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Increasing Performance of the Cassava Industry in West and Central Africa Region (IPCI)

High Quality Cassava Flour (HQCF) Case Study Report

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IFAD- WEST AND CENTRAL AFRICA DIVISION

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Executive summary

During the period of January to March 2016, a joint NRI and FUNAAB team conducted a mission across 4 (Ogun, Osun, Delta and Kwara) of 24 cassava producing States in Nigeria, which had two main objectives:

(1) Assess the quality of product being produced, and the quality management systems in place; and,
(2) Gain insight into their levels of success as measured against their target markets, factory operations, management and technology.

The following HQCF case study examines 7 High Quality Cassava Flour (HQCF) producing Small Medium Size Enterprises (SMEs), representing 5% of processing plants across key cassava producing States, though it should be noted that at least 30% of HQCF SMEs are being supported under the CAVA initiative, thus giving a good insight as to the current status of the HQCF industry in the country. The aim of the case study was to begin to generate a knowledge base (of technical challenges and solutions, business case, potential impact, scaling/capacity requirements, spares and maintenance issues, operating challenges), and identify and share best practice in quality assurance.

Successive governments have hoped to turn the cassava sector in Nigeria into a major player in local and international starch, sweeteners, ethanol, HQCF, and dried chips industries by adopting improved production and processing technologies, and organizing producers and processors into efficient value-added chains. This has not yet been realised. Fiscal incentives have included zero import tariffs on imported cassava processing equipment, tax holiday for Greenfield projects, and higher tariffs on imported alternatives. Agricultural incentives involved public investment in land clearing and development of rural farm roads. Other agricultural incentives included growth enhancement support (GES) on planting materials of improved varieties to farmers.

HQCF was selected for the case study as this cassava subsector has been struggling to take off for almost 15 years, with a significant number of processing plants non-functional despite a variety of government incentives and donor interventions. Nigerian government policy has been to support the development of the HQCF sector to drive demand for small holder cassava production. It was hoped that these interventions would drive demand for HQCF as a partial substitute for imported wheat flour, and generate up to 80, 000 jobs.

Most SMEs struggle to meet defined HQCF quality specifications (Annex 2). No quality management systems or quality control tools were found as should be the case in a food manufacturing business. Many of the quality issues observed were due to lack of scheduling within the process, lack of planned equipment maintenance, insufficient skilled labour, high staff turnover, lack of supervision on the coordination of operations, and availability of labour. Only one of the seven SMEs had a product which conformed 100% to HQCF specifications.

The overwhelming majority of HQCF processors still view the millers as their target market. However, until SMEs can reduce their costs of processing HQCF, and/or receive a much higher price for selling HQCF, it is difficult to see the business case- hence, part of the reason why most are struggling. There are those SMEs who are not located within a suitable distance of raw or semi-processed (wetcake) material, and therefore are unlikely to be viable

in the long-term. Those factories having their own farms, access to cheaper raw material, maintaining quality, or having sought to pursue markets are fairing much better.

During the study, a significant number of complaints were expressed by SMEs over technical challenges. Most concerned the flash dryer burners, the temperature gauges not working, and flour leakages from the cyclone (lower than expected throughput). Whereas, SMEs would blame the technology, the fabricator was inclined to attribute these issues to mismanagement of the equipment. The absence of detailed specifications regarding contracts for equipment supply makes it difficult to audit expected performance.

The most common perceived challenges cited by SMEs were:

- Lack of access to markets
- Poor price offered by end-users
- Lack of access to working capital
- Lack of transport-high cost of transporting cassava roots from farm to factory
- Lack of working capital
- High production costs

In conclusion, there was little evidence of best practice in quality and operations management. However, lessons can be learnt from those businesses who have sought to seek alternative markets other than wheat millers. There exists therefore much room for scaling up SME operations, though with significant capacity building, as well as access to credit.

The following are recommended:

- Further training and capacity building in quality and operations management. This is essential if SMEs are to increase efficiency, reduce variability in product quality and optimise potential profits
- Assistance with the procurement of quality control tools alongside further capacity building in quality management
- A review of individual company constraints (particularly on key financial variables such as raw material) and thus longer term viability
- An assessment of potential market opportunities (including value addition in-house), in their localities. This exercise requires further field studies, and may later involve the development of business plans related to indentified investment requirements. Assistance with end-user demonstrations and marketing may thereafter be delivered
- Monitoring of fabricators/equipment manufacturers for the quality of equipment supplied and service, with periodic training for SME staff, and maintenance perhaps built into the equipment supply contract for a specified period

1. Introduction

The International Fund for Agricultural Development (IFAD) funded project "Increasing the Performance of the Cassava Industry in West and Central Africa" (IPCI) aims to enhance the performance of IFAD-funded national root and tuber crops projects. It is also expected to have wider regional impact through: stock-taking and dissemination of good practice and lessons learned; introduction and dissemination of technological innovations; enhancement of policy dialogue among relevant actors; increasing private sector involvement and promoting private-public partnerships (PPP's). This case study was co-financed by the "Cassava: Adding Value for Africa" (C:AVA) project (funded by the Bill and Melinda Foundation) facilitating the quality training component and assessments of processing operations.

2. Objectives

The main objectives of the study were to:

(1) Assess the quality of product being produced, and the quality management systems in place, and
(2) Gain insight into their levels of success as measured against their target markets, factory operations, management and technology

3. Methodology

Field studies were carried out during the period of January to March 2016 with visits to each factory lasting two days, each across a number of States (Ogun in the Southwest, Osun in the South-West, Delta in the South-South and Kwara in the West) in Nigeria. A guide (Annex 1) was used to give structure to the interviews, whilst the actual processing of HQCF offered the opportunity to observe factory operations and assess product quality. The team was led by Dr. Louise Abayomi of Natural Resources Institute, NRI, UK.

4. Report structure

The report starts off with the contextual background of the cassava processing industry in Nigeria followed by recent policy environment. The main case study findings in relation to the key objectives are then presented, breaking them down into subcomponents. A summary of key constraints highlighted by participating SMEs is then given, followed by opportunities for scaling. Finally, conclusions and recommendation are made. The annexes consist of the following: Interview guide, specification of HQCF, HQCF process flow, individual case study narratives, and case study terms of reference

5. Background to the cassava industry in Nigeria

Nigeria is the largest global producer of cassava, producing over 40 million metric ton per annum of cassava, with about 60% of Nigerian farmers involved in its production given it is one of the nation's food security crops. Cassava is the most import important crop in Nigeria,

in terms of providing calories for the population. The crop is produced in 24 of the country's 36 States in the country.

Cassava in Nigeria is almost exclusively grown as a small-farmer crop, with plantings of between 1 and 5 ha, with only a handful of large commercial farms. Most cassava production in Nigeria goes towards the small scale processing of fufu and gari (a fermented gelatinized product) regularly consumed by a significant number of ethnic groups across the country. Nigeria is the largest importer of wheat in the world, importing four million tons, to the tune of $4 billion every year. Eager to promote self-sufficiency, successive Nigerian governments have been promoting the use of cassava flour (HQCF) as a partial substitute for wheat imports. HQCF is unfermented with potential uses that include the production of glucose syrups, industrial alcohol and bakery products, the production of adhesives, as an extender for plywood glues and as a source of starch in textile sizing. Given HQCF's potential to replace a proportion of imported wheat flour in bakery products, initial investments were targeted at wheat millers to develop composite wheat-cassava flour that could then be sold to bakeries across the country. Cassava flour does not contain gluten and so its inclusion as a substitute for wheat flour is somewhat limited. Different levels of inclusion of cassava flour have been suggested, ranging from 10-20% in bread, but can be higher in other bakery products, and 100 in the paperboard and plywood industries. Further, HQCF has advantages over traditional cassava flours because the process of production greatly limits the likelihood of cyanide naturally present in cassava roots entering the food chain.

6. The recent history of cassava processing policy in Nigeria

The cassava sector has been subject to a number of changes in policy environmernt. The 10% HQCF inclusion policy being promoted by the government (Chief Obasanjo) in 2002 compelled many to start processing HQCF. The flour was targeted at the major wheat millers such as Flour Mills of Nigeria (FMN), Honeywell, Crown, Dangote etc. Many mills issued purchase orders (LPO's) that processors claim weren't subsequently honoured. Consequently, many HQCF SME's defaulted on the loans obtained to set up their processing plants. In 2007, when the former president was behind the cassava initiative, payments by millers were supposedly made within days, thus reducing the pressure of working capital.
The situation was again reviewed by the then Minister for Agriculture (Mr Adesina) in 2013 to bring about the Cassava Bread Fund (CB). The fund was created by increasing import duty on wheat. The CB fund was to target HQCF processors, cassava processing equipment fabricators, cassava farmers, and the bread bakers association. Through Nigeria's Agricultural Transformation Agenda (CTA), the government approved the release of 3.5 billion naira in 2014. The main goal of the CTA was to increase income by at least US$400 every year for 1.8 million farm families and to add a million jobs to the cassava sub-sector in the country through a doubling of production, processing, and marketing of cassava over a period of four years (Table 1). The strategy was to turn the cassava sector in Nigeria into a major player in local and international starch, sweeteners, ethanol, HQCF, and dried chips industries by adopting improved production and processing technologies, and organizing producers and processors into efficient value-added chains. This has not yet been realised.

