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AFRICAN STUDIES CENTRE LEIDEN

RESEARCH REPORT

SORGHUM VALUE CHAIN IN NIGERIA

EXPLORATIVE STUDY

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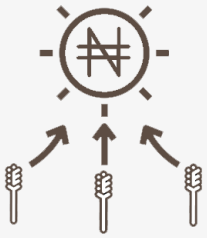
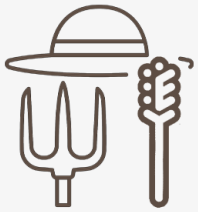
Aggregator-farmer



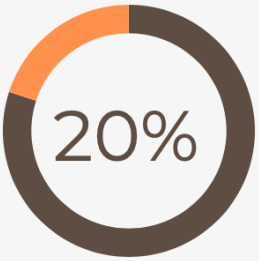
No. of farmers in the study:	27
Av. Land size (ha):	107
Av. income from sorghum (₦)/ha:	77,118

Regular farmer

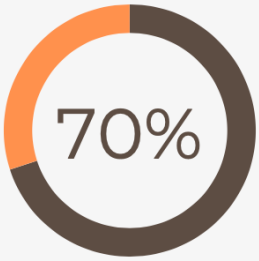


No. of farmers in the study:	406
Av. Land size (ha):	33.6
Av. income from sorghum (₦)/ha:	65,943

HIGHLIGHTS

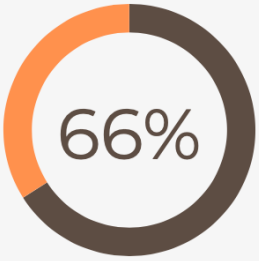


up to 20% (1.4 MT) of the total sorghum produced in Nigeria (6.9 MT) was bought by industries in 2018



of sorghum supplied to large vendors is from middle- and large-scale farmers

Sorghum contribution to annual revenue



For aggregator farmer

For regular farmers

Sorghum farming has become a commercial activity for all farmers participating in this study

EXECUTIVE SUMMARY

This report presents the research findings on the key social, economic and agronomic dynamics in communities whose livelihoods depend predominantly on the farming of sorghum in northern Nigeria. Sorghum has become a major element in producing beer and malt by companies like Nigeria Breweries (NB), which is partly owned by Heineken. The two main objectives of this study were to obtain **NB's diverse sourcing modalities and sourcing practices** and to examine **farm-level issues**. In order to achieve the stated objectives, a mixed methods approach was adopted. Four-stage fieldwork was undertaken in 2018 and 2019 in six sorghum-producing states: Kaduna; Niger; Zamfara; Gombe; Katsina; and Yobe States. Researchers from Dutch and Nigerian academic institutions conducted interviews with six vendors from Kaduna and Kano state, administered a questionnaire survey among 433 farmers in the six sorghum-producing states, and conducted interviews and focus group discussions (FGD) with selected sorghum farmers. Based on the data collected, two main groups of sorghum value chain actors were distinguished for further analysis: 'regular farmers' and 'aggregator-farmers'. The former group is further divided into five sub-groups, based on the size of owned land: smallholder farmers I (< 5 ha), smallholder farmers II (6-10 ha), smallholder farmers III (11-20 ha), middle-range farmers (21-200 ha) and large scale farmers (over 201 ha). The latter group consists of vendors and aggregators who combine their commercial activities with sorghum farming.

SOURCING MODALITIES

The latest estimates of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) suggests that industrial demand for sorghum has grown from a base of 2% of annual production in 2009 to 20% in 2018. NB is one of several industrial buyers and the company takes up 1.4% of total annual sorghum produced. The research findings reveal that, in terms of diverse sourcing modalities, vendors contracted by NB source sorghum directly from farmers and from aggregators who also collect the crop from farmers (on local market days). Some vendors also operate their own-farms, from which they supply various industrial end-users of sorghum. **Sorghum farming has become a commercial activity for all aggregator-farmers and regular farmers** as data obtained indicates that over 80% of their production is for sale, while the rest is reserved for household consumption. **All aggregators-farmers and approximately two-thirds (63%) of all regular farmers indicated an expansion of hectarage for sorghum farming in the 2017-2018 period**. Aggregator-farmers are motivated by 'easier agricultural practice', while the catalysts for regular farmers include better prices and a ready market for the crop. Their harvests have boosted the capacity to deliver expected volumes to industrial buyers.

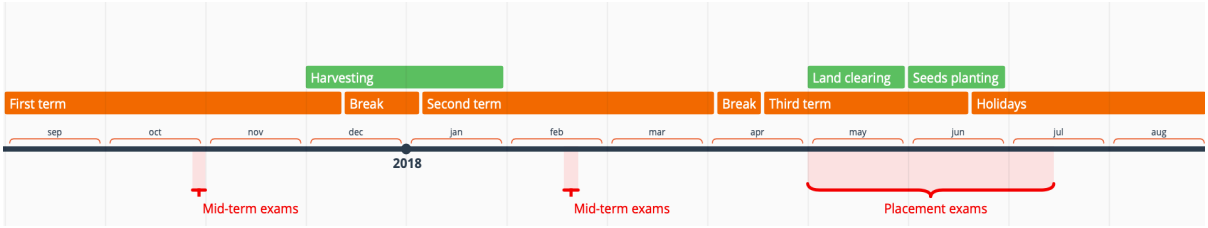
SMALLHOLDER ENGAGEMENT

Data collected shows that middle- and large-scale farmers were responsible for over 70% of sorghum supplied to NB through interviewed vendors (middle-range farmers account for 32%, while large-scale farmers for 42.4%). **Small-scale farmers appear less important during the 2017-2018 season, contrary to the expectation that smallholders dominate the field.** Vendors that became important after NB's contract farming and sorghum buy-back[1] ended, have begun to strengthen their position by engaging in medium- to large-scale farming (sometimes via vertical integration investments). This potentially has two major consequences: firstly, a change in the existing dynamics between vendors, aggregators, and farmers, which may lead to **a new labour market structure, where smallholder farmers are increasingly engaged as farm hands in these emerging larger farms**; and secondly, **a gradual loss of industrial market opportunities for smallholder farmers**. However, it should be noted that smallholder farmers still contribute substantially to the non-industrial sorghum market, which constitutes 80% of the overall production.

[1] NB introduced a buy-back scheme as a part of their engagement in MARKETS I and MARKETS II programmes. The objective of these projects was to develop new hybrid sorghum in partnership with USAID and local partners. Read more about the scheme in Chapter 1.4 and section 1.5 in the Annex.

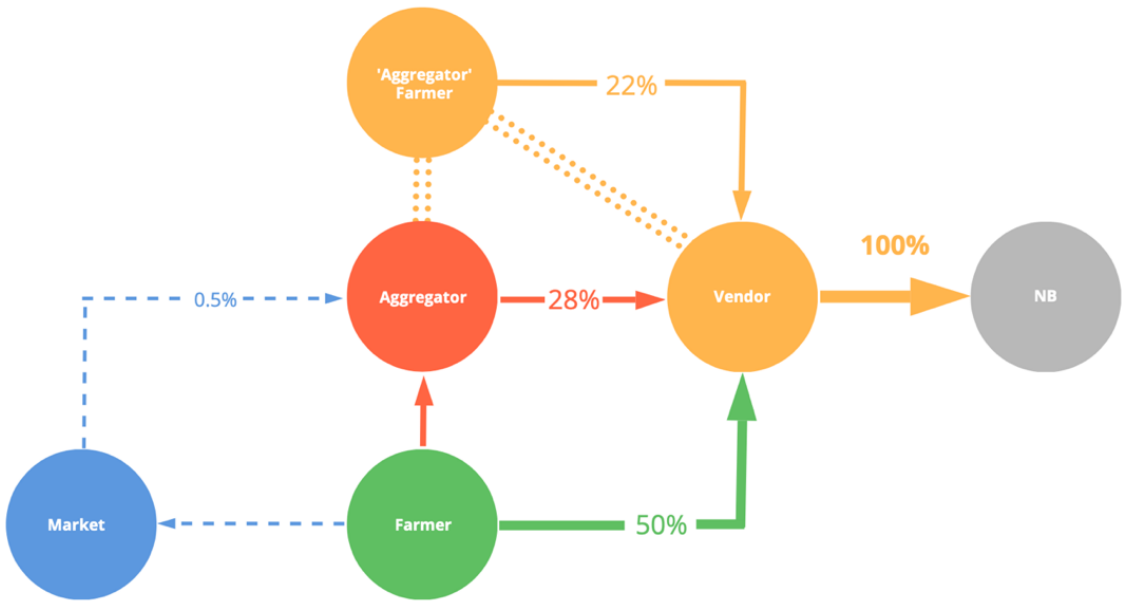
The existence of medium- and large-scale farms has already **provided spaces for temporary job creation** for land clearing (May), sorghum seeds planting (June), and harvesting (December-January). But **data shows that hired farm-hands in two out of the six states surveyed (Yobe and Katsina) are paid below minimum wage. The average rates offered for planting sorghum were lower than for clearing** across all states. Based on information gathered in the field, it is estimated that the average cost of land clearing per hectare during the 2017-18 season was ₦3,792.4 (€9.48) and for planting of sorghum ₦2,572.7 (€6.43). However, these costs differ substantially depending on the location and farm size.

Finally, **family labour constitutes a large proportion of labour mostly among small-scale farmers**. In the surveyed area, generally there are no customs restricting children in helping on the farm. **Nearly 65% of regular farmers, but none of the aggregator-farmers with children aged 7-15 years engage them in the farm work;** these among others include: preparation for sorghum planting (May), planting of sorghum seeds (early June), and helping their mothers to carry cooked food to the farm for community members helping their parents with farm tasks**.** As the crucial (exam) time of the academic year overlaps with two busiest months on the farm (May and June), **some children may miss school due to their engagement in farm activities**.

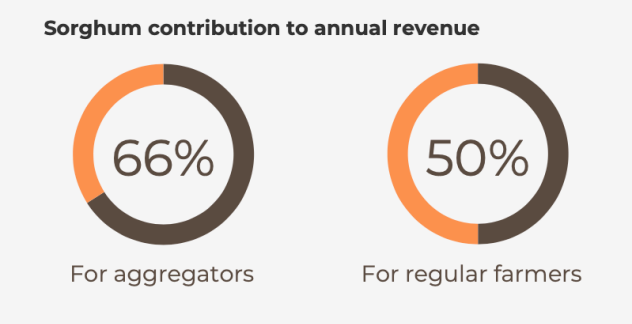


SUPPLY CONNECTIONS AND REVENUE GENERATION

The relative strength of sorghum suppliers in the value chain were measured in terms of proportion of sorghum sold from the total volume harvested, which is also an indicator of the income-earning potential. In terms of supply connections, **about 50% of sorghum supplies are direct transactions between farmers and vendors**; about 28% flow through local markets and aggregators, while the remaining 22% come directly from vendor-owned farms.



Revenue obtained from sorghum farming constitutes about half of all revenues generated by regular farmers and 66% of annual revenue generated by aggregator-farmers (the latter of which could result in a dependency risk). The respondents indicated little or no interaction between formal financial lending institutions (commercial banks) and farmers. The majority of farmers surveyed stated that they use their own savings to undertake sorghum farming and do not resort to bank loans due to unfavourable terms and conditions given by banks. **Vendors have, in some cases, provided farming inputs and loans to farmers** to undertake sorghum farming; such loans are recouped in a sorghum buy-back system.



Market pricing

The market price is the most important factor influencing the decision to sell and the (local) market is the preferred point for sales. For transactions, the local practice is that aggregators visit farmers two days before market day to negotiate prices directly. The transaction is completed on market day when aggregators and vendors come to collect sorghum. Thus, a good proportion of what is seen at market stalls on market days has already been sold to or reserved for aggregators. The clear **preference for market price over contract price** is the result of a combination of two main factors. Firstly, farmers obtain information on the prevailing price of sorghum bags in Dawanu market (major regional crop market located in Kano State), and they use this to negotiate for a better valuation despite the contract price they had earlier agreed. Secondly, some farmers have pressing need for money to meet expenses in periods intervening harvests. These expenses cannot be met by contracts that are honoured only after annual harvests. Some farmers that run low on savings within a couple of months after sorghum harvest resort to borrowing from local lenders (e.g. Chiefs) and Vendors, in order to meet expenses. They eventually pay back in kind (bags of sorghum) to their creditors at next harvest period. It may be read as another contractual mode; a 'pre-payment' that is built on mutual trust between the parties involved, and it is devoid of collateral that formal lending institution would normally impose on the borrower.

The seeds sector

At the national level, **Nigerian Breweries' usage of sorghum constitutes about 1.4% of total annual production**. However, the company's role has also extended to taking a leadership role in the development of improved varieties of sorghum seeds; open-pollinated varieties (CSR-01 & CSR-02) and hybrid varieties (CSR-03H & CSR-04H). This was done in conjunction with national and international research institutions (IAR & ICRISAT), seeds multiplication companies, international organizations (USAID), and pertinent government ministries and agencies (Ministry of Agriculture and Hybrids Release Committee of the National Agricultural Seeds Council) in Nigeria. **The provision and farmers' adoption of these seeds have proven important, not only for industrial use and local consumption as staple food, but also for job generation** (emergence of medium- and large-sized sorghum farms employing farm hands)**, income supplementation** (significant contribution to the revenue on which households depend to meet different socio-economic obligations)**, and market stimulation** (as variety of industrial users now consume 20% of total annual harvests).

Productivity per hectare

Survey data indicates an inverse relationship between productivity and farm size; that is, productivity decreases as farm size increases. Yields on big farms are lower due to less intensive farming methods adopted for sorghum cultivation. Across the board, the average yield per hectare was below the 1,192 kg/ha provided in the FAOSTAT 2017 statistics. Some of the factors that might have contributed to the relatively lower productivity include general lack of adequate

education on good agronomic practice and constant re-use of seeds from harvested grains. The quality of such seeds is expected to have declined over time due to this re-use. In addition, the data shows that **the average productivity of (improved) seeds purchased from a seed company is nearly twice the productivity of seed used from the previous harvest.** Nevertheless, all aggregator-farmers and **78% of regular farmers stated that they depend on seeds saved and re-used from the previous harvest** in the new planting season. Smallholders continue to have problems accessing the improved seed, and these include: high costs of seeds which requires the farmer to borrow money; limited supply of high quality seeds, and in some cases, the bad experience buying of supposedly high quality seed packs that had been adulterated with low quality seeds by some bad agents.

Farmers' well-being

All aggregator-farmers and regular farmers contacted during the survey stated that sorghum farming is very important to their perceived well-being. Within farming communities, the income from sorghum is primarily spent on children's education, food, healthcare, and to support the extended family. **This study reveals that for half of the smallholder farmers (<20 ha), the income from sorghum farming alone is not yet sufficient to fully cover their children's educational needs, and for a third does not cover the family food expenses.** However, farmers in this group do not rely solely on sorghum farming for their livelihoods; they cultivate other crops such as maize, soya beans, and other legumes. In addition, the smallholder farmers often engage in additional paid contracted work to gain supplementary income; this includes working on larger farms. **Although larger farms create employment opportunities for subsistence farmers to earn money, they also raise questions about labour conditions and the potential for labour rights risks.**

Recommendations

Based upon the findings of our current research, the following recommendations are made:

- **First**, the long-term strategy of **Nigerian Breweries to retain sorghum as part of the company's product recipes should be upheld**. Given the projected rise in Nigeria's national population and attendant increase in the consumption of the company's products, the demand for sorghum will be sustained.
- **Second**, medium- and large-scale sorghum farmers (21-200 ha) are increasingly emerging, and are becoming important for on-farm job generation. As such, the use of hired labour is high in the big farms. Thus, **Nigerian Breweries may need to develop mechanisms to understand the working conditions and potential labour rights risks and to put policies in place with the vendors to mitigate these risks.**
- **Third**, it is recommended that Nigerian Breweries collaborates with the government and other value chain actors to **support smallholder farmers in the sorghum sector**. For example, in an education campaign on sorghum planting to achieve a wider reach of knowledge on good agronomic practices.
- **Fourth,** to ensure steady supply of trusted and affordable seeds for planting to farmers, **the seeds system needs a total overhaul.** This can be kick-started with **a re-constitution of the Hybrid Release Committee (HRC)** of the National Agricultural Seeds Council. The HRC is **to appoint new companies for test of seeds purity.** Also, the **HRC must be strengthened with new powers to sanction erring agents of seeds distribution companies** so as to minimize the occurrence of adulterated seeds packages.
- **Finally,** the industry should continue its efforts to **support the development of new varieties of sorghum suitable for the local production environment. We also recommend the release of the CSR-03H and CSR-04H hybrid varieties, starting with the medium-scale 'commercialized' farms in Yobe State, the only location where farmers have demonstrated a willingness to use and invest in new seeds.** Given affordability issues surrounding farmers access to hybrids, more smallholder farmers could be included in OPV seed multiplication programmes (which are less expensive and are reusable after harvests for between 5-7 annual cycles).

CHAPTER 1.
INTRODUCTION

1.1 BACKGROUND TO THE STUDY

In January 1988, Heineken's subsidiary, Nigerian Breweries (NB),[2] started to use locally grown sorghum in beer brewing. Over 30 years have passed since this strategic decision became the catalyst for the creation of an industrial market for sorghum;[3] but how this has influenced key social, economic, and agronomic dynamics in communities whose livelihoods depend on the farming of sorghum is less known. Previous assessments by Steward Redqueen (SR, a Dutch consultancy firm) adopted Input-Output (IO) Modelling, which captured a wider picture of the complexity of the local economy and value chains, but did not address **the socio-economic and agronomic dynamics of the local sourcing of sorghum** on farmer and supplier communities. Consequently, **a more profound understanding of such dynamics** was requested by Heineken. The African Studies Centre Leiden, together with Nigerian partners, thus conducted the study with a more in-depth examination of the geographical spread of suppliers and aggregators, farmers and farming inputs, labour conditions, social dynamics, and the institutional support network in six sorghum farming States. The results of this research will be used to inform the future development of the sorghum value chain in Nigeria by all key actors.

