SOVEREIGNPIALPHA FRANCE LTD

SEEDS OF CHANGE. THE POWER OF MILLETS AND SORGHUM IN THE AFRICAN HEARTLAND - BURKINA FASO, ETHIOPIA, MALI AND SUDAN.

Prepared By:
BOBÉ E.NGUELEGUELE STÉPHANEE

EXECUTIVE SUMMARY

This report comprehensively analyses sorghum and millet production in Burkina Faso, Ethiopia, Mali, and Sudan. These countries have unique but interconnected agricultural environments and face challenges like climate change, economic shifts, and technological development. We aim to understand how they tailor their production methods to both local needs and global pressures.

Methodologically, the study combines qualitative and quantitative research, drawing data from credible international bodies such as UNCTAD, FAO, WTO, USDA, and OECD. The quantitative part utilises machine learning and statistical analysis to identify trends and patterns. The qualitative aspect, on the other hand, delves deeply into textual and visual data to provide nuanced insights.

The report identifies the internal factors that enable these nations to compete effectively in agriculture. It scrutinises key elements like labour, capital, and natural resources and evaluates the market demand for sorghum and millet, considering price volatility, consumer preferences, and trade dynamics. Additionally, the study looks at the framework that fosters innovation in the agricultural sector, considering alliances, methods, and technological advancements that could spur industry growth. Rather than focusing on individual companies, the research takes an industry-wide perspective. It views the sorghum sector as an interconnected system, aiming to offer a holistic understanding of the multiple variables affecting these nations' competitiveness. Climate adaptation, market resilience, and technological integration are critically discussed.

The report furnishes actionable recommendations for decision-makers like policymakers, industry executives, and farmers. It is a robust groundwork for future research and policy planning in these countries' agricultural sectors, particularly developing sustainable and competitive strategies for the sorghum and millet industries.

TABLE OF CONTENT

INTRODUCTION

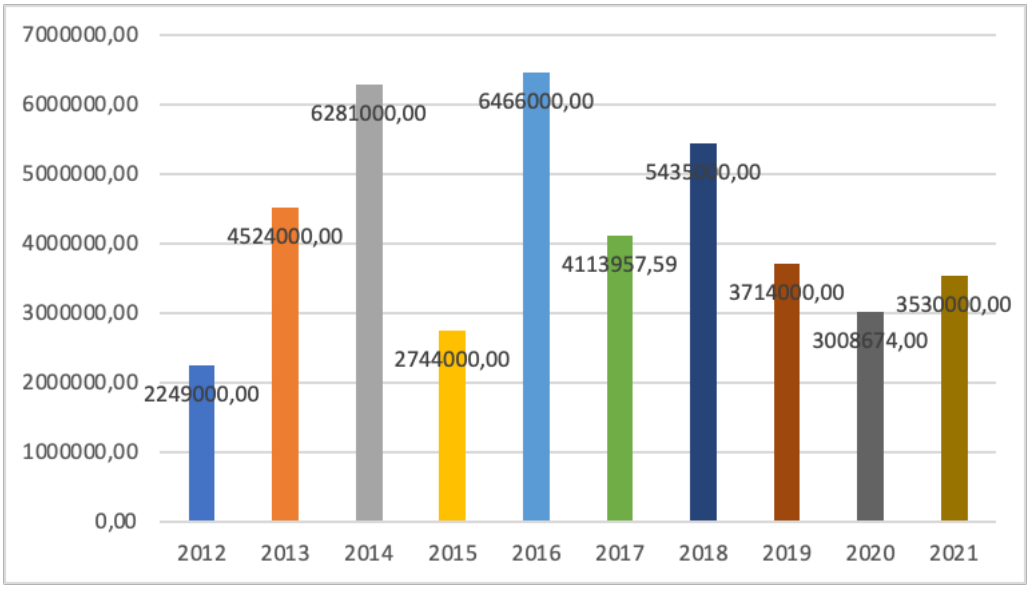
This report is a contribution to the International Year of Millets. The United Nations General Assembly declared 2023 the International Year of Millets. Often referred to as "Nutri-Cereals," millets are rich in nutrients and more nutritious than commonly grown cereals such as wheat, rice, or corn. They play a vital role in achieving SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), and SDG 15 (Life on Land). The International Year of Millets encourages sustainable millet production and highlights their potential for creating market opportunities for producers and consumers. This initiative aligns with the UN 2030 Agenda for Sustainable Development and FAO's Strategic Framework. As underscored by FAO[1], Millets are adaptable to diverse environments, climate-resilient, and essential for local agrifood systems. The International Year of Millets slogan, "Rich in heritage, full of potential," emphasises millets' historical significance and untapped potential. This theme focuses on the many benefits of millets, such as their role in better production, nutrition, environment, and life, which align with various Sustainable Development Goals. Millets' climate resilience contributes to SDG 13 (Climate Action) and SDG 15 (Life on Land), making them essential for climate-resilient agriculture. They can also combat hunger (SDG 2) by providing food security and nutrition in arid regions. Millets offer dietary fibre, antioxidants, protein, and minerals, contributing to SDG 3 (Good Health and Well-Being). Proper handling of millet maintains its quality and nutritional benefits, furthering goals of ending hunger (SDG 2) and promoting health (SDG 3). More significant trade in millets can enhance the diversity of the global food system, aligning with SDG 8 (Decent Work and Economic Growth) and SDG 12 (Sustainable Consumption and Production).

