efforts, apparently this practice is spreading also in DSM (where wheat flour price is lower), even though at a very slow pace. Moreover, research work at IITA has led to the development of other bakery products using cassava flour to fully substitute wheat. These include: doughnuts, cakes, croquettes and 'chinchin'. There was potential for some new products, but not for others. This was reflected in the high take up rates in both the pilot and wider dissemination phases of only certain products (Table 9). One of the main constraints to wider use of HQCF as a substitute of wheat at household level seems to be the very high retail price of HQCF.

Table 9 - Most commonly prepared cassava products in pilot dissemination areas of the Lake Zone, Tanzania.

Cassava product	Number of people still making the product after five months				
	Mwanza Urban (n=17)	Mwanza Rural (n=11)	Mara Urban (n=5)	Mara Rural (n=5)	Total
Doughnut	15	10	4	3	32
Cake	3	1	2	4	10
Biscuit	1	1	0	1	3
Chinchin	4	10	2	3	19
Croquette	1	1	0	0	2

Note: Products contained 100% cassava flour
Source: External Market Task Force, Republic of Mozambique (2004)

In order to assess the potential demand by this sub-sector we have assumed an average HQCF inclusion rate of 10% to 20% and that a 2%, 10% and 20% of traditional dishes would be prepared with HQCF inclusion, in the short, medium and longer term respectively, if a cheaper HQCF was available. This would lead to an overall annual demand of HQCF of 1,000-2,500 mt in the short term, 5,500-12,500 mt in the medium term and 11,000-25,000 mt in the longer term.

Table 10 - SWOT analysis for use of cassava products at household level

Strengths	Weaknesses
• Market acceptability studies have provided satisfactory results • The habits of blending HQCF and wheat flour for traditional dishes is slowly spreading	• HQCF may be less acceptable in areas where panel tests and demonstrations have not yet been conducted • High cost of HQCF at retail level • Requires extensive HQCF distribution channels to reach the majority: not easy entry point • Penetrating this sub-sector would require considerable investment in promotional campaigns to raise consumer awareness • Poor image of cassava (eaten by aged and rural poor)
Opportunities	Threats
• Cost of wheat flour may rise • Change in consumption pattern might favour ready to eat food (Azam is the only companies currently producing chapatti and mandasi at industrial level)	• Cost of wheat flour may decrease

3.1.2 Small-scale mills

Small scale mills produce well-packaged branded flours and flour blends for home consumption directly in-house stores or through mini-markets, supermarkets and small retailers. Maize flour represents the most significant product.

The Team has visited two of these companies in DSM. Other small mills, mainly in DSM, are into the HQCF business but it was not possible to visit them due to time limitation.

The first company visited by the Team purchases cassava chips from Bungu around DSM (and less frequently grits from Mtwara) and mill them into HQCF (around 1 mt/week). The second company purchases and mill cassava grits delivered from Mtwara. Small quantities are regularly purchased directly from Village Processing Groups. Less frequently larger quantities are bought from aggregators/processors in Mtwara.

We found one entrepreneur in Mwanza interested in operating a larger scale HQCF plant based on three villages near Mwanza with high cassava production who will deliver fresh root to his factory gate. He has purchased the equipment to produce HQCF alongside rice milling (a source of husk) and sunflower oil manufacture (a source of oilseed cake). He also does maize milling and has bran available from this. His current plan is to produce HQCF for animal feed production and to sell traditional cassava flour (for 'ugali') in Tanzania, Burundi and Rwanda. His existing plant can produce one mt of HQFC an hour (so 5,280 mt a year based on 220 days and 24 hour production – so 20,000 mt of fresh cassava) and he plans to import a peeler and washing unit from China to speed up production. Drying costs for the production of HQCF are a concern to him and

he would like to know about using rice husk for drying. This entrepreneur was unaware that HQCF could be used in biscuit manufacture. He was also unaware that using HQCF in making mixed feed would be a rather expensive approach compared with, say, using 'improved' makopa.

The HQCF is sold at very high prices in supermarkets. While local retailers in Mtwara sell HQCF at around 800-1,000 TSh/kg, retailers and supermarkets in DSM charge considerably higher prices, 1,500-1,800 TSh/kg (see Figure 5 at the end of the report). In Arusha cassava flour is sold at even higher price, 2,400-2,500 TSh/kg). These prices are considerably higher than prices for wheat flour (up to double) and maize flour (up to triple). It was surprising to find out that the cassava flour sold in supermarkets in Arusha is locally produced by milling semi-fermented dry chips. This process would not meet the quality specifications of HQCF but a consumer would not be able to discern the difference between this product and properly produced HQCF.

The high retail price charged for HQCF does not seem to have economic justification. It seems rather due to the specific positioning of this product in the market: packaged HQCF is considered and marketed as a sort of specialty niche product for wealthy people in urban areas.

Some potential for export seem to exist. One company has reported to have been contacted by a company interested in a regular supply of 40 mt HQCF per month for export. Unfortunately the producers of cassava grits would not have been able to supply quantities large enough to meet this demand.

Some of these mills produce blended flour including HQCF, for instance, composite sorghum/HQCF flour.

It seems that the most common use of this well-packaged HQCF is the blending with maize flour at home for the preparation of ugali (cassava flour inclusion rates vary but it has been reported that it can be up to one third). There is a potential untapped market opportunity for the production and sale of pre-blended flour. The representative of one of the visited enterprises mentioned that the company has plans to test the market acceptability of a composite maize/HQCF flour. However, research is required for understanding the optimal inclusion rate for market acceptability and for minimizing the problem of different gelatinization temperatures.

For the time being, it is extremely difficult to estimate the potential demand of grits from this sub-sector. However, FAOSTAT (2012) reports that around 2.5 million mt of maize are annually used for human consumption in Tanzania. If 5 percent of the Tanzanian population included a 10% HQCF in the preparation of ugali this would result in a demand of 12,500 mt of grits per year. This is a long-term projection. In the short to medium term we can assume one tenth (1,250 mt) and one third (4,150 mt), respectively.

Table 11 - SWOT analysis for use of cassava products by small-scale mills

Strengths	Weaknesses
• Millers say that the urban market is growing, particularly for porridge flours • HQCF has a good reputation for quality in this sector • HQCF could be easily marketed at lower price • Quality of cassava grits is satisfactory (no consignment was ever rejected)	• Few players seem to monopolize the market offering very low price for the grits • HQCF is a side activity for a few small mills • Poor understanding of market, particularly consumer acceptability of different products and blends • Supply of grits is not sufficient and inconsistent • Timing of delivery is unsatisfactory • Seasonal fluctuation of demand (Ramadan high) • Scale of sector (number of players) unknown at the moment • Presentation of finished products poor • HQCF standard not properly enforced • Poor marketing and branding strategy
Opportunities	**Threats**
• Better marketing could drive demand • Possibility to use 'improved' makopa (cheaper) to be explored • Consumers are blending maize and cassava flour at home for better texture – this market seems undersupplied • Blended flour products – the potential demand for a maize/cassava blend is unknown • Potential for export	• Large scale millers could move into this market space and benefit from scale economies

3.2 Animal feed

Livestock is an integral part of Tanzania's economy, the contribution of livestock industry to both Agricultural and Gross Domestic Product (GDP) is 13 percent and 6.1 percent respectively. About 40% of livestock GDP originate from beef production, 30% from dairy products and about 30% poultry and small stock production (URT, 2011).

The production of livestock products is showing a steady growth. Annual meat production increased by 30% in the last six years, from 388,294 mt in 2005/06 to 503,496 mt in year 2010/11. Over the same period milk production grew by 23% and egg production by 55% (Table 12).

Table 12 – Livestock production in Tanzania

Product Type	Year					
Meat production (tonne)	**2005/06**	**2006/07**	**20007/08**	**2008/09**	**2009/10**	**2010/11**
Cattle	210,370	180,629	218,976	221,780	243,943	262,606
Goat/sheep	78,579	80,936	81,173	82,884	86,634	103,709
Pig	29,925	31,721	33,307	36,000	38,180	43,647
Chicken	69,420	77,280	77,250	78,168	80,916	93,534
Total	**388,294**	**370,566**	**410,706**	**422,230**	**449,673**	**503,496**
Milk Production (litre)						
Indigenous cattle	941,815	945,524	980,000	1,012,436	997,261	1,135,422
Exotic Cattle	470,971	475,681	520,000	591,690	652,596	608,800
Total	**1,412,786**	**1,421,205**	**1,500,000**	**1,604,126**	**1,649,857**	**1,738,683**
Eggs production ('000')						
Eggs	**2,145,000**	**2,230,900**	**2,690,000**	**2,806,350**	**2,917,875**	**3,339,560**

Source: Ministry of Livestock and Fisheries 2010/2011 budget speech.

There are more than 65 animal feed industries in the country, most of them located in DSM, Coastal, Arusha, Mbeya and Mwanza regions. Industrial animal feed production grew from 500 mt in 2005 to 852 mt in 2011 with industries utilizing around 70% of installed capacity. In Tanzania feedstuffs accounts for about 60% of total production costs of livestock rearing. The most commonly used ingredient in animal feed are grains, cereals by products, oilseed and oilseed by products, fish and animal by-products.

In the mid-1980s cassava was utilized in the production of poultry and pig feeds by the Tanzania Feeds Company. The use of cassava in the industries was later discontinued when it became more expensive than grains (Abass et al., 2008; Sewando et al., 2008).

Three products are suitable for substitution with cassava: a) composite mash for pig production; b) composite chicken pellets and c) dairy supplement (Abass et al., 2008). Since some prejudices exist about the use of cassava in animal feed, in the short-term, pellets have potentially the largest market because their ingredients are not readily discernible (Match Makers Associates, 2008). However, during our survey we have identified a potential demand for cassava to be used in unpelleted mixed poultry feed.

A study of Sokoine University with "A to Z" Animal Feed Company in DSM (now no longer operational) proved that there are several advantages in using cassava in mixed animal rations, for example 13 to 20% cost saving in feed and higher growth gain in piglets.