1.2 GENERAL APPROACH, RESEARCH QUESTIONS, METHODS, AND OBJECTIVES

An exploratory approach was adopted by researchers from Dutch and Nigerian academic institutions[4] to better understand the driving factors, as well as the challenges that farmers and suppliers experience at the local level in the production and sourcing of sorghum. This study has two main elements: firstly, to obtain NB's diverse sourcing modalities and sourcing practices (see Chapter 2); and secondly, to examine farm-level issues (see Chapter 3).[5] The following questions guided the research work:

- *What are the key (positive & negative) dynamics for sorghum farmers and other actors (aggregators, vendors, NB) in the sorghum value chain in Nigeria?*
- *What can be done by key stakeholders to enhance the positives and mitigate the negatives – particularly, what more can Nigerian Breweries add, and what is needed from the government and other stakeholders to strengthen the sorghum value chain?*

A mixed method approach was adopted to answer the above research questions and achieve the objectives. Firstly, 6 vendors based in Kaduna and Kano states were interviewed. Through these vendors, sorghum farming communities were identified across 6 states. Thereafter, a questionnaire survey of 433 farmers was conducted in 6 sorghum-producing states of Kaduna; Niger; Zamfara; Gombe; Katsina; and Yobe (Figure 1). Additional interviews and focus group discussions (FGD) were held with sorghum farmers.

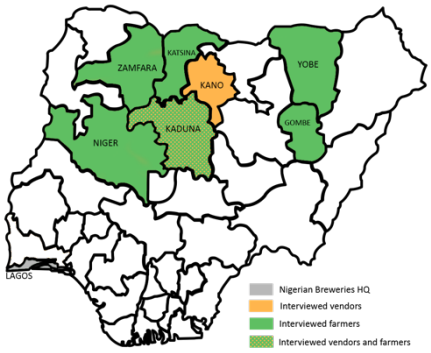


Figure 1. A map of Nigeria with highlighted research locations

[2] NB is a majority-owned subsidiary of Dutch multinational Heineken N.V.
[3] Beverage, cereal, and confectionery producers have increased industrial demand for sorghum in Nigeria [4].
[4] See meeting report: NGOs/Academics Roundtable - "HEINEKEN Social Economic Impact Studies", 29 September 2017, Heineken Experience. Molenzolder.
[5] Detailed description of the research objectives and methods can be found in Sections 1.1 and 1.2 of a separately provided Annex.

1.3 Sorghum in Nigeria

In 2018, 6.86 million tonnes of sorghum were produced in Nigeria on 6.12 million hectares, giving an average productivity of 1,120 kg per hectare [1].[6] Industrial demand for sorghum has grown from a base of 2% of annual production (according to FAO study [2]) in 2009 to about 20% of the total sorghum produced in 2018 - estimated by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) [3].[7] To date, Nigeria has been generally self-sufficient in meeting local demands for sorghum, with some incidental complementary imports[8] with a statutory 5% import tariff. Nigeria does not officially export sorghum. However, over 100,000 tonnes of sorghum is estimated to be traded informally in regional markets, especially to Niger and Chad [4].

Sorghum was among the top three major crops produced in Nigeria in 2017[9] [1] and the most important food cereal in the northern states [5]. There are two **uses for sorghum** in Nigeria: **traditional and industrial** and **three main types** of the crop cultivated in the country: **red, yellow, and white**. Red and yellow sorghums are predominantly used for animal feed and human consumption.[10] While white sorghum is also suitable for human consumption, it can be malted for use in food and beverage industries and processed for use as biofuel [6].

Industrial demand for sorghum by beverage, cereal and confectionery producers is one of the major drivers of the sorghum market [4]. Sorghum production in Nigeria therefore has the potential to be viable and profitable, even in the midst of inhibiting factors such as climatic challenges (in 2012, 14% of the sorghum-producing area in the country was lost to flooding), government policy reversals, and recurring militant insurrections in the dominant cultivation region of north-eastern Nigeria [5,7]. Its traditional reputation as 'the poor man's food' and its rather self-consumer nature results in today's suboptimal[11] farmer-to-market connectedness [5]. Nevertheless, the usage of sorghum for brewing at an industrial level has increased the chances of sorghum moving from staple food and local beverage among people in northern Nigeria to wider consumption and use in the production of other foods and beverages nationwide.

1.4 Sorghum in the Nigerian brewery industry[12]

The Nigerian brewing industry is the second largest in Africa after South Africa [8]. The sector is dominated by global players, such as Nigerian Breweries Plc (NB) (partly owned by Heineken), Guinness Nigeria Brewery, and AB inBev[13] [9,10]. NB and Guinness have committed to sourcing the majority of their raw materials locally (sorghum constituting the majority of this supply). In 2017, NB sourced 50.2% of all agricultural raw materials locally [11], while Guinness Nigeria sourced 75%[14] [12]. NB has a target to source a minimum of 60% of its raw materials locally by 2020; the company's annual demand of sorghum is approximately 100,000 metric tonnes per annum [13,14], which equates to approximately 1.4% of total sorghum production in Nigeria.

The Nigerian brewing industry turned its attention to the use of sorghum in 1988, in response to a proposal from the Nigerian military regime to ban the use of imported barley for national beer production. This shift led to substantial adjustment of all national production plants to become

[6] See Section 1.3 in the Annex for more detailed crop data.
[7] Although the details behind these estimates have not yet been officially published, ICRISAT's estimation will mean that 1.39 million tonnes (presumably of white sorghum) was used by the industry in 2017. This exceeds the often used 200,000 tonnes industry-wide annual usage. New figures obtained based on the 20% will dramatically alter perspectives on the market share of specific industrial entities.
[8] In 2016, 20,000 tonnes of US sorghum was imported to meet local demand, as the Boko Haram insurgency continued to limit access to Nigeria's dominant sorghum-growing areas [26].
[9] After cassava and maize.
[10] Yellow sorghum can also be used in beverage production but only a small percentage is malted before use.
[11] Sorghum farmers have been faced with trading regulations that raise fees and restrict access to agricultural inputs, high transportation costs, local conflicts. See Mundia et al. 2019 [5].
[12] Read more about the use of sorghum in brewing in Section 1.4 in the Annex.
[13] AB inBev (formally SAB Miller) is using cassava in their beer production [27].
[14] Both sorghum and cassava.

compatible with the use of sorghum for brewing beer and to promote the establishment of sorghum malting plants in the country [15]. Despite its potential, no clear national sorghum development strategy was put in place; thus, NB decided to take the lead in sorghum research and development in the country [7].

Different Cultivation Methods

Open-pollinated seeds are seeds that are produced by cross-pollinating two plants of the same variety, usually by wind, birds or insects. This results in plants that are very similar, but naturally varied. The term '**hybrid**' refers to a plant variety developed through a specific, controlled cross of two parent plants. Hybrids are sometimes spontaneously and randomly created in nature when open-pollinated plants naturally cross-pollinate with other related varieties. To create hybrid seeds, plant breeders direct the process to control the outcome [16].

The active exploration of the use of local raw materials by NB was done in collaboration with grain research institutes such as the Institute of Agricultural Research in Zaria and the International Crop Research Institute for the Semi-Arid Tropics in Kano, with the active support of the USAID/MARKETS[15] programme [14].[16] In the frame of MARKETS I collaboration, NB's sorghum development programme recorded a major breakthrough in 2006, when its selection of open-pollinated varieties of sorghum CSR-01 and CSR-02 yielded 2.0 and 2.5 tonnes per hectare, respectively, compared to the annual national average yield of between 0.8 and 1.2 tonnes per hectare at that time [14,17]. These varieties, with maintained high productivity expected to last 8 years, were introduced to the market in 2006 [14]. In 2012, in the frame of the MARKETS II project, NB completed research and development work on two new high-yield hybrid sorghums, CSR-03H and CSR-04H, with the potential to yield 4 metric tonnes per hectare [7,14,18]. In 2014/15, NB signed over the intellectual property (IP) rights for the hybrid seeds to the Federal Ministry of Agriculture and Rural Development (FMARD) to secure government support for seed multiplication and distribution to farmers.

NB's role in the development of the new varieties of sorghum included; the coordination of sorghum activities with stakeholders; training farmers on new sorghum production; coordination of reporting and dissemination of sorghum development activities; supporting the attainment of 50% buy-back success for produced CSR-01 and CSR-02 seeds and; bringing on board its suppliers to be linked to farmers [17]. An assessment of the adoption level of the new varieties (CSR-01 and CSR-02) among sorghum farmers in Northern Nigeria confirmed that 88.6% of the farmers in that study were fully aware of new improved varieties of sorghum, while about 42.7% of the interviewed farmers obtained the improved sorghum variety seeds from extension agents within their localities [18]. The evaluation of the MARKETS II programme implied that farm households in each value chain, including sorghum, were experiencing increased incomes and diversified crops, ensuring higher resilience to intermittent shocks as a result of the project [19,20].

The sorghum buy-back scheme was to ensure steady and guaranteed supply of sorghum for NB and enable the company to maintain stronger oversight of the value chain within the USAID MARKETS programme. Consequently, one of the major roles of USAID MARKETS II was to "Work to attain 50% buy-back success for produced CSR-01 and CSR-02 seeds through timely market price surveys and coordination between producers and buyer."[17] Essentially, this means getting seed companies to multiply the seeds of the open-pollinated varieties and to directly distribute the seeds to farmers for cultivation, with the intention to buy back harvested sorghum directly from these farmers.

[15] MARKETS is the arm that is handling USAID's agricultural development effort on sorghum in Nigeria. USAID/MARKETS have two project teams: MARKETS I and MARKETS II. MARKETS I project team worked with Nigerian Breweries from 2003 to 2006 to develop the CSR-01 & CSR-02 sorghum varieties with improved yield and better malting characteristics in place of available local varieties. MARKETS I project finished and closed, while MARKETS II started collaboration with NB on the development of the new hybrids, CSR-03H & CSR-04H in 2006 (realised in 2012), and to retrain the farmers who were used to production using the open-pollinated variety, on the cropping techniques for the new hybrid, in 2006 [14].

[16] Read more about the development of sorghum varieties and NB's overall buy-back scheme in section 1.5 in the Annex. The process is also well documented in: NB publication titled "Enhancing the Sorghum Value Chain" from 2014 [14].

[17] Re: Raw Materials Development Manager, NB, Lagos February 2018.

This procedure was implemented for five years, but the buy-back process did not function as expected. Farmers did not keep to their end of the bargain and volumes expected to reach NB were never achieved.

A combination of factors accounted for this. The buy-back scheme came with a guarantee to pay the market price plus a 10% premium to the farmer. Some farmers claimed that the company did not offer the premium at the point of purchase. It was also not clear if NB wanted to deduct the value of the seed provided from the price paid to farmers. Another reason for the ineffectiveness of the buy-back scheme was related to annual payment obligations of farmers. Local farmers need to meet certain expenditures, which means they need money at particular stages in the year. These dates often do not align with the annual sorghum harvesting season but happen earlier in the year. To cover their running costs, farmers sometimes obtain loans locally and, after the sorghum harvest, they invariably repay their loans to their local lenders with sorghum instead of selling it as contracted to the NB. According to a certified seed distributor, the farmers proximity to the lenders makes the latter the first points of sorghum supply after harvests. Such lenders are also not necessarily obliged to sell onwards to NB.[18] As sorghum brings good revenues to farmers[19], some of them preferred to sell most of their products to other users who offered more favourable prices than NB. The situation reached a point where NB failed to attain even 1% of the supply of sorghum expected under the buy-back scheme.[20] Such poor results led to the discontinuation of the company's sorghum buy-back scheme and the suspension of the release of CSR-03H and CSR-04H hybrid seeds [14].[21]

Despite unsatisfactory results of the NB's buy-back scheme, the usage of sorghum for brewing, as well as the introduction and free distribution of new varieties of seeds, changed the status of sorghum from 'the poor man's food' primarily found in Nigeria's northern zones to a much more profitable crop used in the production of food and beverages and with national appeal. However, there are also unexpected dynamics of the usage of sorghum for brewing, which are related to the cultural and religious norms in the main area of production. One of the nation's top-5 seed farmers and distributor revealed in an interview that he had to relocate to Kaduna State from Borno State due to direct threats received from insurgents in his home state.[22] Such anecdotal stories contribute to apparent complexity of the context of sorghum production in northern Nigeria, which in itself prompted the need for further research. Hence, this exploratory study was conducted to obtain a deeper understanding of the local dynamics. These are discussed in due course.

[18] Interview. Debiro Agrochemicals, in Abuja, July 2018.
[19] Farmers also did not need to recover the cost of seed.
[20] Re: Raw Materials Development Manager, NB, Lagos February 2018.
[21] The interview with NB's Raw Materials Development Manager confirmed that the buy-back scheme was permanently suspended.
[22] This large-scale farmer's mother was visited by insurgents who requested that he "should stop supplying sorghum to those who make alcohol on an industrial scale" or risk being killed. The farmer, in turn, left the state and relocated to Kaduna State where he acquired large tracts of land to continue farming.

CHAPTER 2.
FIRM LEVEL: SORGHUM SOURCING MODALITIES AND PRACTICES

2.1 CHAPTER SUMMARY

Large scale aggregator-vendors became the crucial link in the supply chain between NB and sorghum farmers after the failure of the USAID MARKETS II sorghum buy-back scheme. Based on the interviews with 6 out or 13 main vendors of NB (February 2018), it was possible to **identify four types of supply connections in the sorghum supply chain** located in the farming zones (North-central) and non-farming zone (Southwest) of Nigeria:

1. **Farmers → vendors → NB Plc**
2. **Farmers → aggregators → vendors → NB Plc**
3. **Farmers → market → aggregators → vendors → NB Plc**
4. **Vendors own-farms → NB Plc**

Obtaining exact information on numbers of farmers associated with aggregators and vendors as well as amounts of sorghum supplied was difficult, as some vendors were hesitant to provide such information. However**, some vendors estimated that there is a good chance that their aggregators maintain supply contacts with 150-250 farmers.** It was also revealed that some **vendors were initially medium to large scale grain farmers who progressed to become aggregators, and, with increased capacity and know-how, they became sorghum suppliers to** malting companies, before becoming NB vendors.

Among **the main challenges** in the supply chain, we can distinguish the **Boko Haram insurgency** in Borno State – an area accounting for 12% of annual sorghum production, **high interest rates** charged by banks, and the **high dependence on logistics of haulage companies**, which may result in delayed supplies of sorghum.

2.2 THE VENDORS

Sorghum vendors became crucial after the failure of the sorghum buy-back scheme - that is, the inability of farmers to deliver expected quantities of sorghum, despite being supported with open-pollinated seeds for five years.[23] Sourcing sorghum through contracted vendors was the alternative given their strong local capacities, experience in working with malting companies, as well as already established networks for obtaining sorghum from farmers and aggregators in the rural areas. Vendors thus became the crucial link in the supply chain between NB and sorghum farmers in regard to their post-harvest activities, financing, and as distributors of seeds, as will be shown later in this report. The essence of interviewing the sorghum vendors was to establish the geographical spread of the sorghum value chain, the position of the vendors in the value chain, sourcing strategies, logistics (transport, storage) systems, and financial arrangements crucial to ensuring year-round availability of sorghum nationwide.

Six sorghum vendors were **selected** for assessment during the Phase 1 of this study. **Two** of these are located in **Ogun State (Southwest Nigeria) and four in Kaduna and Kano States (North-central Nigeria).** Through semi-structured interviews with vendors from two different contexts, it was possible to obtain a comparative understanding of sourcing strategies and facilities of vendors located in the **farming zones (North-central) and non-farming zone (Southwest)** of sorghum in Nigeria.[24]

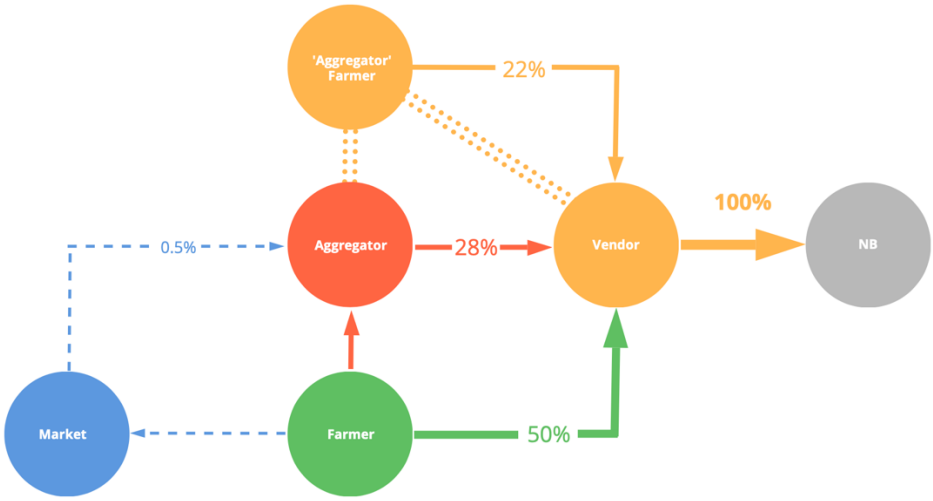
[23] See Section 1.4 above and Section 1.5 in the Annex for more details.
[24] See Section 1.6 in the Annex for more detailed interview guide with the vendors.

2.3 Sorghum supply connections: From farm to factory

Four types of supply connections and their estimated market share were identified in the sorghum supply chain (Figure 2). These are:

1. Farmers → vendors → NB Plc
   This route is responsible for approximately 50% of sourced sorghum.[25] This is the most important route for sorghum sourcing for industrial buyers in relation to other supply connections. Occasionally, sorghum vendors give **seeds and other inputs to farmers**, and lend money[26] to farmers for their farming activities; the vendors also pay random assessment visits to those farmers.
2. Farmers → aggregators → vendors → NB Plc
   In this category, smaller scale **aggregators purchase sorghum directly from farmers** and **supply to vendors**, who, in turn, deliver to NB Plc. Some of the vendors interviewed were hesitant about the exact numbers of aggregators or farmers in their supply chain, on the basis that they do not have direct commercial relationships with the sorghum farmers. However, some vendors estimated that there is a good chance that their aggregators maintain supply contacts with 150-250 farmers. Of equal importance in this measure is the size of farms cultivated by farmers.[27] **This direct connection between farmers and aggregators account for approximately 28% of sourced sorghum.**
3. Farmers → markets → aggregators → vendors → NB Plc
   Here, aggregators purchase sorghum from farmers in local markets on periodic market days, for onward supply to vendors. Only 0.5% of sorghum supplied to industrial markets is obtained by aggregators in the local market on appointed days.
4. Aggregators and vendors own-farms[28] → NB Plc
   This is a new route revealed by our study. It is responsible for approximately 22% of sourced sorghum. This indicates the emergence of larger scale commercial farming in the sorghum sector in Nigeria.