Sorghum is vital in regions with high poverty rates and food insecurity. This cereal is genetically suited for hot and dry environments, making it an ideal option in areas where other crops may struggle to grow. Farmers often cultivate sorghum for grain and straw, making up to 50% of the crop's value in drought years. Around 90% of the world's sorghum is grown in developing countries, with Asia and Africa each contributing 25-30% of the production. Small-scale farmers typically cultivate sorghum, with Africa characterised by extensive, low-input, and less productive farming. In Asia, production is more intensive, with greater use of fertilisers and improved seeds. Developed countries primarily use sorghum for animal feed. Mexico and Argentina are significant forage sorghum producers in Latin America and the Caribbean. Two main groups grow sorghum: the first group, primarily in Asia and Africa, cultivates sorghum for human consumption using traditional agricultural practices with average yields of less than 1 t/ha. In developed and some developing countries, the second group produces sorghum mainly for animal feed using modern agricultural practices with average yields of 3-5 t/ha.[2] Sorghum is grown in various regions across the world. It is cultivated in West and Central Africa from the North Sahara Desert to the South equatorial forests. This crop is grown in dry areas in East and Southern Africa where rainfall is too low for maise cultivation. Nigeria and Sudan are the leading sorghum producers in Africa, and it is a staple food in many other

[1] FAO (2022). International Year of Millets 2023. Roma. Italy

[2] FAO (1998). Part I. Sorgho. Roma. Italy.

areas. In Asia, sorghum production is more concentrated, with China and India accounting for 94% of the regional output. In Latin America, 90% of sorghum cultivation occurs in Mexico, Central America, and the Caribbean. Argentina is the standout producer, accounting for 60% of the regional production. However, it is also grown in Brazil's dry regions and the northern parts of Colombia and Venezuela. Developed countries produce roughly a third of the world's sorghum, with the United States being the leading producer. Sorghum is cultivated in the central and southern plains of the U.S., particularly in Kansas, Texas, and Nebraska. In Europe, it is grown in France, Italy, and Spain. Australia is the primary producer in Oceania.



Sudan Sorghum Production (2012-2021) in tons. From FAO Stat (2023).
The data describes the sorghum production of Sudan for the years 2012 to 2021, measured in tonnes (t). The data suggests a pattern of high variability in production over this period. **Highest Production**: The year with the highest production was 2016, with a recorded 6,466,000 tonnes. **Lowest Production**: The lowest point is in 2020, where it dropped to 3,008,674 tonnes. **Average Production**: The average production for this period is approximately 4,495,470 tonnes. **Volatility**: The standard deviation is around 1,478,506, which indicates significant volatility in production year-over-year. Detailed Analysis: **2012 to 2014**: Production doubled from 2012 to 2013 and increased by approximately 39% from 2013 to 2014. This suggests a strong growth period. **2014 to 2015**: There was a sharp decline of around 56% from 2014 to 2015, which indicates some form of crisis or inefficiency. **2015 to 2016**: A rebound occurred with an increase of around 136%, potentially suggesting recovery or a good year in terms of resources or market demand. **2016 to 2017**: A 36% decline, which is less severe than the 2014-2015 drop but still significant. **2017 to 2021**: The data fluctuates without a clear trend. This period could be influenced by multiple factors, including political unrest, economic challenges, or changes in global demand. Compared to other nations with similar economies, this level of volatility is relatively high. This could be indicative of several potential factors: susceptibility to market fluctuations, political instability, or reliance on a narrow set of resources for production.