The former government took action in 2011 to compliment the subsistence sector with the promotion of large scale cassava processing industries such as those operating in Brazil (e.g. ethanol) and Thailand (e.g. starch) through the CTA. These targets were expected to be

achieved over the period 2011to 2015 but to date most of these subsectors have not progressed much.

Table 1: Summary of projected market opportunities

Market	Projected demand (t/year)	Fresh root equivalent (t/year)	Area required (ha)	Potential employment created
HQCF	250,000	1,000,000	40,400	80,000
Starch	230,000	1,150,000	46,000	92,000
Sweeteners	190,000	950,000	38,000	76,000
Dried chips	900,000	3,360,000	134,400	268,560
Fuel ethanol	0.5 billion litres	3,571,428	142,857	285,714
Gari	455,000	2,730,000	109,200	218,400
Total		**12,758,429**	**510,337**	**1,020,674**

Source: Cassava Transformation Action plan-DRAFT

7. Main case study findings

This section is divided into two sections with reference to the study aims and objectives. The aim of the case study was to begin to generate a knowledge base and identify and share best practice in quality assurance. The current level of implementation of quality management systems across the factories visited is dealt with first, followed by assessments as to the degree of success of operating SMEs.

7.1 Assessment of the product quality and quality management systems (QMS) across HQCF SMEs

Developing and promoting markets requires delivery of consistent good quality product. Since the auditing of HQCF under C:AVA I, most SMEs struggle to meet defined quality specifications (Annex 2). No quality management systems were found as should be the case in a food manufacturing business. In fact, a recent review of Nigeria national food control systems undertaken by the FAO highlights the fact that food operating businesses in the country are not required by law (as is guided by WHO, FSA etc) to have quality management systems in place. Consequently, there was a higher than desired non-conformance to product specifications and basic factory standards. Generally, there was no cleaning scheme for equipment or premises, nor designated areas for waste management, redundant/broken machinery, and many aged dewatering machines urgently need replacing.

None of the SMEs visited possessed tools for in-process or end product testing besides one. This SME had a pH meter that had not been functioning for over a year. Basic tools for quality control are essential if corrective measures are going to be taken and quality of HQCF assured. During the training on QMS, SMEs received practical demonstration on the use of the various QC tools available. All expressed a desire to acquire these but cited lack of funds to do so. A summary of tools required and their associated cost are presented in Table 2 below. All of these items can be obtained in Nigeria. Further follow up is required for those SMEs already having received some training in QMS. Training manuals have been distributed in most cases. Their use in practice will need to be assessed, with further demonstration given in some cases.

The number of SMEs having had QMS training between January and July 2016 is 11. Others (~10) received training under C:AVA I. At the very least, serious SMEs should be willing to invest in a pH meter. . The purchase and ability to use a set of basic tools for quality assessment should be a criterion for further donor support. Adopting the use of some of these tools will greatly assist in resolving issues of fermentation and inefficient dewatering found to be evident during this study.

Table 2: Recommended tools for HQCF quality control

Item	Qty	Unit cost ($)	Total cost ($)
Moisture meter	1	2,300	2,300
UPS (for above)	1	75	75
pH meter	3	30	90
pH 7 buffer solution	1	15	15
250 micron sieve	1	155	155
250micron cover	1	50	50
250micron receiver	1	50	50
Hand scales	2	15	30
Digital (250g) scale	1	50	50
		Grand total ($):	**2,765**

Source: Abayomi, NRI, 2016

7.2 Level of success as measured against their target markets, factory operations, management and technology

In order to provide some understanding of the reasons behind the different levels of success of the SMEs in this study, it is necessary to separate the various functions within the business and also describe briefly their interdependencies. The link between good product quality and markets has already been highlighted above.

7.2.1 Target markets and profitability indicators

The overwhelming majority of HQCF processors still view the millers as their target market. The purpose of this section is to highlight the link between pricing and costs of processing of HQCF and the initial target market for HQCF (i.e. wheat millers). This because in 2014 an audit undertaken by the Natural Resources Institute, through the Cassava Adding Value for Africa (C: AVA) project and the Cassava Transformation Agenda revealed there were 127 HQCF SMEs across the country, most of which were not operating. The main reasons cited by the Nigerian Association of Cassava Processors and Marketers (NCAPMA) at the time (and currently) was the low price being offered by millers, and thus inability of cassava processors to make a profit. The price of HQCF has been unofficially been benchmarked against the price of wheat flour at around 65% for a number of years now. This was expected to create an additional incentive for its use. However, demand from wheat millers has been limited.

Pricing and pricing strategy of HQCF has been an ongoing issue and has now been politicized, with both the cassava growing and processing/marketing associations calling for government to intervene and set prices of cassava roots, and HQCF respectively. The Bank of Agriculture (BOA) partnered with the BOI scheme with the aim of linking processors to

farmers and resolving working capital requirements for purchasing cassava roots. N5mil of the N20mil granted to SMEs under the scheme was for this purpose. The most common price being quoted across SMEs as being offered by millers is N80, 000/t at factory gate. At this price, (with the exception of Thai Farms Ltd., Ogun State, pers. Comm.) cassava processing SMEs claim they are unable to make profit and in some cases breakeven, depending on the efficiency of their operations and access to competitively priced raw material. Processors would like to sell HQCF at is N110, 000/t. At the time of the study, retail wheat prices were around N140, 000/t. A breakdown of the costs associated with processing HQCF was provided by two of the SMEs (Tables 3 and 4). At a selling price below N110, 000/t HQCF, it is clear from these cases that SMEs are unable to make a profit, particularly once essential items such as maintenance, quality control, and marketing allocations have been included. Raw material and energy constitute the greater proportion of processing costs (Table 3). This constraint was aired by most SMEs during the study. Another issue is the low monthly production output which increases unit costs. The production costs given below are based on an average of 20t HQCF/month output. Few SMEs manage to achieve this.

Table 3: Matsol Ltd cost of production for HQCF

Cost Components	Naira/Kg	%
Cassava Tubers	56.00	60%
Cassava Peeling	8.00	9%
Kerosine for heat exchanger	17.00	18%
Diesel for Generator	6.00	6%
Packaging	1.72	2%
Casual Labour	0.50	1%
Milling	2.00	2%
Labour Cost	2.22	2%
Miscellaneous	0.50	1%
total direct cost	93.94	100%
Delivery	4.00	
Delivered Cost	97.94	
Company O/Head	8.03	
total unit cost	101.98	
Selling Price	**80.00**	
Direct Margin	-13.94	
Net Margin	-21.98	
Total Monthly Direct Margin	-1,254,980.00	
Total Monthly Net Margin	-1,977,976.83	

Finished Product Output	150	Kg/Hr
Packaging (50kg bags)	86,100.00	Naira per
Package Size	50	Kg
Estimated Monthly Production	**90,000**	**Kg**

	No	Unit Rate
Farm Manager	1	40,000.00
Security Supervisor	2	25,000.00
Security Guard	2	15,000.00
Factory Operatives	2	15,000.00
Marketing Officer	1	20,000.00
Accounting Officer	1	20,000.00
Cleaner	1	10,000.00
Total	10	

Source: Matsol Ltd.

In conclusion, until SMEs can reduce their costs of processing HQCF, and/or receive a much higher price for selling HQCF, it is difficult to see the business case- hence, part of the reason why most are struggling. There are those SMEs who are not located within a suitable distance of raw or semi-processed (wetcake) material, and therefore are unlikely to be viable in the long-term. Those factories having their own farms, access to cheaper raw material, maintaining quality, or having sought to pursue markets are fairing much better. The IFAD/IITA efforts should be maintained in this case, and if possible extended to support additional SMEs.

It was apparent that there is an opportunity to further explore SMEs targeting local markets around them and also invest in their own value addition (e.g. in the form of local snacks such as 'chin chin'). The current economic situation in the country witnessing a lack of foreign exchange for starch imports, as well as increased wheat prices should present an opportunity for HQCF processing SMEs more than ever than before. Only one of the SMEs has taken the initiative and is now meeting demand from local bakeries. It appeared that selected SMEs would benefit from some assistance in this area- with respect to scoping studies, tailored demonstrations with end-users, support on quality and delivery.