Figure 2. Path-flow of sorghum from farmers to vendors and estimated market share of each routes



Source: Illustration based on interviews of sampled farmers about their preferred selling points

[25] These estimates are based on information provided by a sample of 433 farmers that was surveyed for the purpose of this study. See Table A 10 in the Annex for more detailed calculations.
[26] Some community chiefs also lend money to farmers, who are obliged to pay back with an agreed quantity of harvested sorghum. This agreement is deemed less socially intrusive than demands made by official banks for collateral and high interest rates.
[27] The relative size of supplies according to farm size is presented later as proxy measure of strength and importance of supply connections.
[28] Two out of the six vendors consulted during Phase 1 of the fieldwork run own-farms (see Table 1).

2.4 THE VENDORS: SOME KEY POINTS[29]

Source states for sorghum by suppliers

- Sorghum is available throughout the northern and middle belt of Nigeria.
- Vendors obtain sorghum mostly from Katsina, Kaduna, Jigawa, Yobe, Kebbi, Gombe, Zamfara, Niger, Bauchi, Sokoto, and Zamfara states.
- Borno State accounts for 12% of annual national sorghum production, but the area has been affected by the Boko Haram insurgency.

Duration of the sorghum supply business

- 30 years in sorghum farming and trading activities.
- 10 years of contractual obligations to NB Plc.

Linkage of vendors to Nigerian Breweries for sorghum supply

- Vendors located in Kaduna State were initially grain farmers who progressed to become aggregators to vendors for malting companies, before becoming NB vendors.
- Conversion to supplying sorghum directly to NB Plc occurred when NB reduced the ratio of malted sorghum in their brewing recipes.

Post-purchase activities by sorghum vendors

- First-level value added - Sorghum supplied must conform with colour (white), size (relatively big), and good degree of dryness of the grains.
- Cleaning: involves the removal of all extraneous factors such as stones, stumps, and chaff. Post-purchase cleaning reduces a 100 kg bag to about 97kg.[30]

Capacity of suppliers of sorghum

- Warehousing was the most important capacity facility put in place by all suppliers.
- Suppliers have varying storage capacity ranging from 12,300 to 78,000 metric tonnes capacity.
- Cleaning capacity ranges between 25,000 and 60,000 metric tonnes.

Transportation/trucking

- Haulage (trucking) business is a significant development in the sorghum supply chain.
- Haulage of sorghum harvest is done intensely for 2-3 months a year.

Banking services

- Vendors utilize bank loans in several ways for their sorghum trading business.
- Bank loans attract high interest rates in the range from 21% to 24%.

Identified problems in the sorghum business

- High interest rates charged by banks.
- Dependence on logistics of haulage companies sometimes result in delayed supplies of sorghum.

[29] Additional information from vendors can be found in section 1.7 in the Annex.
[30] After checking, the price may be reviewed downwards if sorghum quality is compromised. Vendors may be blacklisted if the rejected volume is large. But the issue of vendor integrity is affected by differentials in quality demanded by industrial end users, which make it relatively easy for vendors to switch from one user to the other without losing much. As noted by a procurement officer of a beverage company in Lagos, "the situation in Nigeria is such that, for now, industrial demand for sorghum cannot be met with existing rate or supply; it is as if we are competing against each other to secure sorghum supply lines."

Additional background characteristics of the vendors are presented below in Table 1.

Table 1. Summary of key characteristics of some vendors

Vendor (State)	Place of purchase			Own farming	Silo capacity (tonnes)	Supplied to NB in 2017	% of total capacity supplied to NB	Supplying others
	Local farmers	Merchants	Open market					
Vendor 1 (Ogun)	X	X	X	No	140,000	31,000	22%	Cadbury, Guinness
Vendor 2 (Ogun)				No	12,300	6,243	51%	Nestle
Vendor 3 (Kaduna)	X		X	Yes[31]	14,000	14,000	100%	
Vendor 4 (Kaduna)		X		No	38,000	16,000	42%	Guinness, others
Vendor 5 (Kaduna)				No	78,000	40,000[32]	51%	AB InBev (SAB Miller), Grant Cereal Jos (maize), others
Vendor 6 (Kaduna)	X		X	Yes	30,000	12,000	40%	Guinness, Cadbury, others
Total						**119,243**[33]	**51%**	

Source: Compiled based on interviews with six sorghum vendors

[31] The vendor supplies to NB are achieved through aggregation from other sources. However, its supplies to other industrial users are achieved through harvests from its own farm.
[32] This is based on the estimate that NB consumes 100,000 mt for its industrial processes annually. During a field visit, this vendor informed us that they meet 40% of NB's annual demand
[33] A big difference is observed when this figure is compared with the reported volume imported by NB to cover shortfall in 2017 supplies. Ordinarily, the figure quoted by vendors exceeds the 100,000 mt annual demand. Reasons for this difference requires further examination both on the side of NB and vendors.

CHAPTER 3.
FARM LEVEL ANALYSES: KEY AGRONOMIC AND SOCIO-ECONOMIC DYNAMICS OF SORGHUM FARMERS IN THE INDUSTRIAL VALUE CHAIN

3.1 CHAPTER SUMMARY

Analyses of data collected through the questionnaire survey of 433 respondents, as well as information obtained through five focus group discussions with selected farmers in Niger, Kaduna, Katsina, and Zamfara states led to the following key observations.

- Firstly, two main categories of sorghum farmers were discovered – regular farmers, as well as aggregator-farmers who combine sorghum farming with their commercial work as vendors. **Data collected shows that middle- and large-scale regular and aggregator-farmers were responsible for over 70% of sorghum supplied to NB through interviewed vendors** (middle-range farmers accounts for 32%, while large-scale farmers for 42.4%). **Supplies from small-scale farmers appear less important during the 2017-2018 season, contrary to the expectation that smallholders dominate the field.** In Nigeria, small scale farmers still account for the majority of total sorghum production, but industrial markets are supplied by middle-large scale farmers. It can be concluded that the growth of industrial markets is encouraging the development of larger scale farming.
- Prevailing market price, rather than the contract price of sorghum, is a stronger influencing factor for the selling price of harvests. The possibility of disregarding the pre-agreed sorghum supply arrangement with NB is high when contract price is lower than current market price.
- **Revenue obtained from sorghum farming constitutes 66% of annual revenue generated by aggregator-farmers and nearly half of all revenues generated by regular farmers**. All aggregator-farmers and regular farmers contacted during the survey were positive that sorghum farming is very important to their perceived well-being. However, **this study reveals that for half of the smallholder farmers (<20 ha), the income from sorghum farming is not yet sufficient to fully cover their children's education needs, and for a third, sorghum farming alone does not cover the family food expenses.** It is noted that these farmers have other crops / sources of income.
- Finally, the growing importance of medium- and large-scale farmers potentially has two major consequences: firstly, a change of existing dynamics between vendors, aggregators, and farmers, which may lead to **a gradual loss of market opportunities for smallholder farmers**; and secondly, **a new labour market structure, where smallholder farmers are increasingly engaged as farm hands in these emerging larger farms**.

3.2 KEY ACTORS IN THE SUPPLY CHAIN: SORGHUM CULTIVATION AND SALES STRATEGIES

The survey questionnaire was administered among 433 respondents, comprising 27 aggregator-farmers and 406 regular farmers[34] in six northern Nigerian states: Kaduna; Niger; Zamfara; Katsina; Yobe; and Gombe. These regular farmers and aggregator-farmers supply sorghum to previously interviewed vendors. **In-depth interviews with vendors revealed that two of them have also ventured into sorghum farming on a medium to large scale.**[35] This observation indicates the importance of vendors as large-scale farmers and their potential for changing the landscape of sorghum supplies. Hence, this analysis will make a distinction between two main groups of actors involved in the sorghum supply chain: aggregator-farmer (both aggregator-farmer and vendor farmers) and regular farmers. The description of these groups together with their sorghum cultivation and sales strategies can be found below.

3.2.1 The aggregator-farmer

Within this group, we can distinguish two subgroups – aggregators and vendors. The aggregator-farmers supply vendors with the sorghum they collect from farmers, but they also own their sorghum farms. There is also one main vendor who owns a large farm. These two sub-groups (aggregator-farmer and vendor-farmer), 27 in total, are uniquely located in Kaduna State. Among the 27 aggregator-farmers, 2 operate on small farms of 11-20 ha and the one vendor on a large farm of 2,000 ha. A large proportion, **89%, operate on farm size in the range of 21-100 ha and the large majority of those have been in operation for between six and ten years**; only a few aggregators have experienced sorghum farming for more than 10 years. Basic characteristics of the respondents in this group can be found in Table 2.

Table 2. Basic average characteristics per aggregators sub-group

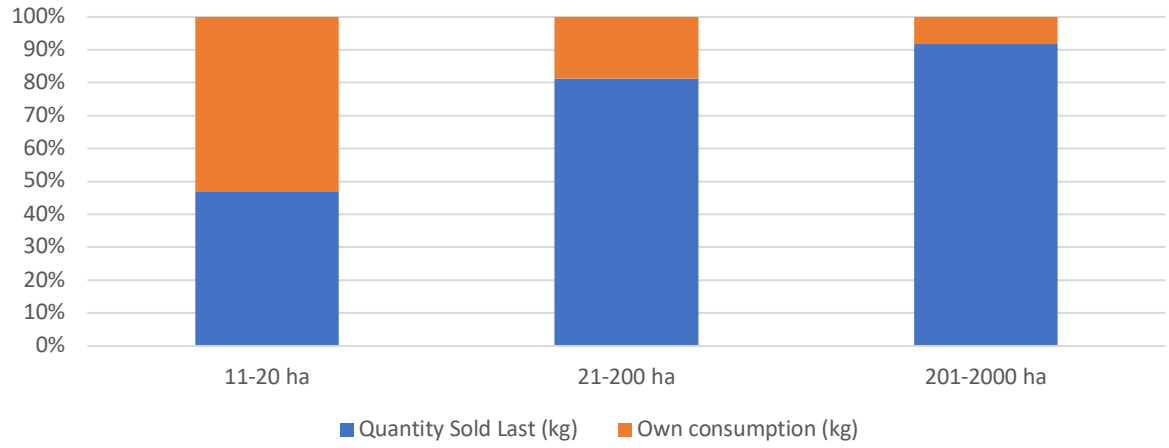
Aggregator-farmer	11-20 ha	21-200 ha	201-2000 ha	Average
Number	2	24	1	
Average age	36	46	51	45
Average no of children	9	14	27	14
Education	Islamic	Islamic & Secondary	Secondary	
Average land size (ha)	18	35	2,000	107
Average years of Farming Sorghum	8	10	22	10
Average income from sorghum (₦)/ha	90,000	76,508	66,000	77,118

Source: Field survey, October-November 2018

All the aggregator-farmers indicated an increase in their land area dedicated to sorghum farming in the year before the survey.[36] For this group, the increase in acreage is motivated by **'easier agricultural practice'** for smaller and middle-range farmers, while the large-scale vendor explained the increase by better prices obtained for the crop.[37] Figure 3 shows that sorghum production by middle-range and large-scale aggregator farmers is largely oriented towards the market, while those with smaller farmlands (11-20 ha) consume nearly half of their farm produce. High operating costs remain problematic for all aggregator-farmers.

[34] The farm-level survey exercise firstly involved the identification of communities where sorghum farmers that work with previously interviewed vendors and aggregators are located. Information-gathering methods used included a questionnaire (proceeded by a pilot), focus group discussions, in-depth interviews of officials and selected farmers, and field observations. Factors that guided the choice, as well as the number of respondents per exercise are presented in the methodology section (1.2) in the Annex.
[35] For example, two vendors in Kaduna indicated that they now operate their own farms; one of these vendors has 40 medium-sized farms, employs labour, and simultaneously engages in sorghum-aggregating activities.
[36] See Table A 6 in Section 1.13 in the Annex.
[37] See Table A 7 in Section 1.13 in the Annex.

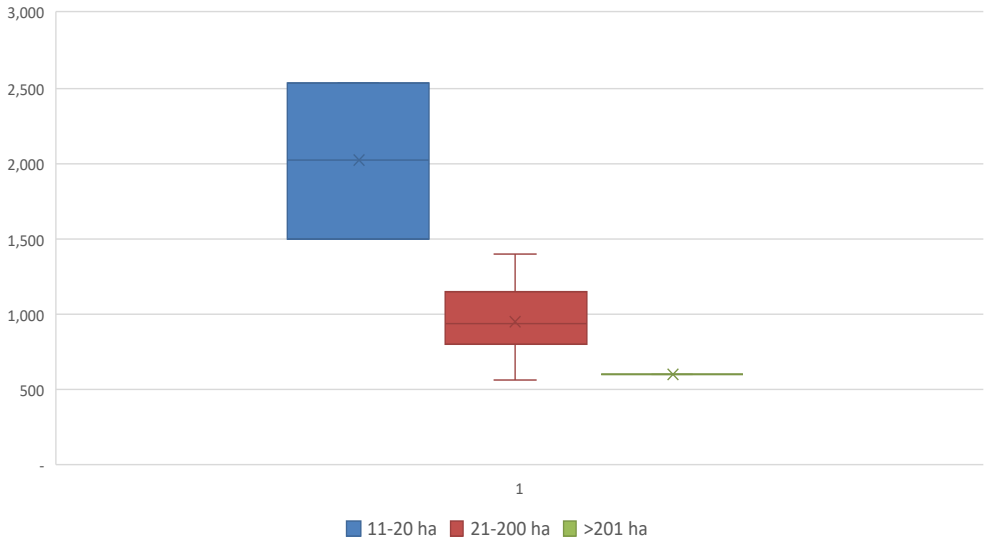
Figure 3. Proportion of sorghum consumed and sold on the market by aggregator farmers



Source: Field survey, October-November 2018

Information obtained through surveys indicates that **all aggregator-farmers used seeds from the previous harvest in the 2018 planting season.** Despite the similarity in the types of seeds used during planting, **productivity (kg/ha) is shown to decline as farm size increases.** Specifically, farms of 11-20 hectares reported average yield of 2,017[38] kg per hectare, compared to 600 kg per hectare on the vendor-owned 2,000 ha farm (Figure 4). In the smaller farms (11-20 ha), reported productivity range from 1500 to 2500 kg/ha; this goes down to 600-1400 kg/ha in the medium size farms; and further downward to 600 kg/ha in the 2,000 ha farm. It was discovered that farming on the very large farm is non-mechanized; the owner uses manual labourers for all types of farm activity. Operators of the aforementioned medium and smaller farms appear to utilise improved farming techniques. This pattern is checked for regular farmers later in section 3.2.2.

Figure 4. Productivity kg/ha per farm size across the aggregator-farmers

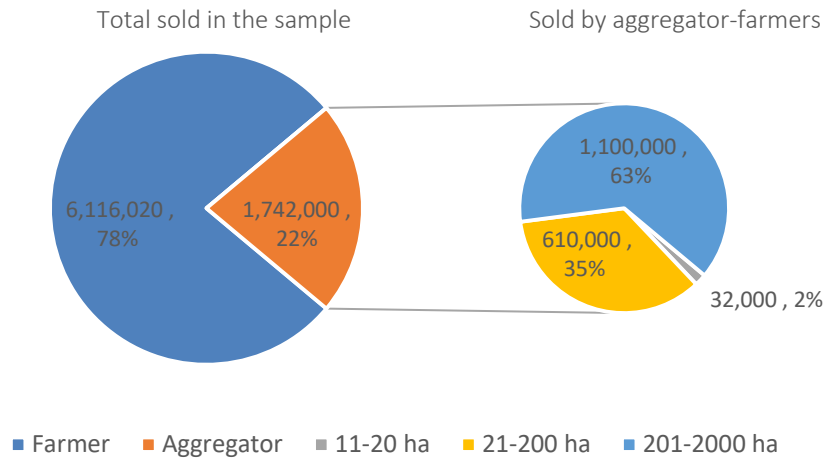


Source: Field survey, October-November 2018

[38] See Table A 8 in Section 1.13 in the Annex.

All aggregator-farmers sell their product through the vendors that supply to industrial buyers.[39] **The market price is the most important factor influencing decision to selling sorghum**; for a few medium-sized farms and the one largest farm, the contract price is adhered to. None of the aggregator-farmers sells sorghum in advance; they use the market price to make supply commitments. Although **the group of aggregator-farmers constitutes only 6% of the sample selected for the survey together with large-scale vendors, they delivered 22% of the total quantity of sorghum received by NB**. Out of this delivery, 63% came from vendor-owned farms and 35% from middle-range and small range aggregator-farmers (Figure 5). All the production of the vendor-owned farms went to NB.

Figure 5. Amount and percentage distribution of sorghum sold in 2017-18 by aggregator-farmers according to farm size



Source: Field survey, October-November 2018

3.2.2 Regular farmers

3.2.2.1 Background description

The second main group of respondents constitutes regular farmers, who operate on land of varying sizes, ranging from as small as 2 hectares to approximately 2,000 hectares. Because of this substantial spread, this group is further subdivided based on the size of owned land. Small-scale farmers (0-20 ha) are the largest category in our sample, constituting 79% of the farmers in the whole regular farmers' group. As this study was particularly interested in this group, it was broken down into five sub-groups: smallholder farmers I (< 5 ha), smallholder farmers II (6-10 ha), smallholder farmers III (11-20 ha); middle-range farmers (21-200 ha); and big- and large-scale farmers with land over 201 ha (Table 3). More detailed characteristics of the respondents in each of the sub-groups are also presented in Table 4 below.

[39] See Table A 9 in Section 1.13 in the Annex.