As suggested by FAO,[3] The sorghum global economy is divided into two sectors: the traditional subsistence farming sector for smallholders in Africa and Asia that focuses on human consumption, and the modern, mechanised sector that targets large-scale production primarily for animal feed in developed countries and Latin America. In Africa, sorghum is crucial for food security, and there is an anticipation of expansion into more arid areas. However, sorghum yields have declined by 1% annually since the early 1980s, a trend that must be reversed to keep up with

[3] Ibid.

population growth. New technologies, institutional reforms, and varieties are being developed to improve productivity, especially in Mali and Burkina Faso. However, challenges include insufficient seed multiplication and distribution and reluctance from seed companies to commercialise open-pollinated varieties.[4] Technologies that enable better water and nutrient access are needed to increase productivity. Most African sorghum crops receive little or no fertiliser, and farmers hesitate to adopt water conservation technologies. Diverse management options are necessary to convince farmers to invest in new technologies, such as fertilisation and water conservation. In Asia, investments should continue to enhance yield stability and grain quality, focusing on integrated disease and pest management. Specific strategies include developing resistance to pests like the shoot fly and midge. The issue of seed mould may require additional solutions beyond plant-host resistance. Addressing pest pressure through chemical, biological, and agronomic means is crucial, with Striga becoming an increasing threat. Solutions include developing resistant cultivars and improving soil fertility through investment in fertilisers or crop rotation programs.

Burkina Faso, Mali, Ethiopia, and Sudan are among the significant sorghum producers in Africa. They endure similar challenges influencing their agricultural production and sorghum outputs. Burkina Faso[5] and Mali[6] experience security challenges hindering agricultural activities and economic dynamics. These countries rank among the nations where populations are facing high food insecurity.[7] Located in the Sahel and the Horn of Africa, these countries are experiencing severe climate change impacts.[8] The security situation in Sudan is degrading, with an ongoing civil war threatening human and food security. The FAO reports that 20.3 million people in Sudan are severely hungry, nearly double the number from last year. 42% of the population is experiencing acute food insecurity due to market disruptions and high food prices.[9] According to the Integrated Food Security Phases analysis, 14 million people are in a 'crisis' state, while six million are near famine. The most affected areas are Khartoum, South and West Kordofan, and multiple regions in Darfur. The conflict has displaced over four million people, damaging critical infrastructure and worsening food. Despite humanitarian efforts, insufficient resources and funding shortfalls are significant impediments.

---

[4] Ibid.

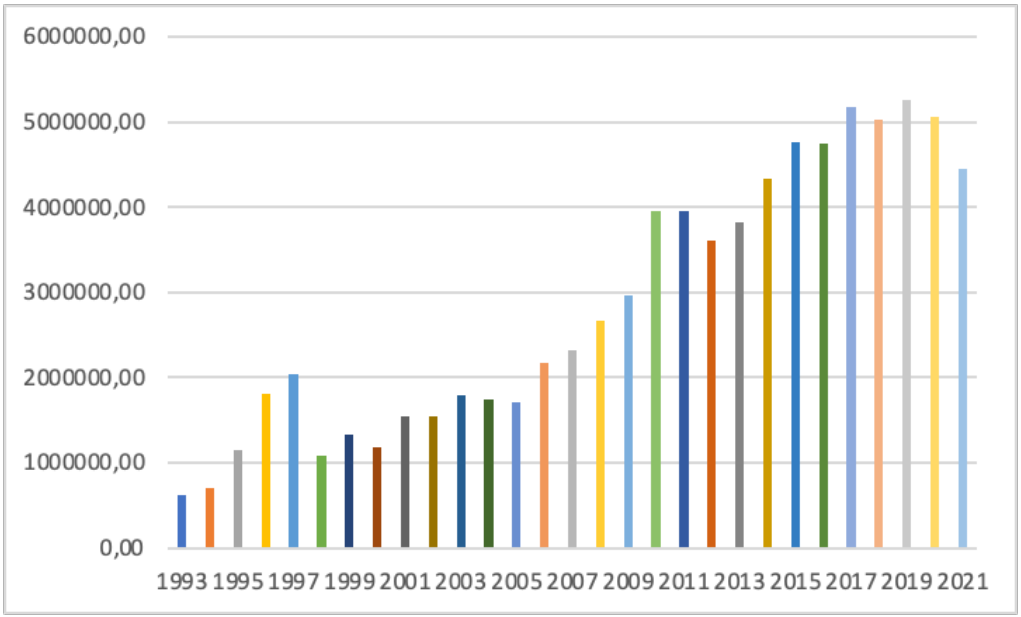
[5] International Rescue Committee (July 2023). Food security in Burkina Faso is worsening amid continued conflict, warns IRC (Online) https://www.rescue.org/press-release/food-security-burkina-faso-worsening-amid-continued-conflict-warns-irc Accessed: 30th August 2023. UN (2023). Greater Support Urgently Needed to Tackle Sahel Region's Growing Insecurity, Aid Fight against Terrorism, Extremism, Senior Official Tells Security Council. https://press.un.org/en/2023/sc15283.doc.htm Accessed 30th August 2023.