Great potential seems to exist for the use of cassava in the animal feed sector. According to Abass et al. (2008) in Tanzania, feed production stands at about 500,000 mt/year. Since maize represents on average 40%of the feed ration and cassava can replace up to 20%of the maize ingredient, it is estimate a potential annual demand of around 40,000-45,000 mt of cassava dried chips (Abass, 2011). This is also the largest market potential in the East African(Abass et al., 2008).

Presently only few small-scale animal feed firms are utilizing cassava chips at commercial level. The quantity of cassava chips in animal feeds is estimated at one tonne per month and this demand is seasonal depending on the price of maize (Abass et al., 2008). According to Abass et al. (2008), the main constraints to wider use of cassava in feed are the irregular and unreliable supply of chips and the relatively low cost differential between maize and cassava chips (the latter should be at least 30% cheaper than maize in order to make them competitive).

A study of Match Makers Associates (2008) found that in the Southern zone (Mtwara and Lindi), it would be feasible to develop and promote the use of cassava in animal feed but this should be developed in tandem with the production of HQCF. This would require the development of a grading system: highest quality chips should be used for HQCF production while second grade chips should be used in animal feed production along with waste peelings. A similar feasibility study was carried out in 2007 in the Lake Zone (Match Makers Associates, 2007). Unlike the Southern Zone the study found that animal feed industry was not a viable option in that region because of the low local demand and high transport cost to DSM. As we will discuss later, the situation seems to have considerably changed in the last few years.

The feed industry in Tanzania seems to be divided into three distinct sub-sectors. Firstly, there are large-scale integrated feed producers who have oil mills and grain mills whose by-products are included in feed for their own animal production and who sell surplus production to small-scale growers (there don't seem to be separate commercial scale poultry, pig, beef or dairy production units). The second level of production is small scale feed mills, who do not have ancillary sources of by-products, but who often have own animal production and sometimes sell the surplus. This group might be termed 'combined animal and feed producers'. The third level of production is people selling animal feed ingredients for individual animal keepers to mix at home themselves. The largest sector in the animal feed industry is by far the one for poultry production. This sub-sector is the main focus of this section.

3.2.1 Poultry

Anecdotal evidence suggests that the market for processed chicken meat in Tanzania is currently under-supplied. This seems to be stimulating substantial growth in the sector (all firms met plan to expand in 2012) and in imports (both legal and illegal). The poultry feed sector is sub-divided into integrated feed mills with animal production and milling, small-scale or emerging poultry feed producers making mixed feed for small local markets and own-mixers who buy feed ingredients for blending at home.

Integrated animal feed mills

The Team visited the largest single animal feed and production operation in Tanzania. This company produces 100,000 broilers and 20,000 layers a week. It also places 30,000 broilers in 'buy-back' schemes where individuals buy a feed/bird package to grow and home and sell back the excess bird to the company. This scheme is very popular and is expanding. Their self-grow scheme where producers buy day old chicks and feed as a package is also growing and they may invest in a pelleting plant – Tanzania's first. Feed conversion rates are poor in Tanzania (said to be 2.5:1) partly as a result of poor breeding stock and consumer demand for 'birds' rather than 'meat', which means that animals are fed until they meet a target minimum size rather than until they have maximised the economic conversion of feed to weight of meat. Currently broilers are culled at 42 days, but pelleting should improve this to 35 days and give the company a considerable market advantage. The company currently uses 60% maize in their products (maize is delivered at TSh 450/kg) and use soya bean meal as their only protein source (soya bean meal is currently TSh 1,300/kg). They have never thought of using cassava as an ingredient but would be interested if supply was assured, the price competitive with maize and the additional protein that would be required. Cassava with any amount of additional protein would make an important difference to the decision of this firm to use the product because they are trying not to use animal protein in their products and struggle to find sufficient soybean meal in Tanzania. The company supplies the fast growing retail and catering sectors in Tanzania, notably the 'Shoprite' supermarket chain, hotels and the fast expanding mining sector.

The chicken feed industry seen from the perspective of Mwanza looks even more promising. One of the company the Team visited has a maize mill and small feed mill in Mwanza supplying their breeder farm (20,000 birds/week) and hatchery (20,000 birds/week). The surplus feed is sold to small-scale poultry farms, mostly in Mwanza town itself. These farms average 300/400 birds. The small poultry farms are selling to local catering operations or to the recently expanded gold mines in the area. The company produces about 30 mt of different poultry rations a day based on maize (550 TSh/kg delivered, but can go up to 700 TSh/kg during times of shortage), soya and shrimp meal which is a very cheap source of animal protein (500 TSh /kg compared with 'dagaa'[3], at 2,000 TSh/kg). There are plans to expand the daily production to 70 mt and 100 mt within the next 6 and 12 months, respectively. He could replace 20% of his maize with improved dried cassava chips ('improved' makopa). The advantages of this are: cost savings (see Box 2) and the potential for year round supply. The company has plans to establish another feed mill around Arusha. This would have a operational capacity of 50-70 mt per day. However concerns about mycotoxins were raised. This miller has no knowledge and has never tested cassava chips.

Mwanza is ideally located for regional trade and this producer distributes throughout Tanzania and in Burundi, Rwanda and the Democratic Republic of Congo. It is interesting to note that Mwanza benefits from very low transport costs to DSM as back-loading is possible at over 50% discounts (e.g. DSM to Mwanza = 150 TSh/kg but Mwanza to DSM = 60 TSh/kg). This back-loading

[3]Silver cyprinid *Rastrineobolaargentea.*

possibility might make it possible to bring HQFC or 'improved' makopa cheaply to DSM from Mwanza and still be competitive.

Box 2: "Improved" makopa for animal feed: estimation of benefits

The company currently produces about 10,000mt of mixed poultry feed a year.
Replaces 10% with 'improved' makopa (1,000 mt per year)
Makopa delivered price = 250 TSh/kg
Maize delivered price = 550 TSh/kg
Annual savings at current production = TSh 300,000 or approximately US$ 190,000 thanks to the availability of an inexpensive protein source (shrimps)

Within one year the company would be able to purchase around 3,200 mt of cassava chips per year with an overall annual saving of around US$ 585,000.

The company would claim that their production will be 100mt/day of finished feed within a year. Assuming 300 days operations a year and 10% cassava replacement this represents a potential demand of 3,000 mt a year. How does this translate into farmers and farmer supplier groups? Assuming from previous Tanzanian experience under C:AVA that farmers groups can produce 15mt/ha with improved practices and 60 farmers in a typical group this means 200 farmers and 3-4 farmer groups would be needed to supply this mill. In reality, each farmer would probably supply much less that 15mt/ha so 6-8 groups or 400 farmers might be a better figure to work with.

The next stage for makopa as an animal feed in Mwanza is to prepare a feasibility study to assess and validate the figures presented here. A farmer group "Improved" makopa production "package" could be developed to allow the feed mill to provide chippers against payment from future chip delivery. The economics of this also needs to be considered.

Small scale animal feed industry

One small-scale animal feed firm in DSM was met by the Team. It produces around 400 mt of poultry feed (mash) a month, 65% sold and 35% used in the own farm (22,000 chicks/week sold mainly to local poultry farms). The feed is delivered to the gate of large farms or sold in the in-store shop. This company is the third largest in DSM. It is estimated that in DSM only there are around small-scale 25-30 poultry feed companies. Their number may be decreasing due to the consolidation process that is characterizing the whole sector with fully-integrated large poultry firm producing the own feed and fewer larger feed companies.

This company is aware of the possibility to use cassava but it was never able to find any chips in the local market. The company is interested to test the

'improved' makopa but it requires to be supplied weekly because of lack of storage space and the product has to be delivered to the factory gate[4].

Two different poultry feed rations are produced by this company:

1) Higher quality feed for own farm (soybean meal, no fishmeal)

   100 kg= 50 kg maize (9% protein; 500 TSh/kg), 25 kg soybean meal (42% protein; 1250 TSh/kg), 25 kg mix of sunflower, cotton cake, maize and wheat bran, bone meal (200 TSh/kg). The cost of this ration is 61,250 TSh/100 kg.

   Cassava chips (1.5% protein) would substitute 20% of maize, e.g. 10 kg. This would determine a loss of 0.75 kg of protein. In order to offset this loss around 1.8 kg of soybean meal should be added. The composition of new ration would be: 40 kg maize, 10 kg cassava chips, 26.8 Kg soybean meal, 23.2 kg mix (200 TSh/kg). The break-even price of cassava chips would be 311 TSh/kg.

2) Lower quality feed for sale (fishmeal, no soybean meal)

   100 kg= 50 kg maize (9% protein; 500 TSh/kg), 12 kg fishmeal (53% protein; 2,000 TSh/kg), 38 kg mix of sunflower, cotton cake, maize and wheat bran, bone meal (200 TSh/kg). The cost of this ration is 56,600 TSh/100 kg.

   Replacing 10 Kg of maize with cassava chips would require the addition of around 1.4 kg of fishmeal to offset the lower protein content. The composition of new ration would be: 40 kg maize, 10 kg cassava chips, 13.4 kg fishmeal, 36.6 kg mix (200 TSh/kg). The break-even price of cassava chips would be 248 TSh/kg.

The results of these calculations are in line with the information collected from the owner. He would not be interested in buying cassava chips at a price higher than 250-300 TSh/kg. Furthermore when the price of maize is lower (around 400 TSh/kg in July-August) the possibility to replace maize with cassava chips would be less appealing. Conversely in time of shortage maize price can easily reach 550 TSh/kg).

At current capacity the company can use around 40 mt/month of cassava chips (480 mt/year). Around 320 mt/year of cassava chips would be required for the production of feed to be sold in the market (i.e., not for the own poultry farm). If the estimations of the owner are correct (8-10% of market share in DSM) the potential demand of 'improved' makopa by feed companies in DSM can be around 3,500-4,000 mt/year. This amount does not take into account the feed

[4]Several feed companies complained about shortage of storage space which limits their ability to forward buy key ingredients when prices are advantageous.

produced by large integrated poultry firms producing the own feed. This amount is expected to be considerably larger.