Table 4: Gon Chuks Ltd income statement for 2015

	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
SALES (@ N80, 000/t HQCF)	1,570,000	1,590,000	1,185,000	1,185,000	1,185,000	1,580,000	1,580,000	790,000	1,975,000	1,560,000	1,170,000	1,170,000	16,540,000
VOLUME (t)	20	20	15	15	15	20	20	10	25	20	15	15	210
COST OF SALES	1,083,900	1,084,100	949,500	975,000	975,000	1,304,000	1,345,000	651,000	1,625,000	1,056,000	738,000	753,000	12,539,500
GROSS PROFIT	486,100	505,900	235,500	210,000	210,000	276,000	235,000	139,000	350,000	504,000	432,000	417,000	4,000,500
GROSS PROFIT %	31	32	20	18	18	17	15	18	18	32	37	36	
OVER HEADS:													
BANK CHARGES	850	2,600	590	948	2,500	2,100	1,940	940	1,200	1,200	980	1,000	16,848
MARKETING LOGISTICS													
OWNERS RENUEERATION													
PRINTING AND STATIONERY													
PROTECTIVE CLOITHING													
REPAIRS AND MAINTEINANCE													
SALARIES AND WAGES	287,000	300,000	120,000	120,000	120,000	120,000	130,000	120,000	130,000	187,000	172,000	180,000	1,986,000
SECURITY EXPENCES													
PREOPERATIONAL EXPENSES													
DEPRECIATION													
TOTAL OVER HEAD	287,850	302,600	120,590	120,948	122,500	122,100	131,940	120,940	131,200	188,200	172,980	181,000	2,002,848
FUNDS GENERATED	198,250	203,300	114,910	89,052	87,500	153,900	103,060	18,060	218,800	315,800	259,020	236,000	1,997,652

Source: Gon Chuks Ltd., 2016

7.2.2 Operations management

Given the highly perishable nature of cassava once harvested, timing is a critical factor in the processing of HQCF. Many of the quality issues observed were due to lack of scheduling within the process, lack of planned equipment maintenance, insufficient skilled labour, high staff turnover, lack of supervision on the coordination of operations, and availability of labour.

Key steps in the processing of HQCF are peeling, washing, grating, dewatering, drying and bagging (Annex 3). There has been a move away from manual towards motorised peeling of cassava, the reason for this being the time taken for peelers to peel, the cost of labour- particularly at certain time of the year (e.g. dry season), and to compensate for late deliveries of roots from the farm. A late delivery of fresh roots leads to fermentation as the product then tends to be dried the following day. Not all peelers are efficient however, with some leaving a significant portion of the peel on the roots. This residual was not always well removed and negatively impacted final product quality of the samples tested during the study. Other models can peel 0.5t/hr with little trimming needed thereafter. Again, before procuring a peeler, the efficiency and effectiveness should be assessed. The social impacts of displacing manual peelers, predominantly whom are women have yet to be evaluated. Efficient grating is necessary to avoid the need to sieve at a later stage. Some SMEs visited performed the additional sieving step once dewatering had taken place, in order to obtain a fine enough product to pass through the flash dryer. 50% of the graters encountered were found to be well maintained. Others required only minor maintenance and adjustments to function correctly. Poor dewatering of grated cassava mash can significantly increase the cost of drying. The benchmark for residual moisture in the dewatered (pressed) wetcake is 35%. Only one SME achieved this result having correctly loaded all bags with cassava mash to a maximum of 15Kg and pressing for 1.5hr with a 30t jack. The average moisture content for pressed cake from the other SMEs was 45%.

A great number of SMEs do not have the business or management skills to run an HQCF factory, or the means of employing someone that does, hence the over-reliance on government and donor schemes to address their challenges. Those businesses found to be faring better and/or having diversified businesses had directors who had worked for private companies and have professional backgrounds. There was little documentation or monitoring of operations on the part of SMEs, this is reflected in some of the lack of information available at the time of the study. For example, grade outs are not routinely weighed as part of the production documentation process, leaving room for theft and making it difficult to assess costs or strive towards best practice. Further, the procurement of quality control tools by SMEs will serve to help operations run more efficiently. For example, using hand scales to spot check the loading of wet mash prior to dewatering can help reduce the time and fuel required for drying. A hand sieve can verify the correct particle size of flour and guide adjustments on the milling machine where necessary. In addition, the sieve allows one to quickly observe the level of fibre in a batch. By using a moisture meter to randomly measure the moisture of dried grits during the flash drying process, this can guide the feed rate of wet cake being fed to the dryer. Over-drying of flour to less than 10% moisture content leads to unnecessary increases in fuel consumption, whilst under-drying leads to degradation in flour quality and safety. Using a pH meter to assess levels of fermentation, allows the SME to make decisions on the best utilisation of semi and finished product. For example, fermented wet cake may be channelled towards gari or fufu. Or slightly fermented

HQCF stocks may be channelled towards alternative markets (e.g. “chin chin” snacks) where this parameter is not so critical.

7.2.3 Technical challenges

There are a number of artificial drying technologies employed across the country which may be used for the production of lafun, fufu, starch, or HQCF. The latter are normally dried using flash (or pneumatic) dryers. Different flash dryer models had been fabricated by a number of companies across the country, mostly consisting of a single-cyclone, and running on used motor ‘spent’ oil or diesel. These earlier dryers tended to be highly fuel inefficient and costly. With support from the Nigerian Bank of Industry (BOI), and technical support from projects such as C:AVA, many factories have subsequently both upgraded first generation flash dryer models and introduced more efficient ones (multi-cyclone flash dryers). These upgrades involved for example changing some machine components such as the heat exchange systems. Some heat exchangers were also designed to utilise solid bio wastes. The efficiencies of the flash dryers have increased the diesel fuel to flour production ratio by 18-fold, reducing costs and CO_2 emissions. Nevertheless, during the field study, a significant number of complaints were expressed by SMEs over technical challenges. Most concerned the flash dryer burners, the temperature gauges not working, and flour leakages from the cyclone. Whereas, SMEs would blame the technology, the fabricator was inclined to attribute these issues to mismanagement of the equipment. The BOI scheme for upgrading flash drying technology across SME’s in 2013 has had mixed results, for example, as at May 2015, 30% of the SMEs scheduled for upgrades from Nobex Technical Co. Ltd had not had their drying systems upgraded (Table 5).

Table 5: Beneficiaries of flash dryer heat exchangers under BOI/C:AVA I

S/N	NAMES OF BENEFICIARIES	QUANTITY	UPDATE
1.	Son-John	1	Installed
2.	Open Door.	1	Installed
3.	Jonak Oshwa	2	Installed
4.	Oamsal	1	Installed
5.	Wahan	1	Installed
6.	Waliki Mata	2	Installed
7.	Joe-Berg Limited	1	Installed
8.	Mastol	1	Installed
9.	Fadek	1	Installed
10.	Blopamed	1	Installed
11.	Lugunut Corporative Limited	1	Installed
12.	Fag-well	1	Not yet installed
13.	Gon-Chucks	1	Not yet installed
14.	Orogunjo Farm	1	Not yet installed
15.	Starchem	1	Not yet installed
16.	Adeoye Okin	1	Not yet installed

Source: Nobex Technical Company Ltd, 2016

Flash drying technology is still evolving in Nigeria, with a few fabricators such as Nobex Ltd having their engineering capacity built by overseas partnerships such as that with NRI. Currently, in granting contracts to equipment fabricators on supplying or upgrading, there is a lack of awareness on the part of government, donors and SMEs of the impact of the skill and professionalism of suppliers. For example, detailed specifications on the dimensions and performance of the equipment are, in the main, lacking. This means that designs can be changed by fabricators (as witnessed) and independent audits cannot be made as to whether there has been a conformance to agreed specifications or not, or whether the purchase has represented value for money. In addition, it becomes difficult to determine which fabricator to procure equipment from. Further, the supply of operational or training manuals/guidelines are generally an absent at the time of equipment purchase. This should be standard practice as the issuing of training manuals makes it easier for new staff to operate the machines better.