[6] UNSC (2023). June 2023 Monthly Forecast. (Online) https://www.securitycouncilreport.org/monthly-forecast/2023-06/mali-23.php Accessed 30th August 2023.

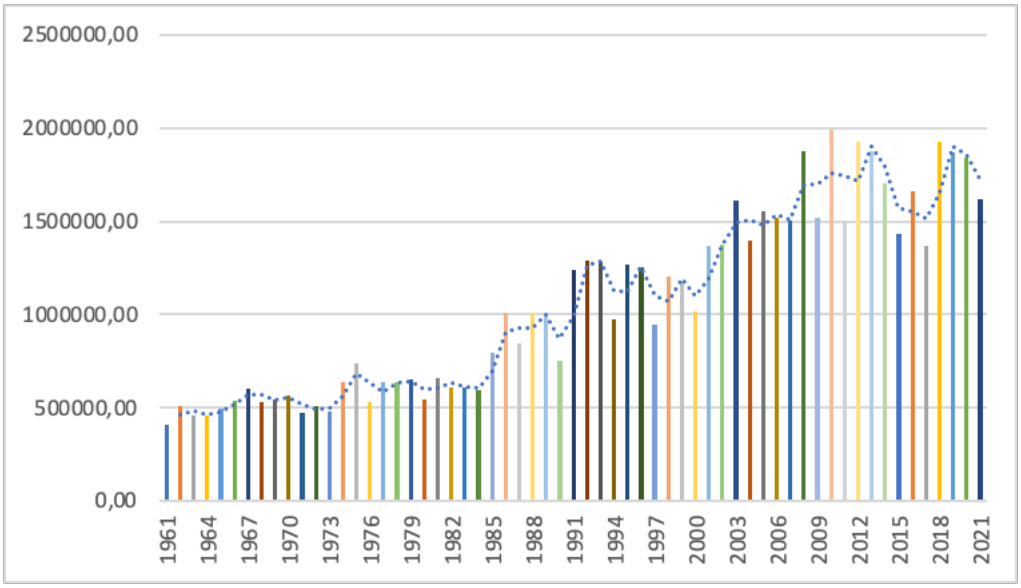
[7] FAO. (2017). The future of food and agriculture – Trends and challenges. Rome. Pp -79

[8] Ministry of Foreign Affairs Kingdom of Netherlands (2019) Climate Change Profile: West African Sahel; Ministry of Foreign Affairs of the Netherlands (2018). Climate Change Profile. Greater Horn of Africa