A second company was visited around DSM producing feed for own consumption. It produces 6,000-120,000 chicks/week (10-15% of Tanzanian market); 1,800-2,300 eggs/week and 4-5 mt of dressed chicken meat/week).

The owner has never tried cassava chips because of its unavailability in the market. Moreover she thinks that the overall cost of the ration might be even higher due to the need to add more fishmeal in the ration. On average she receives a consignment of 30 mt of maize per week (again, she needs a regular supply because of her small storage capacity). If 10% of the ration was made of 'improved' makopa she would need around 1,500 mt per year.

One firm in Mwanza sells 100mt of poultry rations a month and used about 30mt of maize. He started production in 2011 and has already doubled in size and cannot meet demand, mainly from middleclass customers interested in supplementing their income with back-yard broiler and egg production. A typical customer has 200 layers or broilers. Standard rations and samples (say a few tonnes) would get this level of producer using makopa chip flour as an ingredient].

Own mix poultry feed

Several informants told us that there is a separate sector selling feed ingredients for self-mixing. We were not able to locate or visit this industry, but it could be quite large and would be an interesting source of additional demand. More research is needed on the own-mix poultry feed sector.

3.2.2 Pork

A small scale pork production sector seems to be emerging in Tanzania, particularly in the mostly Christian Lake zone. One producer told us that he could greatly increase his production (from 200 animals at present) if enough feed was available. He also complained that he did not have anyone to advise him about how to mix different ingredients to make pork rations. Smaller scale feed makers are commonly unaware that cassava could be and ingredient and how they might use it.

3.2.3 Beef

Like poultry, the urban 'elite' in Tanzania are getting into cattle fattening. Cattle fattening increased by 32.7% in 2010/11 and is expected to grow by 8.2% in year 2012. Under the national plan on land use, a total of 858,995 hectares have been allocated for free range grazing in 440 villages in 49 districts for both smallholder livestock keepers and ranches. Some supplementary feed is necessary. Very little is known about this sector.

3.2.4 Dairy

Recent statistics (URT, 2011) report that 1.74 billion litres of milk were produced in 2010/11 compared to 1.65 billion litres in 2009/2010. The processing is dominated by the private sector. Of the total milk produced in 2009/2010 about 63% came from the traditional sector. It was reported that, like neighbouring Kenya, back-yard dairy, milk collection and distribution through bicycle traders is growing quickly. Yet the milk production and consumption is still low and the growth in milk production does not meet the growing demand from the increasing human population. During the market survey we have not met any company making dairy rations for this market.

Table 13 – Milk processing plants and their capacity in Tanzania

Zone	Region	Processing Plant	Capacity (litres/day)
Eastern Zone	Dar es Salaam	Royal Dairy	90,000
	Dar es Salaam	Azam Dairy	3,000
	Dar es Salaam	Tommy Dairies	15,000
	Dar es Salaam	Tan Dairies	6,000
	Dar es Salaam	Ideal products	3,000
	Coast	Mohamed enterprises ltd	4,500
Northern Zone	Tanga	Tanga Fresh	15,000
	Tanga	Morning Care Dairy products	27,000
	Kilimanjaro	Nronga group	1,000
	Kilimanjaro	Kalali	1,000
	Arusha	Arusha dairy	4,500
	Arusha	New Northern creameries	45,000
	Arusha	International dairy	3,000
Lake zone	Mara	Utegi	45,000
	Mara	Baraki sisters	3,000
	Mara	New Mara dairy	20,000
	Mara	Musoma Dairy	10,000
	Mara	New Musoma Dairy	120,000
	Mwanza	Victoria dairy	15,000
	Kagera	Bukoba Milk trade	6,000
	Tabora	Christian Nyamwezi creameries	3,000
Southern Zone	Iringa	ASAS diary plant	10,000
	Iringa	CEFA/Njolifa	40,000
Others			20,000
Total			**510,000**

Source: Ministry of Livestock and Fisheries

3.2.5 Animal feed – conclusions

There is a real opportunity in the animal feed sector for replacing maize with cassava in some form. This sector looks promising for improved peeled, washed and dried cassava chips ('improved' makopa). The possibility to replace maize

with cassava in the ration seems strongly dependent on the maize price. Low maize price makes cassava uncompetitive while high price seems to depress the profitability of the whole sector with many firms down-scaling their operations (for instance many firm significantly decreased their flock size in the last year due to high maize price). The use of cassava requires a higher amount of protein-rich ingredients in the feed. These ingredients are rather expensive (usually fishmeal imported from the Lake Zone) and this might undermine the profitability of cassava inclusion. The recent improvement in the road connecting DSM to Mtwara can considerably decrease the transport cost of these ingredients. Furthermore the perspective of using cheap protein source from the Lake zone (shrimps) can be particularly conducive to the lowering of feed cost in general and inclusion of cassava in the animal diet in particular. Given the proximity to the Lake the perspective of developing a successful feed industry seems particularly promising around Mwanza and the broader Lake zone. However more in depth feasibility studies are required.

Table 14 - SWOT analysis for use of cassava products in animal feed

Strengths	Weaknesses
• Poultry industry growing in response to urbanisation and rising incomes • Up to 20% substitution for maize so 10-12% for whole ration • Catering industry and supermarkets main areas of growth • Some trials already at Sokoine University– existing feed technology skills • Quality specifications not particularly demanding • Ease to include cassava chips in the ration • Some concern about the presence of toxic cyanide and mycotoxins in cassava • Local ingredients don't require complex and lengthy importation	• Increased cassava use required addition of expensive protein-rich ingredients (e.g., fish and soybean) • Most firms have never had the opportunity to test cassava chips or unaware of this possibility • Enough supply of high quality chips and supply consistency • Firms lack storage capacity so regular supply needed • Firms want all product delivered • Lack of detailed feasibility studies about cassava inclusion in different zones • Poor reputation for cassava as a feed ingredient • Dustiness
Opportunities	Threats
• Inter-seasonal and inter-annual maize price volatility – cassava less susceptible • Sector consolidating so will become more efficient • Some companies investing in pelleting • Shortage of animal feed ingredients supplied on a large scale in Tanzania (especially protein, fat sources)	• Maize price can fall due to external factors and make cassava uneconomical • Maize price can surge and make poultry production less profitable • Ease to increase and decrease the flock size makes the estimation of market potential difficult • Cheap poultry meat imports

Due to the current consolidation process major potential for cassava exists in targeting large integrated poultry factories rather than firm specialized in feed production whose significance in the market is steadily decreasing.

During the mission it was not possible to estimate the overall potential of cassava inclusion in feed in Tanzania but the figures we have collected make us confident that the estimation provided by Abass (2011) is rather accurate (40,000-45,00 mt of dried cassava chips per year).

Firms need samples and recommendations for ration mixes. At the current maize price (500-570 Tsh/kg), replacement with a cheap product based on cassava chips would be a very strong source of future demand.

For each of these levels of production some basic economics are needed to assure businesses that replacing maize with cassava is viable]

3.3 Beer and beverages

Two distinct sub-sectors were identified: clear beer produced on a large scale by international beverage firms; and, traditional beer made my small firms or at home.

3.3.1 Clear beer

The brewery sector is currently Tanzania's largest user of imported starch at about 8,000mt a year (Abass et al., 2007). The Team in Arusha had the opportunity to visit one of the largest breweries in Tanzania. The company uses locally procured barley, maize and sorghum in diverse proportion for the different recipes. Only malted barley is milled by the company itself. Maize and sorghum flour are purchased under contract with very strict technical specifications. In case of maize the product is named "sifted maize" and must have low protein and low fat (< 1%) content and be coarsely milled. The overall amount of maize flour weekly purchased by the five plants is estimated at around 350-400 mt at a delivered price of around 820 TSh/kg. There are no current plans of utilizing cassava as a substitute of maize in their production in the short to medium-term. However, in the longer term cassava beer might be commercialized in Tanzania. In such a case, assuming a beer where 70% of maize has been replaces by cassava and a market share of 5% to 10% of the Tanzanian clear beer market, an overall amount of 1,000-2,400 mt of cassava chips ('improved' makopa) or flour would be required annually. While by using chips or traditional low quality flour the company would save a substantial amount of many in raw material procurement, the use of HQCF would not determine any relevant cost saving. However it is important to bear in mind that the reason for cassava inclusion would not be primarily cost saving but rather product line extension.

Table 15 - SWOT analysis for use of cassava products by the clear beer industry

Strengths	Weaknesses
• Could replace maize at right price • Cassava is low in protein and fat • The use of 'improved' makopa would determine substantial cost savings • Companies used to local procurement of ingredients	• Companies currently unwilling to use cassava • Cassava may be used only for a new product developed for product line extension • Potential overall demand of cassava by the sector is rather small (1,000-2,4000 mt potential demand for 'improved' makopa or HQCF) • Quality specifications are strict • The use of 'improved' makopa would determine some additional cost for milling. • No major saving from the use of HQCF • Consumer acceptability unknown • Level of potential replacement of grains in the Tanzanian market unknown
Opportunities	Threats
• Total beer market size growing • Clear beer market share is growing • Government supporting local procurement (e.g., heavy taxation on imported malted barley)	• Failure in Mozambique may prevent expansion of cassava beer in other African countries

3.3.2 Traditional beer

One traditional beer factory has been visited during the mission. The company is a parastatal company located in DSM (40% government owned). It is the only domestic company producing this product industrially. It produces and sells around 22 million litres per year (but with a capacity of 30 million litres) with an estimated market share of around 60%. The remaining 40% is made up of home or small village level brewers. The beer is produced by fermenting maize, red and white sorghum and immediately sold either to wholesalers for distribution in DSM and Coast Zone or directly to local bar and clubs (the shelf life is just 5 days).