7.2.4 Spares and maintenance

With regards to spares and maintenance, the most common problem found was that there was no planned maintenance of equipment in the plants, and spares (such as the burners) were not kept in working order. Owing to the struggle most are having with the HQCF business, the non-continuous nature of operations, there is a requirement for more maintenance at subsequent start-ups than would normally be the case. Also, there is an expectation on the part of SMEs that fabricators should undertake free maintenance and repairs on their equipment. This attitude needs to change and has partly arisen out of the many HQCF support schemes given to all SMEs since their inception. Owing to high staff turnover those staff originally trained by the fabricator may no longer present to correctly operate the dryers. Further, the skill and technical expertise of staff within these SMEs is generally low. Compounding the issue of plant operation and maintenance is the fact that SMEs have never supplied the market regularly.

With respect to equipment suppliers, no operating manuals or specifications were given to SMEs visited. Further, post installation follow up to assess the performance of the improved flash dryers was not undertaken. This is important for two main reasons: (1) owing to the need for retraining/capacity building of staff operating the equipment, and (2), to evaluate expected efficiencies (e.g., fuel use and throughput, end product quality etc) of the machines are being achieved-and where required make adjustments.

7.3 Summary of common constraints listed by SMEs

Though there are specific challenges in some cases facing SMEs, the most common perceived challenges are cited below:

- Lack of access to markets
- Poor price offered by end-users
- Lack of access to working capital
- Lack of transport-high cost of transporting cassava roots from farm to factory
- Lack of working capital
- High production costs

7.4 Opportunities for scaling

There are still significant opportunities for up-scaling HQCF SMEs. However, opportunities for scaling are linked to the ability to access markets. As at 2012, there were around 156 flash dryers (each with an average capacity of 1-2t/day) within 127 HQCF plants (Figure xx), most of which are not currently operational. Projections in the draft action plan for the cassava transformation predicted that the development of the HQCF market would create over 80, 000 jobs (Table 1) for small holder farmers and associated stakeholders. With the advent of the CTA, many HQCF plants have up to 3 flash dryers in their factories with an installed/theoretical capacity of 5t per single (10hr) shift. There are indications that at best, most currently operate at 20% capacity. If the revelations encountered during field visits and case studies over C:AVA I and C:AVA II are anything to go by, a number of plants are unlikely ever to be viable and should be properly audited to confirm this. In order to get these factories up and running successfully, a significant amount of support is required medium to long term.

With respect to access to funds, there has been virtually no professional auditing of factories pre or post receipt of loans and subsequent installation of new equipment, or evaluation by the BOI scheme on the economic viability of HQCF processing SMEs prior to distribution grants/loans. Thus the default rate is high. Further, there is a tendency for the bank not to grant the full amounts requested by SMEs, with no detailed justification. The impact has been witnessed in either working capital requirements not being met, or much needed equipment not being acquired. Still with a viable business, it would be expected that a SME should be able to make a small contributory investment of his/her own. With the BOI scheme, most SMEs were granted the same amount (~N20mil) irrespective of particular circumstances. The processors association (NCAPMA) had a significant role in developing the funding request. Table 5 above reflects the situation where the plant was not adequately fitted with either the physical structure or ancillary equipment needed before being operational. Had these plants been audited prior to granting of loans, a different strategy for support may have been adopted, and resources better spent. This supports the case that policy alone and/or granting of loans/grants is not sufficient to yield a reduction of wheat imports through HQCF substitution, and that the implementation of schemes either by government and donors needs a better coordinated strategy-with more resources dedicated to auditing and on-going capacity building of SME owners and staff in general.

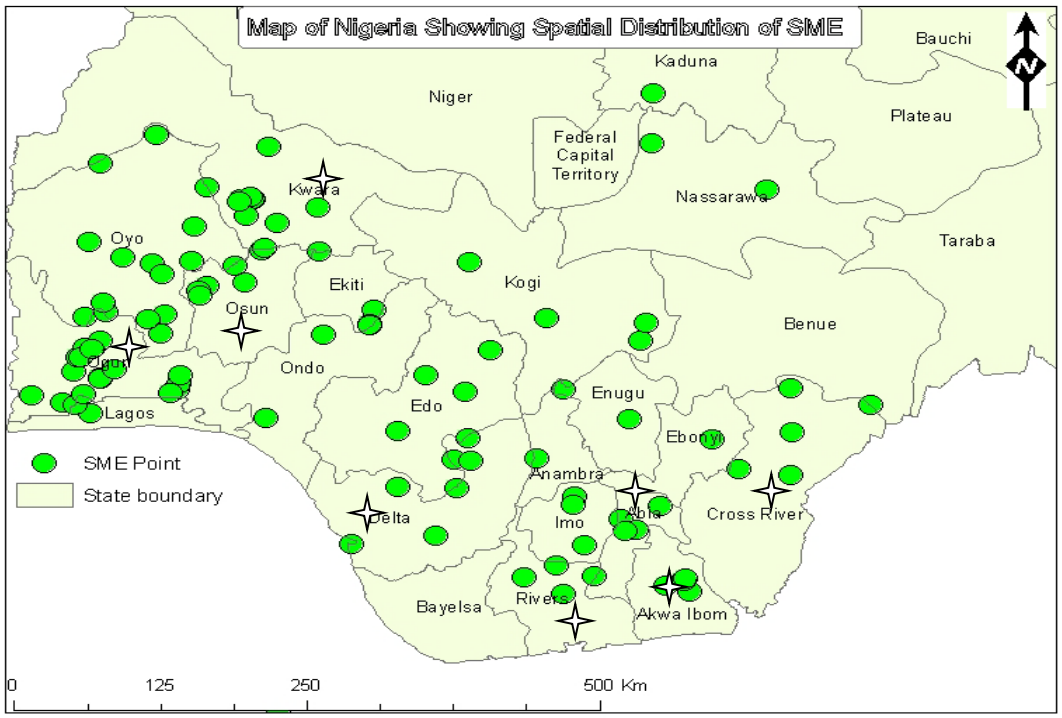

Figure 1: Distribution of HQCF SMEs within Nigeria. States with SMEs benefiting from recent training in quality management and where this case study was developed are highlighted (✧). **Source:** C: AVA report, NRI, 2012

8. Conclusions and recommendations

In can be concluded that on the whole, HQCF processing SMEs continue to struggle to keep their factories running, making small quantities to order. No single reason can be attributed to this situation. However, access to competitively priced raw material and the cost of drying are key variables in the cost of processing, and a significant constraint to many, but not all SMEs. Other challenges observed for some include a lack of adherence to quality specifications, ability to pursue potential markets, as well as technical challenges with operating the flash dryers.

Further training and capacity building in quality and operations management is essential if SMEs are to increase efficiency, reduce variability in product quality and optimise potential profits. Operations management goes hand in hand with training in planned equipment maintenance. Where planned maintenance is not in place, SMEs cannot guarantee to meet market demand. Training materials need to be developed in collaboration with equipment fabricators. Some of this work has already been done under C:AVA I, but will need building upon.

In addition, it is recommended that future engagements of fabricators under contract with projects to supply equipment should include detailed specifications, operating manuals, training of staff in operating the equipment, and on planned maintenance. Such a process was adopted by C:AVA I in developing a contract to export and supply a Nobex flash dryer to a company in Malawi in 2013. Also, where appropriate (for example, as in the case of flash dryers), included in the contract, should be an equipment service agreement specifying the interval and defined duration.

Adequate follow-up of training programs and the assessment of impacts should be built into the planned intervention. Targeting, in the first instance, those SMEs where staff turnover has not been so significant is recommended. Development of an operations manual will help supervisors and managers to deliver training to operational staff. The training and manual should cover various detail and levels of staff:

- Equipment maintenance and operation
- Timing of key operations and the recording thereof
- Minimum staff skills/training requirements (for managers, supervisors and floor staff)

In addition, future engagements with HQCF SMEs should include:

- A review of individual company constraints (particularly on key financial variables such as raw material) and thus longer term viability
- An assessment of potential market opportunities (including value addition in-house), in their localities. This exercise requires further field studies, and may later involve the development of business plans related to indentified investment requirements. Assistance with end-user demonstrations and marketing may thereafter be delivered
- Procurement of quality control tools alongside further capacity building in quality management

A holistic approach to supporting cassava processing factories will be required in order to optimise the chances of success of future interventions, and to allocate scarce resources in the most efficient manner. This should initially involve agreeing/developing a set of criteria for selecting SMEs for initial review. Knowledge on quite a few SMEs is already available. In addition, where the suggestion for capacity building and/or training is given, this should be as practical as possible in order to maximise its effectiveness. Related to the aforementioned are the terms of reference (TORs) detailing the person/skills specification for experts/trainers. These TORs should be developed prior to undertaking assignments by collaborating partners. Given the sporadic nature of the HQCF business and in developing the value chain, a long-term approach to capacity building and re-training is required.
Fabricators must also be monitored for the quality of equipment supplied and service, with periodic training for SME staff, and maintenance perhaps built into the equipment supply contract for a specified period. It is expected that implementing these recommendations will lead to a significant increases in HQCF output from the current level