Table 3. Percentage distribution of respondents in the regular farmer group

Category	Respondents	Gombe	Kaduna	Katsina	Niger	Yobe	Zamfara	Total	%
Smallholder I	1-5 ha	23	2	13	27	9	3	77	19%
Smallholder II	**6-10 ha**	**32**	**2**	**18**	**30**	**17**	**9**	**108**	**27%**
Smallholder III	**11-20 ha**	**29**	**5**	**15**	**24**	**49**	**13**	**135**	**33%**
Middle-range farmers	21-200 ha	5	47	11	6	2	9	80	20%
Big-scale farmers	201-1200 ha						5	5	1%
Large-scale farmers	1201-2000 ha						1	1	0.02%
	Total	**89**	**56**	**57**	**87**	**77**	**40**	**406**	**100%**

Source: Field survey, October-November 2018

Table 4. Basic average characteristics per farmer sub-group

Farmer	1-5 ha	6-10 ha	11-20 ha	21-200 ha	201-1200 ha	2000 ha	Av.
No of farmers	77	108	135	80	5	1	
Av. Age	32	36	38	42	45	43	38
Av. no of children	5	7	8	10	7	8	7
Av. Education	Secondary	Primary/ Secondary	Primary	Primary/ Secondary	Higher education	Higher undergrad	
Av. years of farming sorghum	10	14	16	18	17	18	15
Av. land size (ha)	3.9	8.9	16.6	67.8	542	2,000	33.6
Gombe	4.4	8.8	16.1	42.0			11.9
Kaduna	4.0	10.0	20.0	77.9			67.6
Katsina	3.8	9.0	17.3	40.4			16.1
Niger	3.4	8.7	16.8	53.8			12.4
Yobe	3.9	9.1	16.0	25.0			13.3
Zamfara	4.3	8.7	17.5	81.7	542	2,000	144.1
Av. income from sorghum (₦)/ha	90,081	73,161	58,207	46,826	59,274	34,675	65,943
Gombe	40,213	40,536	41,165	27,400			39,920
Kaduna	95,167	77,500	84,000	36,293			44,127
Katsina	41,359	52,886	45,847	82,180			54,058
Niger	127,351	104,090	75,876	57,762			100,331
Yobe	182,317	111,042	61,108	63,800			86,369
Zamfara	68,000	54,101	57,007	58,352	59,274	34,675	57,205

Source: Field survey, October-November 2018

Information obtained via the questionnaire survey shows that the bigger the farm, the more the likelihood of the farmer being older and having a larger family. Also, **average farmland holdings in Katsina, Niger, Gombe, and Yobe States are several times smaller than land holdings in Kaduna and Zamfara States.** With a few exceptions, there is a general positive correlation between the number of years of engagement in sorghum farming and the average size of land that farmers have dedicated to sorghum farming (Table 5). **Very small-scale (smallholder) sorghum farming is found in Katsina, Gombe, and Niger states. The smallest average farm holdings are in Gombe and Niger. Further investigation is required to determine whether these small-scale farmers potentially double as temporary labourers on bigger farms in neighbouring States.** Furthermore, it remains to be seen whether those with the least years of sorghum farming experience will expand their land area or intensify sorghum production on the current land area in the coming years.

Table 5. Years of farming and average size of farmland holding for farmers according to States

Years of Farming	Average size of land area for farming						
	Kaduna	Katsina	Niger	Zamfara	Gombe	Yobe	Total Av.
21+yrs	47.9	21.6	19.9	66.9	17.3	20.5	28.3
16 – 20yrs	51.8	19.8	19.1	334.4	10.8	18.6	51.9
11 – 15yrs	94.6	11.9	8.4	251.7	10.8	14.7	45.1
6 – 10yrs	65.5	9.9	7.8	114.7	10.3	12.6	28.2
1 – 5yr	20.0	4.3	7.6	25.7	10.3	3.7	10.6
Av. Total	**67.6**	**16.1**	**12.4**	**144.1**	**11.8**	**13.3**	**33.7**

Source: Field survey, October-November 2018

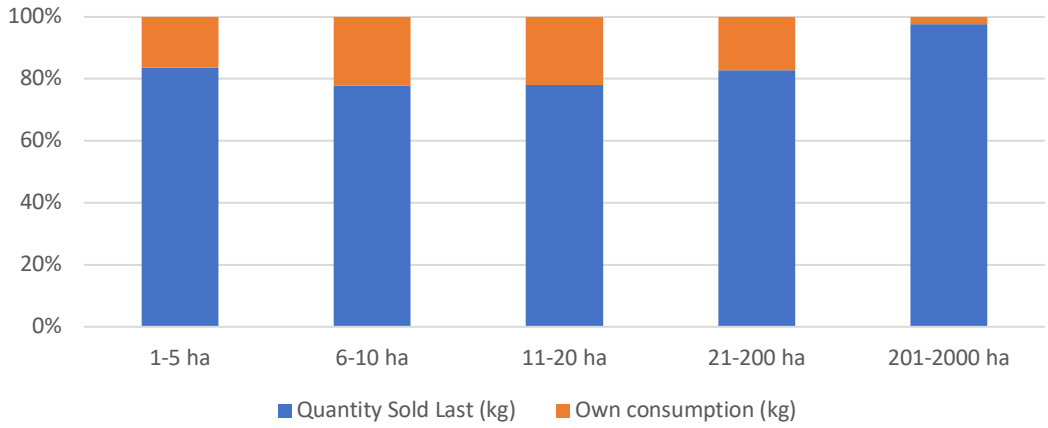
3.2.2.2 Expansion of area cultivated

Approximately two-thirds (63%) of all farmers indicated an expansion of acreage for sorghum farming in the 2017-2018 period.[40] Farmers who recorded this increase are most frequently **motivated by better prices and a ready market for the crop** (33% and 19% respectively). Only 10% of the farmers mentioned improved agricultural practice as a potential motive for expansion.[41] **The increase is particularly visible in Kaduna (98%), especially among middle-range farmers and in Niger State (82%) among the smallholders.** The latter group (also in Zamfara and Kaduna), which has been cultivating sorghum for 6-10 years, is keen to maintain strong supply links with aggregators and vendors who appear to have continued sourcing sorghum in the medium- and long term-term.

Approximately 80% of sorghum harvest by regular farmers is sold; the remaining portion is for household consumption needs (Figure 6). Moreover, **increased sorghum cultivation appears not to substantially influence or replace cultivation of other crops for regular farmers.** Most of the small-scale farms (up to 20 ha) diversify by cultivating other crops next to sorghum.[42] Maize (85%), beans, (38%) and soya beans (35%) are among crops most frequently accompanying the sorghum production, although the popularity varies per state.[43] **The large estates (>201 ha) under consideration diversify only with soya beans and maize, while their sorghum production is done almost solely for sale.**

[40] See Table A 6 in Section 1.13 in the Annex.
[41] See Table A 7 in Section 1.13 in the Annex.
[42] Sorghum occupies farmland for about seven months in a year – from preparation of land in May to harvesting of produce in December/January.
[43] Apart from maize, which is cultivated as a second crop by the vast majority of the respondents throughout the states (as it can be easily cultivated alongside sorghum), beans are mostly cultivated in Gombe and Yobe, soya beans in Katsina and Kaduna, millet in Yobe, rice in Niger state and Gombe, and yam in Gombe. There is also a marginal number of farmers cultivating groundnut and cotton as well. See Table A 5 in Section 1.13 in the Annex for more details.

Figure 6. Proportion of sorghum consumed and sold on the market per farmers' category

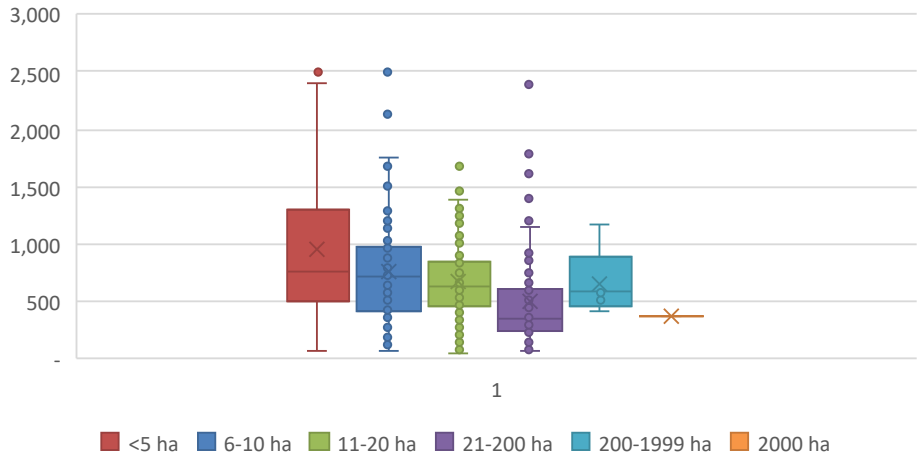


Source: Field survey, October-November 2018

3.2.2.3 Productivity per hectare

Despite the lucrative nature of sales of harvested sorghum for regular farmers, productivity appears to decrease as farm size increases (Figure 7 and Figure 8). The observed decline in productivity per hectare among the farmers is from 994.5 kg of sorghum per hectare among the smallholder group to 365 kg per hectare for the farmers with large land holdings (of 2,000 ha in Zamfara State).[44] Lack of adequate education on good agronomic practice and hampered access to improved seeds might have contributed to relatively low productivity among some groups of farmers. In addition, with land availability, the comparative cost of expanding the area of cultivation may outweigh the costlier option of investment in intensification. It thus appears easier and cheaper to expand area planted than it is to intensify production on the same land area.

Figure 7. Productivity kg/ha per farm size among the regular farmers

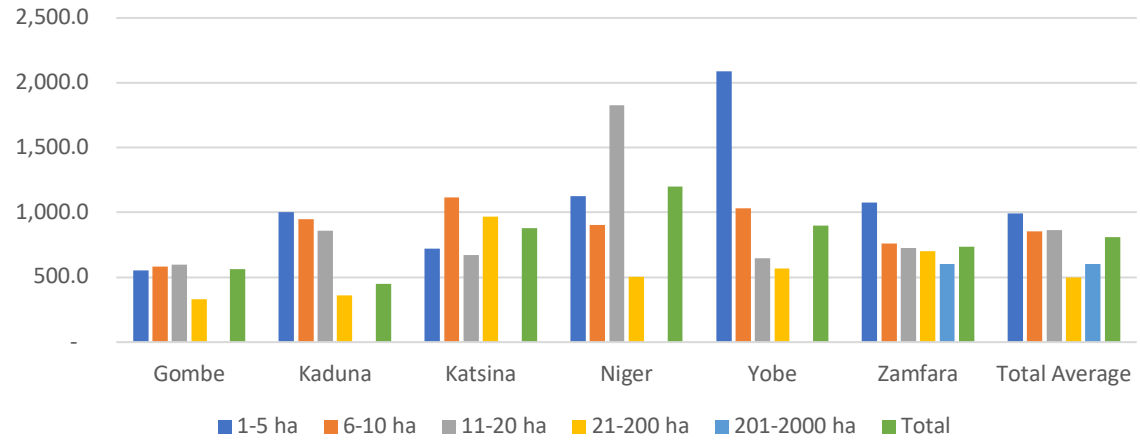


Source: Field survey, October-November 2018

[44] In the case of Zamfara, a claim was made by some farmers that the local soil is not adequate for effective germination and growth of planted sorghum seeds, thus produces a smaller yield (anecdotal information obtained during field visit to farmers in Zamfara State, August 2018.)

The inverse association between productivity per hectare and size of farm is linked to the following plausible reasons. For instance, some smallholder farmers might disclose the volume/value of the last year's harvest for all of their crops (not only sorghum). They stated that sorghum cultivation is often combined with other crops (mixed cropping at the same time) and, in the absence of bookkeeping, disaggregation of data becomes difficult or at best they make raw estimates from values of sales with a bias for their major crop recalled from memory. Larger-scale farmers are generally mono-cropping sorghum. Declining productivity may be related to the use of seeds that might have lost purity due to years of re-use. As will be shown later in the report, 80% of farmers use seeds from previous harvests for new season farming; with years of re-use, the quality of seeds declines and they no longer attain previously high yield levels. In addition, mechanization and other inputs are not widely used on larger farms and these farm owners are generally satisfied with the revenues earned owing to the sheer size of farm area.

Figure 8. Average productivity kg/ha per farm size across the States



Source: Field survey, October-November 2018

It has been observed that the **poor literacy level of the majority of farmers, as well as a lack of available local extension agents, is delaying the learning curves on the use of new farm techniques and application of the right seeds**.[45] The problem persists especially in Zamfara State, where the inaccurate measurements used for spacing and bunching of sorghum shoots continuously leads to suboptimal results during harvest.[46]

3.2.2.4 Knowledge and use of improved seeds

Knowledge about the existence of improved seeds is high. At least 86% of regular farmers indicated being aware of improved seeds.[47] **While the average productivity of (improved) seeds purchased from a seed company is nearly twice the productivity of seed used from the previous harvest**,[48] **78% of regular farmers depend on seeds from the previous harvest in the new planting season. Smallholders reported having problems accessing the improved seed.**

[45] Read more in Section 1.10 in the Annex.
[46] It was discovered that spacing of shoots depends on the height of the person who did the planting; farmers believe that a person's height dictates the length of steps. At each step in the field, the planter dips a hand into the bag of seeds and pours the seeds into the dug hole. The spacing is therefore dependent on the farmer's height and, in many cases, is not aligned with the planting distances required by the seed producers.
[47] See Table A 11 and section 1.13 in the Annex
[48] See Table A 8 in Section 1.13 in the Annex.

In addition to the availability of the seed, cost is a major barrier. New seeds, in comparison to the saved seed, have to be purchased. Farmers are put-off if they need to borrow money to pay for new seeds. Digging deeper, it was assessed that the high cost is not the only reason for not using improved seeds. In-depth interviews with some farmers revealed incidence of **unscrupulous practices by some local agents of seed companies who were 'mixing bad seeds with good seeds', which were sold off to the farmers**. On one hand, limited supply of high quality seeds[49] contributed to the decision of agents to adulterate available supply with lower quality seeds. On the other hand, farmers who used such mix experienced small harvests[50] and consequently became suspicious and reluctant to buy new seeds.

To avoid further loss, farmers resorted to age old practice of recycling seeds from harvests for the new planting season. This led to reduced reliance on acquisition of seeds from agents, despite the known advantages of using improved seeds for planting. It was only in Yobe State did 42% of farmers obtain seeds from seed companies in the 2017-2018 planting season, mostly farmers from smallholder group I and II. This group forms the bulk (±40%) of all farmers interviewed who indicated accessing seeds from seed companies. This indicates that the willingness of farmers to adopt new varieties may be tapped into and **Yobe State may be used as a point for promoting widespread adoption.**

Another dynamic facing the industrial sorghum seed market is **the new (vitamin A-fortified) seed freely distributed in the region** through an initiative of the Bill and Melinda Gates Foundation (BMGF).[51] Some smallholder farmers have been accepting this new seed variety. While this variety of sorghum can be consumed as a staple, it is deemed less suitable for industrial markets due to its darker colour. However, as long as these seeds are distributed free of charge, in the context of declining productivity of CSR-01 and 02 varieties, these factors may disrupt the industrial sorghum market. Distribution of free seeds is not sustainable in the long term.

3.2.2.5 Sorghum acquisition connections

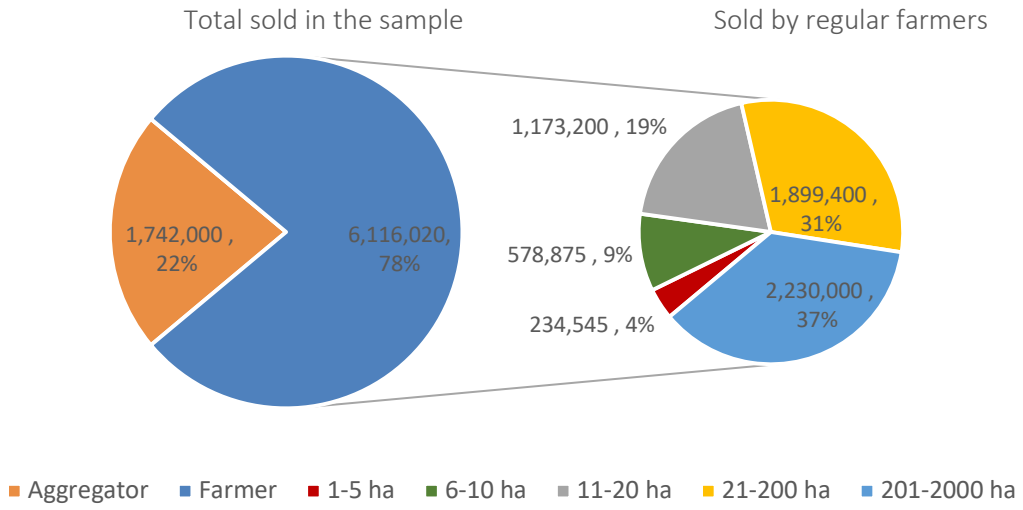
With regard to **the main buyer of sorghum for regular farmers** in this study, over **50% of them sell their produce directly to vendors**. Farmers reported that they get the market price. However, some farmers use their income to offset the cost of farming inputs that were obtained from some vendors during the farming season. Over time, this type of transactional relationship between vendors and farms has translated into a form of socio-financial bonding. This practice helps vendors to secure supply lines while simultaneously allowing farmers to secure sales of harvested sorghum. The second most important route leads **indirectly through local aggregators and other merchants (28%).**[52] **The market price is the most important factor influencing the decision to sell**, followed by the quality of the grain. The local practice is that aggregators visit farmers two days before market day to negotiate prices directly. The transaction is completed on market day when aggregators and vendors come to collect sorghum. Therefore, a good proportion of what is seen at market stalls on market

[49] In the case of hybrid seeds CSR-03H and CSR-04H, there was a need to ensure the purity of grains given to farmers for commercial production, but distribution of hybrid seeds was suspended in 2013 because the appointment of companies to be engaged in testing the purity of the seeds was not done. This affected the attainment of the goal of 25,000 farmer-out-growers slated for 2016. The mandate of the Hybrid Release Committee (expected to be established by the National Agricultural Seeds Council) is to put in place a process for the selection and capacity building of seed producing companies and the selection and training of out-growers who are expected to produce seeds at 90% minimum level of purity. Premier Seeds Nigeria Limited, in conjunction with IAR, were to be involved in the production of certified seeds. Survey evidence indicates that this programme did not run as envisaged, and it invariably affected the supply of fresh seeds.
[50] Initially, affected farmers blamed poor harvests on unsuitability of seeds; eventually, the contamination of seeds for planting was traced to malpractices of agents of seeds distribution companies.
[51] Read more about the improved seeds from BMGF in Section 1.11 in Annex.
[52] See Table A 9 in Section 1.13 in the Annex.

days has already been sold to or reserved for aggregators. Among our respondents, 9% sell their sorghum in advance, none of these farmers belong to the large-scale farmers group.