While in absolute terms the market is demanding larger volumes of traditional beer, this product is suffering the growing completion of domestic and imported clear beer and it has witnessed a decrease in relative market share.

Currently the factory uses 1,600 mt of white maize, 2,200 mt of red sorghum and 800 mt of white sorghum per year at a delivered price ranging between 425 and 450 TSh/kg. The grains are milled to flour in the plant itself. They have never used cassava and, even though they do not currently face any problem in the procurement of raw material, they would be keen to consider this option if consistent quantities are ensured at lower price than their current raw materials. The operations manager has shown a clear preference for the use of HQCF but this is not a viable option given its uncompetitive price. Rather the supply of 'improved' makopa to be milled can be a viable option. The quality specifications

are not particularly stringent (moisture lower than 13.5% and low level of filth). Moreover, the general manager gained some experience about cassava flour inclusion in traditional beer (30% inclusion rate) at the time he used to manage a similar plant in Zimbabwe. According to him the taste and flavour of the beer where not affected and many customers were not able to discern of cassava. Cassava inclusion reached a dead end because the supply of cassava flour was unreliable.

Inclusion of cassava by this company would mean to capture most of the formal market of this product. This can be a relatively easy task if the beer produced with cassava is favourably accepted by the consumers and evidence of saving in cost for raw material is provided.

Table 16 - SWOT analysis for use of cassava products by the traditional beer industry

Strengths	Weaknesses
• Could replace maize and sorghum at right price • Quality specifications for traditional beer are not particularly demanding • The company is a relatively easy entry point • The company is used to local procurement of ingredients • Company's GM with experience is cassava inclusion • Consumers may be unable to discern differences in the product and indifferent to quality • Year round supply of cassava would reduce existing long-term storage costs incurred by factory • Low margin industry – so open to all cost reducing opportunities	• Overall demand of cassava by the sector is rather small (920-1,880 mt potential demand for cassava chips if only the visited company – could be more if also local brewers). • Level of potential replacement of grains in the Tanzanian market unknown • No real understanding of consumer acceptability (of existing or future products) • HQCF not competitive vs maize • Local brewers not visible or easy to interact with
Opportunities	**Threats**
• Total beer market size growing • Company ready to try cassava • Cassava flour (not HQCF) – needs testing • Opportunity for "improved" makopa chips	• Clear beer threatens market share

At current production level (22 million litres) and assuming a 20% cassava substitution of 4,700 mt/year of grains, the annual demand of cassava chips by the company can be estimated at around 900 mt/year. Assuming the plant working at full capacity (30 million litres) and a 30% substitution rate the demand of cassava chips would reach 1,900 mt/year. Assuming 'improved' makopa's delivered price at 250 TSh/kg, the firm would save annually over US$ 90,000 (-8% in raw material procurement cost) in the first scenario and over US$ 220,000 (-13% in raw material procurement cost) in the second one. Furthermore, additional benefits may be expected by the saving in storage costs due to the fact that current grains are purchased during the harvest season and

store all over the year while, in the case of cassava, they would be interested to purchase amount that can guarantee the plant operations for 30-45 days.

While the volumes required by this sub-sector are rather small, this industry can easily switch to using cassava once a reliable supply of good quality chips is guaranteed.

3.3.3 Beverages

Glucose syrup produced from cassava could be a replacement for maize/corn syrup which is an important ingredient for soft drink concentrates. Most of these seem to be imported, particularly from Kenya. More research is needed to estimate the size and use parameters of this niche.

3.4 Sweets

There is a substantial sweet production sub-sector in Tanzania and this uses corn syrup. Products include boiled sweets, chews, chewing gums etc. One of the companies visited in Mwanza, for example, uses 35/40 mt of corn syrup a month imported from Nairobi for about 4,000 TSh/kg delivered. This market is expanding quickly and deserved more research.

3.5 Snacks

During the mission the Team has come across with cassava crisps sold in supermarkets. Furthermore, the owner of a small company that has been producing cassava-based snack ('chinchin') since 2010 was met. While the market is currently limited in size (for instance for the production of chinchin less than 30 mt per year of HQCF are used) potential for growth exist in the near future.

Table 17 - SWOT analysis for use of cassava products by the snack industry

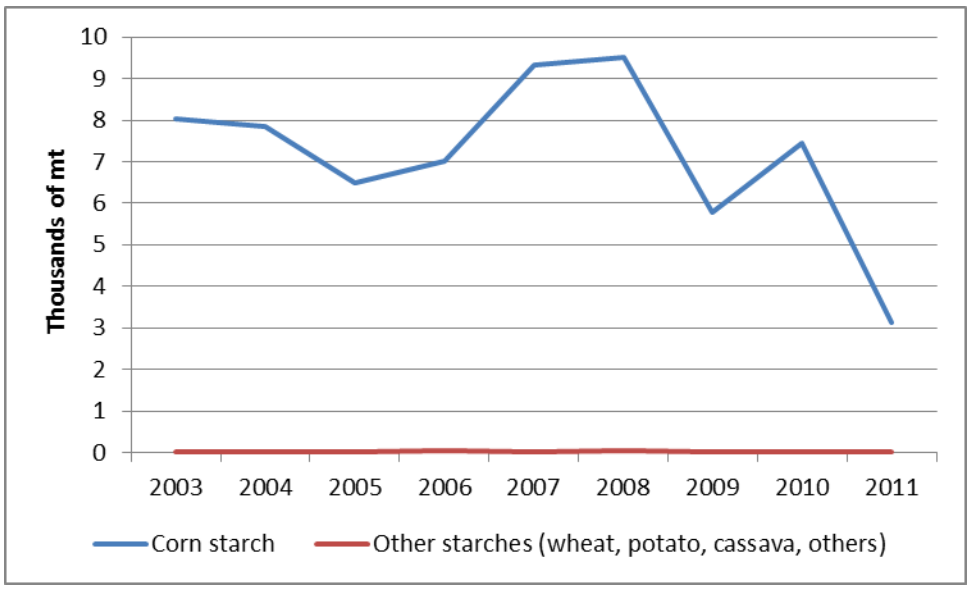
Strengths	Weaknesses
• Some already established products mainly sold on mini-markets • Growing snack market in cities • High level of inclusion (90%+) • High profit margins reported • Purchased by higher income earners	• Very low total demand split between several small snack companies • No data on snack market size and dynamics • Very poor packaging and marketing Very easy to enter this market – lots of competition
Opportunities	**Threats**
• Great potential to grow • HQCF preferred • Expand to street vendors • Technical support to snack production seems available	• Poor reputation of cassava

3.6 Starch manufacture

There are no starch producing factories currently operating in the country. A starch processing plant was established in the Lake Zone in the 1980s but it was closed down due to difficulties in finding a reliable source of raw materials (MMA, 2007; Promar Consulting, 2011). This factory used to produce about 100 mt/month that was all exported to Germany (Hape and Mtalai, 2010).

All starch, either native or modified, is currently imported from abroad. Almost 99% of import consists of corn starch. Import of starch has decreased over the last few years from almost 10,000 mt in 2007/2008 to 3,000 mt in 2011 (Figure 4). Between 2007 and 2001, while the import CIF value dropped from TSh 4.9 (US$ 3.1 million) billion to 2.9 billion (US$ 1.8 million) the unit price considerably surge from 530 TSh/kg (0.33 US$/kg) to 930 TSh (0.58 US$/kg).

Figure 4 - Import of starch 2003-2011



Source: Tanzania Revenue Authority

During the mission we have been informed that two starch factories are currently being planned in Tanzania in Lindi and Rufiji.

The Lindi plant is based on an Export Processing Zone (EPZ) with 8,000 ha of Kiroba variety on a core estate. This plant is just finishing its nursery (400,000 seedlings) and will soon start producing 6 million cuttings. The Kiroba variety released in Tanzania is relatively high in starch (26-28%) and tolerant to the brown streak disease. Eventually this factory will produce 40,000 mt of starch per year, mainly for export. The investor claims that the production cost of starch in Tanzania will be US$ 240/mt. The current international price of native starch from India and Brazil is in the order of US$ 460/mt. If these figures are correct this represents a considerable margin. Operation will start in 2014. Once the plantation is fully operational it will supply enough fresh roots to make

the factory work at full capacity. Until that time the factory will rely on out-growers scheme using the NGOs Limas and the Aga Khan Foundation. Subsequently the factory may re-adopt out-growers scheme only if the capacity is increased by adding a new production line. They plan to use peels, stems and waste from the factory to make biogas to supplement their energy needs. This plant has to export 80% of production to benefit from EPZ tax and duty incentives, but this means that 8,000mt will be available for domestic use.

The second factory is privately funded by a US private foundation. Around 10,000 ha of private land have already been acquired and the pilot processing plant has been established. The industrial production is expected to start by 2013/2014. The annual production capacity will be 17,000 mt with 80% of the produced starch intended for the export market.

With recent imports of all starches ranging between 3,000 and 10,000 mt/year and 80% of this being native starch, these two firms would capture the entire domestic native starch market.

While the combined demand of fresh roots by the two factories can be extremely high (over 220,000 mt per year), most, if not all, of this root will be supplied by their own plantations leaving very little long-term opportunities for small-scale producers.

3.7 Textile factories

Abass et al., (2008) estimated at least 10-15 textile factories operating in the country in year 2006. The authors indicate a consumption of about 1,000 mt/year of starch by the sector. However some of the interviewees reported that a number of factories have been closed and relocated abroad in the last few years.

The sector is struggling due to lack of competitiveness and lack of supportive policies (such as subsidization of cotton production in order to lower the cost of raw material). Furthermore, while the domestic demand for woven fabric and garment is increasing at steady pace, this demand is increasingly met by cheap imports from South-East Asia, primarily from China. Finally, the demand of starch is rapidly declining due to the increase use of synthetic fibres such as polyester: for instance it was mentioned that one company is currently using small amounts of corn starch while in the past its demand ranged between one and three tons per day.