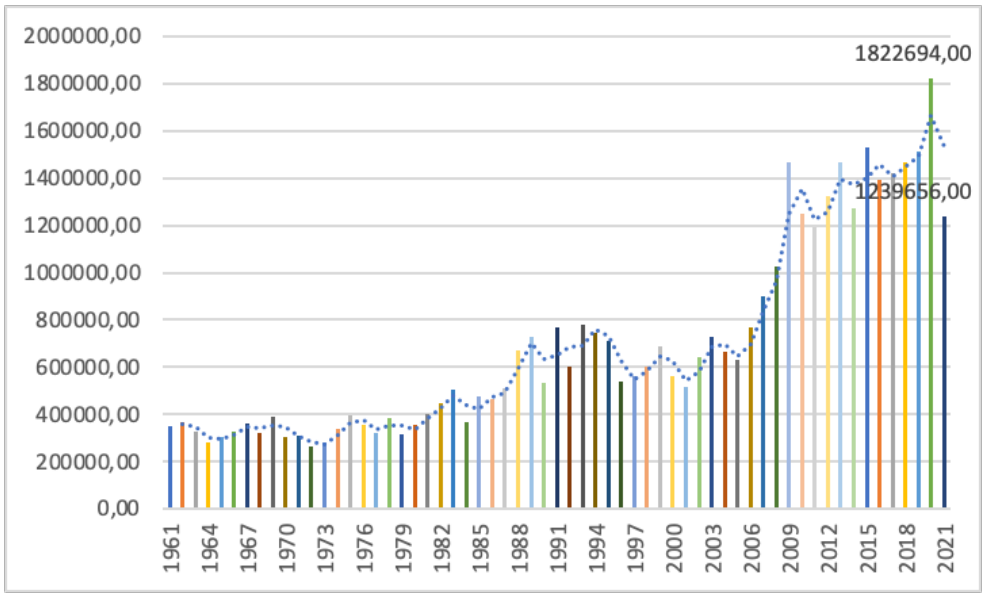
[9] UN (2023). FAO raises alarm on escalating food crisis in Sudan. (Online) https://news.un.org/en/story/2023/08/1139387. Accessed 30th August 2023. FAO (2023) The Sudan: Food security crisis intensifies amid ongoing conflict and economic challenges (Online) https://www.fao.org/newsroom/detail/the-sudan--food-security-crisis-intensifies-amid-ongoing-conflict-and-economic-challenges/en Accessed 30th August 2023



Ethiopia Sorghum Production (1993-2021) in tons. From FAO Stats (2023). **Highest Production**: 5,265,580.06 t (2019) Lowest Production: 628,309 t (1993). Average Production: ~2,896,482 t **Total Production**: ~69,115,556 t over 29 years. **Exponential Growth**: The production has seen a substantial exponential increase, particularly in the initial years. Between 1993 and 1996, production almost tripled, possibly suggesting substantial policy changes or investments. **Volatility in Growth**: The years 1998, 2000, 2012, and 2021 stand out as periods of production decline. Understanding the causes behind these dips may provide valuable insights into vulnerabilities. **Plateauing Trend**: From 2015 to 2021, production seems to plateau. This could indicate saturation in the production capabilities or external factors like political unrest or climate changes affecting production. **Decimals in Later Years**: Similar to the Mali dataset, decimal precision starts to appear in recent years, suggesting increased accuracy in data collection.



Sorghum Production in Burkina Faso (1961-2021) in tons. Fom FAO Stat (2023) Highest Production: 1,992,227 t (2010). Lowest Production: 410,725 t (1961). Average Production: ~1,143,142 t. **Total Production**: ~63,014,840 t over 55 years. Analytical Observations. **Long-Term Growth**: Over the 55-year span, production has generally increased, though with significant fluctuations. This indicate that external influences such as climate change, economic reforms, or technological advances are affecting production. **Periods of Surge and Decline**: Notable surges occur, especially in the 1980s and from the 2000s onwards. Periods of decline coincide with socio-political instability and environmental factors. **Volatility**: Similar to the Sudan data, this dataset also shows significant year-to-year volatility. However, the volatility seems to have slightly diminished in the most recent years. **Data Resolution and Precision**: Recent data (e.g., 2018 and 2019) have higher precision (decimal places).



Mali Sorghum Production (1961-2021) in tons. From FAO Stat (2023). Mali seems to have managed its production more consistently than Burkina Faso and Sudan. The sustained growth indicates robust economic strategies or favorable environmental factors. Highest Production: 1,822,694 t (2020) Lowest Production: 265,000 t (1972). Average Production: ~750,315 t. Total Production: ~41,267,360 t over 55 years. Analytical Observations Sustained Growth: Unlike the data sets from Sudan and Burkina Faso, Mali demonstrates a more consistent and sustained growth in production over the years. The figures triple from the 1960s to the 2020s, with less volatility. Data Inflection Points: Significant increases are evident in the early 1980s and late 2000s, perhaps corresponding to new technologies, policy changes, or international investment in the sector. Exceptional Years: The year 2020 stands out for its unusually high production. Identifying underlying reasons could offer insights into scalable strategies for further improvement. Decimal Precision: Notably, in recent years (e.g., 2018), the data includes decimal points. This may indicate more rigorous data collection methods and should potentially offer more reliable forecasts.