9. Next steps

1. Agree a set of interventions for selected SMEs based on a review of previous field/case studies
2. Develop criterion for selecting which SMEs to support
3. Develop objectives and TORs for interventions

Annex 1: Interview Guide

Company name: **Date:** **Location:**
When business started
How owned
Source of initial capital
Source of support:
Type of support
Main challenges
Technical challenges:
Spares
Maintenance
Lead times
Solutions
Business case:
Products
Volumes
Target markets
No. farmers supplying
Daily throughput
Technology and price of
Technology reliability
Support/planned activities needed and perceived difference it will make
Margins
Vol. roots/farmer
% time of operating
Source of technology/fabricator
Future plans

Annex 2: Specification for HQCF

There is a specification for HQCF which has been developed and adopted by industry and the Standards Organisation of Nigeria (SON). Details below:

- Moisture 10-12%
- pH >5.5
- Cyanide (<10mg/Kg)
- Particle (<0.25mm)
- White colour
- Bland taste, not sour
- No odour that is not characteristic
- No foreign matter
- No mould, low microbial load

Annex 3: High Quality Cassava Flour (HQCF) Process flow

Stage	Description	Key operation and management challenges
1. Fresh cassava roots 	Raw material supply to the processing plant	• Availability of fresh roots • Cost of transporting of roots to factory • Timing of roots arriving at factory
2. Peeling 	Manual or motorised peeling to remove outer layer (skin) prior to washing. Motorised peelers can typically peel 500Kg/h fresh roots, with varying degrees of efficiency. A good manual peeler may manage 500Kg in a day's shift	• Timing of manual peeling operations • Labour availability • Labour costs associated with manual peeling • Effectiveness of motorized peelers

		
3. Washing 	Washing with clean water is required to remove debris (soil, residual skin etc) and achieve white colour (desired quality attribute)	• Access to clean water on site
4. Grating	Grating or wet milling (size reduction) is required to facilitate dewatering and aids cyanide liberation. Typically motorised graters can grate 1t/hr fresh roots. The resultant product is known as wet 'mash'	• Maintenance of grating machines • Access to stainless steel graters • Incomplete grating of cassava roots necessitating additional processing step of sifting out lumps

		
5. Dewatering 	Dewatering commonly takes place using a 30t hydraulic jack press. Occasionally, motorised models are employed. The resultant product is known as pressed 'cake'	• Poor dewatering techniques-leading to high residual moisture in product, leading to higher drying costs • Poor condition of dewatering units
6. Pulverising	Regrating of the pressed cake is necessary to loosen pressed clumps before drying takes place. A grater depicted in stage 4 above is used	• Sifting required if previous step of grating not adequate in breaking down roots

		
7. Drying	6-cyclone flash dryer - flash drying of pulverised, dewatered cassava mash. The resultant dried product is known as dried ‘grits’	• Equipment maintenance • Frequent breakdown • Operator skill in drying • Standard of performance • Overdrying/underdrying of final product

		
8. Milling	The dried ‘grits are milled to a particle size of 250µm or less using a hammer mill fitted with an appropriate screen	Equipment maintenance Testing of fineness of flour

 		
9. Bagging/packaging	HQCF is highly hygroscopic (absorbing eater from the atmosphere) and is therefore stored in sealed polyethylene lined PP bags to preserve quality and safety	• Semi-processed dried grits/flour not sealed properly in bags leading to pest infestation, absorption of moisture, reduction on quality • No traceability of product- absence of production dates on semi-processed or final product packages

 FOR HUMAN CONSUMP DATE OF PACKAGING : EXPIRY DATE : BATCH NUMBER :		

Annex 4: Individual case studies

Case study 1: Gon Chuks Ltd., Delta State (11-12th Jan 16)

The HQCF business started in 2007, inspired by the promotional campaigns of the Obasanjo initiative. The owner/managing director, Mr Ojobu Godwin used his retirement gratuities after working with Shell Petroleum to start the business, with a total investment of ~N37,000,000. However, the plant has had to close down occasionally for a few months at a time owing to lack of access to markets. The owner is the head of processing association in the Delta region. There are apparently 23 plants in the region. The company tries to stay operational as they feel they have an obligation to local farmers to keep them engaged in cassava production-and hope things will pick up.

Markets are a key issue. Eagle flour Ltd, in neighbouring Oyo State, eventually took a batch of their flour, which was tested for quality and passed. But this was a one off sale. Lifelong Mill Ltd, Sapele is a major customer. They pay 2-3weeks after delivery.
The market for biscuits has not yet been explored. The company would like assistance on rural markets as they have only one customer. On the packaging sector, they had tried a company in Kogi state in 2015. Feedback was that the quality was ok-took a 200Kg sample (@79,000N/t). No further sales to them have been made since then. They would like to explore the plywood sector.

The company has 250ha of leased land 40Km from the plant, with ~20ha of their own farm. They could easily lease another 250ha if required. Part of this is used for multiplication purposes, and they supply their farmers with cuttings from higher starch yielding varieties (4 improved and 1 local). Yields from their own farm are ~25t/ha with the application of fertilizer. The company are linked to a cassava cooperative with 109 members. They now maintain 89 members owing to financial constraints. Initially, farmers would be paid cash on ground, but now the company has a good relationship with farmers and can pay when he gets paid from his customers. Generally, they are able to pay farmers within 2 weeks of harvest. They state they are not able to access fresh roots reliably or readily as their van regularly breaks down. They harvest from their own farm during the dry season owing to cost and difficulties in getting labour during this period

The company previously had NAFDAC certification for a snack business (Chin Chop) but they would need to renew it. A 2015 report from Life flour mills was reviewed at the visit and confirmed their HQCF quality met desired specifications. Product quality assessed at the time of the visit also conformed to the standard specification.

The company have 3 flash dryers, two of which are old first generation Peak Products models. The other is a recently acquired BOI 6-cyclone flash dryer from Nobex Technical Company Ltd. They received an improved heat exchanger to upgrade the old model under the first phase of the C: AVA project. This was never retrofitted and currently lies idle (Fig. 1; value N1, 000, 000). Not all the assets listed (e.g. vehicles) exist or are operational. Some have been newly acquired, such as the motorised peeling machine and Nobex dryer, presses, mill and heat exchanger, for example. The graters and 3 presses were procured from the open market.


Figure 1: Heat exchanger

Gon Chuks previously employed 10-12 casual peelers who would take 8-9hrs to peel 4t fresh roots. Now it takes less than 1h. The decision to move towards motorised peeling was due to operational time constraints associated with manual peeling and late delivery of roots to the factory, as well as being dictated to on the cost of peeling (N600/d/peeler) on occasions by the peelers. The peeler cost N700, 000 and has already paid for itself within 12 months. They have a 2t van which they claim often breaks down. Access to water is through an on-site borehole. The plant mainly runs on diesel.
They do not cite any major issues with the technology or its maintenance. They engage two student engineers on site, as well as a local welder/fabricator in case of issues. Prior to that, the lead time for repairs on the Peak dryer was around 1 week.

Table 1: Initial investment costs for HQCF processing plant

Initial Assets	**Year acquired**	**Cost**
Land	2009	1, 500, 000
Building	2007	13, 000, 000
2x Flash dryers	2007	6, 000, 000
1xHammer mill	2007	900, 000
1xSieving machine	2007	350, 000
1xGrater	2007	500, 000
1xPress	2007	
2xTruck	2010	4, 000, 000
Generator 60KVA	2008	2, 000, 000
Generator 120KVA	2008	1, 500, 000
	Approx Investment Value:	**30,000,000**

Source: Gon Chuks Ltd, 2016

The lack of access to reliable, low cost transport is impacting their business. They cite having to pay equivalent to half of cost of roots on maintaining the vehicle. The cost of a hired truck to transport 5t cassava roots from farm to factory is N20,000 regardless of load actually required. The company believe they would be able to make a profit if they were to sell HQCF@ N90, 000/t (factory gate) as opposed to the N80, 000 (factory gate) commonly offered by their target customers (wheat millers). They do obtain sometimes N100, 000/t ($500/t) selling to rural bakers-but the volumes are small and inconsistent. The company produced small volumes of bean and plantain flour during the period they had the Chin Chop business. They outsource wet cake production and also utilise their dryers for drying other factories products in order for machinery not to remain idle and to increase earnings.
The MD does not currently pay himself a salary, but relies on his pension. In short, production volumes are low and the factory is operating at ~ 20% capacity, well below the installed capacity of 5t/d single shift.