Three textile companies were visited during the mission. Starch is used only for yarn sizing (thickening reduces breakages during weaving yarn) and removed later by fermentation or by caustic soda.

The first company produces exclusively pure cotton woven fabric. The current production stands at 10-15 million meters per year, with a potential for 25-30 million meters. They claim to be the largest Tanzanian factory for this product with an estimated 30% market share. In the past they used imported native starch but, due to the quality inconsistency, they switched to modified starch. Presently they import around 10 mt/month of modified corn starch, mainly from India. They have no experience in using cassava starch but the production manager showed some concern about its binding properties. However they would be interested in replacing corn with cassava starch since sometimes they face problem of shortage of corn starch in the market. The cassava starch must meet their technical specifications (not provided) and a consistent supply has to be ensured at a lower or similar price than corn starch (unwilling to disclose price).

The second company is most probably the largest textile factory in Tanzania. Unlike other companies, it targets primarily the export market (mainly Africa, UK and Spain). Its production is estimated at around 250 mt/month of yarn of which half is for knitting (not sized and thus with no use of starch) and half is for weaving (sized). They import around 3.5 mt/month of native starch in powder form, mainly from Kenya (unwilling to disclose price). They have never tried cassava starch as a possible substitute but there is some concern about the ease to be removed by caustic soda.

A further textile mill was visited in Mwanza. It makes one million metres of printed Kanga cloth a month. He uses maize starch to size yarn before dying and then washes this off. Most textile plants have starch recycling, this one did not. Textile users utilise about 10% starch by weight of production, so this plant brings in 13.5mt of maize starch from Kenya a month. He sees advantage in cassava starch because its supply would be year round, whereas with maize starch he finds that the price fluctuates wildly. The minimum quantity such a factor would need to test cassava starch would be 10mt. Apparently, there is a textile grade maize starch sold on the international market that is modified for the sector. We would need to prove that cassava starch is comparable with maize starch before this kind of factory would use it.

By using rough assumptions we can estimate that the Tanzanian textile sector currently uses an amount of cornstarch similar to the one estimated by Abass et al. for year 2006 (1,000 mt/year). While some potential exists for substitution after local cassava starch becomes available, the overall demand is extremely small compared to cassava availability. Furthermore, small firms or small-scale producers are unlikely to directly benefit of this opportunity since this demand is likely to be tapped by the large starch factories that are going to be established in the country in the near future.

Table 18 - SWOT analysis for use of cassava products by the textile industry

Strengths	Weaknesses
• Industry demand = around 1,000 mt/year • Demand of woven fabric and garment on a growth curve • Could be used at 100% replacement of maize starch • Cassava starch may have better viscosity than maize starch • Industry open to use cassava starch if consistent supply of quality starch is ensured	• The overall demand of starch by the sector is relatively small • Cassava starch does not bind with yarn as easily as maize starch • Removal of cassava starch may be more difficult than maize starch • In the future any demand is likely to be met by domestic large scale starch factories
Opportunities	Threats
• Frequent supply shortfalls for modified maize starch	• Several factories have relocated abroad • Lack of supportive policies • Increased competition from cheap import of garment from SE Asia • Increased use of synthetic fibres not requiring sizing

3.8 Paper mills and hardboard

3.8.1 Paper stiffening

Tanzania seems to have a growing paper and packaging sector. All sectors seem to be growing, but the 'kraft', corrugated and tissue paper sub-sectors look particularly promising. Kraft paper is used for packaging, bags and envelopes and is stiffened by starch. The Team met one of the largest maker of packaging and the largest tissue manufacturer in Tanzania. They currently use around 5 to10 mt of imported maize starch a month (delivered to the port in Dar es Salaam from India). They complain that informal and non-tariff barriers for bringing in these containers of starch add substantially to their costs and uncertainty of supply. They are keen to try using HQCF as an alternative paper stiffener and would like to try local cassava starch for other processes such as binding recycled paper. This looks like a good opportunity for HQCF on a very small scale.

Table 19 - SWOT analysis for use of cassava products by the paper industry

Strengths	Weaknesses
• Demand for corrugated, cardboard box and craft paper increasing and all packaging companies growing. • Maize starch is used for stiffening paper and could be replaced with HQCF - This has been tried in Zambia and works • HQCF cheaper that imported maize starch (TSh 700/kg delivered) • Importation of alternative ingredients very laborious	Market small (3 companies) – 5-10 mt a month

Opportunities	Threats
• Regional growth in packaging industry – particularly Kenya • Paper recycling industry – about to start in Tanzania and would use starch or HQCF for stiffening ('Mafindi Paper')	

3.8.2 Glue

No glue manufacturers were identified in Tanzania

3.8.3 Hardboard

There is a small hardboard factory in Tanga using starch. There was not time to visit this factory, but the volume of starch consumption is said to be very small. At this stage pursuing the use of starch or HQFC in hardboard is probably not worth further effort.

3.9 Paint

Even though the Team had not the opportunity to visit any paint factory, it is known that paint production in Tanzania is still very tiny. As such limited opportunities exist for cassava utilization in this sub-sector.

3.10 Pharmaceuticals

The Team visited the largest pharmaceutical company in East and Central Africa. It uses specialised modified maize and potato starch in tablet formulation. Their current demand in Tanzania is for two to three mt of specially modified starch a month which is mostly sourced from India in 10 mt consignments.

The pharmaceutical sector is keen to get supplies locally, but quantities needed are too small to be a driver for cassava demand. There are currently five pharmaceutical companies in Tanzania with a likely demand for pharmaceutical starch of less than 10 mt a month. Furthermore the supplier has to comply with very stringent food safety standards.

Table 20 - SWOT analysis for use of cassava products by the pharmaceutical industry

Strengths	Weaknesses
• Small but fast growing domestic and regional pharmaceutical industry • Uses native maize and potato starch	• Total industry demand @ 100mt/year • Needs pharmaceutical grade native starch • No import duty on pharmaceutical grade starch
Opportunities	**Threats**
• Companies would prefer local supply to avoid complex import barriers	• Cheap sources of native starch (India and Thailand)

4. Summary of potential demand of cassava-based products

The potential demand of cassava-based products in Tanzania is substantial. In the medium to long-term large volumes of cassava products may be required by the end-users in several industrial sectors. Most of them offer considerable opportunities for small-scale producers if consistent quantities of quality products are ensured. Table 21 presents the overall potential demand of cassava-based products over the short, medium and long-term.

We have identified two products as particularly promising: HQCF and improved dried cassava chips.

The possibility of HQCF inclusion in either home-prepared food or industrial products (bread and biscuits) can create an annual demand of tens of thousands tonnes of HQCF. Since most wheat flour (70-80%) is used for the preparation of traditional food at household level, it is in this sub-sector that major opportunities lay. Past experiences have proved that if proper promotional campaigns about the possibility of HQCF inclusion in traditional wheat-based recipes, for instance for preparation of chapatti and mandasi, are developed (in fact many consumers are still unaware of this possibility) and with a lower retail price of HQCF, a potential demand of 11,000 to 25,000 mt/year of HQCF exists (equivalent to 44,000-100,000 mt/year of fresh roots). Furthermore, the possibility of HQCF inclusion in the production of bread and biscuits can determine an overall additional demand of 7,300-14,700 mt/year of HQCF (30,000-49,000 mt/year of fresh roots). In case HQCF inclusion into wheat flour for industrial processing (special baking flour and speciality flour only) is not done on voluntary basis by the firms but rather imposed by the GoT, similarly to what done in Nigeria, an additional demand of 10,000 to 20,000 mt/year would emerge. It is worthwhile to note that the impact of a future imposition of HQCF inclusion would not be as relevant as in other countries, such as Nigeria, because, as noted earlier, in Tanzania most of wheat flour is sold as home-baking flour and, as such, would not be affected by the implementation of the Presidential Cassava Initiative.

The animal feed sector offer very good potential for the use of improved dried cassava chips ('improved' makopa). The livestock sector is growing at steady pace and, in line with the literature, a potential annual demand of 40,000-45,000 mt has been identified (160,000-180,000 mt/year of fresh roots). The availability of cheaper protein-rich ingredients and the recent improvements in transport infrastructure can contribute to facilitate the grasp of this opportunity but further research is required. The use of HQCF is this sector is not economically viable.

Additional sectors that may drive an increase in cassava production and marketing are the small-scale mills and the beer sectors.

While small volumes of HQCF are currently produced by small-scale mills, they are primarily focused on the production of maize flour. In some regions, many consumers are already accustomed to blend maize and cassava flour for the preparation of 'ugali' (stiff porridge). However the high retail price of HQCF is a disincentive to a wider spread of this practice. Well-designed promotional campaigns combined with lower price for HQCF can create in the long-term a potential annual demand of HQCF of around 12,500 mt (50,000 mt/year of fresh roots).

As far as the beer sector is concerned the traditional beer sub-sector seems to offer better potential than the clear beer sector. In fact, despite the larger volumes of clear beer in the market, only a small share of this market would be the target of beer containing cassava while the bulk will be still made of beer exclusively made with cornstarch. Furthermore the industry does not seem interested in developing cassava clear beer for the Tanzanian market before the cassava beer presently produced in Mozambique has proven to be successful. Conversely the traditional beer subsector, whose quality requirements are considerably lower and that it is much more inclined to prioritize the cost saving in raw material, seems a more easily accessible market. This subsector has the potential to easily absorb 2,500-3,000 mt/year of 'improved' makopa (10,000-12,000 mt/year of fresh roots).

The starch industry can apparently seem the most important potential market for cassava. Once the two new starch factories will be established and fully operational they will require over 220,000 mt/year of fresh roots. However these firms will rely on core plantations leaving very little room for the involvement of small-scale producers. In addition the scale of their operations and their capital-intensive production system would make uncompetitive any small-scale starch factories willing to enter the starch business and target the textile, hardboard or paint domestic industry (whose starch demand is however rather limited).