In reference to the quantities of sorghum sold by respondents (Figure 9), **smallholder farmers I (<5 ha) contributed only approximately 4% of sorghum sourced by vendors.** Smallholder farmers II (6-10 ha) contributed 9% of sorghum sold to the vendors while smallholder farmers III (11-20 ha) contributed twice as much – 19%. Together, **smallholder farmers contributed slightly more than 30%. Sorghum supplies to vendors for industrial markets are dominated by medium-scale (21-200 ha) and large-scale (>201 ha) farmers, who collectively are responsible for considerably more than half of the sales.** If we also add the amount of crop sold jointly by aggregators and farmers, middle-range farmers would account for 32% and large-scale farmers for 42.4% of all sales.[53]

Figure 9. Amount and percentage distribution of sorghum sold in 2017 by regular farmers according to farm size



Source: Field survey, October-November 2018

Medium- and large-scale farmers, particularly from Kaduna and Zamfara, are clearly emerging in this study and are gradually becoming important producers. This changing landscape of sorghum supplies potentially has two major consequences: firstly, a change of existing dynamics between vendors, aggregators and farmers; and secondly, a new labour market structure. With regards to the former, a possible implication is that vendors who own large farms may **no longer need the services of aggregators** in the near future and will remain either self-sufficient or will work directly with other large-scale and middle-range farmers. That may mean **a gradual loss of market opportunities for smallholder farmers**, which would have implications for diversification of, and changes to, their livelihoods. That brings us to the second point, as **smallholder farmers may be increasingly engaged as farm hands in these emerging larger farms.**[54] Further investigation is needed, however, on the situation in large farms regarding work and welfare of workers. Moreover, it may appear as if subsistence and small-scale farmers are getting side-lined in the sorghum value chain, however they remain a part of the 80% of the market which is not industrial.

[53] Semi-formal interaction with a large -scale (12,000 ha) sorghum farmer that is not linked to any of the vendors shows that this farmer has developed a supply network of group of farmers who own approximately 25 ha farms each. It could be that some vendors have focused on developing a smaller number of larger suppliers to secure the quantities they need. This requires further research.
[54] See Figure A 3 in Section 1.13 in the Annex.

3.3 Economic dynamics

The profitability of supplying sorghum to the industrial chain is assessed in this study based on information provided about the costs incurred during land preparation and planting seeds, which take place between May and December, versus income obtained from sales of harvests, which begin in January the following year. The cost analysis is done for farmers that hire workers and does not include a valuation of 'unpaid' family labour, although it does acknowledge its occurrence.

3.3.1 Costs

During the 2017-18 season, the average cost of land clearing per hectare for regular farmers was ₦3,792.4 (€9.48).[55] Data presented in Table 6 shows that the range is as low as ₦884.5 (€2.21) in Yobe State and as high as ₦6,318.7 (€15.8) in Niger State. **For planting sorghum, the average cost per hectare is relatively lower at ₦2,572.7 (€6.43)**, ranging from as low as ₦619.3 (€1.55) and ₦4,097.4 (€10.24) also in Yobe and Niger States respectively. Aggregator-farmers pay more than twice as much for clearing activities than they do for planting.

The average rates offered for planting sorghum were lower than for clearing across all states. Average wages paid by regular farmers to hired farm workers for clearing land in preparation for planting was below the national minimum wage[56] rate (₦818.18 [€2.05] per working day) in Yobe and Katsina State; farm workers were compensated better (above minimum wage) in Gombe, Niger, Kaduna, and Zamfara states. Workers in Kaduna and Zamfara states, where the two largest farms in our sample are located, still earned better than their counterparts in the remaining states. A separate analysis is therefore made for costs dynamics of these farms (see Table A 12 in Annex).

Table 6. Financial implications and outcomes of sorghum farming (Aggr. = Aggregator-farmer)

Costs	Aggr.	Gombe	Kaduna	Katsina	Niger	Yobe	Zamfara	Total
Clearing Average (₦) Cost per hectare	4,812	3,349.0	2,493	4,254.2	5644.4	884.5	5,354.3	3,792.4
Clearing Average (₦) Daily ₦ rate pp	1,037	976	1,230	708	1,139	684	1.243	983
Planting Average (₦) Cost per hectare	2,986	2,053.2	1,734	3,903.0	3423.1	619.3	3,171.8	2,572.7
Planting Average (₦) Daily ₦ rate pp	504	736	1,170	695	967	675	1,060	838

Source: Field survey, October-November 2018

The two largest farms are owned by a regular farmer (in Zamfara) and an aggregator-farmer (in Kaduna). They present different financial dynamics. While **both rely extensively on the use of farm workers**, the farm in **Kaduna State employs about eight times the number of workers engaged in Zamfara during land clearing**; and it employs about seven times the number of workers in Zamfara for sorghum planting, though in the latter location, the workers are engaged for a longer period.[57] The Kaduna farm only pays better wages during land clearing; and they pay below the minimum wage during planting, when the Zamfara farm pays above statutory minimum wage for both of these activities. It is an important finding, as vendors are now undertaking large-scale farming and subsistence and other smallholder farmers may be increasingly engaged as farm hands in these farms. **The main buyers of sorghum for industrial use, such as NB, should therefore push to establish compliance conditions for inclusive and fair employment practices for farm workers on these farms.**

[55] €1 = ₦400
[56] Nigeria National Minimum Wage 2018 (₦18,000) monthly. Trading Economics. Nigeria National Minimum Wage 2018-2020 Data | 2021-2022 Forecast | Historical. https://tradingeconomics.com/nigeria/minimum-wages .
[57] See Table A 12 in Section 1.13 in the Annex.

3.3.2 Farm labour

Some studies [21] observed that, in Nigeria, family labour constitutes a large proportion of labour, mostly among small-scale farmers. Our study confirms that family members are helping on the farms, but their involvement depends on the location and size of the farm.[58] For instance, while **aggregator-farmers rarely engage their family members as farm labour** (although the vendor does), **regular farmers use family help most frequently on farms between 11-20 ha**. In Kaduna, nearly all regular farmers work with family members, as well as all large-scale farms in Zamfara. In the context that aggregator-farmers have to employ non-family members, this may explain why they pay nearly twice as much per hectare for both clearing and planting activities in comparison to the regular farmers for the same activities in Kaduna State (Table 6). In addition to family members, farmers also contribute work at each other's farms at set times. Such **communal labour has no financial valuation because it is seen as a social obligation, but together with obtained family support it does lead to substantial savings for the regular farmers.**

3.3.3 Child labour

In the surveyed area, there are generally no customs restricting children in helping on the farm. Nearly 65% of a total of the regular farmers with children aged 7-15 years engage them in farm work.[59] **None of the aggregator-farmers engage their children aged 7-15 years in farm work.** Children help to clear farmland in preparation for farming (mostly in Yobe State), to plant (mostly in Niger and Katsina states), and they **help to convey food from the house to the farm** (all states with the exception of Yobe).[60] Such refreshments are 'payments in kind' to other farmers and persons who have come to assist the requesting farmer. In Nigeria "the minimum age for employment is 12 years. A child (under 12 years) cannot be employed to work in any capacity except where in a family enterprise on light work of an agricultural, horticultural or domestic nature approved by the Government. A child must not be required to lift, carry or move anything so heavy as to injure his physical development."[61]

On a rotation basis, communal help is used among farmers on different days during farmland clearing in May. May and June are, however, crucial months in the school calendar in Nigeria. These two months fall in the third term of the year; promotion exams to the next level are held towards the end of the third term. According to the result of this sample survey, **over half of children of sorghum farmers are at risk of missing hours of education at this crucial time of the academic year due to their involvement in farm activities** (Figure 10).

Education system in Nigeria

While primary enrolment rates are high, primary completion rates are much lower. The net attendance ratio (NAR) for pupils in primary schools is relatively better in southern Nigeria (81% in southeast Nigeria) compared to northern Nigeria (44% in northeast Nigeria), and in urban areas relative to rural areas. Also, the net attendance ratio (NAR) for pupils in secondary schools is relatively better in southern Nigeria compared to northern Nigeria [10]. Though nine years of education are basic, free, and compulsory under Nigeria's Universal Basic Education programme, almost a third of children of primary school age are not in class [11].[62]

[58] In northern Nigeria, different kinds of communal labour were held in high esteem. These include the *egbe* (among Nupe people) which saves a quarter to one-third of the cost of hired labour and extends family working force by 57 additional man-days (see Kohnert [1986] [28] for a more comprehensive description). The *egbe* closely resembles *dzoro* (smaller exchange labour groups between friends) and it is more profitable than *kwadago* and *gaya*. Kohnert predicted that "it is foreseeable that the poor will sooner or later sell their labour power to the highest bidder" [28].

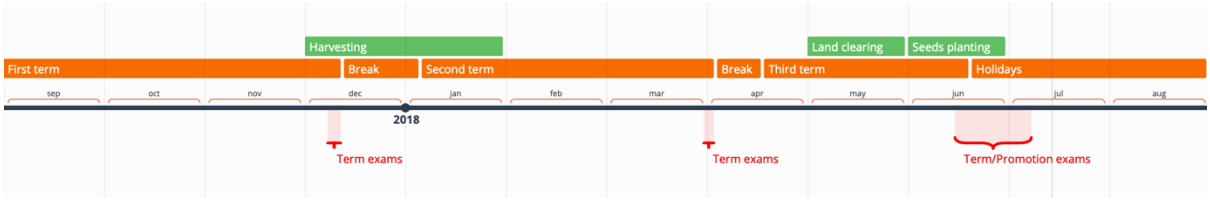
[59] Out of 406 regular farmers, 222 indicated having children between 7-15 years old. Out of which, 161 admitted to engage them in farm work.

[60] See Figure A 4 in Section 1.13 in the Annex.

[61] Re: §18 of the Constitution of the Federal Republic of Nigeria 1999, §59(1-5) of the Labour Act (Cap L1 LFN 2004); §2 & 15 of the Compulsory, Free Universal Basic Education Act, 2004; §15 & 28-29 of the Child's Rights Act, 2003

[62] Read additional general comment on the education system in Nigeria in Section 1.12 in the Annex.

Figure 10. Timeline depicting sorghum farming and school calendar in Nigeria



3.3.4 Financing

Despite family and other farmers' support, hiring labourers and buying seeds and other inputs require upfront financing, which is a challenge in particular for the aggregator-farmers, and the regular smallholder I & II groups. All aggregator-farmers and regular farmers of large-scale farms from 201 hectares and above indicated that they rely on personal savings to cover costs of farmland preparation. The majority of **smallholders also indicated that they rely on personal savings; very few of them stated receiving a loan and/or financial gifts to kick-start the farming season.**[63] However, during FGD sessions, the issue **of informal loans (from local chiefs and other community-based financiers)** resurfaced. This informal loan system is not only for sorghum farming. Due to the level of personal relationship involved in the financial interaction or exchange between the borrower and lender, it is not described as a loan but as receiving money which can be repaid later in kind (for example, bags of farm produce). In addition, local norms generally discourage people from publicly revealing any financial situation, particularly the one that could picture them as 'debtors'. It is a very culturally sensitive topic to discuss.

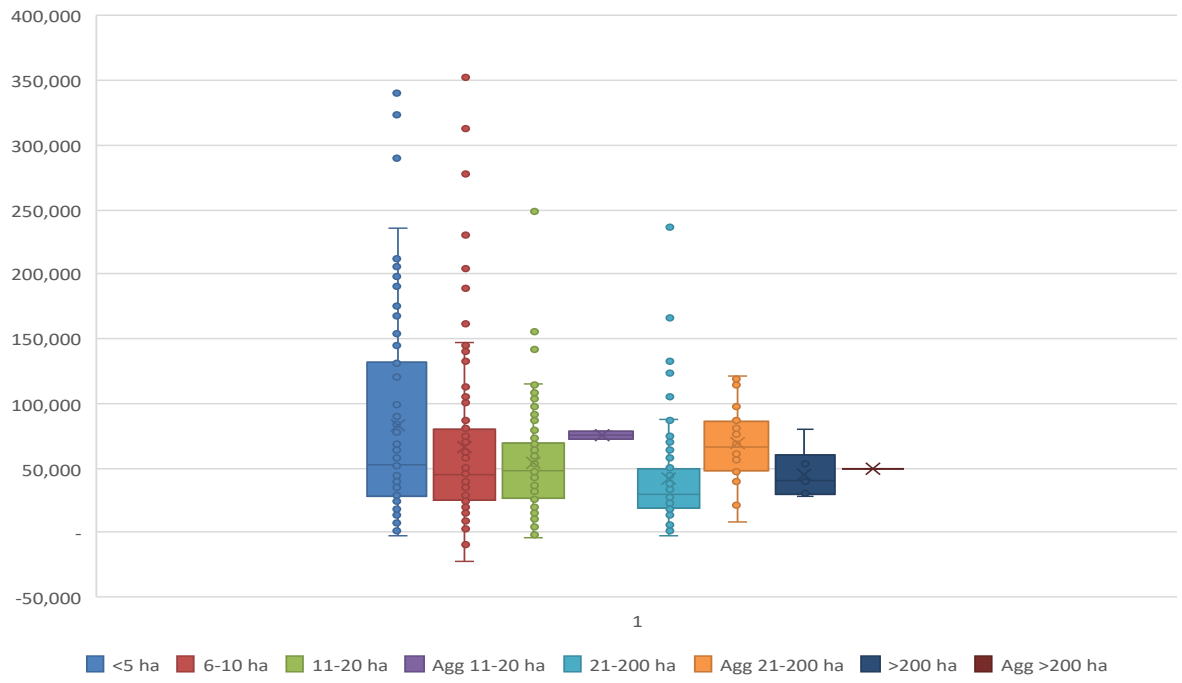
The use of alternative local financiers and/or the reluctance towards commercial banks may be linked to the very high interest rates charged by banks. This experience was corroborated by representatives of vendors and haulage companies associated with sorghum transportation from vendors in Kaduna State to malting companies in the southern part of the country. **Vendors revealed that banks charge between 21-24% interest rate on loans of 180-day tenure.** While haulage companies are able to meet loan conditions (collateral, and non-default credit records among a host of other demands before a loan is given out), information about the stringent loan conditions appear to filter from vendors (some of who own haulage trucks) to farmers and aggregators in the lower end of the value chain, further discouraging farmers and aggregators from using official bank sources for loans to undertake agricultural activities. To further maintain the stable supply relationship, **some vendors and aggregators are reported to be reliable sources of funding for farmers' pre-planting activities.** By implication, 'loans' are not necessarily monetary; other forms of loan include the time dedicated to helping other farmers clear their land.[64] **The informal loans are often repaid with bags of sorghum immediately after harvests.**[65] This lending practice is indicative of how financial systems among the unbanked and the informal sector operates. This has implications for how formal lending institutions may need to repackage their loan products if they wish to attract customers in rural areas and in the informal economy.

[63] See Table A 13 in Section 1.13 in the Annex.
[64] Vendors who own farms mentioned that they support local farmers with their tractors. It can be seen as a type of pre-financing.
[65] One big farmer (100 ha) in Kaduna State who supplies sorghum harvests from his farm to government granaries and some malting companies revealed that they sometimes fund smallholder operations; and during harvests, they receives repayment in pre-agreed numbers of bags of sorghum immediately after harvests.

3.3.5 Revenues and Profits

The highest prices per kg on average are obtained by middle-range farmers (61-200 ha), followed by the smallholders I and II, while large-scale regular farmers obtain the lowest price per kg.[66] There is, however, an observed difference in prices depending on the location of the farmers.[67] Niger State offered on average the highest price per unit during last year's harvest, but this is also the state where the prices of sorghum appeared to fluctuate the most (there is a big difference between the minimum and maximum prices per unit sold). The lowest prices are obtained in Zamfara and they are equal to the average price obtained by the aggregators in Kaduna State. **On average, a kilogram of sorghum is sold for ₦115.2 by regular farmers and ₦100.5 by aggregator-farmers**. Aggregator-farmers reportedly pay the highest price for the crop, especially to the middle range farmers. For the large-scale farmers, the aggregator/vendor from Kaduna, who sells sorghum directly to NB, obtains a nearly 25% higher price per kg than the price large-scale regular farmers are paid by the vendors and aggregators as a step in the supply chain.[68] If we deduct costs discussed in the Section 3.4.1 from the revenue obtained, **the respective average profit per hectare is approximately ₦60.000 for a regular farmer and ₦69.000 for the aggregators**, although the final profit varies substantially between and within the groups (Figure 11; Annex Figures A 5, and Table A 16).

Figure 11. Distribution of average profit per hectare according to land size of regular farmers and aggregators (Agg.)



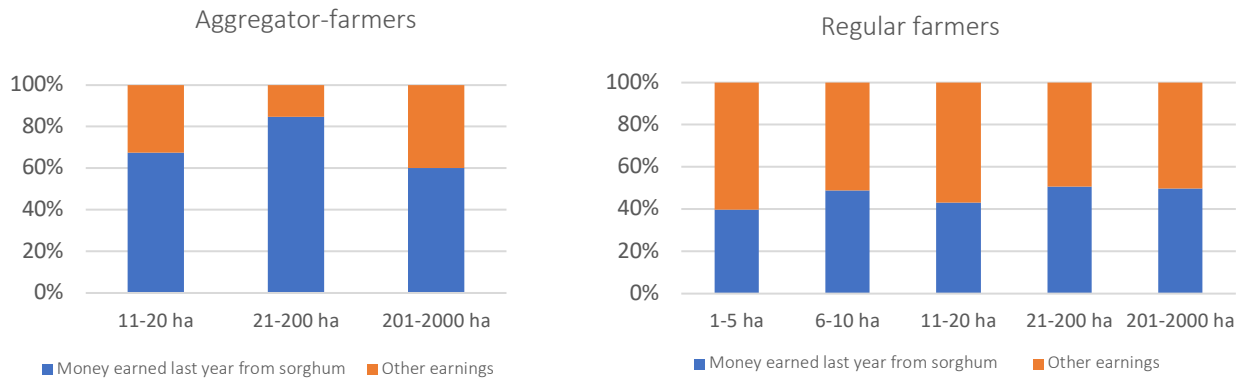
Source: Field survey, October-November 2018

[66] See Table A 15 in Section 1.13 in the Annex.
[67] See Figure A 5 in Section 1.13 in the Annex.
[68] See Figure A 5 in Section 1.13 in the Annex.