Their conversion ratios of fresh roots to cassava flour is around 4 to 1, which is average for the industry. They sometime outsource wet cake production to four rural groups and have provided them with the grating and pressing equipment for this purpose. Sludge, a by-product from the peeling process is sundried and sold to piggeries. They sell this for N10, 000/t ($50/t).

In 2014, the company applied to the Bank of Industry for a loan/grant (N31, 000,000; $155, 000) under the former government cassava scheme- a third of which was intended for working capital, with the remainder for upgrades in order to reduce costs of processing and increase capacity. They received ~ 70% of the fund requested. Despite this, output has not significantly increased.

For the benefit of the training and assessment, the company processed HQCF where factory operations were observed. Gon Chuks have a number of permanent staff including a farm manager, quality or factory manager, and supervisor. At the time of the visit, it was noted that the pressing operation was sub-optimal, with resultant wetcake having a moisture content of 45%. The ideal is 35%, with 40% being the current industry average. High moisture in the wetcake results in additional drying costs (thus reduced profits) and time.

Perceived challenges

- Lack of transport
- Lack of working capital
- Difficulty with in-house value addition to HQCF

Future investments

The company started to diversify by utilizing their own flour within a popular snack called 'Chin Chin'. They named the product Chin Chop (Fig. 2) which consisted of an HQCF-wheat-bean flour mix. They obtained knowledge on this product's development from an ex ADP. During the period of Chin Chop production they claim they were able to make a 20% profit (with volumes of 10t/month). However, there were issues of variability in quality given the production process was manual. In particular, there were challenges in obtaining consistent product colour and oil retention. Customer began to complain and so they halted production in the hope they could move towards a semi-automatic process that would ensure good quality. They produced a business plan for this investment but have not been able to obtain any financial support. They would like a review of this business plan. The reasons for the lack of investment support have not been fully investigated. The required investment would be ~ N16mil ($80,000 @N200:$)- see Annex 3. For this investment, the company spent N2mil on packaging alone. They still have much of this packaging in stock.

Figure 2: Chin Chop snack

Case study 2: Open Door Ltd., Ogun State (2nd-3rd Feb 16)

Open Door Ltd was set up originally by the Ogun State government in 2007 with the idea to partner with the private investors. However, in 2008, they allowed the plant to be operated solely commercially as the partnership with government was not delivering as expected. The current director, Alh. Aderemi Mohammed is a former Central Bank of Nigeria officer. The company initially invested 4-5 million in equipment, coupled with a BOI loan/grant, they used ~2mil for refurbishing the factory (including equipment). Of the N20mil given under the BOI scheme, 15mil was a loan, and N5mil a grant. N5mil of this was intended to serve as working capital (which the company are is currently having challenges with). They used part of their working capital to finance procurement of the improved 6-cyclone Nobex dryer, leaving themselves short.

As at the time of the study, markets were a key issue. There primary markets on initiating HQCF were Flour Mills Nigeria Ltd and Dangote Flour Mills Ltd. They started to have difficulty in selling HQCF in 2010, and thus established gari processing which is keeping them afloat. HQCF is produced currently only on a small scale (<1t/day) since 2015. At their peak, they were producing ~10t/month HQCF.

They re-approached Flour Mills of Nigeria, Eagle Mills and Dangote Mills again in 2015 with samples of their product. Apart from Dangote, they report they have had no feedback, even with regards to their flour meeting potential customer specifications.

They do not appear to have addressed the potential to serve local markets fully or any other end-users. For example, they say local bakers cite the lack of mixing equipment for not adopting HQCF. On the contrary, successful commercial trials have demonstrated that this is not necessarily a requirement.

In 2014/5, there was another initiative under the BOI which put them in touch with an outgrower scheme. They are currently being supported on cassava production by IFAD/IITA. Transporting of roots is at high cost as the same price is demanded of both small and larger trucks (i.e. by distance). Cassava production is far from their main site and so the company was compelled to undertake wet processing (initial steps of peeling-pressing) at a site located near farmland. In 2009, the company planted cassava on leased land (120acres) across two sites within a 25Km radius. They also have 35 acres of their own land 5Km away from the plant, as security. Yields obtained are in the order of 20-25t/ha. The company's perception is that the umbrella organisation for cassava growers does not serve them well. Their current farm manager was 12 years with an established research and development centre, the International Institute for Tropical Agriculture , IITA).

They have NAFDAC certification for their HQCF. Product quality assessed at the time of the visit failed to conform to specification on the aspect of pH, which was found to be 5.1 against a min of 5.5. This was attributed to the time lapse between harvesting roots and processing. All other parameters were ok.

The company has two flash dryers. The first flash dryer was from Peak Products Ltd, with graters of an IITA design, fabricated locally in Ilorin, Kwara State. Niji Lucas Ltd. refurbished the first generation equipment following the move from using 'spent' oil to fuel the dryer. Technology is said to be generally reliable. They obtained a 6-cyclone flash dryer

from Nobex Ltd in 2015. They say it has not been easy to Getting support with maintenance for the improved 6-cylcone flash dryer under Nobex Ltd. ~~they say has not been easy~~, although they are based in neighbouring Lagos State. They say the improved technology has not allowed them to break through due to the difficulties with the HQCF markets. However, with regards to maintenance, the company has a technician that handles simple tasks. They have received training on the operation of the hammer mill for example, and on the flash dryers. With regards to spare parts, they now procure in bulk those items known to have longer lead times in getting to them.

Fresh cassava roots are currently N10, 000/t. The price being offered by FMN is N85, 000/t which they say does not allow them to cover their costs. The company says it needs to be offered at least N120, 000/t HQCF, which will yield a profit of ~N10, 000/t. They believe the millers have deliberately fixed the price at which is being offered to national HQCF processors. Their pure water and gari business is doing well and keeping them afloat
They suggest labour costs are also high relative to HQCF processing costs owing to the lack of desire from locals to undertake farm work. In 2008, many farmers planted cassava with the setting up of many HQCF SMEs, resulting in depressed prices. Thereafter, prices were cyclical. In 2010/11 they had to go as far as Sango and Kwara State (up to 5hr away) to buy fresh cassava roots. This had the impact of pushing up transport costs, as well as late deliveries of fresh roots.

Again, for the benefit of the training and assessment, the company was able to process HQCF where factory operations were observed. Five technical staff of the factory including the newly recruited factory manager, Mr. John Bull, participated. There were additional seven staff mostly corps members serving in the Pure Water line of the factory.

The HQCF factory is split into two sites- one where peeling, grating, pressing takes place- with the other for drying bagging, storing and marketing. It can take up to 2.5h from one site to the other. Dewatering results were the best encountered in the industry, with moisture contents of 35% achieved. This was due to a combination of standardizing the amount of grated mash into press bags, limiting amounts to 12Kg/bag and pressing for 1.5hr. They currently operate the HQCF plant once a month. Their installed capacity is 3t/d single shift.

Figure 3: Wet processing site, Open Door Ventures, Ogun State

Perceived challenges

- Distance between raw material supply and drying plant
- Lack of working capital
- High production costs

Future investments

The company plans to diversify into fufu, plantain flour in the future.
Owing to the distance between processing sites, the company would like to have a flash dryer where the initial wet processing takes place.

Case study 3: Mury Murrison Ltd., Osun State (4-5th Feb 16)

Two directors stand as promoters and advisors to the company. The company is NAFDAC certified. The company were not able to process HQCF at the time of the visit, but for the purpose of training, all HQCF processing stages up to dewatering were carried out. However, their gari line was understood to be fully operational. Six staff including their raw material procurement manager were present. They generally adopt four fulltime staff per shift. According to the manager, staff their shift around 8.20am after dropping their children at the local school. This is too late to start HQCF processing. It was noted that operators did not appear to appreciate the impact of well functioning equipment on quality, and did not differentiate between the production of gari and HQCF with respect to controlling quality. The weights of the pressed cake measured 21Kg, 14Kg, and 10Kg after dewatering. The guide is that bags should be loaded to a maximum of 15Kg prior to pressing to aid uniform and efficient dewatering. It is not therefore suprising that the resulting moisture content of the pressed cake measured 45%. In addition, the company has adopted a standard practice of sieving the pressed pulverised cake twice, owing to lumps of ungrated, woody roots and presence of high levels of fibre (see picture). Owing to the late start of operations, drying could not commence until the evening resulting in a fermented flour.