In conclusion, as reported in Table 21, we have estimated the potential long-term demand of cassava at 530,000-640,000 mt/year of root equivalent if HQCF inclusion in industrially baked products (bread and biscuits) is done on voluntary basis; and at 570,000-720,000 mt/year in case HQCF inclusion is made mandatory by the Presidential Cassava Initiative. The cassava demand potentially available for small-scale cassava producers (and thus excluding what produced by the core plantations of the starch factories) would be 300,000-410,000 mt/year and 340,000-490,000 mt/year, respectively.

Table 21- Summary of potential demand of cassava-based products

Sector		Cassava-based product	Current/potential demand of cassava-based product (mt/year)				Long-term potential demand in root equivalents (mt/year)	Conditions
			Current use	Short-term	Medium-term	Long-term		
a	Large-scale mills	HQCF	0	0	3,500-7,000	17,500-35,000	70,000-140,000	Presidential Cassava Initiative imposes the inclusion of HQCF into wheat flour for industrial
b	Bakeries	HQCF	Very limited	150-300	800-1,600	2,300-4,700	9,200-18,800	Promotional campaign, cheaper HQCF available, ensured quantities
c	Biscuit manufacturers	HQCF	50-100	1,000-2,000	2,500-5,000	5,000-10,000	20,000-40,000	Ensured quantities
d	Home consumption (for traditional dishes)	HQCF	Very limited	1,000-2,500	5,500-12,500	11,000-25,000	44,000-100,000	Promotional campaigns; cheaper HQCF available for urban consumers
e	Small-scale mills	Grits/Improved makopa	Very limited	1,300	4,100	12,500	50,000	Promotional campaign; cheaper HQCF available
f	Animal feed	Improved makopa	10-15	1,000	20,000	40,000-45,000	160,000-180,000	Price considerably lower than maize; lower cost of protein-rich ingredients
g	Clear beer	Improved makopa/HQCF	0	0	500	1,000-2,400	4,000-4,800	Success of cassava beer in Mozambique; Market acceptability
h	Traditional beer	Improved makopa	0	900	1,900	2,500-3,000	10,000-12,000	Market acceptability; Darbrew accepts chips rather than HQCF
i	Beverage	Cassava syrup	0	0	Very limited	Very limited	Very limited	Price competitive with imported syrup
j	Sweet	Cassava syrup	0	Very limited	Very limited	Very limited	Very limited	Price competitive with imported syrup
k	Snacks	HQCF	Very limited	Very limited	Limited	Limited	Limited	HQCF cheaper than maize
l	Starch factory	Fresh root	0	0	56,000	228,000	228,000	Foreign investors still willing to invest
m	Textile	Cassava starch	0	100	500	1,000	4,000	Cassava starch cheaper than imported maize starch. Cassava starch meeting the technical specifications
n	Paper mills	Cassava starch/HQCF	0	0	very limited	very limited	very limited	Cassava starch cheaper than imported maize starch. Growing paper and hardboard industry
o	Paint	Cassava starch	0	0	very limited	very limited	very limited	Establishment of a domestic paint industry
p	Pharmaceutical	Cassava starch	0	0	0	0	0	-
	Total (without mandatory 10% HQCF inclusion in wheat flour for industrial use) [b+c+d+....p]						530,000-640,000	300,000-410,000 (excluding core plantations of starch factories)
	Total (with mandatory 10% HQCF inclusion in wheat flour for industrial use) [a+d+....p]						570,000-720,000	340,000-490,000 (excluding core plantations of starch factories)

5. Emerging market inefficiencies

While the Terms of Reference of this study did not require us to conduct an in depth value chain analysis - and thus to focus on the whole range of activities and relations associated with production, exchange, transport and distribution of fresh and processed cassava - we have decided to analyse the flow of a specific product from harvesting to final consumption in order to identify the value created and retained by the different actors in the chain and clarify the dynamics in the commercialisation.

Since the C:AVA country coordinator was part of the Team it was an obvious choice to conduct this simplified analysis for HQCF produced in the target area of the project, the Mtwara region. The objective was to provide estimates of value at the different stages in the value chain and for the different actors involved in order to uncover patterns of value-addition and identify domains of value-appropriation.

The value chain of HQCF in Mtwara is presented in Figure 5. It presents the different actors of the chain, the type of transaction (sales are represented by solid lines; service provision by dashed lines), the type of product (well-packed HQCF for higher-value markets is indicated by underlining) and indicative prices (either delivered or at the farm/factory gate).

Different issues emerged:

- Larger HQCF end-users in DSM, namely the biscuit manufacturers, tend to purchase through aggregators (either as agents or traders) rather than dealing with a plethora of small producers;

- The supply of well-packed and properly labelled HQCF to supermarkets and shops in DSM is controlled by few agri-food processing industries in DSM that mill grits purchased from the Village Processing Groups (VPG);

- Sale of HQCF directly from farmers or VPGs (i.e., without aggregators' involvement in the commercialization process) is confined to local retailers or traditional markets;

- Similar products show substantial price differences across diverse channels. Price for grits ranges from 350-400 TSh/kg if sold locally to 600-650 TSh/kg if sold to agri-food processors in DSM. Purchasing price for bulk HQCF ranges from 500 TSh/kg (rural market) to 700 TSh/kg (to local retailers), while retail prices for well-packed HQCF range from 800 TSh/kg in local retailers to 1,800 TSh/kg in supermarkets in DSM. The transport cost (50 TSh/kg) cannot explain such a large difference;

- Agri-food processors in DSM are the only HQCF suppliers for supermarkets in DSM. They seem to be in a lead actor position for this

high-value market and, while rather limited costs seem to be incurred for milling and packaging, they are able to capture a large share of the final price. According to the information gathered, on the one hand they benefit of completion among a large number of potential suppliers of grits; on the other hand, supermarkets in DSM are willing to pay higher prices to processors able to guarantee quality flour, proper packaging and consistent supplies;

- Similarly, local retailers in Mtwara are ready to pay higher prices for HQCF supplied by aggregators;

- There is clear evidence of market failure emerging in the 'new' HQCF sector. Existing HQCF producers are practicing price discrimination between markets and sub-sectors. As a result, some sectors are being under-supplied or are over-paying. This is a symptom of an emerging cassava processing sector in Tanzania that has not yet reached sufficient scale to begin to meet demand and consolidate.

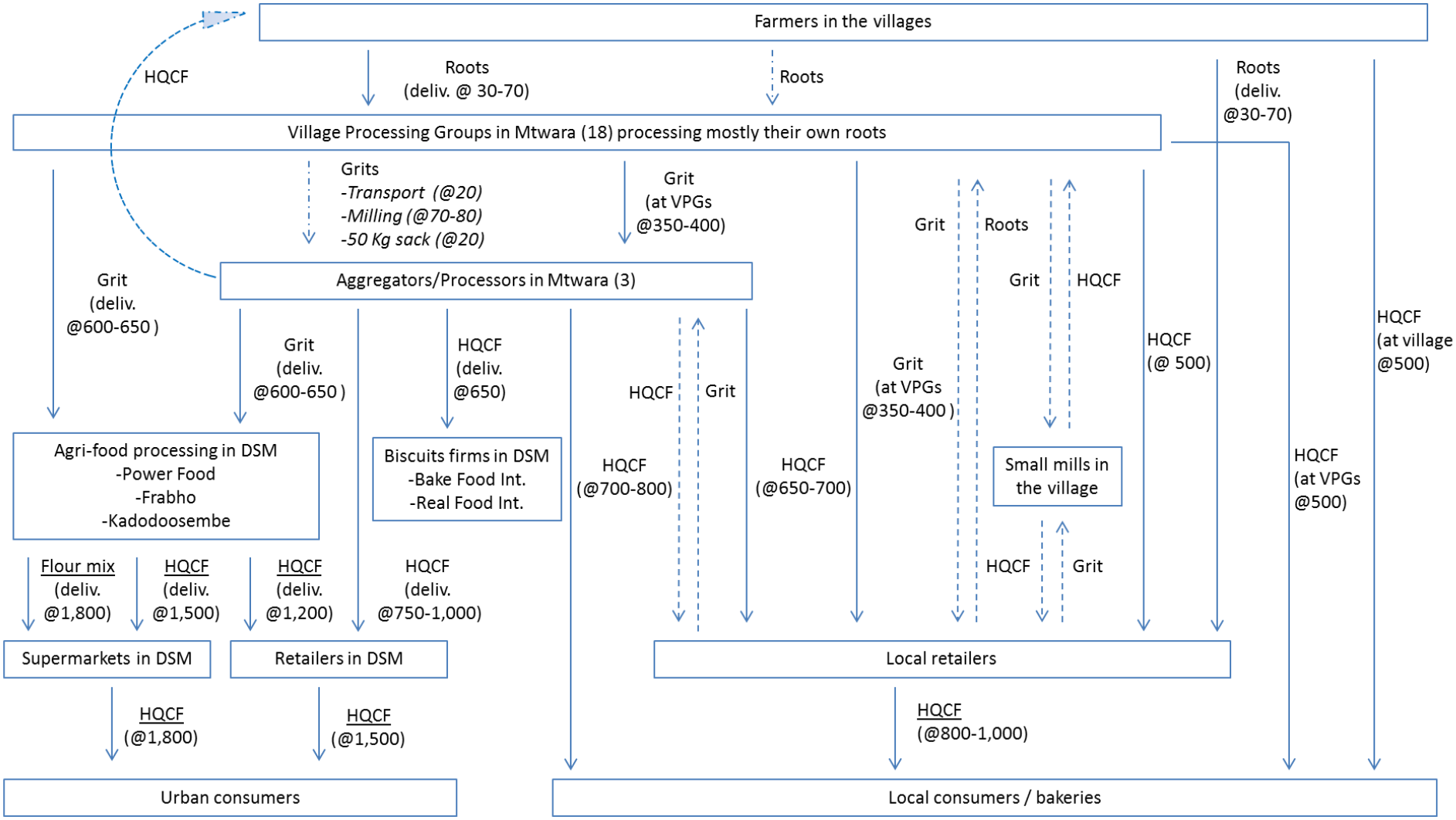


Figure 5 - Schematic representation of HQCF value chains in Mtwara.