3.4 Importance of sorghum farming to revenue and general welfare

Revenue obtained from sorghum farming constitutes 66% of annual revenue generated by aggregator-farmers and nearly half of all revenues generated by regular farmers. Specifically, aggregator-farmers that are operating farm sizes 21-200 ha are dependent on sorghum as it constitutes 85% of all their earnings (Figure 12). At the State level, aggregator-farmers in Katsina State, as well as subsistence and smallholders I (regular farmers) from Yobe and Zamfara, indicated a higher than average contribution of sorghum to revenues.[69] **Field data further showed that for the two large-scale farms of 2,000 ha (aggregator-farmer/vendor in Kaduna and a regular farmer from Zamfara State), the income from sorghum is equally important and constitutes 60% of obtained revenue.**

Figure 12. Proportion of earnings from sorghum by aggregators and regular farmers



Source: Field survey, October-November 2018

All aggregator-farmers and regular farmers contacted during the survey were positive that sorghum farming is very important to their perceived well-being.[70] Respondents indicated that well-being included; living in their own-house, having a motorcycle, and mobile phone; and these are within the reach of a majority of sorghum farmers. The welfare of sorghum farmers is now considered sufficient to afford basic necessities when needed. According to farm ownership, the larger the farm size, the more important sorghum farming is for farmers' well-being, especially for the middle-range, large-scale regular farms, and for all aggregator-farmers.[71] **Meeting children's educational needs constitutes the largest proportional response for how income from sorghum farming is spent. This is followed by food needs, healthcare, and contributions to the extended family.**[72]

The majority of large-scale regular farmers (83%) attest to having spent the largest proportion of their income from the sorghum harvest on their children's education, in comparison to 45% of the smallholder I & II group of regular farmers. **This study reveals that for half of the smallholder farmers (<20 ha), the income from sorghum farming alone is not yet sufficient to fully cover their children's education needs, and for a third – to cover the family food expenses.**[73] Aggregator-farmers do not share this concern. During FGDs, **some smallholder farmers revealed that they do other work to make ends meet. This includes planting and cultivating other crops (i.e. maize in addition to sorghum) and working on larger farms to gain additional income.** This reiterates the trend that subsistence and smallholder farmers are increasingly engaged as farm hands on large-scale farms. **This changing dynamic in the industrial sorghum value chain should encourage key actors to pay more attention to the employment practices and working conditions for farm workers on these farms and push for inclusive and fair practices.**

[69] See Table A 16 in Section 1.13 in the Annex.
[70] See Table A 17 in Section 1.13 in the Annex.
[71] See Table A 18 in Section 1.13 in the Annex.
[72] See Table A 19 in Section 1.13 in the Annex.
[73] See Table A 20 in Section 1.13 in the Annex.

CONCLUSIONS

The main finding of this study is that **medium-scale farmers (21-200 ha), together with the large-scale (201-2000 ha) regular and aggregator-farmers, constitute a large part of the vendors network, jointly suppling approximately 70% of locally sourced sorghum to NB. Smallholder farmers (0-20 ha) supplied the remaining 30%.** Consequently, medium and large-scale farmers are becoming more important than small-scale farmers for the cultivation and supply of commercial sorghum varieties to industry.

New market structure and dynamics

Vendors are becoming increasingly important players in the sorghum supply chain and some of them have become medium- or even large-scale aggregator-farmers. This new dynamic was identified while mapping different types of supply connections in the sorghum supply chain. As these vendors and aggregators vertically integrate into farming to secure part of their sorghum needs, they still need to buy from other sources to get everything they need. This potentially has three major consequences.

Firstly, a change in the existing dynamics between vendors, aggregators and farmers, which may lead to **a gradual loss of market opportunities for smallholder farmers** with implications for diversification of and changes to their livelihoods.

Secondly, in the case of smaller farms, the practice of using family labour and shared community labour is set to continue for clearing and planting purposes because there is no concrete attempt to adopt mechanized farming. For farmers, it is easier to expand the planting area than it is to intensify farming on the same land.

Thirdly, **a new labour market structure is developing, where smallholder farmers are increasingly engaged as farm hands in these emerging larger farms.** The need to understand the labour rights risks, for example fair wages, arise in this situation. The opportunity of working as labourers in bigger farms is effectively limited to three months (May, June and December). Therefore, its effect on participating in other vocations must be carefully weighed – for their food security, income generation, local social relationships, and obligations. Further investigation is also needed into the livelihoods and welfare of farm workers as we observed that, across the states, the average payment rate offered for planting sorghum was lower than for clearing land. The **wages indicated for temporary workers vary according to the state location, but they remain around minimum wage** except in Katsina and Yobe States, where wages were recorded as lower.

Consequently, more attention is needed on what goes on in large farms regarding work and welfare of workers. Larger farms create employment opportunities for small-scale farmers to earn money, but they can also result in risks to employee rights. This underscores the importance for Heineken to understand the labour issues on larger commercial farms **in cases where vendors have their own farms or buy directly from large commercial farms that have been shown in this study to employ farm hands.** Periodic investigation to prove that large farms are meeting employee rights can be part of NB's supplier management approach.

Improved varieties and government participation

The productivity of farmers recorded in this survey showed that it is far below potentials heralded by the development of OPVs CSR-01 and CSR-02, and for hybrids CSR-03H and CSR-04H. The use of the hybrid seeds has also been limited as farmers indicated a preference for the OPVs. Though the NB signed over the IP rights for the hybrid seeds to the Federal Ministry of Agriculture and Rural Development (FMARD), some factors are still inhibiting the distribution and adoption/use of the seeds in the field. The lack of professional hybrid seed multipliers for sorghum is also a key issue. In the meantime, the use of OPV seeds have contributed significantly to annual production. The practice to re-use grain from harvest of previous season as seed has significant impact on yield, in addition to the more gradual losses coming from varieties ageing. Thus, overall productivity has declined over the years of re-use.

Farmers' reliance on seeds recycled from harvest also came as a consequence of negative experiences of buying contaminated seeds from seed agents. Some agents allegedly adulterate 'pure bags of seeds' with those of low quality, and selling them off at high prices to farmers. Efficiency of the seeds systems is thus compromised.

Data management at farm level

Obtaining exact information on numbers of farmers associated with aggregators and vendors as well as amounts of sorghum supplied was difficult as some vendors were hesitant in providing the information. The quantity of sorghum acquired by vendors (directly from farmers, indirectly through aggregators, and vendor farmers), was based on a proxy measure where the respondents stated amounts sold out to aggregators and vendors out of the total produced. This helped in noting the relative strength of sorghum supply routes from the farms. Thus, in order to appropriately quantify supplies of sorghum via the four channels (open market, vendors own farms, farmers on buy-back arrangement with vendors, direct relationship between farmers and aggregators), vendors may be encouraged to develop, maintain, or keep comprehensive accounts of their sources. Where this is not available, reverse projections can also be made from the records of good-quality sorghum received at the brewery.

RECOMMENDATIONS

Sorghum has become a cash crop with steady industrial demand, which makes it attractive to farmers. Given the projected rise in population and attendant increase in the consumption of the company's products, the industrial demand for sorghum will continue. Therefore, we recommend that **Nigerian Breweries' long-term strategy to retain sorghum as part of the company's product recipes should be upheld**. This, however, has implications for expansion of business opportunities throughout the sorghum value chain.

The main findings of this exploratory study indicate the **increased interaction between the industry and the medium- and large- scale sorghum regular farmers (21-200 ha)**, as well **the new market structure with vendors, who are increasingly vertically integrating to becoming medium-scale sorghum aggregator-farmers themselves**. These changes may happen at the expense of the smallholder farmers, who may increasingly choose to become farm labourers for the larger farms. This has a number of potential implications for the sourcing policy of the company. We therefore recommend the following:

On improved transparency in the value chains:

In the quest for greater transparency in the local value chains, the industry should acknowledge the new emerging dynamics and structure and reflect on how it will affect their local sourcing strategy and policy. Thus, there is a need to gain deeper understanding of what is happening at the farm level, especially where farm labour is employed.

Systematic collection of data from local supply chains is key to enhancing value and further improving transparency in the value chain. Therefore, the industry may consider **introducing a 'technology platform' to collect and digitally record data from farmers on production levels and other key metrics**. Such a platform has the capacity to provide up-to-date information about the (place of smallholders in) supply chains and allow the company to track the business performance and social impact of various parts of the supply chain. It will also provide an opportunity to share data with farmers on pricing, production, farming practices, and business requirements.

On a new market structure and dynamics:

The company may **need to switch its focus and develop policies relevant to medium- and large-scale vendor farmers by addressing issues of adequate working conditions on these farms**. One way to do this is to **oblige the vendors to buy sorghum from certified farms**. It also means that there is a need for vendors to monitor and understand what is happening at the farm level. This could be done by first identifying and supporting medium- and large-scale regular and aggregator-farmers with necessary inputs that will enhance their production and supply capacities. Farmers contracted by vendors to grow sorghum for them may then be upgraded for certification if the farmers and farm workers are engaged on the basis of productive employment. Minimum standards to be adhered to include hours of work, living wage remuneration, absence of child labour and sexual harassment, safe use of chemicals, quality of grains, and other pertinent points.

On improved varieties of sorghum:

First, there is a need for improved productivity via new variety development for higher yields, improved disease resistance and resilience to climatic variability. Therefore, the industry should **continue its efforts to support the development of new varieties of sorghum suitable for local production**.

Second, given affordability issues surrounding farmers access to hybrids, more attention could be paid to the multiplication of OPV seeds, which are less expensive, give proven yields and are reusable for 5-7 annual harvest cycles). An opportunity exists to engage smallholder farmers in seed multiplication programmes for OPV seeds, by providing farmers' collectives with training and facilitating their participation. If an arrangement is institutionalised, the advantages are that small scale farmers would still be gainfully employed and the expertise they gain in seed multiplication would help to spread knowledge regarding the quality and potential of newly produced OPV seeds in local communities. However, it is noted that while seed multiplication by smallholders is possible, but it would only be feasible for a small number of the best farmers.

Third, data obtained shows that medium- and large-scale sorghum regular and aggregator-farmers are responsible for over two-thirds of sorghum supply for industrial use. Therefore, there could be a **move towards a more strategic partnership with medium- and large-scale regular and aggregator-farmers in the local sourcing model connected to vendors**, taking into account the emerging structure and market dynamics. We also recommend the **release of the CSR-03H and CSR-04H hybrid varieties, starting with the medium-scale 'commercialized' farms in Yobe State, the only location where farmers have demonstrated a willingness to use and invest in new seeds. Then** NB (Plc), together with multiple stakeholders across the value chain, may be able to collaborate to support professionalization of medium scale farmers to become hybrid seed multipliers.

On government involvement:

Establishing effective seed production systems for OPVs and hybrids should be another key goal of Federal Ministry of Agriculture and Rural Development (FMARD). The use of hybrid seeds holds more promise in yield than OPV and challenges remain on how to enable farmers to pay for hybrids. However, it appears that the availability of hybrid seeds have been constrained by the inability to achieve one of the major roles of MARKETS II programme; to "manage the CSR-01 and CSR-02 and hybrid sorghum outgrowers scheme to achieve 25,000 farmers by 2017". This target has not been attained because the Hybrid Release Committee (HRC), which has a mandate to ensure that the purity of grains given to farmers for commercial production is maintained at the recommended 90% minimum level, has not been working [14]. Seeds production is a specialist job and testing purity of seeds is one of the preconditions for the release of high quality seeds to out-growers.

- Distribution of hybrids has been 'suspended until the appointment of companies to be engaged in testing the purity of the seeds'[14]. Here, Premier Seeds and IAR Zaria can play leading roles for the establishment of an efficient or fully functional seeds purity testing programme.
- The strengthening of the production base would result in more high quality seeds for supply to farm units through existing licensed agents distribution channels.
- The scope of the HRC can be expanded to include the creation of a sub-unit to conduct periodic field checks for seeds contamination at the level of licensed agents. Where seeds ready-for-sale are found to be below the 90% minimum threshold level, such agents may be sanctioned (through imposition of stiff financial penalties and withdrawal of license for repeat offenders). The threat of closing-down the business of repeat offenders may stimulate better practices among licensed agents; with the restoration of circulation of better seeds, farmers' confidence would be gradually restored for procuring new (instead of recycled) seeds for planting.

The Government's backward Integration Policy of the late 1980s has been the catalyst for the brewing industry's adoption of locally grown sorghum as a substitute for imported malt barley in their production processes. While the positive transformation has mostly been industry-led, there is still a lot of space for government's support to deepen the gains made in the past three decades. Crucially, government's practical role must be in terms of: **sustained support for the provision of inputs to farmers, inter-agency cooperation between Ministries of Agriculture, Education and Departments of Welfare Services, to cater to the needs of children who are out-of-school in land preparation seasons for sorghum production. Government has the responsibility to protect labour rights, especially on larger scale farms that have now been identified as regular users of hired labour in the production of sorghum.**

On greater smallholder engagement:

First, it is recommended that the industry **supports better organization and structure of the sector for smallholder farmers.** In order to do this, the industry should engage relevant stakeholders and facilitate the required investments to support the process of capacity building of medium size regular farmers to accelerate their transition to commercial farming. For smallholders, initiatives to improve their livelihoods should aim to reduce farmers' risk, as well as increase their incomes. An international collaborator that may be approached is the Food and Agriculture Organization of the United Nations (FAO), which announced plans to establish 100 Farmer Field Schools (FFS) in north-eastern communities of Nigeria to boost agricultural production in 2018. This FFS initiative aims to support the most at-risk farming households, such as smallholder I and II interviewed in this study.

Second, individual company standards may be used to further establish industry-wide quality specifications for sorghum sourcing for industrial end-users. A standard specification (co-developed by industrial users and adapted into individual industrial sourcing operations) will be helpful for the sector by assuring that workers will benefit from better working conditions, improved living wages and community benefits for farmers and farm workers. This will naturally require **industry-wide cooperation** of other industrial end-users of sorghum, as well as the education sector and vendors, who are increasingly becoming farmers and employers of labour. For this purpose, it is **worth exploring links with the newly established** (May 2019) **National Association of Sorghum Producers, Processors and Marketers of Nigeria (NASPPAM)** under the Federation of Agricultural Commodity Associations of Nigeria (FACAN).

On knowing more:

Finally, in light of the new sector dynamics, more people will be employed on medium- and large-scale regular and aggregator-farms. However, the number of employees varies per farm and depends on the type of work during the farming season and location. Importantly, industrial buyers are to be more aware that bigger farms are part of the sorghum supply chain and take steps with the vendors to ensure that, for example, labour conditions are up to the required standards. We therefore recommend **conducting a follow-up study among medium- and large-scale regular and aggregator-farmers** to collect more in-depth information on the following points:

- hiring processes;
- profile of wage labourers;
- working conditions of farm employees;
- organization of the production process;
- verification of the position of seasonal workers;
- and the best ways of improving transparency in the value chain, especially regarding labour conditions

ANNEX TO THE RESEARCH REPORT

1.1 DETAILED OBJECTIVES OF THE STUDY

Two main objectives were embarked on in this study:

1. Obtaining **NB's diverse sourcing modalities and sourcing practices** in terms of:
    a. **Modalities and channels used**, as well as relative importance and effectiveness of identified channels.
    b. **Identifying suppliers and mapping out the different supply chains**, so as to know the quantity of sorghum that is being supplied through each chain and estimate the number of farmers supplying to each chain.
    c. **Financing suppliers** – relationships with financial institutions and local lenders
2. Examination of **farm-level issues**, which are highlighted as follows:
    a. **The dynamic farm-level practices** of different actors and institutions along the sorghum value chain.
    b. **Understanding farm level outcomes** such as income / profitability
    c. **Employment creation at the farm level:** contexts of farm workers employment, minimum-vs-living wage issues, household spending, etc.
    d. **Farmer financing**
    e. **Social dynamics** (opportunity costs at farm level - children's education vs farming, etc.)
    f. The **land** question: size and scale of production

1.2 DETAILED DESCRIPTION OF THE ADOPTED METHODOLOGY

In order to achieve the first objective, a mixed methods approach was deployed. This included acquisition of both primary and secondary data, with the aid of qualitative methods (especially key informant interviews of actors involved, contractual arrangements, factors of quality and rejection, and value addition activities) for the tracing of NB's sourcing practices. Quantitative methods were deployed for estimating delivery capacities of suppliers (henceforth referred to as vendors[74]) and volumes of supplies, and the financial implications for transporters and financial services along the supply chain.

Towards achieving the second objective, four stages of fieldwork in the sorghum-producing states were conducted. Firstly, communities or local government areas (in 6 states) that have both direct and indirect links between sorghum suppliers and NB vendors were identified (June-July 2018). In this period, a pre-test of questionnaires was also conducted. The second and third stages (October-December 2018) involved (i) a questionnaire survey (to obtain information on farmland preparation and planting activities, farmland maintenance, income, and a host of other topics), and (ii) focus group discussions (FGD) – to tease out sorghum farmers' agronomic experiences and related expenditure (incurred in farm work and household). The fourth stage covered harvesting activities (January 2019) – farmers were interviewed on social and economic activities that go into preparations for harvest and post-harvest activities. The completion of fieldwork was delayed until the end of the first quarter of 2019 due the following factors: (i) instability caused by clashes between artisanal miners and farmers in some rural areas of Zamfara State in October-November 2018, and (ii) instability further elongated by societal fragility in the northern States in the run-up to the national and state elections of February 2019. The final report of this study was also completed several months later due to the first draft being subjected to rounds of editing from academic and industry advisors, results

[74] NB Plc terminology for its contracted suppliers.

validation meeting at the NB in Lagos, and Covid-19 pandemic that disrupted plans for the final meeting.

Overall, primary sources of data include farmers, aggregators, and vendors in sorghum-producing states, a former Director of Rural Development at the Ministry of Agriculture (Abuja), representatives of haulage companies, relevant managers at NB Plc, a local sourcing manager of a Lagos-based brewery, and a large-scale sorghum farmer who was not supplying to NB Plc.

Table A 1. Number of respondents per exercise

	Gombe	Kaduna	Katsina	Niger	Yobe	Zamfara	Total
Survey							
Aggregator-farmer		27					27
Farmer	89	56	57	87	77	40	406
Total survey	89	83	57	87	77	40	433
Focus group discussions	-	9	9	18	-	9	45

Source: Field survey 2018

Field research process & timelines

In Phase 1, the researchers identified 13 vendors registered to Nigerian Breweries. These vendors are active in ten states in northern Nigerian: Kaduna; Niger; Gombe; Katsina; Kano; Jigawa; Zamfara; Kebbi; Yobe; and Benue. The second phase of research was undertaken in six of those states (Kaduna, Niger, Zamfara, Katsina, Yobe and Gombe); local researchers worked with the teams of two research assistants per state. The research assistants were involved in identification of the research sites (sorghum farming communities) in the six States. They also participated in the pre-testing of research instruments before the actual survey was conducted in stages 2 and 3 of Phase 2. Vendors connected researchers to farmers and aggregators in communities where sorghum was sourced for NB following the 2017 season. Types of farmers identified include:

- Large-scale (big[75]) farmers who directly provide sorghum to the vendor active in each particular state;
- Small-scale farmers who sell directly to locally active aggregators. These farmers also sometime supply directly to Vendors;
- Aggregators who own sorghum farms in addition to collation activities.