The UN has urgently appealed for an additional $65 million to assist over six million people. The ongoing conflict between Sudan's armed forces and the Rapid Support Forces has led to a humanitarian crisis, with over four million displaced, mainly within Sudan. The UN warns that the situation is spiralling out of control and condemns indiscriminate targeting of civilians, which may constitute war crimes under international law.

Ethiopia is grappling with the aftermath of a 2020-2022 conflict in the north and a 2020-2023 drought in the south and southeast. The situation is dire, particularly in the Tigray region, due to the cessation of US aid. FEWS NET's field observations indicate worsening food security outcomes, rising malnutrition, and poor access to farming inputs. Southern and southeastern areas, while recovering from the drought, still face high food prices and rely on aid.[10] According to *Starvation Accountability,* as of March 2022, 150,000 to 200,000 individuals have died from malnutrition-associated fatalities.

Additionally, by May 2022, approximately 9.4 million residents across Tigray, Amhara, and Afar will require urgent humanitarian aid. This dire food situation is worsened due to the deliberate targeting by conflicting parties of Essential Life-

[10] FEWS NET. Ethiopia Food Security Alert, (May 30, 2023). The emergency in Ethiopia is far from over, as food aid remains vital to saving lives 2023.

Sustaining Assets (ELSA), including agricultural resources, healthcare centres, and water infrastructure.[11] With a Coefficient of Variation of 58.5%, Mali's production shows higher volatility than Ethiopia's 43.2%. However, scale matters: Although Ethiopia appears less volatile, the magnitude of production is substantially higher. A small percentage change can translate to a sizeable actual tonnage difference. The standard deviation for Ethiopia from the given data is approximately 1,410,588 tonnes. approximately 1,253,728 tonnes for Mali. For Sudan, the standard deviation is approximately 1,517,448 tonnes and about 415,091 tonnes for Burkina Faso. Ethiopia showcases a Coefficient of Variation of roughly 47.71%, 65.71% for Mali, 49.64% for Sudan, and 50.95% for Burkina Faso. Mali's production is the most volatile, with a CV of approximately 65.71%. Indicating higher risk and uncertainty in production. Despite having the highest standard deviation, Sudan has a slightly lower Coefficient of Variation than Mali, making it less volatile when standardised to the mean. Ethiopia is the least volatile (CV: ~47.71%) and has the highest production. This suggests Ethiopia is a stable and high-performing market.

Regarding Risk, despite having the lowest standard deviation, Burkina Faso is more volatile than Ethiopia when scaled to its mean. Given the high Coefficient of Variation, the high standard deviation for Mali implies that production is less stable and more prone to significant swings, which can be disruptive for both short-term operations and long-term planning. In Ethiopia, although the Coefficient of Variation is lower, the absolute standard deviation is high. This implies that although the relative year-to-year changes might be less volatile, the actual tonnage can vary significantly, posing logistical or market challenges. For Mali, strategies need to focus on stabilisation. For Ethiopia, the strategy might be more about managing large-scale changes efficiently. In each case, however, experts, policymakers and stakeholders must understand the drivers of these production patterns, given the position of the analysed countries in the sorghum continental market.

AIM AND OBJECTIVE

We aim to identify the critical dynamics of sorghum production in Burkina Faso, Mali, Ethiopia and Sudan and assess their resilience to the shocks they face. To this end, we must build a framework for the research based on an extant literature review on millet and Sorghum production. We also need to develop a methodology for data collection and identify the key trends, factors and opportunities influencing millet production in Burkina Faso, Mali, Ethiopia and Sudan.

[11] Starvation Accountability (2022).Ethiopia (Tigray) Non-international armed conflict (2020 –) (Online) https://starvationaccountability.org/publications/ethiopia-tigray/ Accessed 30th August 2023.