6. Regional trade in Cassava

According to Minot (2010) there is no regional trade in cassava from Tanzania to neighbouring countries. Notwithstanding, there does seems to be existing and substantial potential trade in products that contain cassava, particularly from Mwanza where trade to Burundi, Rwanda and the Democratic Republic of Congo is growing. Poultry chick and feed producers in Mwanza all talked about existing and expanding trade to these countries. Millers also mentioned the export potential. A considerable amount of starch is currently imported from Kenya.

7. Finding of the Cassava Breeders and Value Chain Workshop

A workshop was held in DSM on the 26th April with the participation of the Team members and some key-cassava breeders (including the National Roots and Tuber Coordinator – Dr. Geoffrey Mkamilo) from different Zones of Tanzania (DSM, Coast Zone, Lake Zone and Southern Zone). The list of participants is presented in Annex IV and the outline of the meeting in Annex V.

The workshop has attempted to marry the state of the art in the national cassava breeding programmes of Tanzania with an up-to-date review of value chains for cassava and processed cassava products. Questions addressed included: the current cassava breeding objectives, the history of variety release, and the key traits that have been addressed in breeding?

The cassava breeding programme in Tanzania is coordinated at national level but regional research institutes are involved in decentralized research to identify varieties adapted to the different agro-ecological conditions. A participatory approach is adopted involving farmers in the on-farm selection trials. Furthermore the national performance trials for official release seem to be carried out under farmers' management conditions.

Even though the different regional research institutes work independently, the current objectives of the breeding programmes are set at centralized level and are homogeneous across the different regions. The main objectives are: varieties with high dry matter and resistance to major diseases (cassava mosaic disease, brown streak disease and cassava green mite) and abiotic stress (drought). The spread of diseases across the country is still the most serious constraint to the increase in cassava productivity.

While the focus has been almost exclusively on traits required by small holders, more recently attention has been paid to the selection of varieties with higher starch content (for industrial starch extraction) and higher nutritional value (such as higher beta-carotene content). In particular the demand for high starch varieties has been driven by the private sector. However, for the time being, no varieties have been released for these specific end-uses.

Breeders seem aware of the interest in higher protein content in cassava by several industrial sectors. It seems that in the past research in this field was encouraged by the GoT while, later on, efforts for the selection of high-protein traits have been discontinued and the responsibility fully given to CIAT and Embrapa. However, breeders admitted that they have never received any material to be used in the national breeding programmes.

While no effort has ever been undertaken to develop varieties suitable for use in animal feed, breeders have discussed the work currently done in Uganda to select varieties with high beta-carotene content as demanded by companies in the poultry sector in order to give yellow colour to the yolk.

So far breeding efforts, taking into account farmers' preference, have focused almost exclusively on sweet varieties (except one variety, Kyaka). Even though the cassava breeding programmes have started relatively recently a number of varieties have been released so far. They are:

Zanzibar (first generation varieties):

- Kizimbani
- Mahinda
- Machui
- Kama

Central Zone (priority to drought resistance):

- Mumba
- Hombolo
- Dodoma
- Makotopora

Coastal Belt (priority is tolerance to mosaic disease and brown streak disease):

- Kiroba
- Naliendele
- Kibaha
- Mkumba
- Pwani

Lake Zone(priority is tolerance to mosaic disease): [5]

- Mkombozi
- Kyaka
- Meremeta
- Nyakafulo
- Rangimbili
- Belinde
- Suma

No specific breeding programme has been developed for the area around Arusha since cassava production is not widespread in that region.

During the workshop, it has been mentioned that the poor dissemination of new varieties represent a serious constraint to increased technology adoption. Unlike other crops, the GoT (through the Agriculture Seed Agency), a part from some multiplication undertaken in the prisons, is neither involved nor supporting the multiplication of the new planting material. For instance in the Lake Zone the multiplication and dissemination of new varieties is conducted only by NGOs, such as Catholic Relief Services supported by BMGF as part of the

[5] All of these except Mkombozi were abandoned by GLCI because of susceptibility to brown streak disease. In the past priority was mosaic disease but now brown streak disease resistance is required.

Great Lakes Cassava Initiative (GLCI). It is not possible to estimate the adoption rate of improved varieties in Tanzania.

In conclusion, to date a focus on farmer led trait identification seems to have driven breeding. By connecting the findings of new value chain analysis with existing breeding programmes it has been possible to reveal some interesting new opportunities to slightly re-balance this programme based on addressing the needs of end users and possible new market opportunities. However new alliance between demand and supply-side ends of cassava value chains should be built in order to promote a more market-driven client-oriented research. Furthermore, the strengthening of the multiplication system of planting material and advisory service is of overwhelming importance in order to promote a wider adoption of the improved varieties released by the research institutes.

8. Emerging recommendations from value chain analysis

This section highlights the recommendations that have emerged from this research.

8.1 Cassava demand drivers

With respect to the milling sector and replacement of wheat flour from imported grain for the baked food sector in Tanzania, the Team see composite flour as an important future large-scale demand driver. To achieve this more research will be needed on devising and implementing composite flour standards to promote its use by key sub-sectors such as bakeries. Policy initiatives by the GoT may be needed to promote uptake among mills and consumers.

There is potential for using a policy led approach to drive demand for cassava by setting mandatory inclusion rates for HQCF in industrial wheat flour products. However, the Team recommends that before this policy is applied a substantially enhanced cassava sector development plan is required. This plan should address the question of how wheat flour users will meet mandatory cassava inclusion levels and recommend the correct phasing of the introduction of policies and the support elements needed to make this work.

Tanzanian bakeries and biscuit manufacturers seem keen to adopt the inclusion of cassava flour if the price is competitive, quality assured and supply efficient. The Team recommends a number of initiatives that could support increased adoption of cassava flour by bakeries and biscuit companies. HQFC needs to be properly marketed to the baking sector with recipes and advice. Bakers would probably like to have a "Bakery Quality" cassava flour product targeted directly at them. A programme, building on existing work done by C:AVA, of supplying bakeries and early adopters with cassava flour samples and following this up with offers of supply would stimulate demand.

Most wheat flour in Tanzania is used at household level for the preparation of traditional food. Many consumers are unaware of the possibility to include HQCF in their recipes. Lessons learnt from previous experiences have provided evidence that, once exposed, consumers appreciate the use of blended flours in their traditional wheat-based dishes. Furthermore, there seem to be potential for some new products. Wider adoption of HQCF at household level seems to offer tremendous potential. This requires promotional campaigns (such as participation at food fairs, TV and radio programmes, panel tests, etc.) and more affordable HQCF at retail level where currently it is marketed as high-priced specialty product for wealthy consumers.

This discourse suggests two possible strategies: firstly, targeting mills to produce ready-to-use composite flour for baked products, and, secondly, targeting the end-users by marketing "Bakery Quality HQCF" to bakeries and biscuit

manufacturers. Research on what would constitute a "Bakery Quality HQCF" product is needed.

The Team considered the scale and scope of existing HQCF producing operations supported by various donors. The existing HQCF model does not meet the scale needed by many of the demand drivers identified. Furthermore, many companies seem reluctant to deal with several small-scale producers and complain about the lack of reliable intermediaries able to guarantee consistent supplies as required by industrial operations. The logical next step is to scale-up product by encouraging the emergence of some medium scale cassava processors (of both HQCF and cheaper cassava flour products such as 'improved' makopa) and/or increasing the number of small-scale village level processing enterprise. We found evidence that this is already happening and could be accelerated with technical and business support as well as soft loans for early adopters.

For emerging HQCF and 'improved' makopa businesses a business 'starter-pack' should be developed to stimulate investment by local entrepreneurs.

The potential for a commercial 'ugali' flour (maize/cassava flour blend) in Tanzania has not been fully exploited. Research to overcome the technical barriers to a pre-mixed commercial flour for ugali's home preparation could strongly stimulate commercial milling interest in HQFC.

Tanzania's animal production sector is growing quickly and stimulating demand for animal feed and animal feed ingredients. Seasonal low prices of maize, cost of added protein if cassava is used and insufficient and inconsistent supply are the key constraints. Availability of cheap protein in the Lake zone and the variability of maize prices represent an important commercial opportunity for cassava which could be met by a cheap 'improved' makopa chip product. The Team recommends that a more in-depth study of the economics of this sector be completed as the first phase of the potential development of a new 'improved' makopa production sector in Tanzania.

Production of cassava chips for the animal feed industry based on 'improved' makopa in the Lake zone of Tanzania would need to address supply side constraints by resolving the current disease issues. The increased demand for cassava might be a win-win if it gives farmers the stimulus needed to improve seed and management practices. Mycotoxin contamination and cyanide toxicity would need to be researched. Varieties that combine any amount of added protein content with disease resistance would substantially increase the chances of success with 'improved' makopa.

The Team looked mainly at the fast growing Tanzania poultry sector. We recommend that follow-up research on other fast growing animal feed sectors be considered including: dairy, pork and cattle fattening. This research should focus on basic production economics of using an 'improved' makopa product in a range of animal feeds.

Several other minor (and potentially not so minor) demand drivers were identified by the Team. These include the traditional beer sector, the fast growing paper and packaging sectors, and the maize syrup replacement market (sweets and beverages). For all these sectors more in depth feasibility studies should be conducted.

The analysis seems to suggest that other possible sources of demand for cassava flour should not be targeted at the moment. The textile and pharmaceutical sectors currently do not require sufficient product to warrant more effort. We are uncertain about the building materials sector (e.g. hardboard) but believe that, at present, it is not large enough to drive cassava demand on any scale. The snack market is currently very small and diffuse. All these sectors should be revisited in the future.