Product quality assessed at the time of the visit was poor. There were inadequate roots inspection and quality checks. Cassava roots were woody and stalks were not well trimmed. This is not such a significant issue for gari production however. The bags used in packing the wet mash had green printed ink which was leaching into the product. These bags were also line, making the dewatering process difficult. Ink used on the marketing bags was the same as that used for dewatering and so also chipped on handling. The pH of the wet mash prior to drying was 5.7. Further, an assessment of the pH of HQCF stock measured 4.5 for one sample (i.e. fermented), and 5.9 for the second. The latter however, had a slight odour and contained foreign matter. In addition, the wet cake which was processed during the training was fermented, with a pH of 4.8, and HQCF with 4.5. Further, poor washing resulted in a greyish color of HQCF. All these issues would impact negatively on product marketing.

The HQCF operation is housed on 7 acres of land, with 3 acres for the factory alone. They have 4 dewatering presses, purchased from Niji Lucas Ltd., and a sifter which cost N150, 000 in 2008. No planned maintenance is carried out. The grating operation did not break down whole roots effectively. This was partly due to poor maintenance.

Significant material is wasted through losses that have ended up on the factory floor. A number of measurements were made during the study revealing that losses between the pulverising and sieving stages alone gave~20% waste (in the form of ungrated lumps). This waste subsequently used to produce elubo. Further, the initial flushing of the dryer with cake resulted in ~50Kg of material with black specs which would not conform to HQCF specifications and represents an additional loss which could be avoided if the equipment were adequately cleaned after each processing operation.

Perceived challenges

- Lack of access to markets

Real challenges many more from what you described above

Case study 4: Matsol Ltd., Ogun State (25-26th Feb 16)

Matsol Farms Ltd was visited on 25th and 26th February 2016. The team were met by the Managing Director Chief Femi Adegbite. The director previously had a career with Mobil Oil before retiring. The company was registered in 1997 and moved from their original site in 2005.
Personal savings of the owner amounting to N20mil were used in setting up the business. The factory closed shop for 6 years. They sourced for Bank of Industry (BOI) funds in 20014. They requested N20mil, but received N12mil which they used for renovations within the factory. The funds were to cover an additional flash dryer, generator, and working capital.

As with many factories, the company was originally set up for starch production. This formed the basis of their business plan.

Figure 4: Matsol flash drying plant, Ogun State

Matsol have been selling HQCF to Temitope biscuits, Ogun State. They sell ~2.5t/month, but the biscuit company is always seeking sales on credit terms. Matsol believe local content policy will help in stimulating markets.

The company struggles to supply HQCF regularly and regularly faces significant issues sourcing raw material. For instance, it had taken all week to source for the trial batch that was used during the current evaluation. They do not have their own farms and face stiff competition from gari processors. Farmers obtain more income selling cassava roots to the gari industry.

In 2006, the company explained they had issues with meeting moisture content and particle size specifications. This was the feedback from flour millers. With a 180µm mesh, the particle size issue was resolved. However, they still have problems with high moisture content. They would like a moisture meter to be able to test for this key parameter.

Their existing technology consists of a single-cyclone flash dryer by Peak Products Ltd. The dryer operated utilizing 'spent' oil. Following the sector review in 2013, the company managed to upgrade their technology and acquire a 6-cyclone Nobex flash dryer utilizing kerosene. However, the market side of the business was not fully addressed.

The early plan to process 3.5t/d starch could not be achieved owing to maintenance or design issues. They found smoke was being introduced back into the single cyclone dryer, and thus, product after a number of hours of production. The company however mention that under the Peak contact any technical issues were quickly addressed whilst the dryer was still under warranty. With the 6-cyclone dryer, the company complain of the electrical motor and panel getting burnt-supposedly for having installed the wrong (i.e. too low) capacity. Matsol claim other SME's had similar issues. In addition, the filter on the top of the cyclone keeps being displaced. There appears to have been little of the company's own undertaking of preventative maintenance.

The company was invited to the International Fund for Agricultural Development (IFAD) workshop. The basis of obtaining the fund is through States. Six States are participating. The fund will support infrastructural developments (e.g. access to roads, boreholes etc), with States providing matching funds up to 70%. They are not aware of Ogun State being involved in this scheme, but explain it is important to the company as they have challenges with accessing water. They say they need a borehole, and have so far spent N400, 000 on this but found out the water table is now considerably lower than thought and ran out of funds for this. A recent survey showed they must dig 400ft. use meter not feet

Using the single-cyclone flash dryer, producing 3.5t/d formed the basis of the original business plan. The company estimate their cost of production at N90, 000/t HQCF and explained that they need to sell HQCF at N110, 000/t in order to make a profit (Annex 5). They very occasionally produce bean flour in units of 1Kg (Fig. 4) in order to generate additional income for the business, including minimal volumes of odourless fufu and gari.

Figure 5: Bean flour, Matsol Ltd., Ogun State

It was difficult to fully assess operations as the factory is barely operational. The drying process could not be observed as a component of the flash dryer (the burner) had technical issues.

Perceived challenges

- Access to working capital
- Access to water (borehole)
- 5-10t pickup truck
- Marketing. The target market for HQCF has always been bread (by partially substituting wheat flour). Currently, no rural marketing is undertaken, though the company is aware of a range of other uses of HQCF, including chin-chin, puff puff, biscuits.

Future investments

- They would like to invest in chin-chin (a traditional wheat based snack) and estimate the payback for this investment would be 18 months, with a profit margin of 30%. However, they do not have the capital estimated to be around N2.5 mil to invest.

Case study 5: Arogunjo Farms Ltd., Kwara State (29th Feb-1st Mar 16)

Arogunjo Farms Ltd is owned and managed by retired Judge. The company are one of the few not accessing the BOI loan. In addition to cassava, the company has a diverse number of small business units including oranges, mangoes, animal feed (fish floating pellets), palm of which the kernels are also used for fuel), plantain, and poultry. They started out in 1983 with corn but have since ceased this side of operations.

The company initially went for gari production before venturing into High Quality Cassava Flour (HQCF). They had heard of the Peak technology and on that basis decided to enter into HQCF production. Thus far, the HQCF business has not been very successful, but they still hope for improvements. Markets are a key issue.

They have 75ha of their own farm dedicated for cassava. Their production operations are also currently being supported under IFAD/IITA.

Arogunjo Farms also received a heat exchanger under CAVA I, but also is not ready to install. They have no issues with spare with respect to technology This is because they have their own competent technician. The original and currently used flash dryer is that of Peak products Ltd. The Peak dryer was the single cyclone model. This was later modified in 2006 with a biowaste heat exchanger utilizing cashew nut kernels. The motivation behind was owing to the availability and cost of 'spent oil' at that time, including its variable quality. They also procured a Nobex 6-cyclone flash dryer utilizing diesel burners, in 2015, but this is yet to be installed as the burners have not been delivered. They are not sure when it will be completely installed and operational. The company moved from manual to motorised peeling in May 2015. There was a good number of old/redundant equipment arbitrarily occupying both the inside of the HQCF factory and around the premises.

Figure 6: Arogunjo Ltd. Intake and pre-processing area (Kwara State)

They say primary production is expensive, as well as fuel consumption for the HQCF process. Current throughput of HQCF is very low at ~0.5t/d apparently owing to a shortage/cost of diesel

Though the company do not claim to have any issues of labour availability, it was observed that they have few staff dedicated to the HQCF business. For example, there is no farm

manager, no QA personnel, no separation of key skills for key operational areas. Fresh cassava roots arrived an hour late as labourers are said to be unreliable. No women were engaged in HQCF processing, other than one. This was supposedly as a result of moving from manual to semi-automated peeling of cassava roots, where most women were made redundant. It was the perpetual late arrival of fresh roots that prompted the company to go for mechanical peeling in order to reduce the time to process.

Perceived challenges

- The need for a backup generator. He says large generators however need artisans who have the ability to carry out repairs
- A planter- the company want to adopt IITA recommended methods for planting cassava using improved varieties and agronomic practices. There is only one planter in the whole State

Case study 6: Wahan Foods Ltd., Kwara State (2-3rd Mar16)

The MD of Wahan Foods is an executive of NICAPMA with significant influence in the sector. Markets do not appear so much of an issue compared with other SMEs visited. Wahan have an LPO with Honeywell Mills Ltd. In order to meet customer demand, Wahan aggregates product from other SMEs. They also process for other SMEs with different brands.

They have 100ha of their own farm. The farm manager Mr Adewoye Rasheed manages supply operations. They grow predominantly two 'improved' varieties 30572 and 30419. They reckon their land preparation could be improved, but is expensive. They cultivated 50ha in 2015. The cost of land clearance is high. Their yields are 10-15t/ha. They estimate their cost of cassava production to be N100, 000-120, 000/ha. IFAD/IITA are supporting the company on production-planting material and capacity building on agronomic practices. The terms were that the company make land available.