Phase 2 research (third quarter of 2018 to the first part of 2019) was developed by ASC researchers with their Nigerian (two) partners, and support from Wageningen-LEI and KIT, all in conjunction with Heineken/Nigerian Breweries. Armed with the information obtained in USAID MARKETS I & II programmes' 20,000 farmers, the expectation was that small-scale farmers would form a bulk of the sampling frame. This was not so.

It is also recognized that measuring income effects is difficult, as farmers often have many income sources and do not keep reliable overviews of the amounts of all sources. Therefore, the research team used sorghum yields, which are normally easier to measure of the relative power of sorghum revenue among other livelihoods. The results of data analyses were used to inform and guide more responsible management practices, with reference to the link between NB/Heineken and farmers in the sorghum value chain.

[75] The subsistence sorghum farmer works with a farm size range 1-2 hectares. A locally acclaimed 'big' farmer owns about 25 hectares (or in some cases a lot more).

1.3 Detailed FAOSTAT statistics

Table A 2. FAOSTAT crop data 2012-2017 (area x 1,000ha)

Crop	2012	2013	2014	2015	2016	2017
Sorghum	5,100	5,449	5,702	5,899	6,651	5,820
Millet	1,328	1,485	1,511	1,592	1,827	2,212
Maize	5,751	5,763	6,347	6,771	6,601	6,540
Cassava	6,402	6,741	6,458	6,216	6,151	6,792

Source: [1]

Table A 3. Crops: yield in kg/ha

Crop	2012	2013	2014	2015	2016	2017
Sorghum	1145	973	1,207	1,188	1,136	1,192
Millet	964	612	926	933	850	678
Maize	1,512	1,462	1,585	1,560	1,750	1,593
Cassava	7,959	7,032	8,722	9,273	9,685	8,758

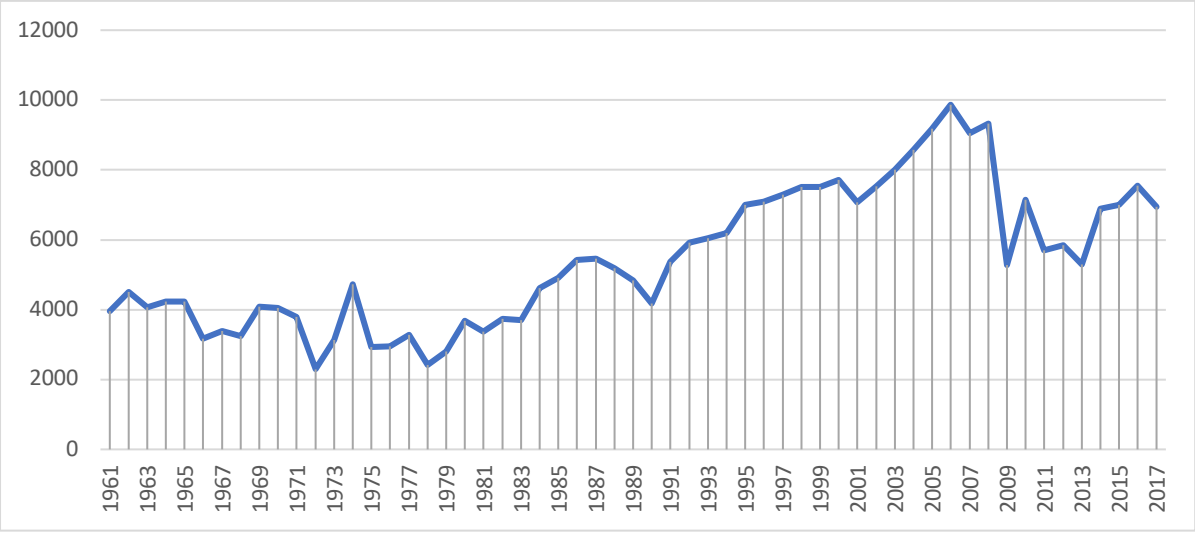
Source: [1]

Table A 4. Crops: total output in tonnes x 1,000

Crops	2012	2013	2014	2015	2016	2017
Sorghum	5,837	5,300	6,803	7,005	7,556	6,939
Millet	1,281	910	1,399	1,485	1,553	1,500
Maize	8,695	8,423	10,059	10,562	11,548	10,420
Cassava	50,950	47,407	56,328	57,643	59,566	59,486

Source: [1]

Figure A 1. Sorghum total output in tonnes x 1,000 (1961-2017)



Source: [1]

1.4 The use of sorghum in brewing

Prior to the advent of lager beer into the Nigerian market, local (opaque) brews made from a variety of grains dominated the Nigerian brewery industry. Local brews such as jego, oti baba, burukutu or pito were made from sorghum, millet and guinea corn, while ghia (giya), oti-oka, oti agbado, yangan or shekete brews were and are still made from maize [22–25]. From the 1960s, NB had begun discussions about sourcing its raw materials locally, the efforts were mainly concentrated on trying to grow barley in Nigeria. It was not until 1985 that "a new lager, Rex, had been developed by the company using substantial quantity of local raw materials." By September 1988, in conjunction with its Dutch technical partners, Heineken, NB "announced that it had achieved the unprecedented feat of 100% success with the use of local materials in the brewing of Star and Gulder" [7].[76]

1.5 The development of sorghum varieties and the buy-back scheme

When NB started the sorghum programme, the company acknowledged the fact that sorghum is a staple food in the areas where it is being grown; therefore, the development of high-yielding varieties must simultaneously address food security and meet the demands of the industry. Principles that guided the development of the open-pollinated series thus included: yield; taste; good milling quality; likeability; good malting quality; and good brewing value. Secondly, for quick acceptability, it was crucial that the taste of new varieties must match or be better than the local/existing varieties, and at the same time, the taste should not be too different from the existing product taste. The issue of good milling quality has to do with developing varieties that will have less chaff when milled, thereby producing enough food per quantity when compared with the existing varieties. NB and research institutes also worked towards a white seed, a likeable colour to a variety of users. Critically, good malting quality for industry use was the imperative.

Consideration of these factors led to the development of the open pollinated (CSR-01 & CSR-02) varieties in collaboration with the Institute of Agricultural Research (IAR, Kaduna State). These two varieties came with the potential of tripling of yield from below 1 metric tonne to 3.3 metric tonnes per hectare,[77] on the assumption of improved agronomic practices by the local farmers.

Other hybrid varieties (CSR-03H & CSR-04H), with potential yield of 5.0 metric tonnes per hectare, were developed in 2012. Despite the promising potentials of the developed seeds, the relative lack of knowledge by farmers on the actual size of the farms contributed to their inability to calculate actual yield of sorghum per hectare; even with CSR-01 and 02 varieties. The hybrid varieties heralded higher promise in the farming of sorghum. "In 2013, the seeds were released to farmers but due to the need to ensure the purity of grains given to farmers for commercial production, distribution was suspended until the appointment of companies to be engaged in testing the purity of the seeds. Our Company expects that by 2016, we will reach 25,000 outgrowers to specifically grow the CSR-03H and CSR-04H hybrids." However, at the time of this study, we could not verify whether the goal of reaching 25,000 outgrowers was reached (using a list or register of outgrowers in the scheme).

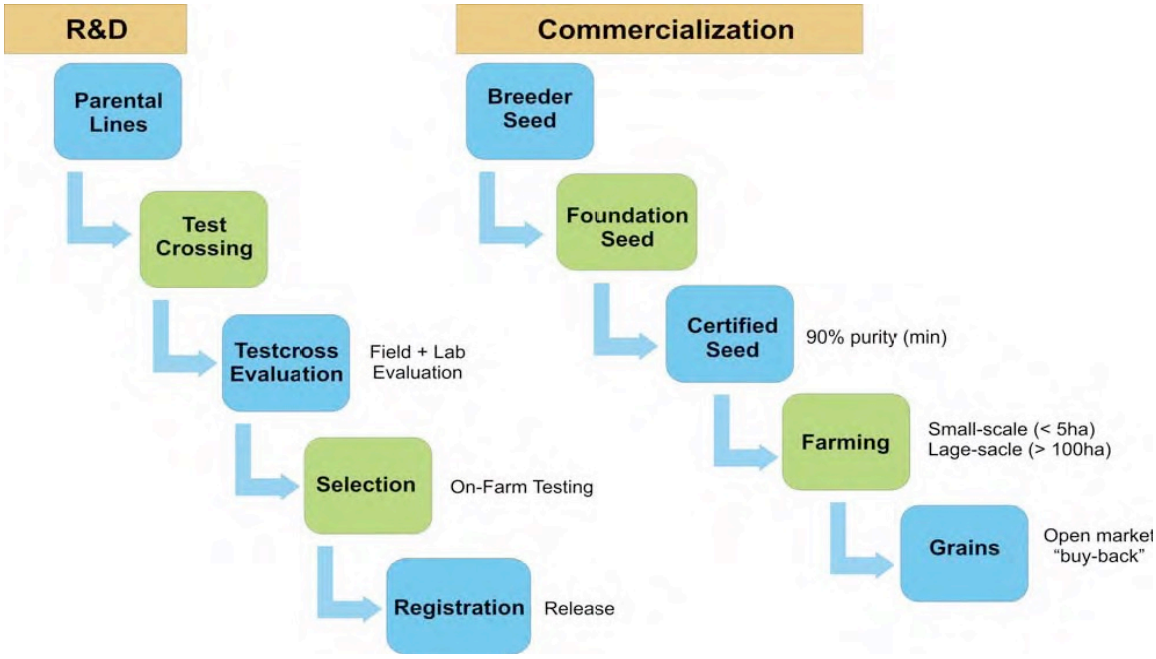
In this private sector-led initiative for development of the new hybrid sorghum, NB collaborated with partners such as USAID/MARKETS I & II (whose responsibilities include to collate, analyse and report hybrid sorghum agronomic data in partnership with IAR or engaged consultants); the Institute for Agricultural Research (IAR), an arm of the Ahmadu Bello University (given the national mandate by the government to develop and improve sorghum varieties for the different ecological zones and to

[76] A more comprehensive account of how sorghum became adopted into the Nigerian Breweries following a series of policy changes by successive Nigerian military governments have been documented and published in Akinyinka Akinyoade, Ogbuagu Ekumankama and Chibuike Uche, 2016, The use of local raw materials in beer brewing: Heineken in Nigeria, Journal Institute of Brewing and Distilling, 1-11 [7].

[77] Interview Mr Uzodinma Onuoha, Raw Materials Development Manager, NB office Lagos, Feb 2, 2018. Re: NB Plc Publications

participate in the production of certified seeds in conjunction with Premier Seeds Nigeria Limited); the International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT), which "provided the parental lines used in the development of the new hybrid sorghum"; and the National Agricultural Seed Council (NASC), which is involved in the development of seed varieties and establishing a Hybrid Release Committee. The process also included the selection and capacity building of seed producing companies and the selection and training of outgrowers. Premier Seeds Nigeria Limited, in conjunction with IAR, was involved in the production of certified seeds.[78]

Figure A 2. The commercialization process



1.6 Guide to interviews with vendors

Information gathered from vendors was guided by the following points:

1. Year of commencing business with NB Plc as a sorghum supplier.
2. The facilitator of business link with NB Plc.
3. Other lines of business the vendor is engaged in, other than supplying to NB Plc.
4. The location/states where the vendor obtains sorghum; approximate number of farmers worked with.
5. Capacity of the vendor's plant/quantity supplied to NB Plc.
6. How vendor meets the quantity demanded by NB Plc.
7. Challenges faced by the vendor, and how the challenges are surmounted.
8. Financial arrangements the vendor uses for its business.

[78] For comprehensive details, see Nigerian Breweries Plc 2014 publication titled "Enhancing the Sorghum Value Chain" [14].

1.7 Additional information from vendors

Purchase price by merchants

- Seasonal variations exist in the price per bag (100 kg) of sorghum.
- Harvest period prices: Range ₦9,500 and ₦10,000
- Mid-season prices: ₦12,000 for the white sorghum and ₦10,000 for the other varieties (Dawanu market in Kano)
- Off-season price: ₦18,000 per 100 kg bag.

Transportation/trucking

- Vendors own and operate in the range of 8 to 52 trucks to strengthen transport logistics.
- One haulage company runs 100 trucks. In the company's permanent employ are 25 drivers and other maintenance personnel
- The sorghum supply chain has generated jobs in the transport sector; multiplier effects in this case include patronising truck repair shops, increase in know-how of truck maintenance.

Banking services

- Agricultural loans and other governmental intervention funds are theoretically available but difficult to obtain in practice.

Other lines of business by vendors

- The vendors supply other grains to other businesses as part of their all-year round activities.
- Sorghum is preferred grain given industrial demand for its use.

The Dawanu Market, Kano

- Dawanu market in Kano (Kano State) is an important trading centre for sorghum, serving both national and international interests.
- Other agricultural products traded in Dawanu market include: maize, millet, and sorghum, as well as legumes (particularly beans).

1.8 Farm size

A study commissioned by the Nigerian Breweries [18] showed that the average land area cultivated by farmers using CSR-01 ranged from 0.95ha to 3.5ha in Bauchi, Jigawa, Kaduna, and Kano states. For CSR-02, the maximum land area cultivated ranged between 2.5ha to 3.5ha using information based on 2015/2016 cropping season activities. It is on the basis of these results that an assumption was made that smallholders form the bulk of supplier of sorghum to aggregators and vendors, and that smallholders are crucial actors in the sorghum value chain.

In another study [21], average sorghum hectare for small-scale farm in northern Nigeria was estimated at 1.6 hectares while that of large scale farm was 8.8 hectares. Small scale farmers represented 64% of the sample. These land holding pales in significance when compared to the findings of our study.

1.9 Knowledge of improved seeds

In the 'Adoption Study' [18], overall knowledge of improved varieties of sorghum was measured at 88.6% among farmers. In terms of adoption for planting, Kaduna State ranked second (after Kano State) as 71% of its sorghum farmers adopted CSR-01. Kaduna farmers ranked highest in the adoption of CSR-02 as 50% was recorded to have done so. CSR-01 is much more cultivated by farmers than the CSR-02 on basis of characteristics such as: good taste (palatability), good milling results, high yield, higher growth weight, ability to resist insect infestation, resistant to lodging, short maturation, and resistant to weed attack.

1.10 Problems with the usage of improved seeds

It was observed that **farmers do not follow the proper agronomic practices that should enhance the yield of the improved varieties of sorghum; rather they follow the traditional methods of farming**. This problem was reiterated by the different State Ministries of Agriculture (the extension services department), and Premier Seed Nigeria Limited (which is one of the major seed companies in Nigeria). On further inquiry about the agricultural extension services of the ministry to the farmers, the director of the extension services department in the Kaduna Agricultural Development Authority (KADA) revealed that they were facing the **challenge of not having sufficient extension agents to service the farmers**. However, KADA tries to make the optimal use of the few extension agents for outreach to a few farmers whose farms serve as demonstration farms. On the part of Premier Seed Nigeria Ltd, the seed company indicated that all the seeds being sold by their agents to the farmers go with instruction manuals on how to optimally use the seeds. This, however, has a natural challenge, as most of the farmers are not usually educated enough to comprehend such user manuals.

1.11 The Bill and Melinda Gates Foundation seeds

The sorghum seeds distributed freely to some sorghum farmers are Vitamin A fortified. According to a former local sourcing manager, the seeds are good for consumption as staple but not suitable for malting for industrial use as it turns brown in colour. Furthermore, the emergence of the BMGF seeds, appears to coincide with the declining productivity expected in the re-use of CSR-01 and 02 varieties.

1.12 General comment on the educational system

In the Northern part of Nigeria, almost two thirds of students are functionally illiterate. The states of Jigawa, Kaduna, Katsina, Kano, and Sokoto in the sorghum producing belt have shown commitment to improving their education systems, but they face severe challenges including high poverty levels, low enrolment, gender disparities, poor quality and relevance, poor infrastructure and learning conditions. An additional challenge is the direct threat to schooling, especially for girls, emanating from political insecurity through insurgent activities, and attacks on schools.