The emergence of commercial starch production from cassava is likely in the next few years. In developing a sector approach in Tanzania the likely impact of cheap native starch from these factories on local industry should be taken into account and suggests that a strategy based on avoiding direct competition with industrial starch production in these specific sub-sectors should be adopted.

8.2 Cassava market inefficiencies

In order to address some of the market inefficiencies identified in Section 5, the Team recommends to:

- Further strengthen organization and coordination of Village Processing Groups involved in the production of grits;
- Support their negotiation skills;
- Improve access to market information;
- Promote the establishment of a number of HQCF producers in order to increase the market competition and offer better opportunities for the sale of grits;
- Promote larger-scale processors of grits into HQCF and/or larger numbers of village processing enterprises in order to create scale economies, increase value adding and facilitate better linkages with end-users;
- Facilitate the dialogue and support the partnership between smallholder farmers, intermediate processors/aggregators and end-users.

8.3 Cassava breeding and value chains

Tanzania has an existing and successful cassava breeding programme based on farmer led trait identification. Scope exists to combine current work on improved varieties for disease resistance with traits desired by the market, such as a slightly increased protein content.

It is clear that any demand driven approach resulting from the findings of new value chain analysis will need to be allied to a supply of improved disease resistant planting material to allow new and larger cassava market demands to be met.

Annex I: Terms of Reference

- A review of published and grey literature on cassava markets and value chains in Tanzania.
- Consultations with key informants (including actors in value chains, various service providers, policy makers and funding agencies with an interest in cassava markets and value chains) in Tanzania.
- A field survey of potential market options, including regional markets
- Communication of outcomes of investigations to Foundation staff and other stakeholders in-country. A dialogue will be maintained with staff of the Foundation to ensure synergies between activities.

Annex II: List of meetings and persons met

Annex III: List of guide questions

Check-list for cassava market study in Tanzania – April 2012

Date of interview

A. General information

1. Company name
2. Address
3. Name of respondent(s)
4. Position
5. Phone
6. E-mail

B. Type of business

7. Sector (e.g., plywood factory, textile, multi-sector, etc.)
8. Scale and type of business (e.g., large, small, regional, international, integrated)
9. How long has your business been operating?
10. Product range
11. Which of your products is most important to you? (in term of sales)
12. What has been your annual output over recent years? *(for a large factory tonnage is best; for a bakery, an estimate of value would be more appropriate)*
13. What are your markets? *(local/export/both, if both, then what are the proportions)*
14. What is the size of your sector as a whole in Tanzania (if there is import/export ask how much)?
15. What is your (domestic) market share? What are your main competitors?
16. For the industry as a whole, is demand for your main products static/increasing or decreasing?
17. Do you use cassava or cassava-based products? If yes go to 18; if not go to 27.

C1. Current cassava use

18. What cassava-based end products do you produce? What annual output? Trend?
19. What type of cassava or cassava-based products do you use as raw material? What product(s) do they substitute (substitution rate)?
20. Source *(imported/local get details of supplier in each case)*
21. Amount, past trend, price and seasonality of purchase (if any) in recent years

22. What are the advantages of using cassava as substitute of traditional raw material? *(e.g., price - price comparison -, quality, availability, product specifications)*
23. What is the price of cassava-based end products? How does it compare to "traditional" products?
24. Do you face any problems in getting supplies of cassava or cassava-based products *(if yes, get details, and ask how they overcome the problems)*
25. What are the perspectives to increase the use of cassava and cassava-based products and under which conditions would you be interested in it?
26. In choosing cassava or cassava-based products, what are your specifications? *(e.g., m*oisture % (max), pH, colour, odour, total ash % (max), crude fibre % (max), viscosity, price (max./kg/t)*)*

C2. Potential cassava use

27. Do you face any problems in getting supplies of raw materials (if yes, get details and ask how they might be overcome)?
28. Are you prepared to use cassava or cassava-based products as raw material in the future?
    - If yes, why? (reasons, and conditions that have to be in place), and go to 29
    - If no, why not? (reasons, constraints), and jump directly to section D

29. What cassava-based end products do you think you could produce and market?
30. What quantities do you think you could produce per year?
31. What would be substituted and at what rates? Quantities of cassava or cassava-based products potentially required in the future?
32. If you were to use cassava-based products, in what form would you want to buy them? What would be the minimum specifications required?
33. What is the price range of current raw material that could be substituted by cassava and cassava-based products?
34. What prices would you be prepared to pay for cassava-based products (range of price depending on quality). Is price for product "delivered at factory gate"? (If the person interviewed cannot give a clear price, try to obtain a price ratio, for example, dried cassava chips compared to maize, or cassava flour compared to wheat flour).
35. If you purchased cassava or cassava-based products, would you have a minimum quantity required to make raw material worthwhile?
36. What potential suppliers of cassava-based products (location and operators) can you envisage?
37. At what price do you think cassava-based end products could be sold in comparison to "traditional" products?
38. If you were to use cassava-based products as raw materials, how would this influence your processing costs and overall profitability?
39. Can you envisage any problems with using cassava-based raw materials? (e.g., quantity, quality, timeliness of delivery).

D. Potential cassava use in the sector

40. Which customers are more likely to purchase cassava-based end products?
41. How many mt of cassava-based end products do you think your sector as a whole would be prepared to purchase per annum in the short/medium/long term?
42. How does government policy might affect the use of cassava and cassava-based products in your sector?
43. Would you be interested in being involved in future activities (industrial trials of cassava based products)?

Annex IV: List of cassava breeders workshop participants

Name	Organization	Position	Contact
Edward E. Kanju	IITA (DSM)	Breeder	e.kanju@cgiar.org
Geoffrey Mkamilo	Naliendele Agricultural Research Institute (Mtwara)	Breeder	geoffreymkamilo@yahoo.co.uk
Kiddo Mtunda	Kibaha Sugarcane Research Institute (Coast Zone)	Breeder	kidomtumda@yahoo.com
Henriko Kulembeka	Ukiriguru Agricultural Research Institute (Mwanza)	Breeder	Kulembeka@yahoo.com
Vincent D. Assey	TNFC	Acting Director	vdassey@gmail.com
Ben Bennett	NRI	Economist	ben.bennett@gre.ac.uk
Diego Naziri	NRI	Economist	d.naziri@gre.ac.uk
Grace Ngwasy	C:AVA	Country representative	gngwasi@yahoo.com
ElifatioTowo	TNFC	Food Technologist	eetowo@hotmail.com

Annex V: Outline of cassava breeders workshop

Questions

What are the current cassava breeding objectives in Tanzania?
What cassava varieties have been released and what are their key traits?
What traits are desired by cassava end users?

Objectives

To understand the relationship between cassava breeding and cassava market development in Tanzania.

Agenda

Item	**Method**
Welcome	TFNC Director
Introduction of participants	Ben – round table
Description of C:AVA	Grace
Agreement on workshop objectives	Ben – open discussion
Discussion #1 – Cassava breeding objectives	Ben – open discussion
Discussion #2 – existing varieties and traits	Diego – workshop using a list/table
Discussion #3 – understanding of end user needs	Diego – workshop by end use and value chain actor (list to be drawn up before workshop)
Round-up and general conclusions	Ben

References

Abass (2011) Exploring best options for the inclusion of rural poor in cassava value chain: lessons from small-scale cassava processing in East and Southern Africa. PowerPoint presentation.

Abass, A., Alabi, T., Nkuba, J., Rweyendela, V. (2008) Cassava in Tanzania: Advances in Research and Commercialization..

Abass, A., Abele, S., Ndunguru, Jani, D., Rweyendela, V., Wanda, K. (2007) Business planning for cassava processing sites in Tanzania.

External Market Task Force, Republic of Mozambique (2004) Report on cassava. Available at <http://www.mic.gov.mz/docs/comercio/pdf/estProjectos/Cassava_03_2004.pdf>
FAOSTAT (2012). FAOSTAT Database [accessed on 10.5.2012].

Kleih, U., Sanni, L., Dipeolu, A., Abass, A., Abdulsalam-Saghir, P., Butterworth, R., Siwoku, B. (2008) "Value Chain Analysis for Nigeria", Natural Resources Institute, Chatham, UK.

Hape, I.M., Mtalai, M.R. (2010) Evergreen agro-processing industries - Starch processing factory business plan.

Match Makers Associates (2008) Processed Cassava Sub Sector and Value Chain Analysis, Mtwara and Lindi Regions – Study commissioned by One UN JP1 Programme.

Match Makers Associates (2007) Cassava Value Chain Analysis – Study commissioned by Kilimo Trust. Available at <http://www.thekilimotrust.org/index.php?option=com_docman&task=doc_view&gid=11>.

MITM, (2011), Integrated Industrial Development Strategy 2025, Ministry of Industry and Trade, Tanzania.

Minot, N. (2010), "Staple Food Prices in Tanzania", Prepared for the COMESA policy seminar on "Variation in staple food prices: Causes, consequence, and policy options", Maputo, Mozambique, 25-26 January 2010 under the African Agricultural Marketing Project (AAMP).

Posthumus, H., Kleih, U., Abass, A., Butterworth, R., Mbogoma, J, and Milingi, N., (2009), "Market Value Chain Analysis Tanzania", Natural Resources Institute, Chatham, UK.

Promar Consulting (2011) The Cassava Industries in Mozambique and Tanzania: production, processing, distribution and consumption of cassava and its related policy challenges. Report for the Ministry of Agriculture, Forestry and Fisheries of Japan.

Sewando, P.T., Mdoe, N.Y.S., Mutabazi, K.D.S. (2008) Farmers' Preferential Choice Decisions to Alternative Cassava Value Chain Strands in Morogoro Rural District, Tanzania. Department of Agricultural Economics and Agribusiness, Sokoine University of Agriculture (SUA), Morogoro, Tanzania.

United Republic of Tanzania (2011) Ministry of Livestock Development and Fisheries, 2011/2012 Budget speech.

United Republic of Tanzania (2006) Report on investment opportunities in livestock industry.