HQCF stock samples assessed- greyish in colour. Wet cake encountered on arrival at the factory was tested and found to have a pH of 3.7 (i.e. significantly fermented) before processing into HQCF.

The pH of their processing water was 7.6. The pH of fresh roots harvested on 3rd March was 6.2.

The company have two single-cyclone flash dryers, one of which is operational at the time of the visit. They say the issue with the 6-cyclone dryer is that there are long residence times of the cake within the feed chamber. The Nobex 6-cyclone flash dryer has been utilised a lot and runs on diesel. The tunnel has cracked however. In addition, apparently the electric motor on the 6-cyclone Nobex burnt out, with the cost of replacement increasing from N25,000 to N50,000. They find the dryer easy to operate, but say throughput is low. They believe the conversion rate for the 6-cyclone is higher than the single-cyclone dryer-thus preferring to use the single-cyclone. They intended to use their 6-cyclone dryer to process larger quantities such as 5t. One technician gave the reason as owing to the machine not given sufficient time to heat up before feeding.

They say the heat exchangers on one of the Peak single-cyclone dryers is not working. Their second single cyclone flash dryer was being used during the evaluation. Bio-waste in the form of cashew kernels mixed with firewood is used to generate heat. They quote the capacity of the single cyclone dryer as ~500Kg/shift. They sometimes run two shifts per day, yielding 1t. They say the heat supplied to the dryer is not continuous owing to changing heat capacity of the biowaste. They have a wet mill which utilises 12lit diesel for 4.5t fresh roots. Wahan Ltd have a 100KVA generator and a smaller 22KVA one. The small generator uses 30lit diesel over ~16h. They have a motor driven peeler thought to have capacity of 4.5t roots/hr (Fig. 7). The peeler uses 7 litres diesel. The MD is an engineer and therefore is able to assist in identification of technical problems and some repairs.

Figure 7: Motorised peeling machine. Wahan Foods Ltd., Kwara State

There products was assessed at the time of the study and was found to be poor. Reasons for poor quality product include insufficient number of staff, drying more than 24h after harvesting, mixing of good and poor quality batches. They are currently looking for a production manager.

Case study 7: Wakilinmata Ltd, Kwara State (4-5th Mar 16)

The initial investment to set up the factory was by the local government on lease and was initially focused on starch production. In 2012/3 the government gave ~N5mil to repair some of the equipment within the starch section. Starch ceased being processed in 2014. Starch was not productive and between 2006 and 2014 they were using 'spent' oil. In June 2014 they were using cashew kernels to fire the burner, then switched to firewood in Aug 2014.
The company applied for the Bank of Industry (BOI) funds consisting of part loan/grant. N10mil was estimated for working capital, and also budgeted for a wet mill and dewatering press. They, however, only received N3.4mil which was not sufficient to procure the aforementioned equipment, so they used the allocated working capital to do so. In addition, they procured a 6-cyclone flash dryer.

They don't believe they have any issues with markets, but complain profits are low. They so far have sold 30t in 2016, 150t in 2015, nothing in 2014 though. They sell mainly to Honeywell Mills.
They have just started trialling odourless fufu since Oct 2015. They can sell fufu at N140,000/t. Unit sizes are 1.5Kg bags @N210/bag. They have started marketing this to the University of Ilorin.

Dangote Ltd is one of their customers of HQCF who apparently carry out sample testing on their product to assess quality.

Cassava varieties commonly used are Oko Iyawo. They have 170ha of their own farm in Lafia, Ilorin, 120Km away. Current yields are ~12t/ha. They plan to dry wet cake from there at the factory in the near future. They have around 30-40ha under production

They would like to acquire a NAFDAC certification to be able to sell fufu. They are in the process of awaiting inspection. Testing of fufu- the colour was white, with a pH of 3.6. Fibre content was~ 5%. No foreign matter was present and the % MC was 10-12.

They procured their Peak single-cyclone flash dryer in 2006 with the cashew waste. But the kernel was not always dried properly and was caking. They also have a diesel run single-cyclone flash dryer in Lafia, and a 6-cyclone flash dryer also designed for both kerosene and diesel. The combined capacity of their flash dryers is ~7.2t/day (double shift)
The heat exchanger on one of the single cyclone models is burnt. It was obtained under the CAVA I project and not originally designed for waste. However, they express preference to have the 6-cyclone flash dryer run on firewood also. They prefer to use the single cyclone dryer. They think end product quality is superior using the 6-cyclone dryer-though more expensive to run.

The factory does not have issue to make small repairs, and have a maintenance department with technicians. They are having problems though with the filter bags of the 6-cyclone flash dryer. The bearings and pulley system also got damaged. Nobex Ltd has not returned to repair the dryer according to their reports. Further, they claim the electric motor on the dryer is always burning through overheating of the cable. There appears a mis-match of technology accessories, or loading on the dryer. Thus, they may need a separate generator to run the 6-cyclone dryer alone.

Perceived challenges

- These are the heat exchanger and the transport of root

Annex 5: Terms of reference for case study and QMS training

Background

Through Nigeria's Agricultural Transformation Agenda, the government approved the release of 3.5 billion Naira in 2014 to allow for low interest loans and some grants via the Bank of Industry (BOI) for processors and Bank of Agriculture for farmers to encourage production of HQCF. As a result, a number of High Quality Cassava Flour producing SMEs had their factories upgraded, along with the provision of working capital. Many of these factories have not been operational for some time. Previous audits across some SME's revealed issues of quality for the HQCF produced, as well as inefficiencies in operating the plants, and inability to successfully market their products, thus having a direct impact on profitability, and thus sustainability. A number of SME's (table 1) proposed for this field work have been selected based on their adoption of upgraded process technology, current level of operations and potential for sustainability.

Terms of Reference

- Assess the current activities in quality control and management
- Assess the current level of operations management
- Identify shortcomings with the above, and, where possible, provide hands on training in implementing quality and operations management procedures
- Make suggestions/recommendations for long-term improvements
- Discuss follow up support with SME's and country manager C:AVA Business Development Coordinator
- Generate a knowledge base (to include, technical challenges and solutions, business case, potential impact, scaling/capacity requirements, spares and maintenance issues, operating challenges)
- Deliver a report for each SME detailing the above
- Fieldwork for the assignment will take place in Jan/Feb/Mar 2016 in Delta, Ogun, Kwara and Osun states (2days in each factory + 10 travel across states + report writing= total 24days)

Table 3: Selected cassava processing SME's

NAME OF COMPANY	LOCATION	CONTACT PERSON	TELEPHONE NUMBER	EMAIL ADDRESS
Gon Chuks Agro Production Ltd	Km 1, Agban Quarters Mbiri, Off Umunede, Asaba Road, Mbiri, Delta State.	G.C. Ojobu	08069800686	gonproducts@yahoo.com
Matsol Farms Ltd	Siun, Abeokuta Sagamu Expressway, Ogun State	Femi Adegbite	08054318033	femiadegbite@gmail.com
Open Door Ventures Ltd	Abeokuta Ogun State	Alhaji Aderemi Mohammed		

Wakilin Mata Farms Ltd	No 3, Old Jebba Road, Adewole Estate, By Ministry Of Agriculture, Ilorin, Kwara State.	Alhaja Fati Kadir	08033154992	nuhu.addulkadiri@icloud.com
Mury-Murrison	Integrated Cassava Processing Plant and Resources Centre, Opposite Low Cost Housing Estate, Ekusa Road, Okuku, Osun State	Olapade Olagunju Mohammed	08035351286	info@murymurrison.com
Arogunjo Farms Ltd	No 1, Solicitors avenue Oloje Ilorin, Kwara State	Hon Justice Lambo	08060726667	honjusticelambo@yahoo.com
Wahan Ltd	Ilorin, Kwara State	Alhaja Ramon Daramola		wahan.foods@yahoo.com

The training will include:

1. Hands on training/capacity building in quality management systems
2. Demonstrations of simple testing equipment
3. Documentation to demonstrate/provide evidence of systems in place
4. Documentation for use in product traceability (if NAFDAC certification is desired)
5. Identifying the importance of links between product quality, safety, marketing, compliance, process efficiency, and business growth

In order to benefit fully from the training, generate knowledge, and share 'best practice' companies are encouraged to be transparent with regards to their challenges, constraints, and facilitators' access to documentation.

Participating in the training will also serve to identify further opportunities for assistance and allow companies to prioritise their activities and future planned investments.

Unless permission is given, company names will not be identified, thereby retaining company confidentiality.

Key staff involved in the quality, production, and marketing of products should attend, with the MD/CEO available for debriefing at the end of the session.