1.13 TABLES SUPPORTING THE SURVEY RESULTS

Table A 5. Other crops grown by two groups of farmers

Aggregator-farmers

Farm size	Maize	Soya beans	Beans	Millet	Rice	Yam	Other	Grand Total
11-20 ha		50%						2
21-200 ha	17%	25%	8%		4%			24
201-2000 ha	100%	100%						1
Total	**19%**	**30%**	**7%**	**0%**	**4%**	**0%**	**0%**	**27**

Regular farmers

Farm size	Maize	Soya beans	Beans	Millet	Rice	Yam	Other	Grand Total
1-5 ha	86%	34%	40%	5%	14%	4%	6%	77
6-10 ha	90%	31%	39%	12%	14%	4%	2%	108
11-20 ha	82%	25%	41%	30%	12%	4%	6%	135
21-200 ha	81%	54%	35%	19%	8%	3%	1%	80
201-2000 ha	83%	83%						6
Total	**85%**	**35%**	**38%**	**18%**	**12%**	**4%**	**4%**	**406**

Table A 6. Increase in land area

	Gombe	Kaduna	Katsina	Niger	Yobe	Zamfara	Grand Total
Yes							
Aggregator total YES		27					27
Aggregator total YES %		**100%**					**100%**
Regular farmers N	89	56	57	87	77	40	406
Farmer total YES	61	55	28	71	18	23	256
Farmer total YES %	**69%**	**98%**	**49%**	**82%**	**23%**	**58%**	**63%**
1-5 ha	14	2	8	18		3	45
6-10 ha	20	2	8	24	6	5	65
11-20 ha	24	5	6	23	12	10	80
21-200 ha	3	46	6	6		3	64
201-2000 ha						2	2
No							
Farmer total NO	28	1	29	16	59	17	150
Farmer total NO %	**31%**	**2%**	**51%**	**18%**	**77%**	**43%**	**37%**
1-5 ha	9		5	9	9		32
6-10 ha	12		10	6	11	4	43
11-20 ha	5		9	1	37	3	55
21-200 ha	2	1	5		2	6	16
201-2000 ha						4	4

Table A 7. Reasons for increase in cropped area

	1-5 ha	6-10 ha	11-20 ha	21-200 ha	201-2000 ha	Grand Total
Aggregator			2	24	1	27
Yes			2	24	1	27
Easier agricultural practices			2	23		25
Better price				1	1	2
Regular farmer	77	108	135	80	6	406
Yes	45	65	80	64	2	256
Better price	25	32	45	32	1	135
Ready market for sorghum	14	19	25	18	1	77
Easier agricultural practices	6	13	10	10		39
Better grain/produce				1		1
More rainfall				1		1
Unknown		1		2		3
No	32	43	55	16	4	150
Total	**77**	**108**	**137**	**104**	**7**	**433**

Table A 8. Average productivity per type of respondent and source of seed

Farmer type & farm size	From previous harvest	Buy from seed companies	Local market	Both previous and hybrid seeds	Exchange from co-farmers	Personal savings	Un-known	Grand Total
Aggregator	950.1						1,866.7	1,018.0
11-20 ha	1,500.0						2,533.3	2,016.7
21-200 ha	941.4						1,200.0	952.2
201-2000 ha	600.0							600.0
Regular farmer	660.8	1,032.5	25.9	466.7	300.0	228.6	315.0	729.2
1-5 ha	843.1	1,676.2						994.5
6-10 ha	682.1	1,259.0	400.0		300.0		315.0	786.7
11-20 ha	612.0	927.5	288.9					675.0
21-200 ha	532.7	388.5		466.7		228.6		497.4
201-2000 ha	601.7							601.7
Total	**682.0**	**1,032.5**	**325.9**	**466.7**	**300.0**	**228.6**	**1,090.8**	**747.2**

Table A 9. Main point of selling sorghum per respondent group

Farm size	Local aggregators/merchants	Vendors supplying companies	Co-farmers who double as vendors	Marke-ters	Un-known	Grand Total
Aggregator		24 / 89%	1 / 4%		2 / 7 %	27 / 100%
11-20 ha		2 / 100%				2 / 100 %
21-200 ha		21 / 88%	1 / 4%		2 / 7%	24 / 100%
201-2000 ha		1 / 100%				1 / 100%
Regular farmer	195 / 48%	151 / 37%	54 / 13%	1 / 0.2%	5 / 1%	406 / 100 %
1-5 ha	51 / 66%	21 / 27%	4 / 5 %		1 / 1%	77 / 100%
6-10 ha	53 / 49%	38 / 35%	14 / 13%	1 / 1%	2 / 2%	108 / 100%
11-20 ha	44 / 33%	60 / 44%	29 / 21%		2 / 1%	135 / 100%
21-200 ha	46 / 58%	27 / 34%	7 / 9%			80 / 100%
201-2000 ha	1 / 17%	5 / 83%				6 / 100%
Total	**195 / 45%**	**175 / 40%**	**55 / 13%**	**1 / 0.2%**	**7 / 2%**	**433**

Table A 10. Share of sorghum sold through four supply chain routes

Supply routes	Grand Total	%
Chain 1: Farmers -> vendors -> NB Plc.	3,890,445	50%
Chain 2: Farmers -> aggregators -> vendors -> NB Plc.	2,189,275	28%
Chain 3: Farmers -> market -> aggregators -> vendors -> NB Plc	36,300	0.5%
Chain 4: Vendors own-farms -> NB Plc.	1,742,000	22%
Total	**7.843.020**	**100%**

Table A 11. Percentage distribution of farmers according to knowledge and access to seeds

	Knowledge of different sources seed		Access	
	Yes	No	Yes	No
Aggregator	93%	0%	93%	0%
11-20 ha	100%	0%	100%	0%
21-200 ha	92%	0%	92%	0%
201-2000 ha	100%	0%	100%	0%
Regular farmer	86%	10%	36%	36%
1-5 ha	79%	16%	22%	73%
6-10 ha	88%	8%	32%	65%
11-20 ha	86%	12%	44%	55%
21-200 ha	88%	5%	45%	49%
201-2000 ha	100%	0%	0%	100%

Figure A 3. Average number of people hired for clearing and planting per size of the farm

Table A 12. Breakdown of costs of pre-planting activities in the two 2,000 ha sorghum farms (Zamfara and Kaduna)

Costs	Zamfara	Kaduna
Clearing; no of people	160	1,000
Clearing; daily rate pp (₦)	1,200	2,000
Clearing; days needed	30	14
Total Pre-planting Cost clearing (₦)	**5,760,000**	**28,000,000**
Planting; no of people	120	800
Planting; daily rate pp (₦)	1,000	500
Planting; days needed	30	14
Total Pre-planting Cost planting (₦)	**3,600,000**	**5,600,000**

Table A 13. Sources of financing farmland preparation

Farm size	Personal savings	Financial gift	Other loan
Aggregator-farmer	100%	0%	0%
11-20 ha	100%	0%	0%
21-200 ha	100%	0%	0%
201-2000 ha	100%	0%	0%
Regular farmer	95%	3%	2%
1-5 ha	95%	3%	3%
6-10 ha	98%	1%	1%
11-20 ha	92%	6%	2%
21-200 ha	98%	0%	5%
201-2000 ha	100%	0%	0%
Total	**95%**	**3%**	**2%**

Table A 14. Proportion of farms using on-farm help from family members

Row Labels	Gombe	Kaduna	Katsina	Niger	Yobe	Zamfara	Grand Total
Aggregator		7%					7%
11-20 ha		0%					0%
21-200 ha		4%					4%
201-2000 ha		4%					4%
Regular farmer	54%	89%	61%	74%	73%	87%	71%
1-5 ha	41%	100%	54%	62%	29%	67%	52%
6-10 ha	53%	100%	44%	74%	53%	75%	60%
11-20 ha	64%	100%	87%	83%	86%	92%	82%
21-200 ha	60%	87%	64%	100%	100%	89%	83%
201-2000 ha						100%	100%

Figure A 4. Count of regular farmers' children's (between 7-15 years) activities on the farm per state

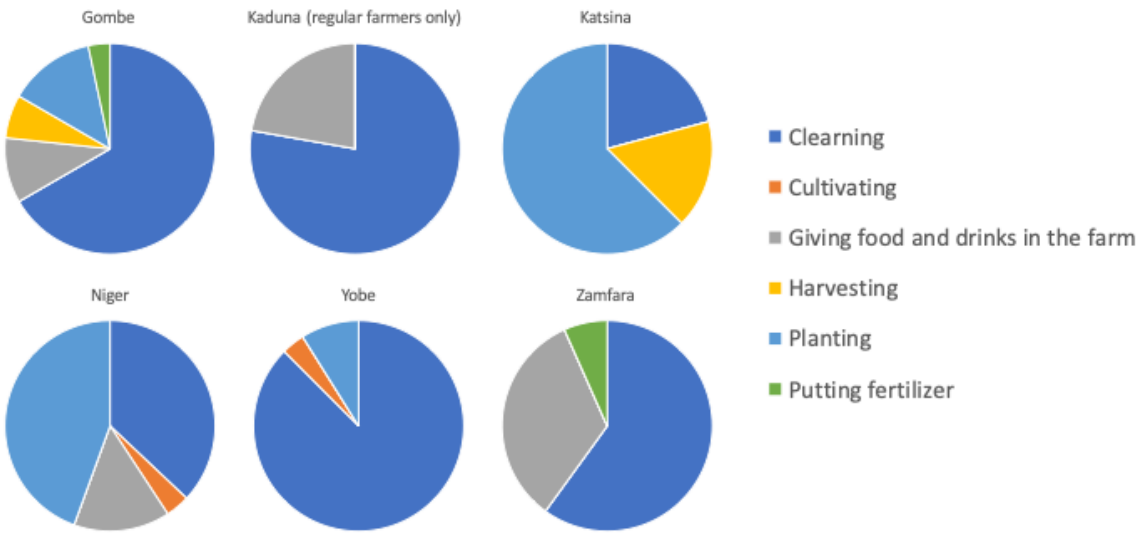


Table A 15. Average ₦ Price received per kg per state

Costs	Aggre-gator Av.	Gombe	Kaduna	Katsina	Niger	Yobe	Zamfara	Farmer average
Average ₦ Price per kg	100.5	112.5	128.6	100.7	130.5	110.8	98	113.2

Figure A 5. Average ₦ price received per kg per state and land size

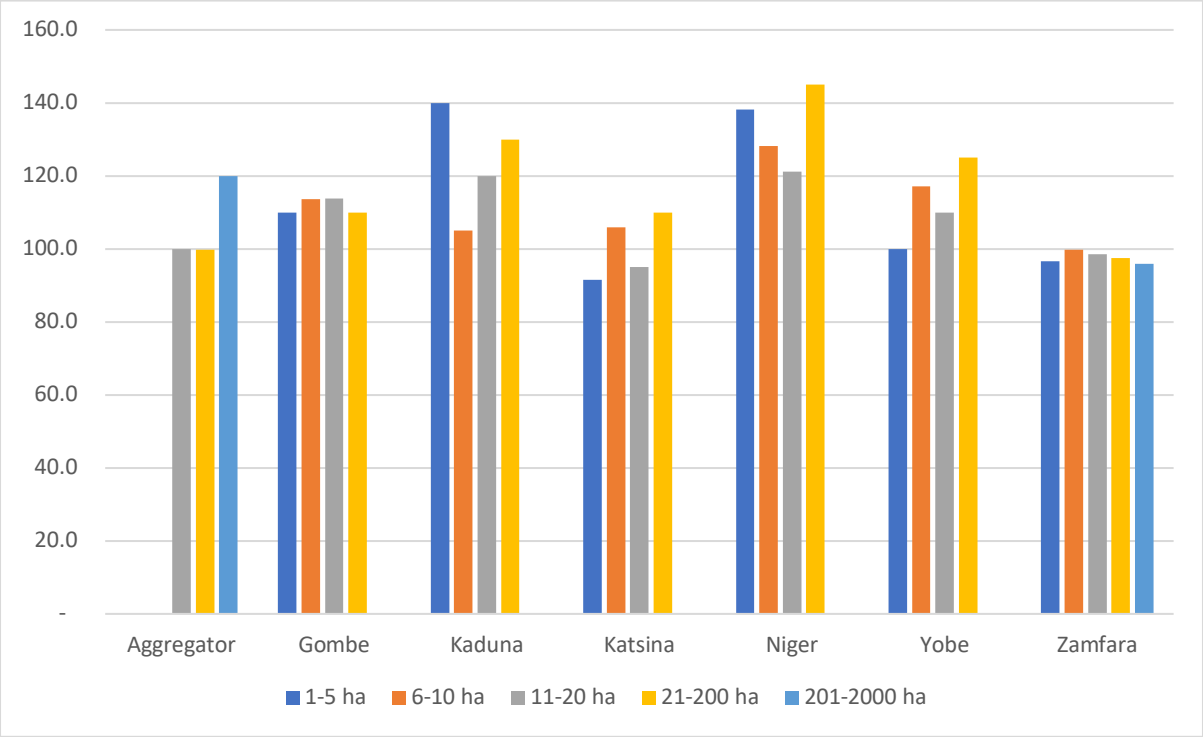


Table A 16. Proportion of revenue obtained from sorghum per land size

Farm size	Aggregator	Gombe	Kaduna	Katsina	Niger	Yobe	Zamfara	Average
1-5 ha		26%	40%	57%	41%	73%	60%	43%
6-10 ha		56%	43%	54%	41%	57%	60%	49%
11-20 ha	67%	43%	49%	62%	41%	42%	38%	43%
21-200 ha	85%	47%	52%	65%	54%	45%	41%	51%
201-2000 ha	60%						50%	50%
Total	**66%**	**43%**	**52%**	**62%**	**43%**	**47%**	**48%**	**48%**

Table A 17. Importance of income from sorghum farming on respondents' general welfare

Importance	Aggregator	Farmer	Total
Neutral	0%	5%	4%
Important	0%	25%	24%
Very important	100%	70%	72%
Total	**100%**	**100%**	**100%**

Table A 18. Importance of income from sorghum farming on respondents' general welfare per farm size

	Very important	Important	Neutral	Total
Aggregators	100%	0%	0%	100%
11-20 ha	100%	0%	0%	100%
21-200 ha	100%	0%	0%	100%
201-2000 ha	100%	0%	0%	100%
Regular farmer	70%	25%	5%	100%
1-5 ha	57%	35%	8%	100%
6-10 ha	68%	28%	5%	100%
11-20 ha	73%	25%	2%	100%
21-200 ha	80%	14%	6%	100%
201-2000 ha	100%	0%	0%	100%
Total	**72%**	**24%**	**4%**	**100%**

Table A 19. Ways that respondents spend income from sorghum farming

Farm size	Children's education	Extended family	Food	Health	Other
Aggregator	27	12	23	13	
	100%	44%	85%	48%	0%
11-20 ha	2	1	2		
21-200 ha	24	10	20	13	
201-2000 ha	1	1	1		
Regular farmer	347	100	325	198	13
	85%	25%	80%	49%	3%
1-5 ha	56	13	62	32	3
6-10 ha	87	29	88	54	4
11-20 ha	120	34	103	54	5
21-200 ha	78	19	67	53	
201-2000 ha	6	5	5	5	1
Total	374	112	348	211	13
%	86%	26%	80%	49%	3%

Table A 20. Sufficiency of income from sorghum for meeting children's education needs

Farmer type and farm size	Education			Family feeding		
	Yes	No	Total	Yes	No	Total
Aggregator-farmer	96%	4%	27	96%	4%	27
11-20 ha	100%	0%	2	100%	0%	2
21-200 ha	96%	4%	24	96%	4%	24
201-2000 ha	100%	0%	1	100%	0%	1
Regular farmer	48%	47%	406	64%	36%	406
1-5 ha	35%	57%	77	56%	44%	77
6-10 ha	48%	45%	108	77%	23%	108
11-20 ha	31%	62%	135	50%	50%	135
21-200 ha	84%	16%	80	74%	26%	80
201-2000 ha	100%	0%	6	100%	0%	6
Total	**51%**	**44%**	**433**	**66%**	**34%**	**433**

REFERENCES

[1] FAO. FAOSTAT Database 2020. http://www.fao.org/faostat/en/#data/QC (accessed October, 2020).
[2] Gourichon H. Analysis of Incentives and Disincentives for Rice in Nigeria. Technical Notes Series, MAFAP. FAO, Rome. Rome: 2013.
[3] ICRISAT. Women and youth in Nigeria turn to sorghum processing for better incomes. ICRISAT 2018. https://www.icrisat.org/women-and-youth-in-nigeria-turn-to-sorghum-processing-for-better-incomes/ (accessed July 5, 2019).
[4] Nzeka U. Nigeria Grain and Feed Annual. Washington, DC: USDA Foreign Agricultural Service; 2019.
[5] Mundia CW, Secchi S, Akamani K, Wang G. A Regional Comparison of Factors Affecting Global Sorghum Production: The Case of North America, Asia and Africa's Sahel. Sustainability 2019;11:2135. doi:10.3390/su11072135.
[6] IFAD. Developing nutrition-sensitive value chains in Nigeria. Findings from IFAD research for development. 2018.
[7] Akinyoade A, Ekumankama O, Uche C. The use of local raw materials in beer brewing: Heineken in Nigeria. J Inst Brew 2016;122:682–92. doi:10.1002/jib.383.
[8] Elumah LO, Shobayo P. Performance Analysis of Nigerian Brewery Industry. Binus Bus Rev 2018;9:47. doi:10.21512/bbr.v9i1.4047.
[9] Chisom N, Anyanwu C. Let there be beer! A focus on the Nigeria brewery sector. 2015.
[10] Nurin T. It's Final: AB InBev Closes On Deal To Buy SABMiller. Forbes 2016. https://www.forbes.com/sites/taranurin/2016/10/10/its-final-ab-inbev-closes-on-deal-to-buy-sabmiller/#35f996fb432c (accessed September 3, 2019).
[11] Nigerian Breweries Plc. Annual Report and Accounts. 2017.
[12] Punch Newspapers. We source 75% of raw materials locally – Guinness MD. Punch Newspapers 2017. https://punchng.com/we-source-75-of-raw-materials-locally-guinness-md/ (accessed July 5, 2019).
[13] Heineken NV. Brewing a Better World: our sustainability performance 2017:135–52.
[14] Nigerian Breweries Plc. Enhancing the sorghum value chain 2014.
[15] Nigerian Breweries Plc. Scheme of Merger between Nigerian Breweries Plc. and Consolidated Breweries Plc. 2014. http://nbplc.com/Inves- tor Relations/Scheme_Document.pdf.
[16] SFF. The Difference Between Open Pollinated, Hybrid and GMO Seeds. Small Footpr Fam 2018. https://www.smallfootprintfamily.com/hybrid-seeds-vs-gmos (accessed July 5, 2019).
[17] ICRISAT. The grain sorghum. ICRISAT n.d. http://www.icrisat.org/impacts/impact-stories/Icrisat-impacts-58.htm (accessed July 5, 2019).
[18] Ohen S. Final report on assessment of the adoption level of two (2) open pollinated varieties – CSR-01 & CSR-02 amongst sorghum farmers in Northern Nigeria. 2018.
[19] Schubert K, Mason J. Cost-Benefit Analysis of USAID/Nigeria's MARKETS II Program. Washington, DC: 2015.
[20] McNamara P, Gertner I, Merten C. USAID/Nigeria MARKETS II ex-post study. 2019.
[21] Baiyegunhi L, Fraser G. Profitability in sorghum production in three villages of Kaduna State Nigeria. J Appl Sci Res 2009;5:1685–91.
[22] Kolawole OM, Kayode RMO, Akinduyo B. Proximate and microbial analyses of burukutu and pito produced in Ilorin, Nigeria. African J Biotechnol 2007;6:587.
[23] Ekundayo JA. The production of pito, a Nigerian fermented beverage. Int J Food Sci Technol 1969;4:217–25.
[24] Heap S. Transport and liquor in colonial Nigeria. J Transp Hist 2000;21:28–53.
[25] Heap S. " We think prohibition is a farce": drinking in the alcohol-prohibited zone of colonial northern Nigeria. Int J Afr Hist Stud 1998;31:23–51.
[26] Nzeka U, Taylor J. Nigeria Grain and Feed Annual. Glob. Agric. Inf. Netw., Washington DC.: 2017.
[27] Makhubu M. InBev maintains SAB Miller smallholder farmer's supply. Swazi Obs 2016.
[28] Kohnert D. The transformation of rural labour systems in colonial and post-colonial Northern Nigeria. EconStor Open Access Artic ZBW - Leibniz Inf Cent Econ 1986:258–71.

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